Handbook of Urban Landscape

CONSULTANT EDITOR

Cliff Tandy FILA, ARIBA

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Timothy Cochrane AILA RIBA MLA (Penn) DipLD (Dunelm)
Allan Hart AILA AIPRA (Dip)
Hal Moggridge AILA RIBA AADip
A. E. J. Morris DiparCh (UCL) DipTP (Lond) RIBA
Gordon Patterson DipLA AILA
G. A. Perrin DipTP AMTPI RIBA
Cliff Tandy FILA ARIBA (see also under Consultant editor)

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Section 1 **Urban landscape review**

Technical study Landscape 1

Introduction to landscape design

CLIFF TANDY, *consultant editor for this handbook, explains the relationship of landscape architecture to allied professions, reviews factors currently influencing landscape design and forecasts future trends*

1 Context of landscape design

1.01 Writers on the art of landscape design either equate it with gardening, and—assuming that Adam was a gardener—place it as the earliest art, or believe it to be the youngest. In fact, although it has centuries of history, landscape design comes late to every civilisation, usually not appearing until a period of stable peace has prepared the people for this gentle and somewhat fragile pursuit.

1.02 All the arts are, of course, inter-related to some degree. Landscape design appears to have closest relationship with the 'practical' arts of architecture and civic design. Historically, however, it has close links with painting. Painters have always been visionaries, seeing far ahead of more practical men; consequently painting has often been a pathfinder to landscape design. Sometimes, as in the late seventeenth and early eighteenth centuries, painters have created an 'ideal' landscape which inspired its physical execution fifty or more years later. In this century, painters such as Cezanne, Braque and Mondrian have taken new roads which architecture has followed and which landscape design has only just begun to follow. At first sight it appears that at present the fine arts reflect the dissatisfaction and confusion of society and have rejected their role as leader. Probably a retrospective view will show this to be untrue and will reveal a path leading in a new direction, but certainly from our position in the centre of the melee, such guidance is undiscernible.

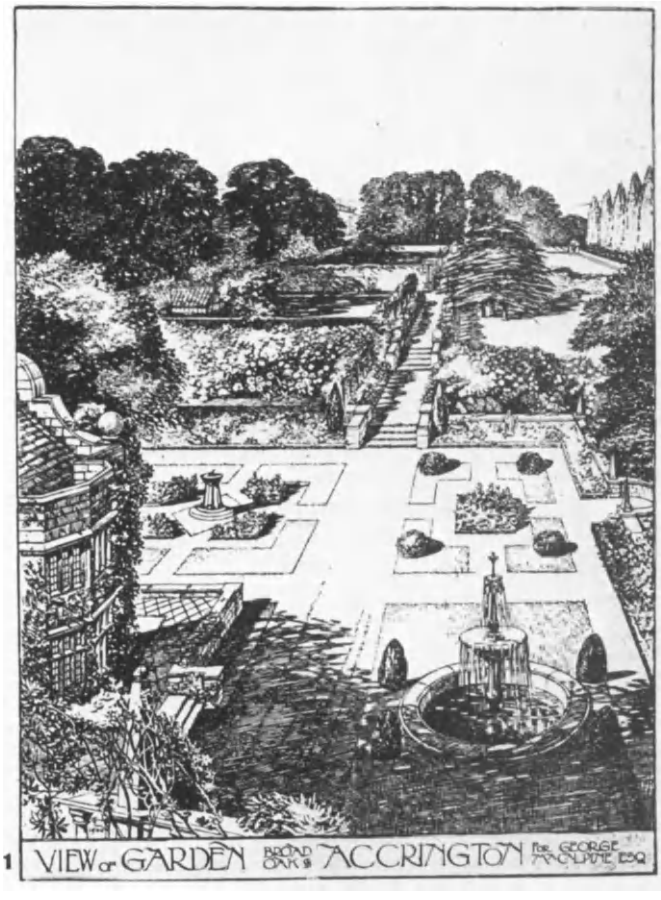
2 Role of the landscape architect

2.01 Up to about 1860 the role of landscape architects was clear. Although they had not the same unmistakeable professional status as architects, Repton, Paxton and Loudon were clearly *professionals*. During the eclectic 'seventies and 'eighties Robinson and Jeckyll were not accorded this status, and though in Britain the profession was kept alive by men like Milner and Mawson **1** it became somewhat eclipsed by the rise of 'landscape gardeners', many of whom did excellent work at garden scale, but in a well-worn style that had not progressed since William Robinson. Not surprisingly, the revival caused by the creation of the Institute of Landscape Architects in 1929 met a mental climate which, while not hostile, relegated the profession to the role of 'external decorator'.

2.02 However, other countries escaped this inhibiting restriction and early in the century the profession flourished in the US and in Germany, Switzerland and other European countries. It must be admitted that because professionals on the Continent were allowed to contract and execute work, comparisons between professional landscape designer and landscape contractors did not occur. The ethical separation of the two functions is probably the first change to record. While always in force in Britain and America, only now is this becoming effective on the Continent.

2.03 Unlike artists and sculptors, landscape designers depend wholly upon being commissioned, and their effectiveness is limited by clients' whims and bankbooks. As in architecture, the state has largely replaced the wealthy private landowner as patron, but as the process was rather slower in landscape, the image of garden-designer for the wealthy lingered even into the immediate post-war period. Since then, through opportunities from competitions, public commissions, improved training, and above all through new social problems set by demands for open space and recreation, the scope of landscape architects' work has widened enormously, even to the level of rural planning on a regional scale.

1 *Garden at Broad Oak, Accrington, Lancs, by Thomas H. Mawson (c1880)*



3 Relationship with other professions

3.01 This country has one of the strongest systems of planning control in the world, with consequent benefits and disadvantages which have been well argued professionally. One limitation of special concern is the rarity of opportunities for planning commissions to go out to private consultants; consequently there are few chances for balanced comprehensive teams—including a landscape designer—to work on large planning projects. This is unfortunate, as team working is the only way in which 'total environment' projects can be tackled, and the professions should have every opportunity of working together. It would be beneficial—as has been proved in Germany—for the 'land-based professions' to start their training with a common first year.

3.02 At present, co-operation with architects is good: they are often in a quasi-client relationship with the landscape architect. With planners there is slight competition over the role of 'country planners', a title which town planners relinquished soon after the war. Engineers often have landscape architects working with them on large projects. Earlier misunderstandings over the aesthetic component of major works have evaporated and the partnership is now usually very fruitful. Collaboration with members of the Institute of Parks and Recreation Administration is now more common and younger members of that organisation recognise the scope for working together. It is also to be hoped that landscape architects recognise the benefits of working with qualified horticulturalists.

3.03 There is still a considerable shortage of qualified and senior landscape staff in this country, although educational facilities are constantly increasing and about twenty qualified graduates enter the profession annually. There is also a small but continuous 'reverse brain-drain' of staff who have received further training or experience in the US. Whether the shortage continues or not, undoubtedly a large proportion of external space will *not* be designed by landscape architects, just as a lot of buildings are created without architects. As there are few teachers of landscape design and appreciation other than those on wholly landscape courses, the subject is inadequately covered in the training of architects, planners and other professions. This handbook is intended to help to fill this gap.

4 Recent trends

4.01 The post-war period has seen many changes and developments which have stimulated the growth of landscape design and the need for designers. A few of these must be noted as a guide to future trends:

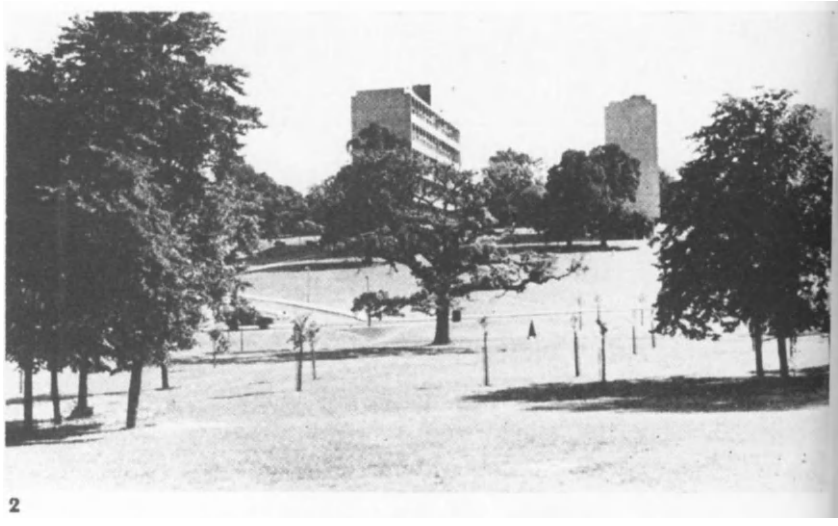
The Town and Country Planning Acts of 1947 and 1962 were the most significant legislation as they controlled, for the first time, any form of development of land. The National Parks and Access to the Countryside Act, 1949, and the Landscape Areas Special Development Order, 1950 were perhaps more directly concerned with landscape. Though the early stages of their implementation consisted mainly of designating existing areas of beauty, work has expanded to take in problems of upkeep, public access and recreation needs.

The Countryside Act of 1968 set up the Countryside Commission and emphasised use of rural land for recreation. It included an interest in commons, coast, and particularly the creation of country parks. Use of inland water for recreation was covered by the Transport Act of the same year.

The amenity clauses in the Hydro-Electric Power Acts and Electricity Acts ensured that existing beauty of the sites mentioned in the Acts was preserved and set a precedent for using professional advice in planning the surroundings of major engineering works. This was followed up in Acts controlling opencast coal and other mineral workings, while the offer of government grants encouraged reclaiming past dereliction, including reshaping and planting of shale and other waste tips.

Other legislation which had repercussions on landscape work includes the Caravan Sites Act, 1960 and subsequent Orders, tree preservation legislation and the Civic Amenities Act, 1967.

4.02 In recent years, local authority housing standards have been progressively upgraded. While most professionals would agree that this has not yet gone far enough, and while external space-treatment standards have not remotely reached those for interiors, there has nevertheless been improvement and a recognition that external layout is



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2 *Multi-storey housing blocks set in a mature landscape, Roehampton* (LCC)
3 *Married officers' quarters, Putney, built within a mature landscape (Architects department* MPBW*; landscape architect C.R.V. Tandy)*
4 *Communal landscaped gardens in the private sector. The Hall, Blackheath (Eric Lyons for Span)*
5 *Dense planting in Jacobsen's housing at Bellevue, Denmark*
6 *Extensive communal landscape in a new housing layout at Tapiola, Finland*

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significant **2**, **3**. Similarly, provision for children's play is now an integral part of every housing estate, even though problems of siting and detail design are rarely adequately solved.

Formerly, in the private house building sector only large properties had gardens worthy of the name; speculative 'semis' were laid out on land geometrically divided into long narrow plots of little value. Developers of the calibre of Span and Wates have shown that much more imaginative layouts are possible, even for middle incomes, and that landscape treatment of an estate is an important selling factor **4**, **5**, **6**. Britain has even accepted the concept of communal garden areas and unfenced fronts, though not exactly with nation-wide enthusiasm.

4.03 Experts say that industrial demand for land may reach a peak and then fall off, as industry becomes more efficient, more intensive and less expansive. Meanwhile, demand for industrial land is still increasing, and this has influenced landscape opportunities in two ways. In the first place strategic location of industry—particularly power plants—on the coast, in national parks and other places of natural beauty, has meant a call on services of landscape designers to assist in assimilation of these artefacts by the countryside **7**. At its minimum this can be little more than concealment or camouflage, but at the highest level of work there is team co-operation in which the location, exact siting, design of the industrial plant, and landscape treatment of a large area of adjoining land, all contribute to a successful composition. In rare cases the nobility and scale of large engineering works may even benefit mediocre pieces of country.

The other half of the problem is re-use of derelict land by new industry, and the consequent need to reclaim land, remove dereliction and find ways to create a new man-made but attractive landscape setting.

4.04 Probably the greatest pressure on land today is the demand for recreational use **8**. As a result, much land is coming out of agriculture or other use and must now often be redesigned for dual or multiple use; weekday grazing being shared with weekend camping, forestry interspersed with picnic sites, water catchment areas crossed with trekking routes and nature trails. Furthermore, public pressures on land for recreation cause much greater wear and tear than before, so that a form of landscape *reinforcement* needs to be planned.

4.05 Agriculturalists rarely feel the need for what they regard as the 'aesthetic' professions, but there are signs of a change, particularly in the design of farm buildings as more acceptable features in the countryside. Opportunities to create new farmland usually only occur when reclaiming land from the sea (eg Dutch polders) or restoring after dereliction. In such work landscape designers can contribute to better shaping, draining, sheltering and planting of land so that it is better economically, as well as more attractive.

4.06 The most recent influential factor is the growth of the conservation movement and the rousing of the public conscience to care for the environment. This has already taken many forms from increased interest in historical gardens to the melting down of old cars. It calls for landscape design and management skills in rejuvenating old town centres; protecting features of natural beauty; restoring derelict canals; removing sources of toxic waste, reclaiming old colliery tips and other industrial waste

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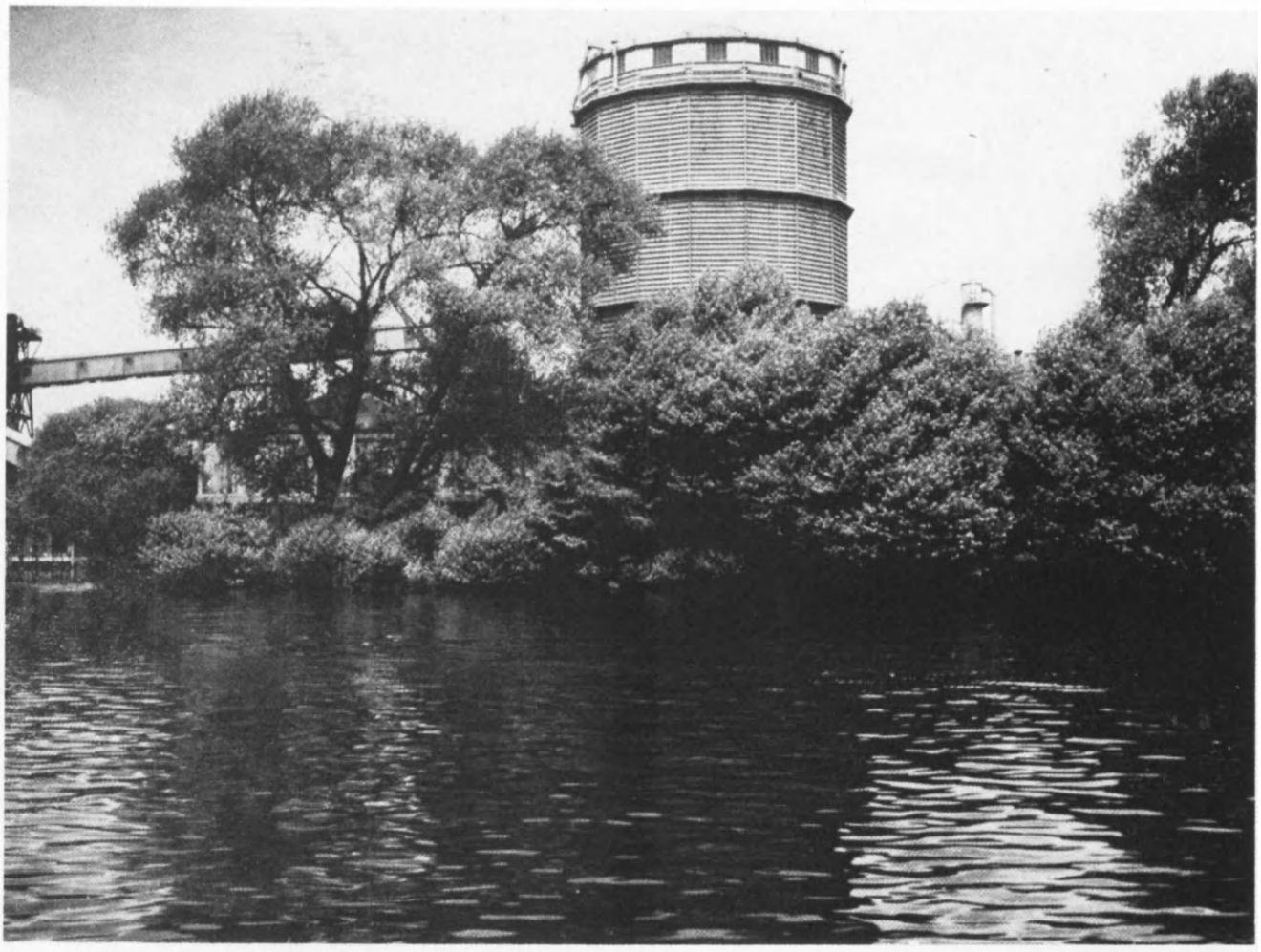

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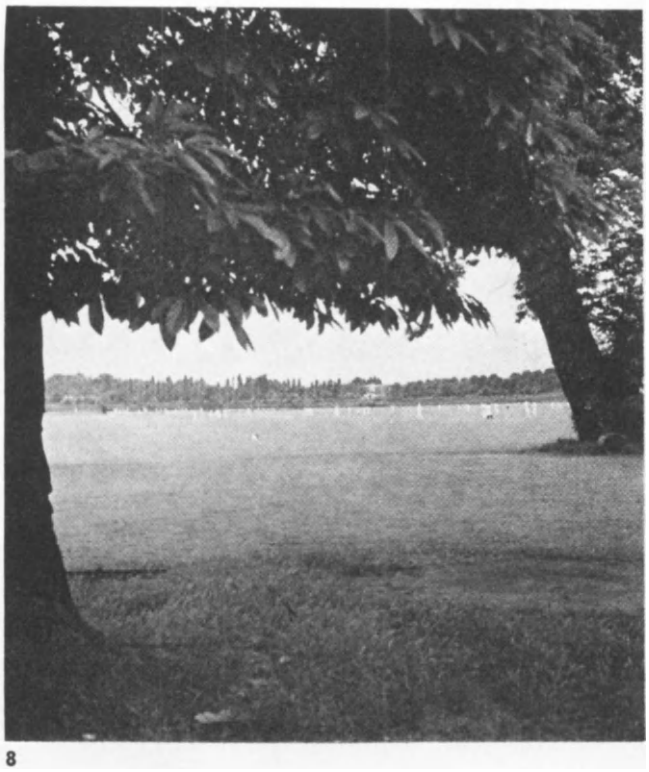
7 *Landscaping around Lee Valley power station*
8 *Polytechnic sports ground, Chiswick. Wet gravel pits forty years ago*



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deposits; in restoring land after extractive industries **8**; in the planting component of Civic Trust type facelifts and in many other ways.

5 Progressive techniques

5.01 Professional and technical skills of the trade have not stood still in the face of these demands. Though transplanting large trees had been practised for centuries, it received such impetus through the availability of many large trees in nurserymen's gardens which had grown unsold during the war years as to amount to a new technique **10**. The demand for 'instant landscape' has continued unchecked, but trees have now to be grown-on deliberately to large size, though a more modest middle height with better future prospects is usually chosen.

5.02 Sowing grass by hydroseeding, a new technique from the US, is now well established. Many different emulsions, seed-mixes and mulches can be used. When used intelligently and on suitable surfaces hydroseeding has proved itself, though it suffered somewhat from extravagant publicity.

5.03 Of methods to extend the planting season, one of the most effective is the use of plastic sprays to reduce transpiration through leaves and stems during dry or warm weather following planting. The use of inert materials as substrates in place of soil has also been tried, including plastic foams to encase roots during transplanting and transport. Though in their infancy, these methods surely have a future. Perhaps the greatest development has been in containerisation (transferring plants into plastic or other containers in the nursery—even if not 'pot-grown') enabling

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9 *Recreational use: Olympic boat-race course in the Amsterdam Bos*
10 *Michigan tree transplanting machine in operation*

them to be offered for sale at all times of the year and safely planted out. This technique has been related mainly to the growth of retail 'cash and carry' garden centres, but it has also benefited the contracting sector.

5.04 Selection of plants grown by the nursery trade has become somewhat better related to the demand for indigenous species for landscape work, though there is still a long way to go. The trend has been hampered by the opposite demand by the retail public for almost unlimited supplies of the latest fashionable plant mentioned on radio or tv.

5.05 Following an article* complaining that there were no British Standards for landscape work, BSI set up a committee structure to prepare standards for materials, techniques, definitions, maintenance methods and nursery stock. Although at present in abeyance for lack of adequate financial support, many standards have been published and work has now extended into the international field.

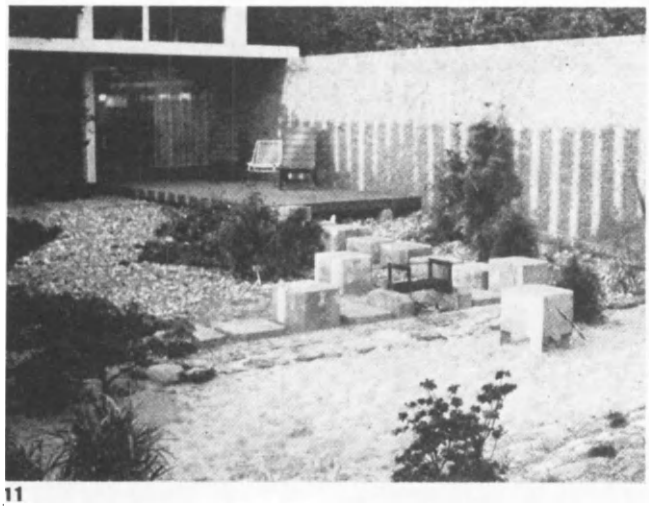
6 Future trends

6.01 It is difficult—and often unwise—to predict future trends, but by looking back at progress in the last quarter century and projecting forward, several possible ways for advancement stand out.

6.02 Changes in land use are inevitable as agriculture becomes an intensive industry and consumer countries are obliged to grow more of their own food. Though there will probably be no real shortage of farm land, first-class land will become sacrosanct for food growing only. It will be too valuable even for grazing, and farm animals will be reared in buildings and fed from fodder crops. Marginal and hill land will be in demand for forestry, water catchment and recreation rather than being used for poor farming. A result of this intensification should be that large scale changes in land use—even in agriculture and forestry—will need planning approval in future.

6.03 The rising demand for space for leisure, particularly water recreation, seems likely to continue. Of course many forms of sport do not need a beautiful green setting and could be accommodated on hard urban wastelands or in tattered remnants of 'green belts'—now often a dirty grey.

* AJ 25.10.61 *The lack of technical information for the landscape designer* C. R. V. Tandy.



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6.04 More rational approaches to open space standards is likely, with hygiene-orientated municipal parks giving way to a logically planned open space *system* throughout a town. Urban pressures will mean that such open space will no longer be able to imitate arcadian values but will have to cater for sophisticated tastes of the 'King's Road' kind.

6.05 Change in housing patterns to cater for population increase is too big a subject to argue here, but whatever the form, a more intensively used—hence hard and more consciously designed—landscape setting will be demanded **11**. This may eventually extend to creation of open spaces—even to well-planted sitting and recreation areas—on decks over buildings, car parks **12** or other land uses. They may reach several storeys, following the Montreal 'Habitat' concept.

11 *Is this the future trend in garden design? (The Individualist's garden by Günther Schulze, Hamburg)*
12 *Large tree planting in a public open space created over an underground garage, Chicago*

6.06 As in towns, so in the countryside, public pressures will destroy the very qualities that people seek, unless means are found to cope with them. This should *not* make concrete, asphalt and wire fences in the countryside inevitable. Instead there is scope for considerable experiment into biological methods of withstanding use and controlling wear and tear.

6.07 In technology one can expect attempts to meet the desire for 'instant' landscape through increased container selling at larger sizes, more ideas to prolong the planting season and another crop of inventions to enable horticultural maintenance to be done by amateurs and unskilled labourers. Among ideas to be resisted will be attempts to grow tropical plants in this country through cheap-rate electricity; attempts to turn our diversified soils into a standard growing medium by chemicals and containers; and continued plant-breeding for fashion until every flower is available in every colour and all distinguishing characteristics of form, fragrance and plant-habit have been bred out. In contrast one must commend the new retail garden centres for displaying such an exciting array of species, that the public are even beginning to buy plants other than standard rose trees.

6.08 In three aspects of professional skill, new methods are essential. The first is classification of landscape quality. Though many authorities are experimenting with this problem, there is no recognised technique by which national or international landscape values can be compared. Allied to this is the need for a method of comparing values of different resources. Cost-benefit analysis has proved inadequate to deal with amenity values—some non-monetary method of 'value-analysis' could perhaps be devised. Finally, though the concept of 'grounds maintenance' as a technical skill for upkeep of cultivated landscape has begun to catch on in this country, there is still scope for upgrading staff to positions of seniority—even perhaps for introducing landscape managers in the way that housing managers have evolved to care for buildings.

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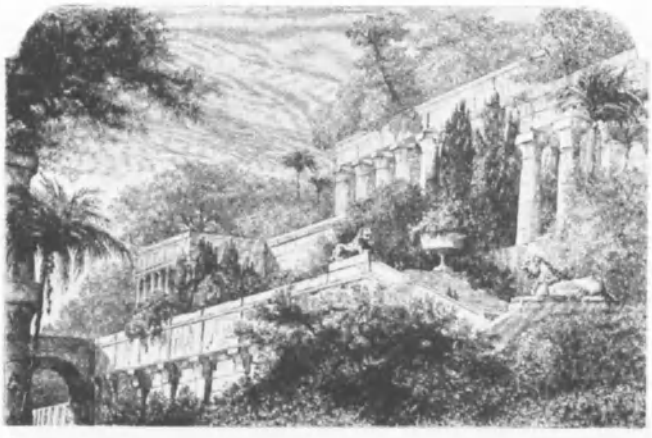
Technical study Landscape 2

Section 1 **Urban landscape review**

Urban landscape review: Current and future trends

In the first technical study, CLIFF TANDY *reviewed the work and responsibilities of a landscape architect and briefly outlined discernible trends in landscape design. In this present study* TIMOTHY COCHRANE *examines those trends in greater detail and in a more pictorial form*



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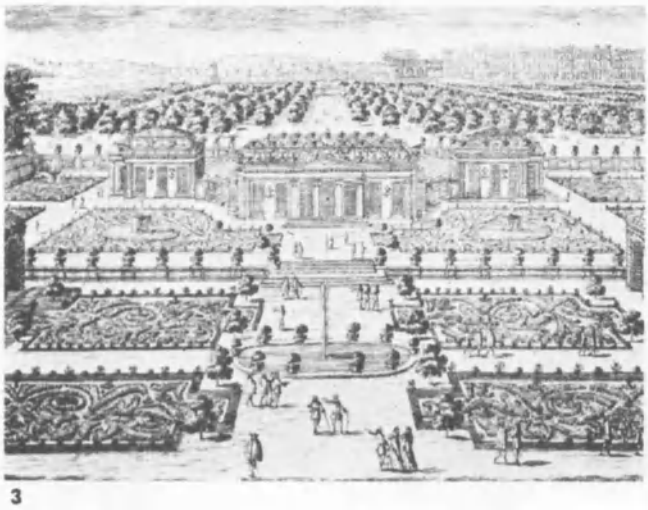

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1 The beginnings of an urban landscape

Urban landscapes of supreme power for King and Church

1.01 The first glimmerings of urban landscape came inevitably with cultures of the 'Fertile Crescent' in the Middle East. Assyrian hunting parks and Persian gardens showed the way, but none of these matched the closely integrated urban infrastructure of the hanging gardens of Babylon **1**. Of apparently enlarged ziggurat form it shows how the trees were fitted into the structure.

1.02 While Kublai Khan's 'Green Hill' in China, one of the first town arboreta known, was but an example of little-known Chinese urban landscape, urban landscape as such was hardly practised by supremos until the Renaissance, apart from the brief interlude of the 'carmen' philosophy of Moorish Spain. Here, there was complete unity as building spaces flowed into one another. Although the Renaissance overshadowed the end of supreme power—its landscape flourished in the Italian squares, piazzas **2** and in the work of Le Notre for Louis XIV **3**, while Nash produced grandiose plans for the Georgian kings **4**.

Democratic urban landscapes

1.03 Some first flowerings of democracy were to be noted

1 *Hanging gardens of Babylon. This reconstruction shows complete fusion of structure and soft landscape*
2 *St Mark's piazza, Venice. Unequalled space articulation*
3 *Gardens at Versailles (Le Notre). Formalised statement of power*
4 *Nash's plans for St James's. Superb essay in new English style, foreshadowing a democratic landscape after previous formalised statements*

4

in the urban open spaces or agora of the Greeks and Romans. In medieval times market places sufficed for the commoners but few urban landscapes for them were created until the collective conscience of the nineteenth century led to the insertion of green spaces into the by-law streets. These designs, green would-be arcadian squares in our urban pattern, are still conditioning our minds as to what we should expect of our public open spaces, still shown in green ink on planning maps.

2 What is happening now?

Low density urban situations

New and expanded towns

2.01 Note how the concept of *rus in urbe* has continued, with the work of Ebenezer Howard's Welwyn and Hampstead Garden Suburbs being crystallised in the post-war New Towns. Harlow's green blandness in the midst of the arable scene **5a** with only clumsy attempts at urbanity in the centre **5b** gives way to the aborted concept of Hook, partially realised in Cumbernauld. Placed, against all logical siting rules for Scotland, on a windswept hilltop it yet showed signs of a new landscape in its closely set housing with children's play integrated into its hard surfaced linear corridors **6**.

2.02 Later work still tends to follow this trend with smoothly rounded grassy sweeps and only the odd urban touches in the centres. Even the latest entrant—Milton Keynes—does not look as if it will break away, rather the reverse.

General development

2.03 Landscape standards are either negligible or appalling, except for a few enlightened developers, Wates, Wren and Span among others. Span in their estates created for middle-class 'Span man' have provided some of the few refreshing glimpses of low-density housing landscapes in this country. In its short life (1955-69) while maintaining a consistently high standard of detail, Spanscapes have ranged from the prettified and eclectic face of Parkleys **7** through the more uncompromising and simple palettes of Field End **8** and some of the Blackheath estates to the more rampant and exuberant use of plant material in their later Weybridge estates of Templemere and Weymede.

New Ash Green **9** points a way for small community developments with its integration of small and larger spaces (see also **15**).

High density urban situations

Housing

2.04 High-density housing generally shows a pathetic disregard for the new open spaces supposedly liberated by tall blocks. Even in well-designed schemes architecturally the external spaces have been left as caged flat green spaces **10**. Two exceptions are Winstanley Road and Lillington Street. Although fussy in detail Winstanley **11** yet shows a pattern


5a


5b


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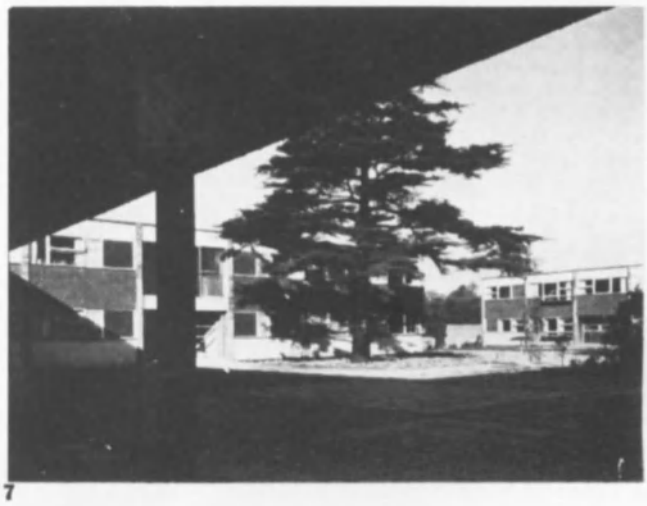
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5 *Harlow new town.* **5a** *Fill up the spaces with grass - it's useless but it's cheap in first cost.* **5b** *Centre - a mess of furniture*

6 *Cumbernauld (Cumbernauld Development Corporation). Fluid flow of pedestrian routes linking spaces with children's play at nodes*

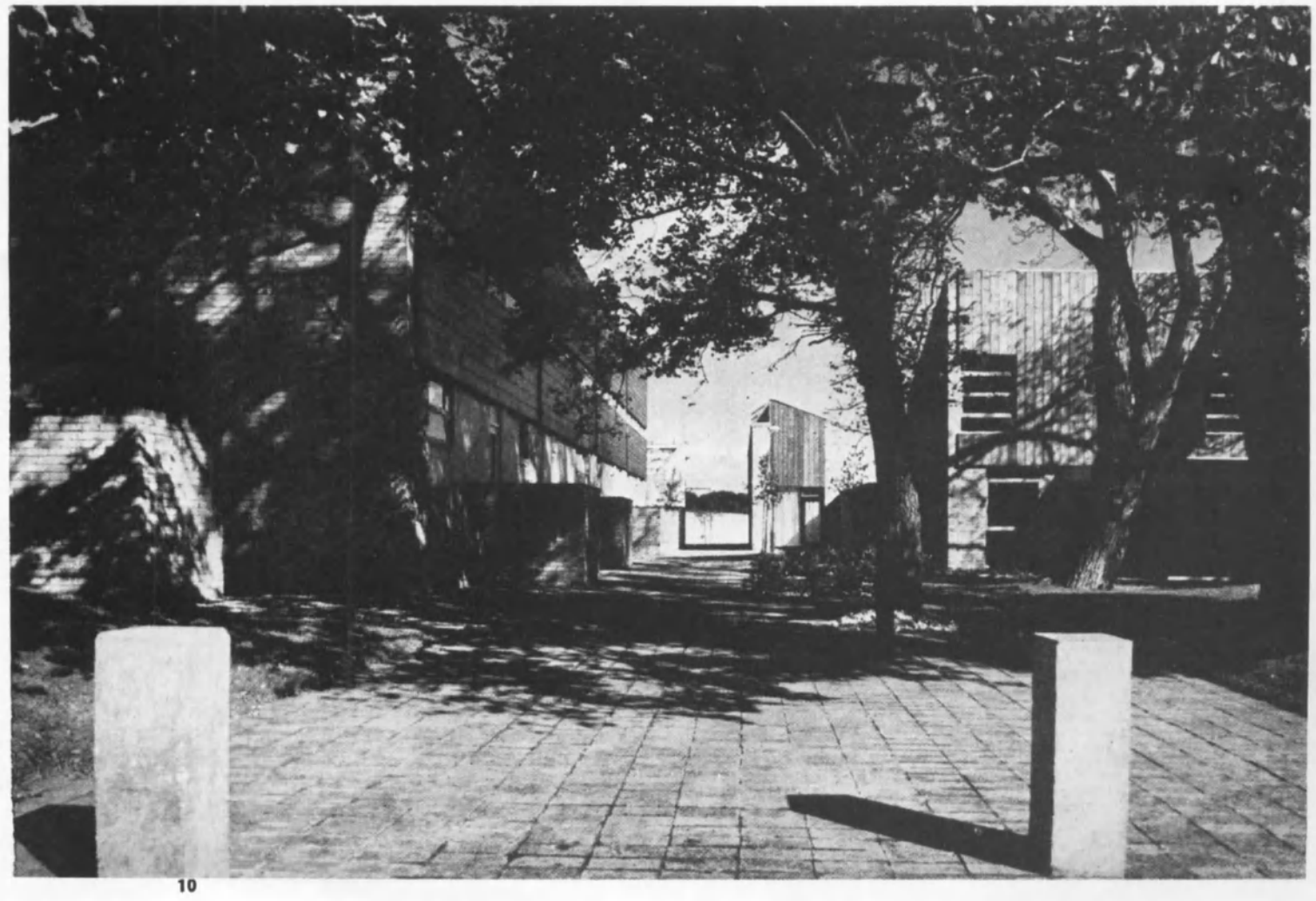
7 *Span at Parkleys, Ham Common, Richmond (Eric Lyons & Partners). First example of new landscape. Variegated and coloured planting matches brashness of coloured glass and bright red Surrey tiles*

8

11a

9

8 *Span at Field End, Waldegrave, Twickenham (Eric Lyons & Partners). Close up birches and limited palette of ground covers, give pleasantly quiet effect*
9 *Churchill Gardens, Pimlico (Powell & Moya). Good architecture of its time with solitary trees in useless caged green spaces*
10 *Span at New Ash Green, Kent (Span Kent Ltd). Note sophisticated advances in detailing from Parkleys* **7** *(and fluid linkage of spaces in shopping street* **15**)
11a *Anonymous architecture with good landscape of hard surfaces and trees—marred only by some over-fussy detailing (housing at Winstanley Road, Battersea, George, Trew, Dunn; landscape architect: Michael Brown)*



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11b

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13

for the future with its design for high intensity, high-density urban use, with an imaginative use of levels, and hard pavings. Lillington Street's access balcony planting provides a further promise **12**, even if the over-rustication of its internal courts and its use of trees are not as successful as they should be.

Precincts, plazas and pedestrian ways

2.05 Current examples of old-fashioned static spaces include Seagram Plaza **13**, the Economist podia **14** with the sophisticated Mellon Square, Pittsburgh, as successors to those squares which were inserted into the urban fabric in previous centuries.

On the other side of the coin the civic spaces at St Paul's, Paternoster Square, is a grim reminder of unachievement in

11b *Sensible, sturdy landscape detailing at Winstanley Road housing, Battersea*

12 *Superb balconies with planting (Housing at Lillington Street, London* SW1, *Darbourne & Darke). Later versions have been severely curtailed by* MHLG *cost yardsticks*

13 *Seagram Plaza, New York (Mies van de Rohe and Philip Johnson). Well articulated static approach to a static building, with fountains and creeping beech*

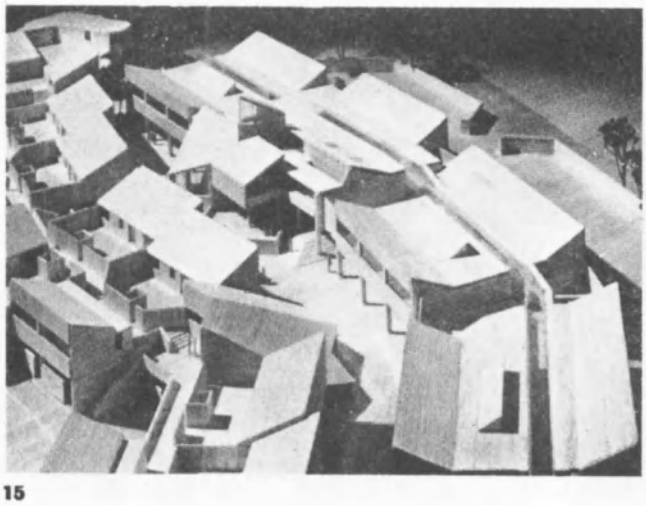
14

this field. Fluid linkage of spaces in the urban fabric appears a forgotten art—apart from some small-scale attempts **15**.

Shopping malls

2.06 Little progress appears to have been made from the US developments of a decade back (Detroit and Santa Ana **16**) though half-hearted attempts have been made in Coventry and in Rotterdam **17** while the most dreadful warning is

14 *Economist building, London. Good example of a simply detailed hard space (A. & P. Smithson)*
15 *Fluid linkage of urban spaces. Model of shopping centre, New Ash Green (Span Kent Ltd)*
16 *Sophisticated and smooth shopping mall surrounded by acres of cars (Santa Ana, California. Architects: Pereira & Luckman. Landscape architect: Ruth Shellhorn)*



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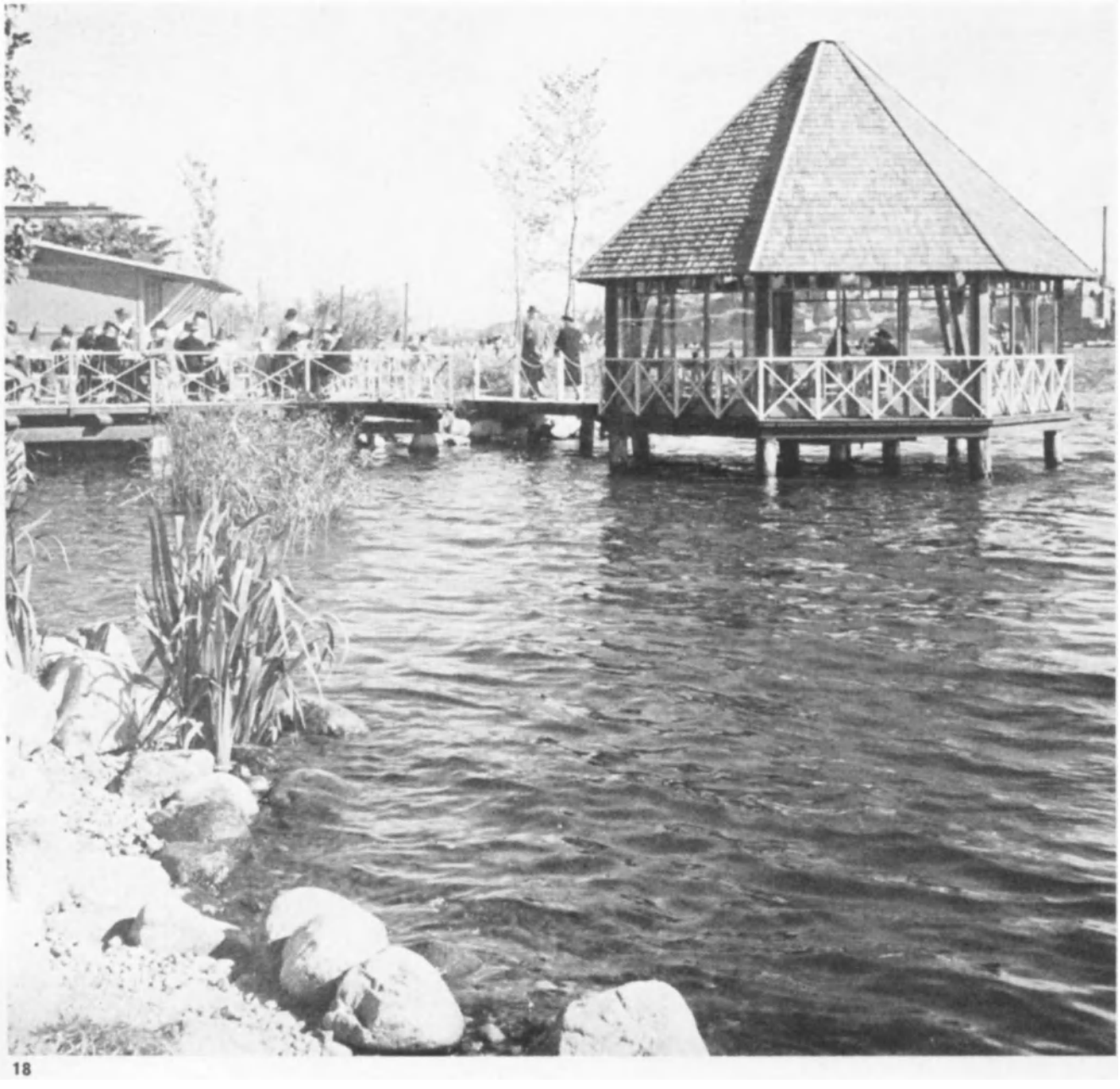
16

17

19

17 *Well-known, long established Dutch shopping centre (Lijnbaan, Rotterdam, Van den Broek & Bakema)*
18 *Norr Malarstrand, Stockholm (Holger Blom). Still about the best example of linear waterside park where pedestrian scale persists throughout*

19 *Bos Park, Amsterdam. Integral spaces set in large wood*
20a, 20b *Restaurants set sensitively by Serpentine—an example of multi-use zoning (swimming, rowing, sailing)—but still car has not been tamed. (Hyde Park Restaurant Patrick Gwynne)*



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echoed at Birmingham's Bull Ring. Today, US experience is now tending towards controlled environments with their own particular landscapes (see para 3).

Open spaces

Permanent

2.07 Stockholm and Amsterdam epitomise the best of recent decades in large urban open spaces with Stockholm's Norr Malarstrand **18** as an excellent example of a linear park, while Amsterdam's successful Bos Park **19** consists of integral spaces for rest and leisure set in a new wood. In this country there are no examples as yet of integral leisure areas.

2.08 As in New York's Central Park, London's Royal Parks are now slowly changing their faces for modern requirements. In London's Hyde Park, restaurants by the Serpentine **20**—excellent but for car parking arrangements—pop groups entertain in the cockpit and an art gallery opens. Unfortunately there is no cohesive landscape policy and poor St James's Park continues to be butchered.

2.09 *Linear parks* The potential of canals, rivers and old railway lines is only now slowly being realised as at Regent's Park Zoo **21** and at Farmers Bridge, Birmingham (page 126), and Stoke-on-Trent.

Large new spaces The Lee Valley progresses slowly while Liverpool's Everton Park and Newcastle's Town Moor press on at an even slower rate.

Temporary or 'fun' landscape

2.10 Landscapes for pleasure or exhibition have always been a feature from the Vauxhall and Cremorne gardens for the 19th century 'toffs' to today's Tivoli gardens (Copenhagen) for the *hoi polloi*. The first glimpses in this country

20a

of a new urban landscape was at the 1951 South Bank exhibition and its lighter-hearted twin at Battersea Park. Ephemeral and evanescent, both have been butchered by the GLC into pale shadows of themselves. Abroad, harder and tougher landscapes have been emerging through the excellent German International Garden Exhibitions (IGA) from Hamburg in 1963 through Stuttgart and Karlsruhe to Hamburg again in 1973, and at Zurich in 1959. Often the result of open competitions, they differ from British examples (Chelsea Flower show!) in that permanent urban parks were left for the cities to use. Note the varied and intelligent use of water, a German speciality in these examples from

20b

Stuttgart **22** and Karlsruhe **23**.
See also technical study 5 and information sheet 11 para 3.04 for Essen.

Incidental spaces

2.11 'Left-over' spaces are what make an urban landscape. An intelligent appreciation of scale is all that is needed especially in our latest problem of urban motorways where success depends on pedestrian scales being designed independently of the motorway superstructures.
These impacts have been handled well in Germany and Sweden **24** but hardly touched upon in this country. Bristol's Cumberland Basin is weakly handled, research in depth has been undertaken on Liverpool's motorways while arguments rage over the afterthoughts to London's Westway.

3 Future trends

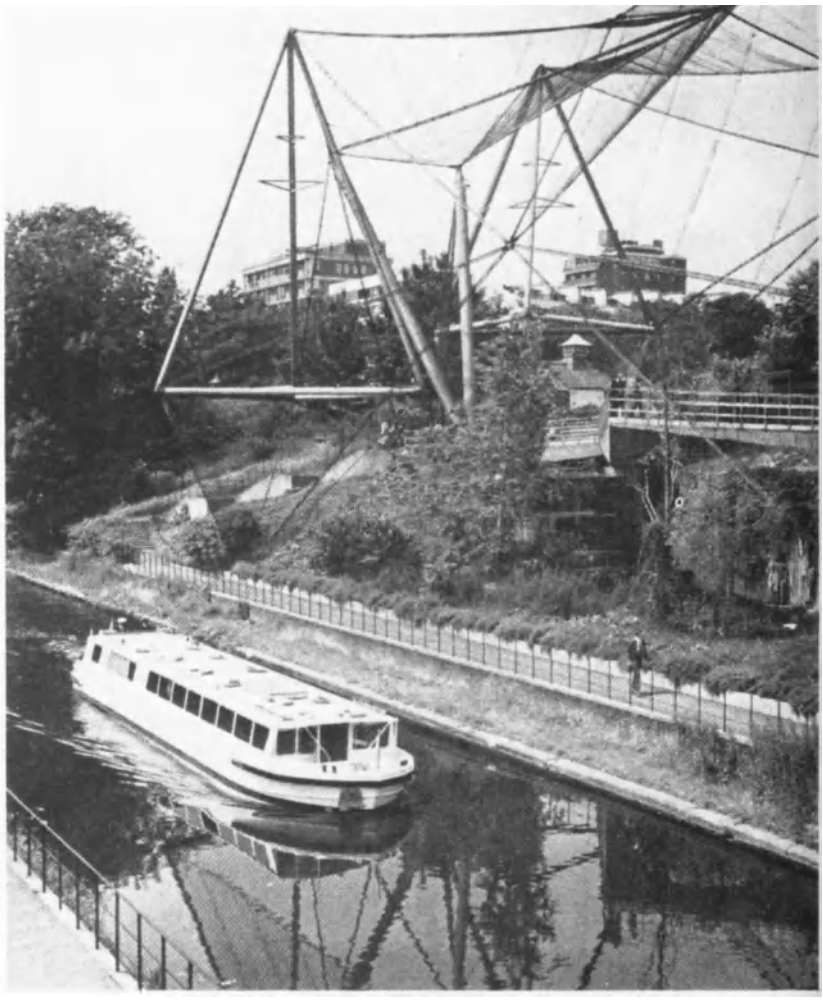
Socio-economic influences

3.01 General trends are towards better and longer education, higher living standards and shorter working weeks; to greater leisure, mobility and adaptability. All these influence the urban scene.

Mobility (both physical and social) and adaptability

3.02 *Flexibility* will cause the greatest problems in that changing uses and disposable dry building forms will have to be accommodated within slow-maturing wet and organic landscapes. This could mean greater reliance on inorganic or hard forms of enclosure and flooring with 'instant planting' within urban complexes with major linear groupings of undisturbable plant material (large trees) in between. It has even been suggested that forests should be planted now in which new developments could be sited—in the same way that early settlements were carved out of virgin forest.

3.03 *Impatience* People are not so prepared to wait twenty to twenty-five years for landscape to mature and will pay more for 'instant work' in hard expensive materials. The present so-called semi-mature tree industry could well move upwards to providing those big trees that Baron



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21 *A really urban/rural landscape of water/walkways/bridge, with gravel and ground covers of neighbouring Regent's Park Zoo*
22, 23 *Examples of permanent parks created as result of biennial horticultural exhibition held in Germany in different major cities: Stuttgart in* 1961 **22**, *Karlsruhe in* 1967 **23**

22

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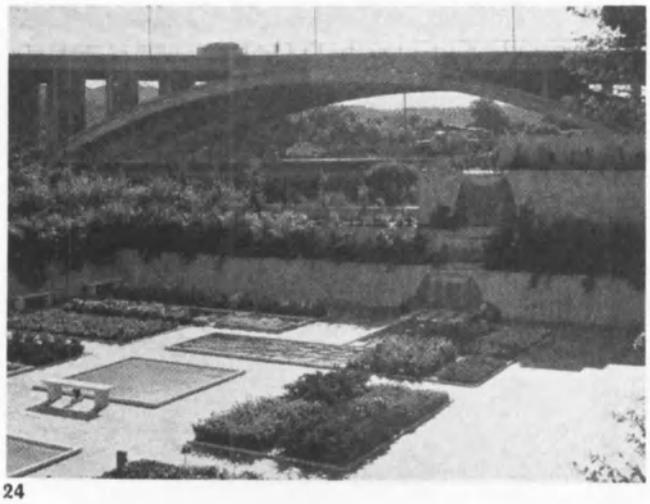

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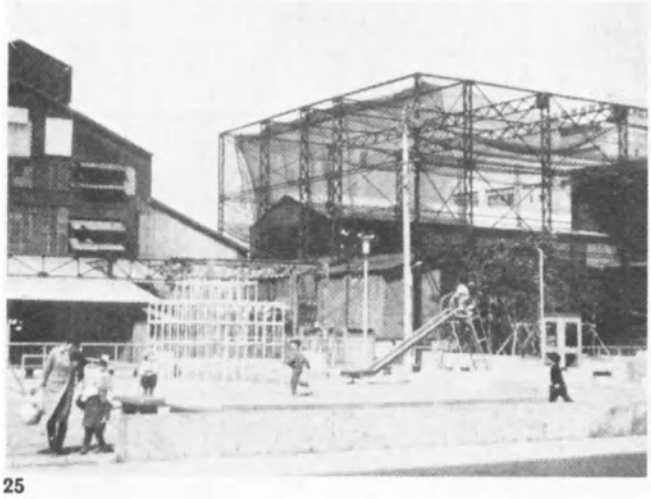

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24 *Tullgarden, Sweden. Relaxation and calm, by and yet right away from elevated road systems*
25 *Is this the future pattern of leisure? Industry (left) cheek by jowl with children's play area and industrialised leisure pattern of future in caged golf driving ranges (right) (Tokyo)*
26 *Midland Arts Centre, Birmingham (Jackson & Edmonds). Integration of arts and sport. Full circle to Greek ideas of full integration of mind and body*

26

Haussman used in Paris in the eighteenth century. Meanwhile planting design will have to adapt to providing other shorter lived plants.

3.04 *Personalised transportation* Increasing numbers of cars, bubble cars, gyros, will lead to increasingly introverted layouts, with sterilisation of large areas for car parking.

Higher living standards

3.05 Rising labour costs should desirably lead to higher standards of design with robust finishes and low maintenance (that is, if current cost accounting methods can be changed). It could even mean that in high-density redevelopment, obliteration or relocation of existing organic landscape elements and their replacement by new materials could be more economic, although possibly undesirable on other grounds.

Leisure explosion

3.06 The horrifying pressures on spaces for leisure combined with increases in population densities are shown vividly in Tokyo where caged three-decker golf driving ranges are now the norm **25**, and every leisure activity is swamped by ant-like hordes. Multi-use of land is now considered essential using all available space on decks below ground and on roofs. There is also a much closer integration of buildings and outdoor spaces, and of functions, eg multi-use of water areas or school recreational facilities. These all lead to multi-purpose landscape plans.

3.07 Integrated leisure complexes include: Billingham forum (but with no integration of landscape—see AJ 22.11.67 and 27.8.69); Midland Arts Centre, Birmingham **26** which shows integration of indoor cultural activities with outdoor pursuits; Aviemore leisure centre used both in winter and summer; and Monaco development *below* beach level (see AJ 2.9.70).

Educational and social awareness

3.08 This awareness results in an increased social consciousness, an increasing desire to be involved in a healthy environment. Coupled with greater mobility (day trips to historic sites and so on) places like Longleat and Woburn could lead to a greater emphasis on history and continuity, and a more active involvement on the part of the visitors. Landscaping of conserved areas will grow and adaptation will continue of hitherto wastefully used external spaces for more intensive use.

Increasing public ownership

3.09 More public ownership of open spaces could lead to even more design for hard wear and defence against vandalism, as well as for increasingly low maintenance.

4 Technical advances

Mesoclimate and microclimate

4.01 Major advances can be expected in knowledge of this field as applied to urban design. Research is now beginning to be applied in depth at the BRS and university research units.

Wind

4.02 Wind is possibly the biggest factor on external comfort conditions in this country. Wind tunnel testing is being used increasingly to determine optimum shapes and sizes for buildings, especially for tall blocks, and for barriers. It is also being used in the design of open air leisure complexes.

Heating and cooling

4.03 Much has already been done in the US on heating of outdoor spaces: pedestrian ways, outdoor entertainment areas, shopping malls and so on. Apart from some pioneer installations for ramps and covered ways little work has been done in this country, probably because of higher power costs. Cooling techniques will be studied further for hot climate situations **28**.

Artificial light (outdoors)

4.04 The effect of artificial light on plants has been noted but no definitive data has yet been evolved; this is another field in which some advances can be expected.

Controlled environment

4.05 All this leads to the ultimate in climate control--the completely controlled environment as suggested by Buckminster Fuller for New York and practised on a smaller scale as in some shopping malls overseas and notably in the Ford Foundation building in Manhattan **27**.

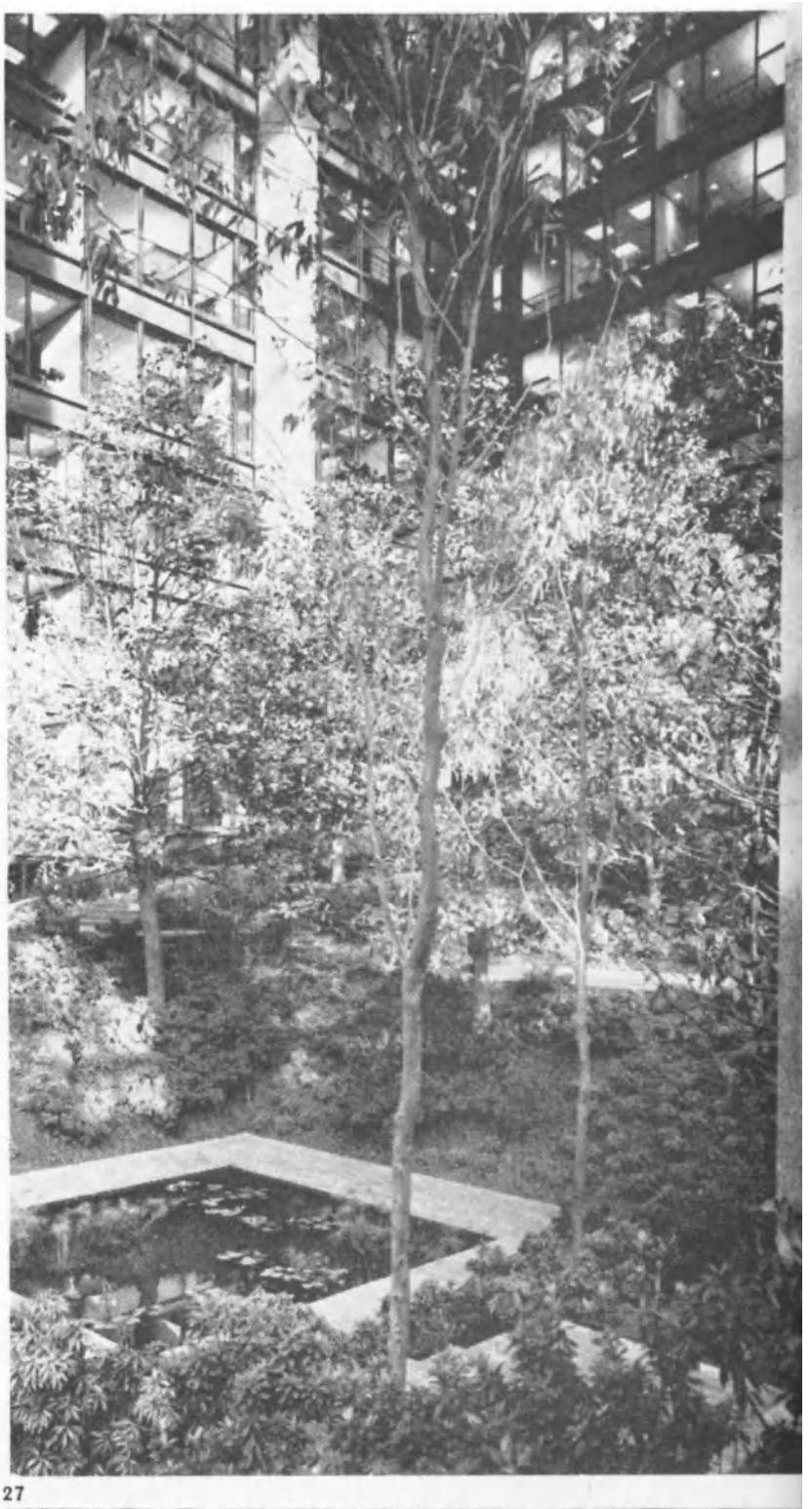
Materials

4.06 There is likely to be far greater usage of pavings with possibly more research into wear and non-slip properties. Substitute materials for plants are also likely.
Inorganic materials are being increasingly used for playing surfaces while some cheaper German derivatives are being imported. Though expensive they may well become more economic with increasing requirements for multi-use of space, and manufacturing costs could drop with increased demands. Grass is an obvious candidate for substitution, taking into account its relatively poor wearing qualities and maintenance requirements in high density usage situations. Considerable advance in grass technology is now taking place and various other ground covers will offer increasing opportunities—especially as mass production techniques take over in nurseries.

4.07 Purpose-bred plants are being increasingly used in other countries for urban situations and further advances will be necessitated by the use of plants in controlled climate zones.

4.08 Containerisation of plants, combined with increasing use of anti-dessicants, are extending planting seasons dramatically. Further developments are inevitable as are the uses of inorganic materials such as glassfibre mulches. More drastically we can expect a greater increase in the science of hydroponics to cut out soil as a growing medium.

4.09 Most plant material industries (growth, supply, planting and design) in this country are still very much in the horse and buggy era and increasing rationalisation and industrialisation will have to accelerate to keep pace with the industrialisation of building processes. Battery production processes, of organic materials with mechanisation of growing and planting processes, are inevitable to meet the growing demands of society.



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27 *Ford Foundation Building, NY (Roche, Dinkeloo & Associates; landscape: Dan Kiley). Completely controlled environment can bring its own problems of pest control. Difficult to determine optimum conditions for men and plant life*

28 *Architects' Consortium offices, Los Angeles (Architects Smith & Williams; landscape architects: Eckbo, Dean & Williams). Expanded metal screening overhead and permeable screens around, provide pleasant comfort conditions for freestanding office units below*

Technical study Landscape 3

Section 1 **Urban landscape review**

Space around buildings

After a brief historical sketch of changing attitudes to space around buildings, this study by HAL MOGGRIDGE *explains the general principles and objectives behind its design, and the factors which influence the design process*

1 Historical survey

1.01 The Greeks regarded space as an infinite medium in which buildings floated. The Acropolis is the most sophisticated example of this concept, which depends on placing each object in a precise sculptural relationship.

1.02 As urban areas enlarged, preventing such exact visual control, spatial effects came to rely on enclosure—usually by buildings and tree masses. From the Middle Ages, townsmen in Europe learned to manipulate external space and to combine it into continuous systems. Space became such a positive concept that Dr Johnson defined it as 'any quantity of place'. Within enclosures, sculptural relationships were formed between objects such as statues, lamp standards and groups of trees.

1.03 Today, solutions dependent on buildings enclosing space are becoming unsatisfactory because they tend to be fragmented by the ease with which structures can rise into the infinity of the sky and by the sweeping scale of modern traffic routes.
Buildings are decreasingly significant beside great elevated motorways, bridges, transport terminals and decks above becoming an increasing part of built-up areas, though such large elements have not been part of the urban scene since the disappearance of town walls.
Possibly existing enclosures will gradually become details within a broader arrangement of space, as—earlier and on a smaller scale—sculptural relationship became incidents in enclosures.

1.04 On its edges, urbanisation itself is becoming fragmented into Nan Fairbrother's 'green urban' category,[1] where buildings can only be placed according to the primitive concepts of ancient Greece and where landscape is intermediate between urban and rural, needing special study.

2 Design philosophy and aims

2.01 At whatever scale development of landscape space is carried out it is essential to think of its *total* organisation. At the largest scale the main concerns are orientation and lucid, readily appreciable relationships between components. At smaller scales, eg enclosed or partly enclosed courtyards, forecourts and so on, bounded on at least one side by the building of which it is an external part, other considerations become equally important. As with interiors, visual characteristics are insufficient to describe exterior space completely: one needs to know the acoustics, temperature, illumination and so on.

2.02 As urban areas are perpetually changing, it is most important to ensure compatibility between what is being done now and what has been done in the past or will be done in the future.

2.03 The purpose of any spatial design technique is to produce places with physical conditions to suit their use, such as comfort, shelter and protection. Essentials are accessibility and easy circulation which do not disrupt other activities. If these simple demands are met, space around buildings will at least 'work' and opportunities may then arise to satisfy the imagination.

2.04 As urban areas are fully occupied by man, all their outdoor space should be usable or should contribute to the usefulness of adjacent spaces. Layout of buildings should be based on the design of the space around them. Though designing buildings from inside outwards makes for better understanding of their interior spaces, it can leave the space *around* them in primitive neglect. Photographs of architecture often show fine buildings in formless wastelands, whereas external space needs to be designed as carefully as interiors.

3 Design influences and constraints

Topography

3.01 Historically, much urban layout has derived from landscape layout. Instances include the effect of Le Nôtre on Paris, St Peter's Square developing from an Italian garden, medieval towns growing from meandering paths between vineyards and fields and from infilled orchards and kitchen gardens.

3.02 London exemplifies an urban layout sympathetic with its topography **1**. Chaotic though it seems in detail, it is magnificently arranged on a grand scale. The city lies near the centre of a large clay basin surrounded by gravelly hills which curve inwards, especially on the south. The most prominent hills, themselves visible as a huge skyline of trees, are capped with open spaces overlooking the spread of the metropolis. The largest of these are Hampstead Heath, Blackheath and Wimbledon Common. Between them lies a string of little parks along the rim, the pivot of which is St Paul's and the heap of towers around it. The suburbs clamber outwards towards the chalk escarpments of the North Downs, the Chilterns and the hills near Royston. Once over the escarpment the capital is left behind with a drama quite disproportionate to the modest height of the hills. On the smaller scale the organisation of the working part of London also sensitively emphasises the topo-

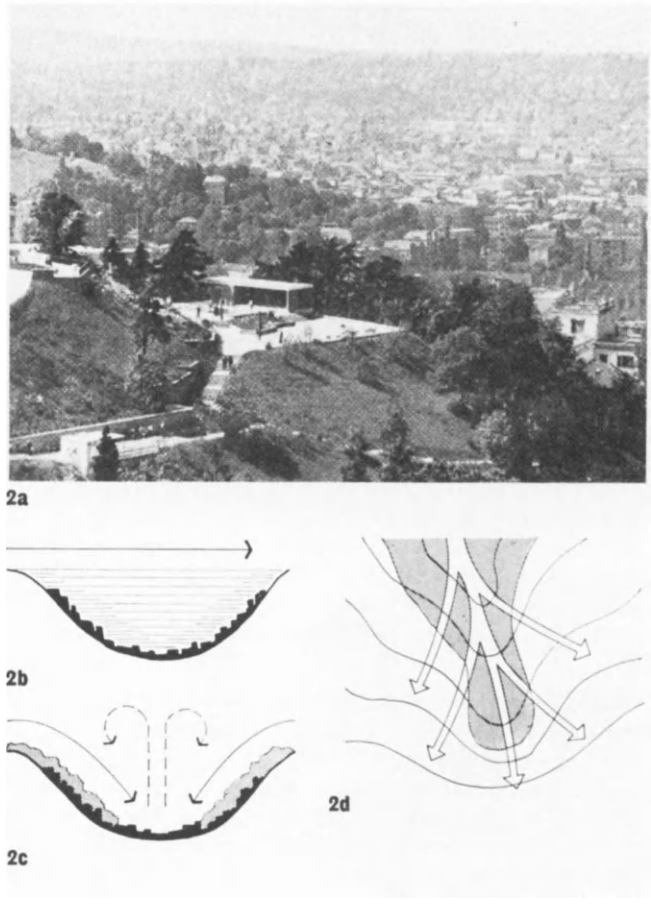
graphical pattern beneath. Each river terrace carries a straight street—the Strand, Piccadilly, Oxford Street: climbing the slopes between them is a series of less direct streets, Charing Cross Road, Regent Street and numerous lesser ways and alleys. Each element has a distinct civic function.

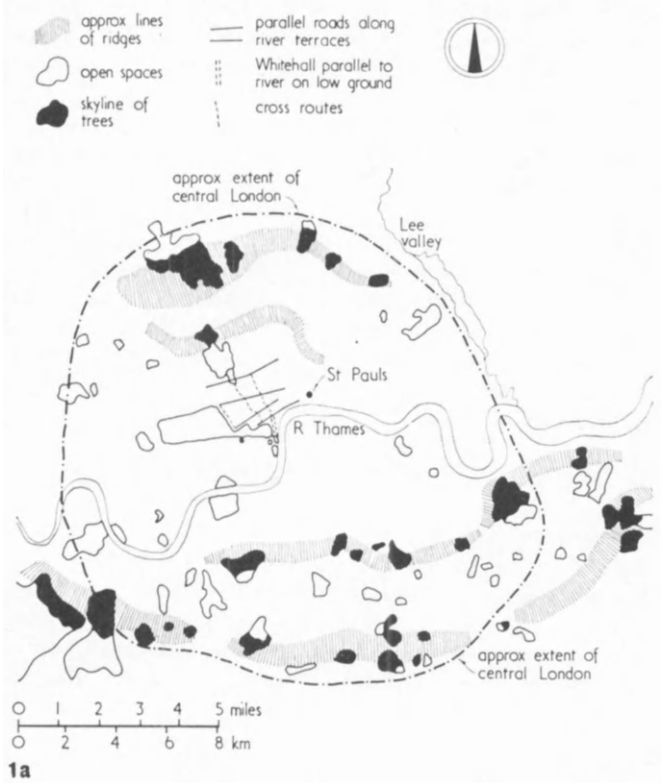
3.03 Sympathy with topography is not the only basis for urban layout. San Francisco is an example of the very opposite. A very strong geometric pattern is placed blindly on a very strong topographical pattern. Where the two conflict—and they often do—the powerful reactions determine the character of the place. On the other hand, there are many cases where a rigid geometric pattern is imposed on a weak, gently undulating topography to the detriment of both.

3.04 Stuttgart, with its green hills descending into the centre of the city on every side, is the prima donna of cities organised by land shape **2** (see also para 3.14).

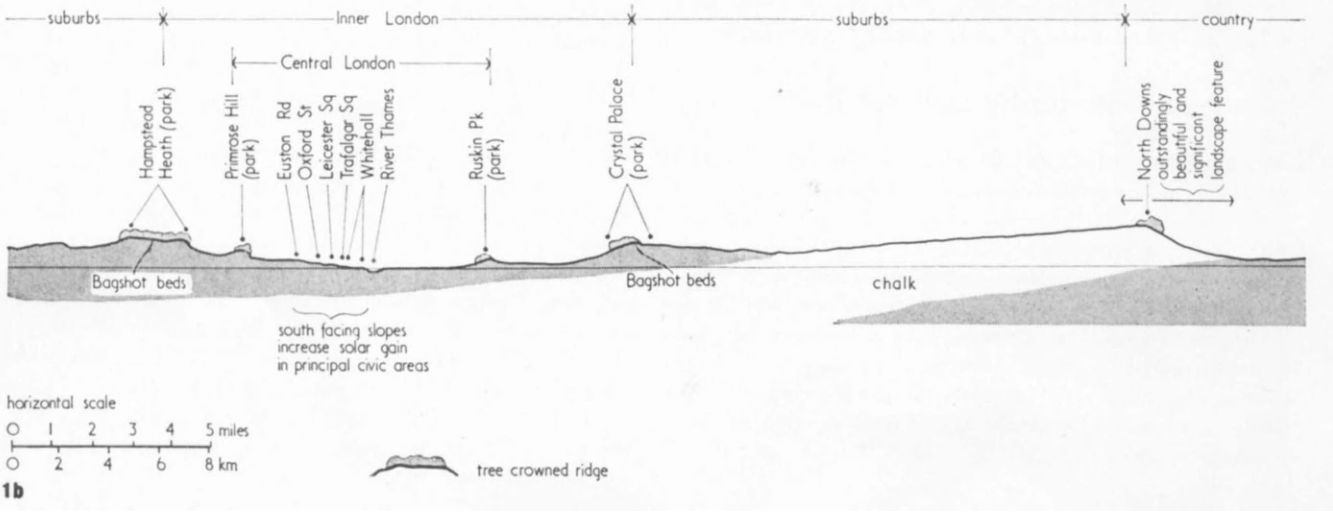
Predominant skyline elements

3.05 In societies where the church is (or was) supreme, a single spire, tower or dome may be the dominant feature. Rome is orientated by a series of such features; domes in the





1 *Topographical organisation of London*
1a *Sketch plan of central area showing surrounding hills with St Paul's acting as pivot to small parks around rim. Note Lee Valley and how correct a long open space in this position is—a present day addition to structure of metropolis.*
1b *Cross section from Hampstead Garden suburb to North Downs, showing relationship between topography and land use. Note principal civic areas on south facing slopes—one reason why the centre of London is not at Greenwich, even though that site was a royal palace and strategically crucial.*
2 *Stuttgart climate control.* **2a** *Green hills descend into centre of city, improving air flow.* **2b** *Natural air flow causes temperature inversion, because cold winds blow across valley and trap hot air within it.* **2c, 2d** *To break this pattern any ridges which protrude into main valley are used as green open space. Cool air is drawn across this land and falls into stuffy basin, tending to improve air flow. Parks are on most difficult terrain but this has provoked exceptionally interesting and unique solution in detail*



low ground and needles at high points. Long vistas and views link them so that location is by reference points as in marine navigation.

3.06 Small towns can be organised around an office tower rising above a group of shops, restaurant and cinema, eg Tapiola. But such a focal element is not effective beyond a certain radius and unless a larger scaled reference pattern is developed as the town grows, the place will lack orientation.

3.07 In Prague, a mass of buildings related to a greater mass of vegetation—the castle standing isolated from other buildings by a long wooded hill—acts as a focal point **3**.

3.08 This illustrates the fact that buildings and vegetation are equally relevant as focal elements, though until recently land form had no built counterpart.

3.09 Large scale civil engineering structures (see para 1.03) may fill this gap because—like topography—they have formal flexibility and freedom of contour. However, if they are to play an important positive part in orientating urban areas, they must be designed as an element in the totality. In some cases their poetic contribution will be the most important.

Open space

3.10 The use of open space as a structuring element is a current design concept. London's West End, with its squares and parks, is a historic example.

Roads

3.11 Road systems do not in themselves structure towns; they only explain how vehicles move from one locality to another. They have the same relationship to the whole as veins in an animal; coherent and comprehensible when isolated and displayed diagrammatically, but giving no indication of the total structure.

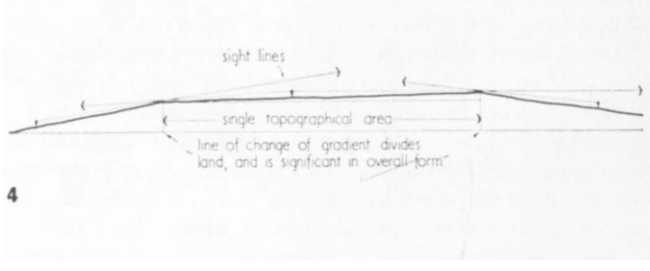
Gradients and contours

3.12 Changes of gradient always act as visual dividing lines as it is not possible to see across the ridges formed by convex curves even when both gradients fall the same way **4**. Whereas building interiors can be regarded as a series of level planes, sometimes connected by sloping planes, the ground is based on the flow of water and consists of a modulated flowing surface. Though it is possible to connect points in such a surface with level lines, as at the front of a terrace or dam, the ground must be conceived completely three dimensionally if it is to be competently handled.

3a

3b

3 *Prague, showing relationship of building mass to vegetation mass.* **3a** *Plan showing Hradcany castle surrounded by tree covered escarpment falling towards river*
3b *Castle and cathedral rising from wooded ridge*
4 *Section showing effect of gradient changes in dividing open spaces*



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3.13 All drawings of space around buildings should include contours and every written document should analyse drainage falls, levels and sight lines. This information is fundamental to the design of spaces around buildings.
As Le Corbusier realised, the tops of buildings are especially important on sloping ground, where they can be part of the main pattern of a place.

Climate

3.14 Weather is the most problematic factor affecting exterior space: its effects can only be modified, not shut out.

3.15 Occasionally climatic features have been made design principles in urban layouts. Examples (probably accidental) are Brighton's long south facing cliff walk, where people sit and read in the sun even in February, and the grid iron of tree lined avenues in Buffalo NY, which create a sheltered fashionable suburb beside the winds of Lake Erie.
After the war Stuttgart arranged its open spaces to increase air circulation. Whereas the terrain formerly trapped hot air, parks are now placed on spurs running into the city's sultry basin. Air is cooled over the vegetation, drops into certain prescribed channels (where zoning regulations prohibit building) and passes down the slopes into the city as cooling winds **2**.

Macroclimate, mesoclimate and microclimate

3.16 At a geographically regional scale climatic features are called *macroclimate* ; at the general spatial scale *mesoclimate*, and those at a minute scale—eg against a wall or leaf—*microclimate*, though this term is often loosely used to include mesoclimate.

Britain's climate

3.17 The great climatic variation in the British Isles is detailed in AJ Handbook Building environment[2] and in atlases such as the *Meteorological Atlas of the British Isles*[3] For instance one may compare four new communities situated on the January isotherms of 4°C (see table 1).

Table 1 Comparison of four new communities on the January isotherms of 4°C

Town	Average July temperature	Annual rainfall	Town with comparable rainfall
Harlow (SE England)	17°C	25in (635 mm)	Haifa
Runcorn (NW England)	16°C	40in (1016 mm)	Florence
Cumbernauld (SW Scotland)	15°C	Nearly 60in (1524 mm)	Saigon
Fort William (NW Scotland)	14°C	Well over 80in (2032 mm)	Singapore

3.18 Despite these marked differences, much more is written and thought about types of layout and organisation of space which is believed to be common between these places than about how to modify their characteristics in sympathy with their climates.

Extremes of climate can also be compared: for instance, Penzance, with a 45°F (7°C) average winter temperature and a nine month growing season, and Inverness, with a 39°F (3·8°C) average winter temperature and a five to six month growing season.

3.19 In spite of such wide variations, most of the UK is in a climatically marginal position: ie on most days spaces around buildings are enjoyable where the conditions causing mesoclimate are sympathetic, but where these are unfavourable, the spaces usually become intolerable. It therefore seems that climatic modification should be a cornerstone of design ideology in the UK.

Shelter and wind control

3.20 Shelter is a prime requirement, especially from wind. Though temperatures in Britain are rarely low, wind-chill (moving air rapidly removing heat from the body surface) makes weather seem cold. Shelter from rain is often less important as rain is usually intermittent and light, though our average of above 50in (1270 mm) results in many wet hours. However, need for shelter conflicts with that for exposure to sunlight, particularly in winter when the sun is very low. The balance of these needs varies according to the region's megaclimate.

3.21 As wind control is important, an understanding of wind behaviour is necessary. Wind source greatly influences its hostility. As east and north winds are far colder and harsher than more frequent south-west winds, perhaps their exclusion will prove more essential.

In urban areas buildings often divert wind direction. A north wind striking a high building may be funnelled along a street and be diverted to blow from the south.

Built shelter

3.22 There are two main ways of providing wind shelter. Long low structures such as high walls or terraces of buildings provide sheltered areas two to three times their height on the windward side and about ten times their height on the leeward side. However, the ends of such structures are particularly turbulent, wind reducing towards the centre, and of course if wind is along their length, no shelter is provided and tunnelling may occur. Solid structures always induce turbulence and openings in solid protections act like weirs. Water, wind and frost seem to behave in a very similar way against solid structures.

5 *Eltville, Rhineside waterfront—clipped lime provide shade against strong summer sun (in front). Combination of trees and buildings behind, shelter interior of town from cold winter winds blowing off Alps across Rhine valley*

3.23 A form has been used throughout maritime European urban culture, in collegiate quadrangles, in Georgian cities or kitchen gardens, where the relationship between height of enclosing structure and width of space is about 1:10. This gives reasonable wind shelter, and avoids gross overshadowing occurring in domestic courtyards. The most direct solution to the shelter problem is the medieval cloister.

Planted shelter

3.24 Whereas Oxford and Cambridge work splendidly for pedestrians, motor traffic has to be kept to the rims of the enclosures, lest with the car the wind swirls in. Belts of trees are the best wind alleviating element yet discovered. They liberate designers from the somewhat rigid pattern of enclosure by buildings. Their open texture avoids turbulence and gives twice the span of shelter provided by solid screens. A shelter belt 16 m high gives some shelter across 150 m in its lee without tunnelling effects.

3.25 Shelter from trees and structures can be very effectively combined to help to overcome wind exposure **5**. But the decision to use trees requires allocating space at the conceptual stage. The plane trees along the Thames by the Houses of Parliament take up a strip of land as wide as Millbank, but they help to counteract wind flows induced by such an irregular group of structures beside a river. Trees need space in plan and section: they are living organisms and must have properly designed conditions.

Sunlight: glare, shade and thermal effects

3.26 Sunlight requires wide horizontal spaces in winter, particularly in SE and SW alignments. The usefulness of spaces around buildings is determined by their orientation and by their shape in relation to the height of surrounding structures. Trafalgar Square, with all its falling ground to the south, is an ideal open space **8**. Deciduous trees are useful over hard surfaces. During summer sun they provide shaded cooler areas free of glare, and in winter they allow sunlight to filter across a wide area. Vegetation may also be used to reflect sunlight against structures in shadow.

6

6 *Monadnock building from Federal Centre, Chicago. Brick building radiates heat at night. Mies' glass façade, magnificent from within, is less effective climatically outside*
7 *St James's Park. People in the lunch hour enjoying narrow microclimate induced by grass cooling air in contrast with sun*
8 *Cross-section (north-south) through Trafalgar Square, London. High buildings on the south side of square would largely destroy usefulness of space*

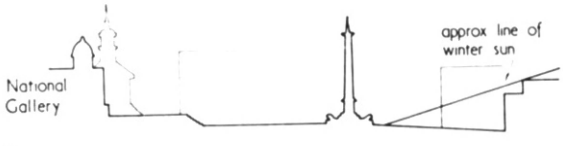
3.27 In urban areas, the sun provides not only direct heat but radiation and heat storage. Earth-based materials are most effective radiators. South-west facing corners enclosed by masonry capture sunshine, store it and radiate it back into a sheltered space, the process continuing into the night **6**. Radiation from the ground is governed by the material of the surface. Grass is so delightful in summer because it creates a cool microclimate a few millimetres high in contrast to the megaclimate of hot sunshine **7**.

Noise

3.28 Vegetation is useful in combating noise and air pollution. On Earth as a whole, it prevents life from being rapidly extinguished in a world of carbon dioxide. In towns, foliage has little measurable oxygenating effect but one can detect the slight freshness of air over vegetation, always emphasised by a slightly lower temperature.

3.29 There are conflicting claims about tree and shrub barriers as effective deadeners of noise. Theoretically they can have little effect in diminishing volume, but they do make practical use of the space needed between noise source and hearer. The fact that the source is visually screened is said to lessen its offensiveness. However, there is evidence that grass and thick herbaceous ground cover attenuate sound intensity by sound absorption, whereas water and hard pavings do not, and may even increase the apparent loudness by reflection.

3.30 Background noise could perhaps be introduced to make traffic noise acceptable. Trees with fluttering leaves, such as poplars, produce several decibels in wind. Splashing water might be more effective. Trafalgar Square with its starlings and fountains is again an example **8**.



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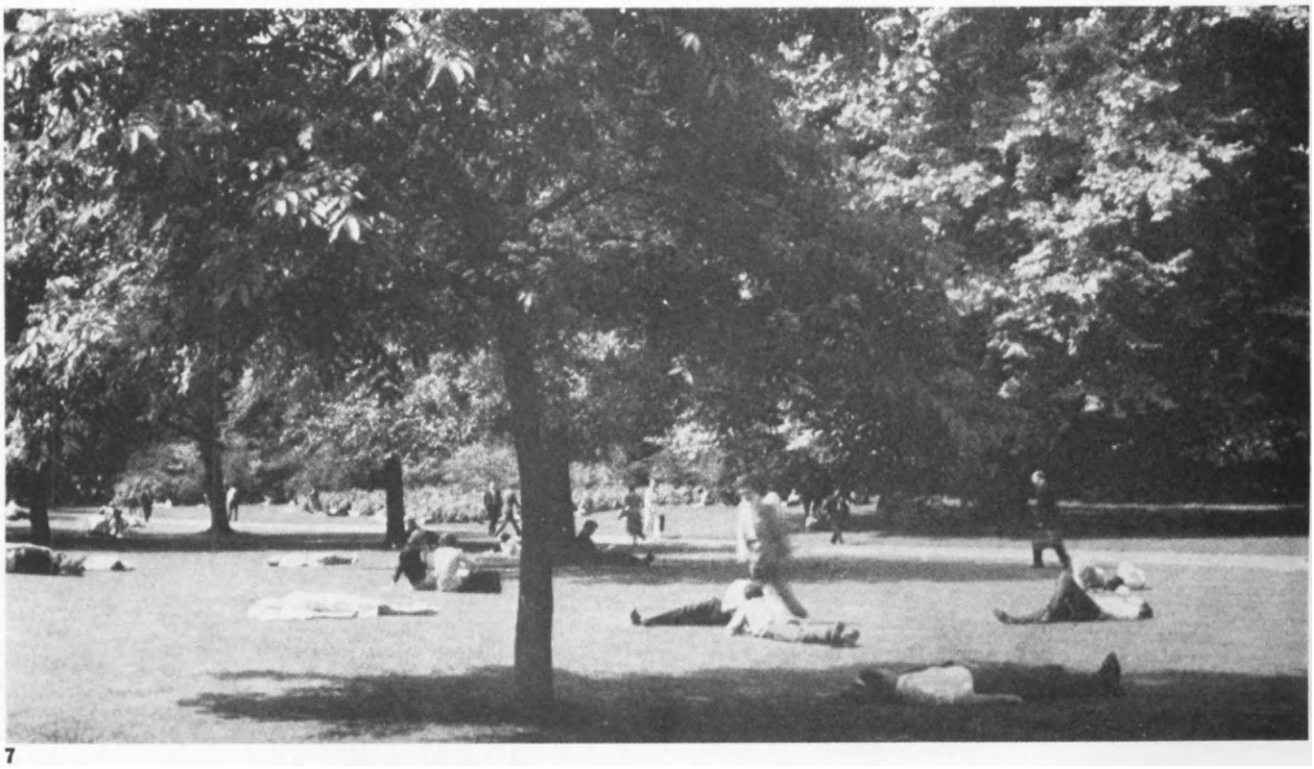

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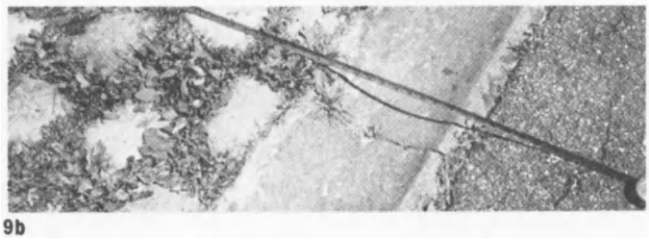

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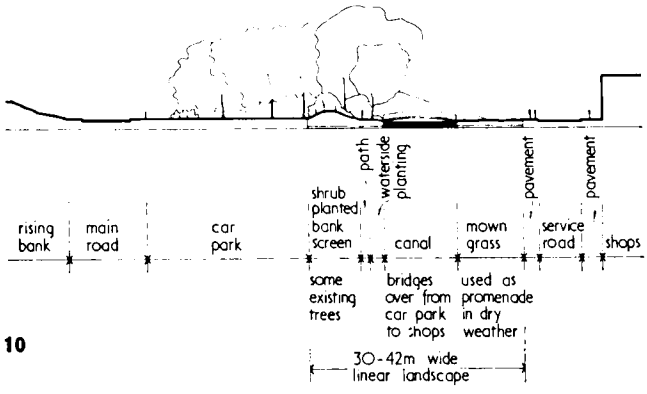
9 *Killesburg car park, Stuttgart.* **a** *General view and* **b** *detail. Note preference for shaded position and actual character of 'grass' ie mainly rank weeds. This type of treatment could not withstand heavy use every day but heavy use every weekend would not damage it*

10 *Hemel Water garden, Hemel Hempstead, cross section. Although there is only a narrow space between car park and shops each space has ample room for its function*

11 *Hemel Water garden. Screening of cars from pedestrians*



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Action, storage and movement

3.31 Comfortable conditions alone do not make outdoor spaces satisfactory: they must be *planned* to work well. Once they work they attract activities and access is required. But it is essential not to regard roads and paths as the dominant component of space between buildings. Spaces between buildings function very similarly to theatre foyers: they are for occupation and circulation. To design them as corridors is to kill them.

3.32 Buildings are very specific in their use and this tends to classify and sift users. Some are for exchanging goods, some for exchanging ideas and some for administering these exchanges. Others house people, buses, books and so on. People stream out from their entrances and intermingle in the space between buildings. Places for lingering and mixing are essential and the presence of cafés, leaves, birds, the scents of markets, all help to make them more inviting and work more efficiently.

3.33 Storage is as important as action. Sometimes storage points are interchanges between two scales of movement, eg car parks. Other types are for rubbish and waste or for storing 'urban freshness' in the form of plant and bird life. These uses are essential to the function of urban areas, even though they appear unused or 'ripe for development'.

3.34 Car parks are often, in essence, pieces of derelict land suitable for leaving temporarily unused objects. Urban freshness arises from land which is alive, but which is derelict from the point of view of urban use. There seems no reason why by storing cars in urban nature conservation areas, these two uses should not be combined **9**.

3.35 Effective urban spaces are very often small. Modern towns tend to have unusable space: too much to maintain and too much to use effectively; not truly space around buildings but rather 'space *around* space around buildings'. The cross section through Hemel Water gardens **10** shows the narrow distance between car park and shops. Yet each part is fully used and there is ample room for each function. Cars are screened behind an embankment completely

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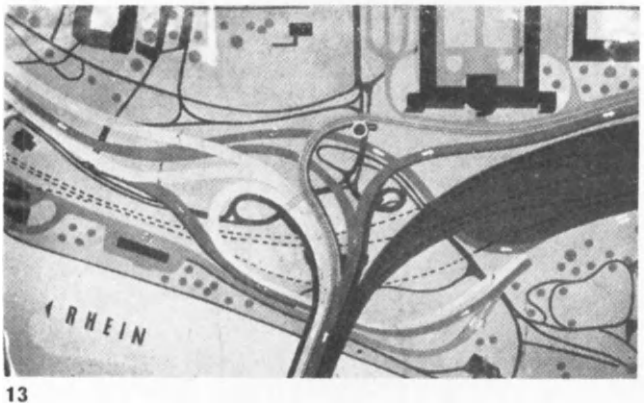

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covered with vegetation, creating a place with an air of mystery **11**. Enough horizontal space is left for bank and planting. A narrower space, ample for promenading, runs along the waterside. It is long in one direction and there are long views across the bank at chosen points.

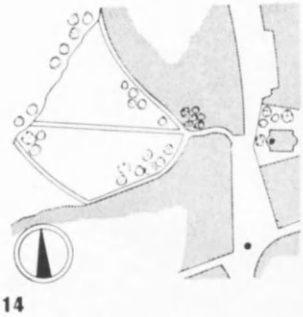
3.36 When a road is considered as a route through a space in use, there is more hope of a satisfactory design, for then there must be a more controlled layout and not a jumble of useless triangles scattered through the urban area. A road's alignment is only one of several factors. Indeed its proportions can be modulated according to the requirements of traffic density, parking, passing, turning and service to buildings. The flyover in the centre of Dusseldorf **12** demonstrates how every space is treated as valuable.

3.37 Pedestrian movement is just as important as vehicular movement. Two attitudes tend to predominate in this country. One completely ignores pedestrian needs until all other routes have been laid out, then a tangled route is threaded through (usually including several right angle turns) with dark stinking flights of steps and unsavoury underground passages and a plethora of railings. The second attitude operates on spaces. These are criss-crossed by desire lines, which eliminate the usefulness of the area.

3.38 Control of pedestrian movement needs as much care as that of vehicles, but different criteria **13**. People are very mobile, they can accelerate rapidly and turn suddenly, but are prepared to take the most effortless route regardless of safety —though willing to be diverted twice the distance for a little stimulation.
Therefore movement of people is best achieved by sustaining interest and suspense, and setting buildings at varied angles and relationships to each other. Routes should pass around the edge of activity areas and by disposing obstructions and objects of interest, a longer route can be made to appear the most natural. The faster people are moving, the less space they need. A narrow alley is enough to guide a crowd into a market place **14**. But leisurely movement needs much more space – friends walk five abreast and mothers let the children out of the pram to dawdle on both sides.

12 *Dusseldorf Autohochstrasse* **12a** *General view of structure*
12b *Flyover descends to ground level across right of picture, with planting screen*
13 *Plan of Mannheim Bridgehead showing how footpaths are a system forming part of overall layout plan. At no point is it necessary for a pedestrian or cyclist to go up and then down again. Curved ramps rise up to level of footpath over bridge*

14 *Centre of Banbury showing wide space in park converging to narrow alley which slips into market square. Larger spaces have functions other than movement*
15 *Pedestrian underpass, Dusseldorf. Ramp is very gentle and bridge is as wide as path. On one side ground hardly rises after underpass*



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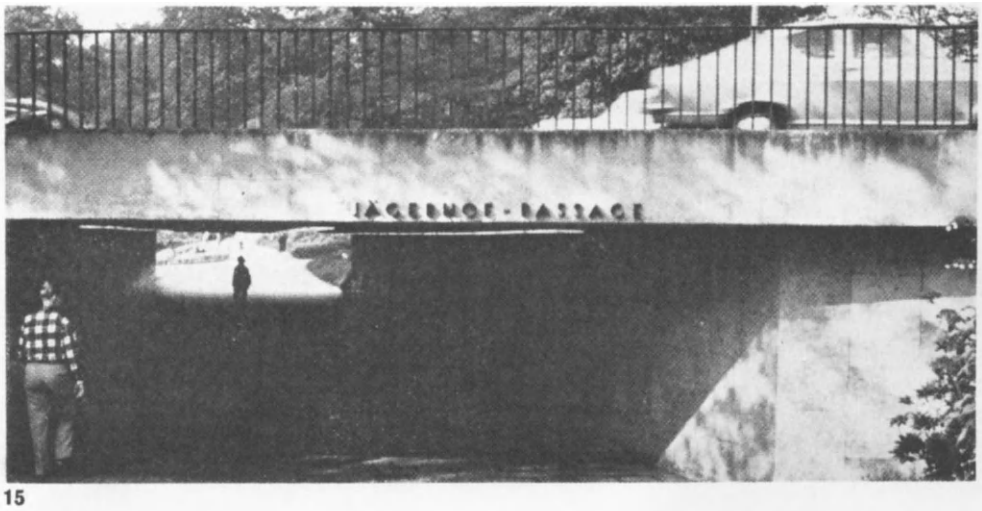

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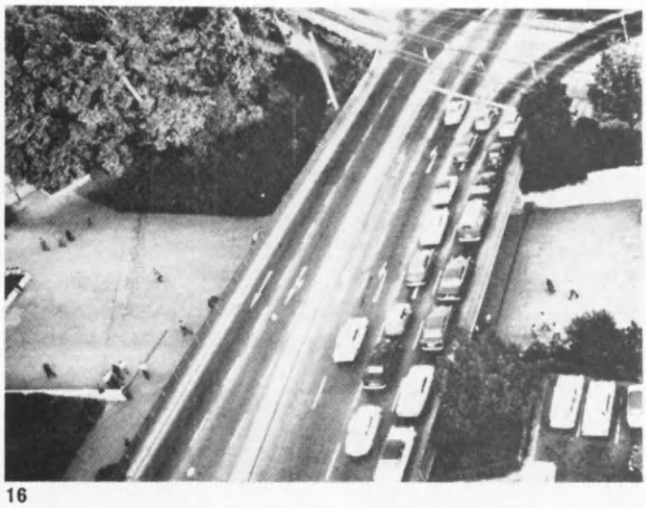

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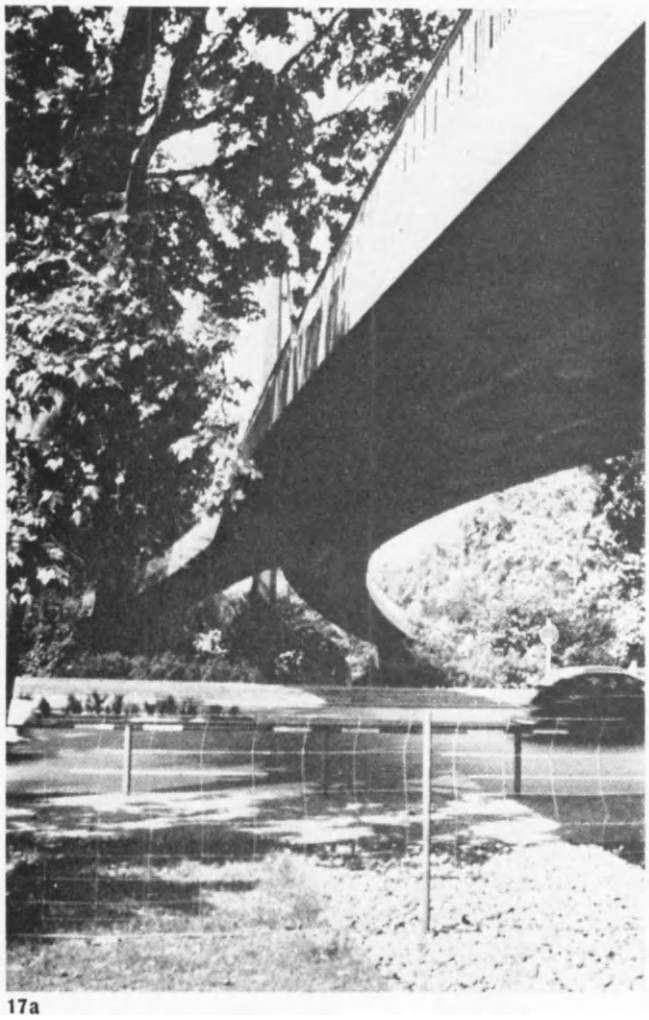

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16 *Pedestrian underpass, Stuttgart centre. Ramps here are steep and occur on both sides of road. To alleviate this, footpath grows wider as it falls and underpass is at the widest point*
17 *Footbridge over road, Schlossgarten, Stuttgart (city centre).* **17a** *Footbridge rises very slowly over road and branches. Space between rising of bridge and road is filled with vegetation shutting off roadway.* **17b** *Method of lighting handrail which avoids mass of lamp standards*
18 *Cumbernauld Seafar. Great skill has been shown in design of this area, but houses in distance are in another housing area. Retaining wall holds up a 'between area' which breaks continuous flow of pedestrian system. Steps lead up to roadway beyond which another sort of footpath starts in another position. Enclosure and shelter of each housing area is dissolved in space where two areas meet*

3.39 Pedestrian routes over or under roadways are a difficult problem. To prevent people braving traffic, easy flow of space to crossings is essential, with gentle ramps and wide underpasses to create confidence. The essence of pedestrian layouts is to understand that the mind has to be won over **15**, **16**, **17**.

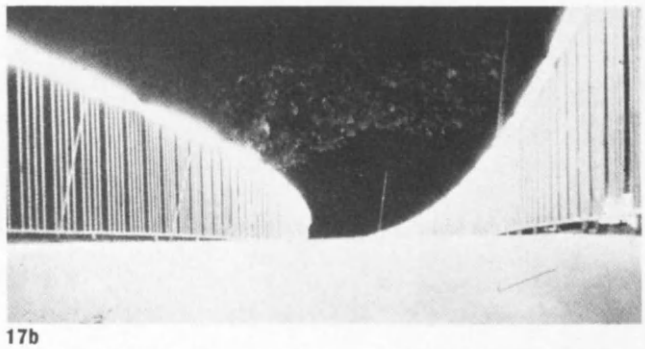
Inadequacies of present technique

3.40 As urban space structure slackens (para 1.03) administrative problems arise, leading to slack design. Town mapping techniques are very crude and usually do not show changes of level or continuity of spaces which are small in relation to the total land area.

3.41 Plans showing different land uses with different colour or texture draw maximum attention to problems and interest at boundaries. For instance, at the junction of open land and woodland, the border strip is ecologically the richest. Yet the administrative machine which executes these plans gives least attention to such areas, usually ignoring them like the unused land between east and west Europe. Even at the smallest scale, units are studied in isolation rather than as part of their surroundings **18**. Building elevations do not show their neighbours and housing areas stop arbitrarily. Such techniques actually prevent coherent design of spaces around buildings. Perhaps inadequacies of existing practice are caused by doubt about the aims of organising urban space.

References

1 FAIRBROTHER, N. New lives, new landscapes, London, 1969, Architectural Press, £3.75 [08]
2 Handbook of building environment Architects' Journal Information Library (AJ 2.10.68–13.8.69) see especially section 1 Climate and topography (AJ 2.10.68 and 9.10.68)
3 METEOROLOGICAL OFFICE MO 488 Climatological atlas of the British Isles, 1952, HMSO [(E7) SfB (1961): Aa9] o/p



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Technical study Landscape 4

Section 1 **Urban landscape review**

Urban landscape review : Housing

MICHAEL BROWN *and* A. E. J. MORRIS *argue for a new approach to housing landscape, for more involvement by the people and more imaginative administration and participation by public bodies.*
*They also urge that present use of resources should be reassessed and money found to pay for decent settings for current housing, to create and maintain a high quality outdoor environment. Skill in planning land uses and designing the buildings should be followed up by applying an equally devoted sense of design craftsmanship to the spaces around the dwellings. The contemporary town is visualised as analogous to a biological organism and it is urged that the human habitat should be seen as part of a total ecosystem**

1 Beyond the threshold . . . ?

In one way or another almost everyone has a stake in housing, for unlike most other urban land uses, it concerns us all. Although housing occupies by far the greatest amount of our urban land, exceeded, as a proportion of the whole, only by public open space in some of the more favoured urban areas, the individual home constitutes the smallest unit in the urban fabric. In this contrast in size and quantity there is a direct ecological analogy—in the vital importance of the healthy functioning of the component cells of an organism.
There is a second marked contrast between the domestic privacy of the individual and family units and the communal activities of the social group in which they are located. There is therefore a dual basis to urban life with, for most people, the source of their social activity founded in the small intimate group—usually that of the family. Many of our most pressing social problems appear to be due to a failure of this interrelationship between individuals and society to function properly.

2 Relevance of landscape to housing

2.01 Because the landscape of housing forms the boundary between individual domestic privacy and the spatial continuum of communal activity, its importance should be self-evident. However, even among architects, landscaping in *any* situation is too often regarded as an inessential extra, dispensed by green-fingered specialists murmuring Latin plant names and frequently called in only after the essential design decisions have been made. And even when its cost-effectiveness is proved, landscape is one of the first victims of pressure to economise.
Architects lack a fundamental study of the function of landscape. Perhaps this is the principal reason why, with disturbingly few exceptions, they rarely achieve even an adequate standard of landscape in housing schemes.

2.02 Despite the vast sums spent on supposedly adequate new housing since the war, the new residential environment has not only failed to cure the social ills, but—it can be argued—has engendered them. What has gone wrong?
'Today modern cities and other man-made elements are becoming shapeless for lack of an informing principle. But no such principle will be forthcoming, and no action will be taken until the processes of design are themselves informed and controlled by the recognition of new realities . . . any further attempt to design in the conventional way, without a careful fresh look at the problem, and the help of some defensible basic principle, will do little more than add another set of shapes to the growing catalogue of architectural millinery.'[1]

3 The town as an organism

3.01 Perhaps it is here then that this biological analogy will help us, where the town is compared with a biological organism, with urban society consisting of interrelated living systems. Ecologically, therefore, the human habitat may be seen as part of a total ecosystem*, with each dwelling unit being the basic cell.
In considering problems of mass housing this analogy is the basis of the ideas which Habraken[3] had developed, for he has concluded that the traditional approach to housing is, by its nature, unable to work as individual dwellings cannot change: as 'cells', therefore, they cannot rejuvenate themselves in response to social needs. He stresses that 'cells must be small enough to correspond to the components of

*Abbreviation for ecological system.

society itself' and that 'a truly modern town should have an infinitely complicated structure built up of a much larger number of cells than an old town'.

3.02 Through excessively enlarged scale in their rigidly linked arrangements of individual cells, contemporary towns lack the flexibility and vitality of viable ecosystems, which characteristically tend to increase their stability under changed conditions (see para 3.03). The resultant coarsened urban structure **1** and **2** bears the characteristics of a *primitive* organism instead of the more desirably complex and multi-cellular nature of those in a more advanced stage of evolution.

1 *Coarsened urban structure—unlikely to be capable of responding to changing needs. Brandon Development Lambeth:* LCC *Architects Department*
2 *A more complex, less primitive redevelopment scheme (see also* **6**) *Lillington Street, London* SW1 *(architects: Darbourne & Darke)*

Stability increased by differentiation

3.03 A healthy ecosystem evolves by a process of differentiation. This increases its complexity, which in turn increases its stability in the face of change. Through their increased specialisation and proliferation, basic parts become individually less essential to the survival of the ecosystem as a whole. If a single part is destroyed or grows too big, being one of many, the loss or damage to the system is proportionately small. On the other hand, when the complexity of an ecosystem is reduced to a primitive and undifferentiated level, its lack of complexity renders it more readily susceptible to disturbance, or even disaster, through relatively minor changes or accidents. Being a simpler organism, it can support much less life and will be even more vulnerable to further changes. This is illustrated by the extent of deterioration in urban areas which results from large-scale redevelopment, and the dehumanising, polluting effect on adjacent development of massive urban motorway constructions as they sear, primitive and unsubtle, through the small-scale texture of an older urban fabric.

3.04 For those to whom the narrow so-called 'organic' view of architecture has seemed inadequate or even half-baked,

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it may well be that readers should be reminded that this view underlay the fundamentally biological concepts in the ideas of Patrick Geddes, himself a biologist.
We should be warned by the failure in planning to consider this approach, for just as in the years after Geddes's prophetic work, responsibility for town planning was withdrawn as an exclusively architect-oriented domain, history could now well repeat itself in the withdrawal from the architect of responsibility for the details of urban housing.

Urban residential renewal

3.05 The ecological analogy seems crucial—perhaps vital—to our problem. As the social fabric of family dwelling units and community are constantly changing, towns must be able to change and renew themselves, old and new structure interweaving as building and rebuilding occur. Yet the system as a whole remains stable.
The cycle of decline, decay and redevelopment of the urban matrix may be thought of as a form of energy conversion such as natural processes involve in a recycling of their energy. They minimise reusable waste by adapting from one system to another the waste products of the former, these in turn become the raw material for the next.
This should be the guiding principle for urban residential renewal; reuse of existing social and physical fabric—through conservation and rehabilitation—being added to new development as interdependent parts of the same system **4**. As Habraken remarks 'there is a need for housing which can become old without being outdated and to remain modern without losing its history'.

3.06 All too often, the linking of modest small-scale infill schemes to rehabilitation areas is inhibited by administra-

3 *Philadelphia—old and new buildings interwoven to create a new physical and social fabric*
4 *Philadelphia—old buildings, new landscape—renewed life*
5 *Wyatt Close, Birmingham (City architect: J. A. Maudsley, chief landscape architect: G. W. Hyden)—modest, unpretentious buildings enhanced by carefully preserved trees*
6 *Lillington Street, London* SW1*—a positive sense of place, achieved by careful use of simple landscape elements*
7 *Lafayette Park, Detroit (architect: Mies van der Rohe)—meticulous attention to architectural detail in an environmental vacuum*

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tive complexity. In the short term, costs may seem relatively higher, but the social benefit of reduced disturbance and enriched urban character seem irrefutable. The buildings' scale and fabric—and frequently existing trees and other natural features—can be readymade assets **5** (see also 5.01 and 5.02).

4 Essentials of housing landscape

4.01 People need to be able to take the opportunity of making decisions about matters that are of importance to them. If they are deprived in this respect, by having choice thrust upon them, it can be the cause of a feeling of helplessness and frequently resentment also. There is good reason to believe that deprivation can affect both adults and children and can contribute to ill-health and certainly to vandalism and delinquency. There need to be positive elements in the environment which will exist to symbolise the relationship between people and place. The places where people live should be capable of acquiring a sense of identity and relatedness so that they will have meaning for them.

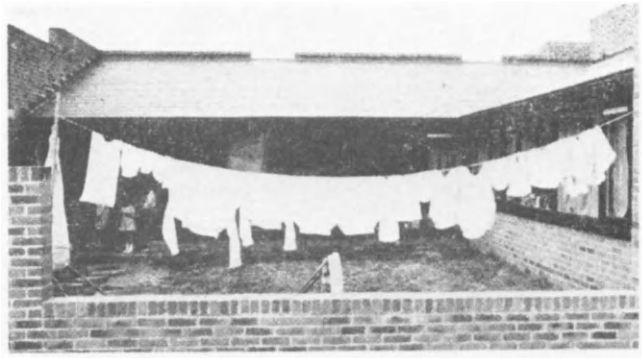
4.02 How far should the influence of the designer extend? How can the boundaries of responsibility be defined **8** and what new arrangements for ownership and management are needed, to achieve an effective and satisfying involvement of the people? These are of crucial importance to housing landscape **9**. At present the most potent factors influencing the standard and quality of that landscape are mainly *outside* the family's responsibility **10**.

4.03 Communal space within housing layouts must be designed to withstand wear appropriate to its density. Housing landscape is too vulnerable to survive without adequate care, even when skilfully laid out for intensive use. Risk of damage is often too high to encourage good layout. One can sympathise with public officials who have to assume responsibility for care on behalf of their elected—or appointed—bosses, when they seem excessively to limit the designer. They are, after all, indirect agents for those whose homes they sincerely strive to create. Perhaps this is the essence of the matter, for the indirect line of responsibility creates the 'us and them' situation; detaching those who live there from responsibility for their surroundings **11**.

4.04 There are, then, limits to the extent that social factors can be influenced by manipulating physical arrangements to create a sense of place. The most fruitful social conditions cannot necessarily be created, influenced or changed without a further stimulus. Perhaps the most potent stimulus, as yet unrealised, is the marshalling of people's energies and enthusiasm to improve their situation *by their own initiative and effort.*

The idea of participation in planning is now taking root but it needs to extend beyond planning into physical reality in a way which more directly affects people's lives. Will this increased freedom of choice and action affect the role of the professional designer? Could it prejudice the achievement of high-quality landscape in public or semi-public spaces? Indeed, could it conflict fundamentally with the unifying objectives of design?

There is no reason why a well designed, well cared for public and semi-public outer environment should not be a valuable and often necessary adjunct to increased private freedom. Modifying the boundaries of private and public responsibilities and ownership **13** could increase involvement and diminish the indifference that so often leads to dereliction of land around housing.



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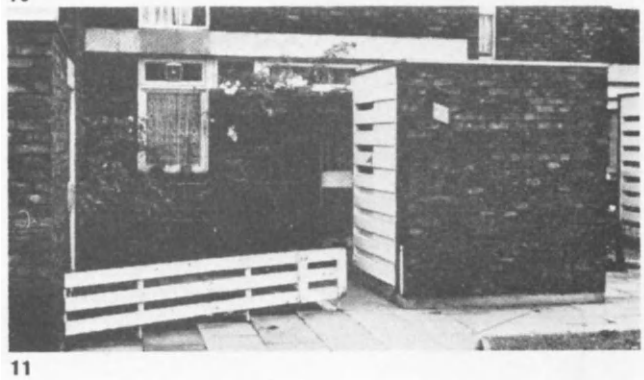

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8 *Undesirable visual sharing ('negative overlap') between private and communal domains*
9 *Failure to define boundaries of responsibility, making private disorder public*
10 *Lack of adequate management provision resulting in communal dereliction outside individual family responsibility*
11 *Individual participation within simplified discipline of new architectural form*

Conflicts on the edges

4.05 Designing landscape for housing is inevitably a process of compromise, sometimes between apparently irreconcilable essentials. The conflicts of these are most frequently

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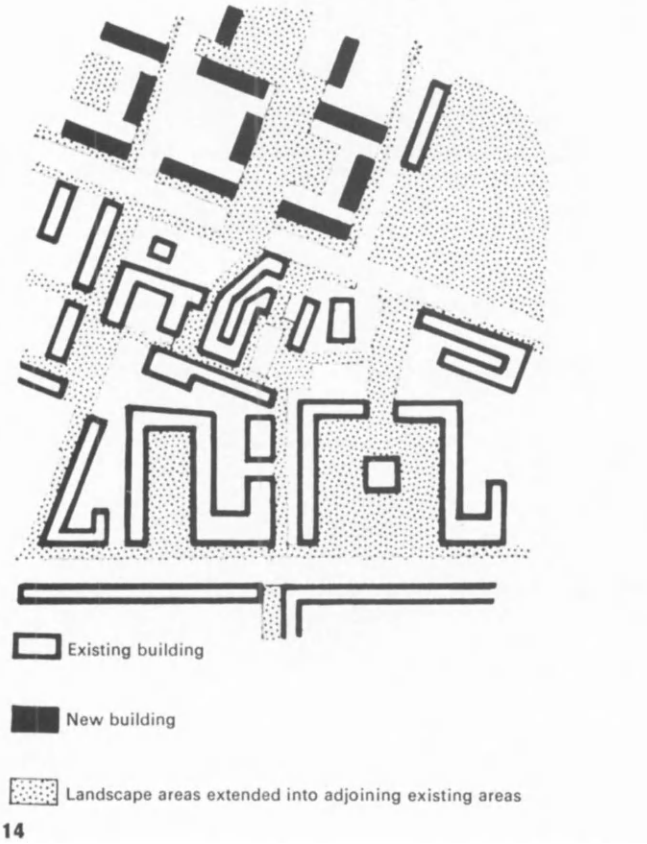

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12 *Natural expression of individuality beyond the threshold of the dwelling effectively extends residents' zone of responsibilities*
13 *Modified boundaries of private and communal responsibilities as basis of rehabilitation project (Birmingham city architect's department)*
14 *New landscape shown taken out beyond boundaries of redevelopment area to promote rehabilitation and selective renewal*

and forcibly experienced on their edges – for these are the lines along which differences of use and ownership occur.
Well cared for private land that is visible from the public realm is an asset, and vice versa, but this is not so where land in one or other of these realms is uncared for due to a failure in identifying ownership, of neglect in a discharge of responsibility for care, or a basic incompatibility of adjacent uses.
The junction of concurrent edges needs to be made into a positive asset, for this is precisely where deterioration most readily sets in.
The problem of the junction is indeed one common to building also; identifying and dealing with the edge condition seems similarly to be the crux of the problem of urban landscape—it certainly is central to that of housing. For this reason the physical form, function and identification of the edge conditions of spaces have been regarded as the best basis of the approach to the analysis of external spaces which is adopted in information sheet 25, page 155.

New forms of housing and layout

4.06 If the problems of financing management and maintenance can be overcome, new methods of communal layouts could be devised. Some of the many possibilities may follow naturally from current work, for example at Milton Keynes, where the ideas of freedom of choice and flexibility which underlie the philosophy of the new city should be able to lead to different forms of house ownership and of construction methods providing this future flexibility, perhaps in the form of do-it-yourself construction. The latter in particular would pose entirely new problems that might greatly benefit the landscape, especially in the immediate area of the dwellings.

4.07 Unless the landscape implications are fully understood and realistically tackled there is a risk of visual and physical disorder; at its worst, a junkyard of partially developed land and unfinished buildings. Lack of an appropriate system of land husbandry could result in large areas of uncared for space—neither specifically public nor private—used or misused by everybody and with no clearly defined responsibilities for ownership or upkeep.

Existing housing layouts and rehabilitation

4.08 Similar measures could be applied to vast areas of existing towns where ambiguous boundaries between private and public ownerships and responsibilities discourage a well cared for environment. Thousands of miles of Britain's streets are lined with dreary, unending rows of terraces or dotted with semi-detached houses, which are featureless, treeless and depressing. Transformation of these drab wastelands must start with administrative arrangements, ownership agreements, management costs and firmly defined responsibilities. A re-examination of these matters could well lead to adjustment of highway and path widths, stopping roads, and providing communal open spaces perhaps by absorbing front gardens. Residents' and other management groups could be established.

4.09 An AJ article on rehabilitation[3] stressed '. . . the need to balance internal and external amenities . . .' for there is '. . . little point in modernising a home if outside the front door there is only roaring traffic, a mile long walk to a bus stop and nowhere for the children to play. . . .'

4.10 Quite modest changes can have great value: selective demolition and clearance, adjusting garden sizes (both front and back) and moving boundaries to improve public

open space provision. Even the reuse or sale of underused backland for new infill housing can benefit the environment if new development is skilfully done. Sale of council houses can be accompanied by obligations on new owners to carry out, or at least contribute to, environmental improvement.

4.11 At present, when dereliction, depression and formlessness become intolerable, people either stop caring—leading to neglect, vandalism and delinquency—or, to quote Habraken, if they have retained the ability to care, they move on like nomads, instead of staying put and improving their habitat. It is like a game of musical chairs in which people must adapt to what is offered in order to meet their real social needs instead of themselves initiating change.

4.12 Continuity of existing communities in new housing is important, whether rehousing is partial or total. On the Winstanley Road, Battersea, site where a new housing estate was introduced, an unusually low cost for making good after vandalism to the landscape is credited largely to the considerable housing management skill by which people already living in the area were rehoused quickly with the minimum of disturbance. Residents sensed the social continuity and responded by feeling involved in the new estate. In this phased housing scheme, great care was taken to ensure that the landscape and buildings were finished at the same time so that residents lived in a completed environment from the start. Integration of existing older dwellings with new development makes for physical and social continuity. It can also enable private initiatives—with or without financial assistance—to contribute to varied forms of ownership.

4.13 New development should allow changing the status of existing roads and rights of way to produce a new and better integrated system of movement—eg by culs-de-sac, narrowing roads and so on. Division of responsibility for cost and maintenance is too often permitted to become a stumbling block. New tree planting beyond development area limits could support new development and act as an arm of conservation **14, 15**.

4.14 An integrated arrangement of this sort will enable changes in house type and ownership to occur more readily: this could greatly increase flexibility of choice in response to change in family needs as well as a family's varying capacity to contribute financially at different stages of its life. Older buildings, often too large for small family occupation, can be made to provide flexibility through internal rearrangement. This again illustrates the biological analogy of a multi-cellular organism's ability to increase its stability through change.

4.15 A multiple system of private and public initiatives and ownership could eliminate the conflict between the two and enable them to complement each other. For instance, in areas of privately owned dwellings public rights of way could be treated, maintained and financed as extensions of the communal spaces within adjacent housing. The housing landscape could thus interweave between the various privately and publicly owned components, with interlocking arrangements for responsibility and involvement **16**. This reasoning leads at least in the private sector to a flexible arrangement capable of adapting itself to a do-it-yourself, privately owned and initiated, layout whose spaces—

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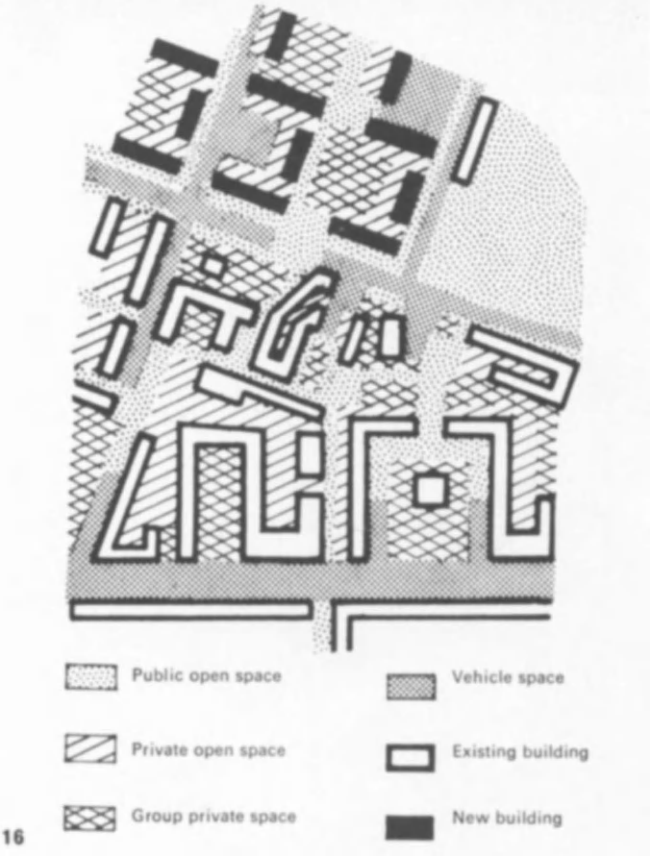

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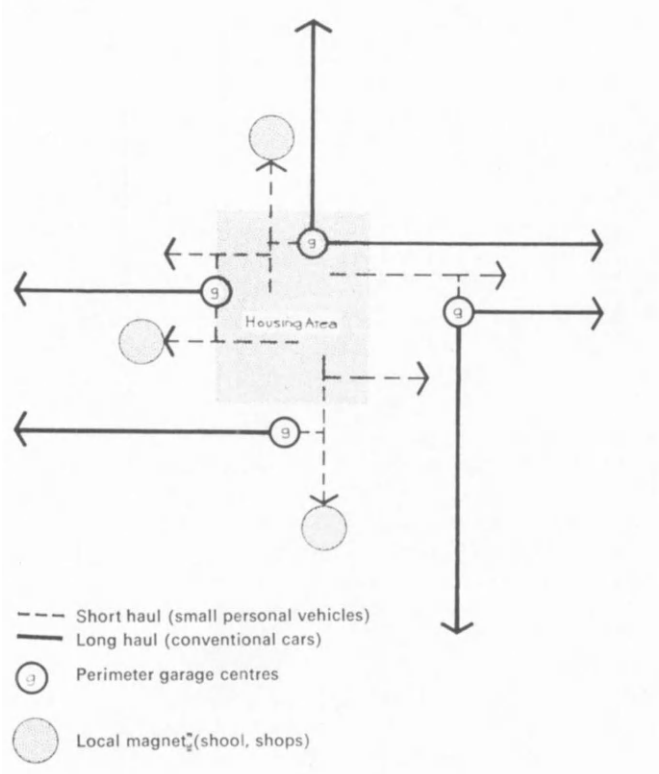
15 *A missed opportunity to expand landscape routes outwards from new developments (in background—a situation frequently resulting in demolition of adjacent old housing instead of rehabilitation*
16 *Interpenetration of ownership: diagram of housing landscape interweaving across private and public areas*

integrated with the communal landscape—would be of high quality, otherwise difficult to achieve.

Shared facilities

4.16 Integration needs to extend to facilities also. Large communal spaces may be less necessary in a housing layout immediately adjacent to open land, wood or public open space. Equally, facilities of adjacent users—especially schools—should be available to housing schemes. Hard play and kickabout spaces are often provided in housing layouts, when those of a nearby school site could so readily be used. Despite pleadings and official sanctions in DES and MHLG joint circulars, the ideas of multiple use of school and communal facilities has received very little attention and scarcely any action.



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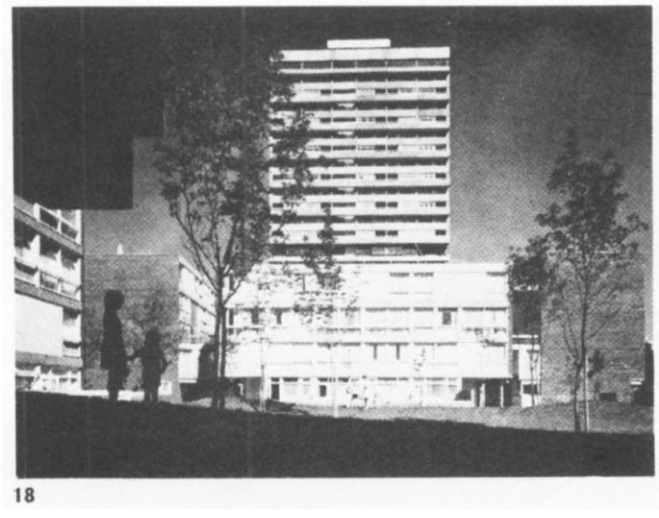

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17 *The vehicle for the job: possible new route system inside housing area, with conventional cars exchanged for small new means of personal transit for short journeys from perimeter garage centres*
18 *The therapeutic value of the relatively simple inexpensive elements of townscape—grass banks, trees, controlled space (Winstanley Road, Battersea: architect—George, Trew, Dunn; landscape architect—Michael Brown)*

4.17 It seems ludicrous to allow purely administrative difficulties or local government departmental rivalries to sabotage obviously sensible policies, which could form a very significant asset to housing estates and greatly influence their layout. Territorial rivalries between competing departments in local authorities frequently aggravate the situation. Difficulties of control, maintenance, and finance are not insoluble. One of the most compelling considerations is that the timings of different needs complement each other so perfectly. In studies of universities, much has been made of the fact that sophisticated facilities remain idle for a very large proportion of the year when they could be giving a fruitful return on investment. Applying this rationale of cost effectiveness at the other end of the educational scale could indirectly increase resources needed for housing landscape.

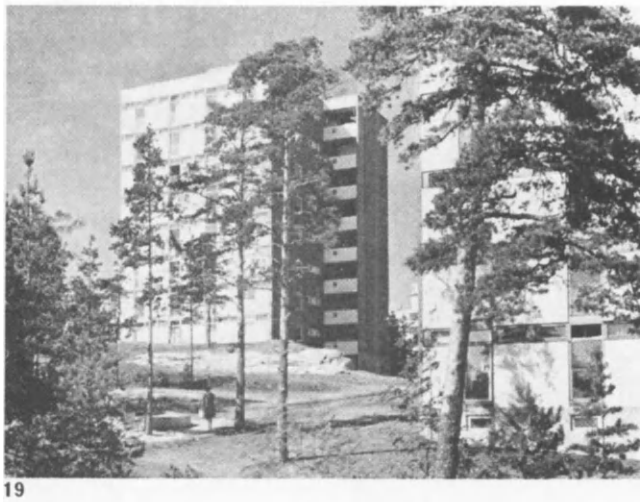
4.18 The multiple-use principle should be applied to other things, such as parking and garage space. If this is provided on the edge of housing schemes it can frequently be available to people living, working or shopping in adjacent areas, offering a better return on initial investment.
Rationalisation of even one-third of the total parking provision could transform almost every housing scheme in the country. It would also give public transport a much needed fillip and help to eliminate extravagant use of land by cars **17**.
There are already new technical possibilities which more than compensate for the disadvantages of not having traditional motor vehicles on the doorstep of every dwelling. An intermediate technology is needed to solve problems of scale and compatibility of the types of vehicles suited to be close to the dwelling.

4.19 Another advantage of balanced as opposed to single-use development is the opportunity it gives for variations of character close to where people live. This can help to provide visual and social variation and interest for residents, as well as greater liveliness which has obvious social and economic benefits. Shops, libraries, primary schools, club rooms, pubs, open spaces and so on can enormously improve an otherwise unvarying townscape. The therapeutic value of relatively simple, inexpensive elements of townscape, **18** compared with the detrimental, costly, sterile ones that frequently displace or exclude them, make the benefits of a humanised, enriched urban landscape irrefutable.

5 Cost of housing landscape

5.01 An analysis of the cost effectiveness of what makes our towns good to live in will undoubtedly reveal how unstrategic use of resources has led to gross distortion in the direction of effort **19**.
Any significant existing assets—buildings or natural features —must be regarded as items whose removal may result in greater expense to make good their loss. Where buildings, individually, or in groups, can contribute to the new development after rehabilitation, they should be regarded as, if not irreplaceable, at least capable of giving some maturity which may well be totally missing from new projects, or can at best take several decades to develop. The retention of existing trees, hedges or water courses may be costly, but the expense of replacing them with new amenities may be much greater. New trees may need twenty or thirty years to acquire anything near the landscape value of large mature trees which have been removed.

5.02 A site's natural or man-made advantages and disadvantages affect its social and economic value. Unfavourable orientation, difficult topography or poor drainage all vitally affect housing layout **20**. Indeed some sites may well have such cost implications or constraints on their use as to rule them out for housing development. But if there is little choice, as sometimes happens, we must be sure that the total cost of meeting the difficulties justifies the choice that has to be made. It is not enough to expect that the ordering of land uses, assuming it to be on the right basis,



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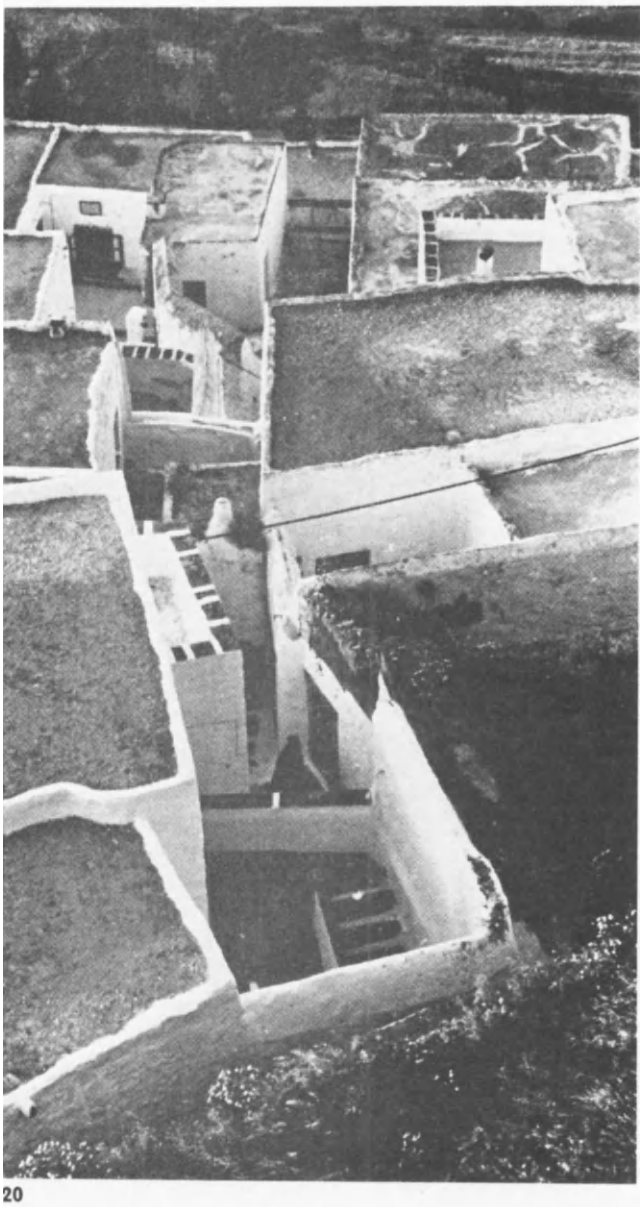

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19 *Assets comparable with these Finnish trees and rocks seldom exist in this country, but conservation of existing natural features is especially vital and can offer economies in capital costs as well as contributing immeasurably to the sense of maturity and identity of new projects: Housing in Finland*
20 *Greek roofscape. Primitive buildings fitted into a hillside site unconsciously produce variation and interest in routes and spaces*

will automatically produce appropriate landscape. As Nan Fairbrother has pointedly observed in *New lives, new landscapes*[6] the relationship of planning and landscape is a bit like ordering a restaurant meal—the order is sent in but someone then has to do the cooking!

5.03 The best (or worst) example of cost effectiveness is the disproportionate management of resources, both of land and capital, given over to the motor car. In most housing layouts the proportion of land involved is seldom less than twelve to fourteen per cent and is frequently fifteen to twenty per cent of all site uses.
These percentages frequently equal or exceed the amount of hard pedestrian space. The cost of providing vehicle space is only exceptionally twenty per cent and more normally fifty per cent to seventy per cent of all externals costs—a staggering expenditure on large projects. Reconsidering disposition of resources would lead to much greater social and environmental benefit. The strikingly low allocation of funds to hard and soft landscape where motor vehicles' share of resources is high is clearly significant.

Housing investment
5.04 It is seldom realised how small is the total investment in the fabric of the building after land costs, rates, maintenance and loan costs have been taken into account. How much smaller it must therefore be for the visible externals where cost is seldom more than ten to twelve per cent or so of the total building costs.
Referring generally to the question of investment in housing and in particular to the views of the Parker Morris Committee, Lewis Womersley stated that our dilemma consists in '. . . deciding at what level to pitch housing standards when living standards generally have risen and are still rising substantially; and yet building costs are also rising fast and interest rates are about the highest of all time . . . it seemed that the way out of this dilemma . . . was being sought in the direction of producing dwellings of a quality that was quite inadequate . . . in comparison with our standard of life generally—our acquisition of (the) luxuries of mid-twentieth century life'. He doubted '. . . whether many architects and the public generally realise how limited the physical building cost is in relation to the gross cost paid for a dwelling on mortgage or loan repayments. . . .'
'. . . Regardless of the fact that government grants and tax relief considerably ease the financial burden of interest payments on the tenant or the owner the fact remains that the portion on which the architect is continually asked to make economies represents considerably less than one-fifth of the total cost of a dwelling.'
It is thus '. . . quite futile to talk about housing standards and costs in terms of architecture and building without relating them to the basic background of housing finance and to standards of living generally. . . .'
5.05 In 1963 Lewis Womersley reported the detail breakdown of the economic rent of a three-bedroom house, with 6 per cent interest rates and 60 year repayment period as follows:

Interest payments . .	53 per cent
Cost of building . .	17 per cent
Land	3 per cent
Rates	15 per cent
Maintenance	12 per cent

By 1969 the cost of building item had fallen to 11 per cent. Based on the later, ie 1969, figures if the external costs average say ten per cent of most total project costs—and these include underground services which are environ-

mentally invisible—this would average only around £1·70 for every £100 spent on buildings. By 1980 what then will they be?

The truth is that seen in relation to the real costs of housing development the best possible landscape would cost only a quite trivial sum, say one-tenth of the eleven per cent referred to, yet it can and does make an overwhelming difference between a good place to live in and an environmental disaster.

These facts must surely put into perspective the idiotic and irresponsible policies which continue to deny adequate investment sums to making a decent environment.

5.06 Unfortunately, the depressant effect of the housing cost yardstick as currently operating has hit hardest at the less quantifiable aspects of housing and tragically the landscape has suffered most, and continues to do so. Although the Parker Morris report concerned itself principally with the arrangement of the dwelling itself, the importance of the setting was strongly implied.

Its main recommendations being already watered down, yardstick controls often make it increasingly difficult and sometimes impossible to achieve even these reduced standards in spaces outside dwellings.

Surely we cannot continue to spend countless millions every decade in building houses that are situated in environmental slums even at the time they are built? What then will they be like by the end of each of these decades?

The misuse of opportunity and the distortion of real values is nothing short of criminal.

Recent work by DOE'S R & D section on residents' reactions shows that people do respond positively to well laid out housing estates where investment is adequate and management good. It may eventually be possible to prove as persuasive a case for the intangibles of landscape as for the more obvious demands of drains.

References

1 CHERMAYEFF AND ALEXANDER. Community and privacy

2 CHERMAYEFF AND TZOMIS. Shape of community

3 HABRAKEN, N. J. Supports: an alternative to mass housing. London, 1972, Architectural Press £1·50 [05]

4 GEDDES, P. Cities in evolution. London, 1968, Benn, £2·50 [052]

5 New homes for old. AJ 10.6.70 and 1.7.70 [81 (W6)]

6 FAIRBROTHER, N. New lives new landscapes. London, 1969, Architectural Press. £3·75 [08]

7 LEWIS WOMERSLEY. Productivity for what

Technical study Landscape 5

Section 1 **Urban landscape review**

Urban landscape review: Recreation

A more sensible sharing of sports and recreational facilities between educational establishments and town is urged by G. A. PERRIN *in this article. He also shows, by illustrating foreign examples, how we might revolutionise our parks and turn them into comprehensive recreation centres*

1 Introduction

1.01 Two previous AJ studies—*Designing for leisure* (in 1964[1]) and *Community recreation centres* (in 1967[2]) reviewed urban landscape with particular reference to sport and recreation. The latter described the important function of the Sports Council and regional sports councils, and the possible implications of their policies on facilities such as sports/recreation centres, and joint-use projects based upon school premises.

1.02 Between then and now there has been a seemingly unending economic squeeze, national expenditure has fallen to an extremely low level and construction costs have soared. Nevertheless general interest has quickened to an extent where it is estimated that there are now over 200 towns planning, or building, sports centres of one kind or another, plus an equal number of schools projects considering public use of their facilities outside school hours.

1.03 The underlying consideration at all levels is undoubtedly cost—value for money, analysis of costs in use, and general sensible husbandry. Co-ordination of effort is an important part of the day to day work of the regional sports councils. Minimising the fragmentation which still takes place among local government departments is another. The recent establishment of recreational offices, with recreation directors to guide their development, is a step towards a more effective and co-ordinated use of resources and effort.

1.04 Reports such as *Planning for leisure*[3] and the Sports Council's *Planning for sport*[4] have provided useful guide lines for those embarking on major recreational provision for the first time. But we are still unquestionably far behind our nearest neighbours in Europe (West Germany for example) who are currently spending up to ten times as much on comprehensive recreational programmes. In this country, the Maud Report indicates that recreational uses (under the block grant system) will have to fight for a share of whatever money is available and take their chance with all other urban users. Successive governments show little concern for increasing the present rate of progress.

2 Standards

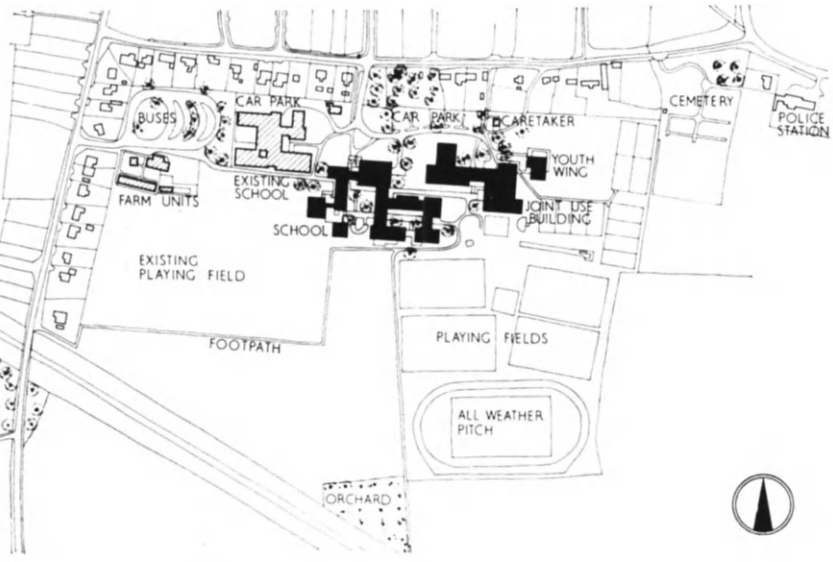
2.01 Where and how can resources be used to their maximum potential? To take one example: grass pitches, on which this country has always depended so heavily, are badly in need of appraisal and re-evaluation. They offer limited use in poor weather, and cannot be used after dark without floodlighting. Hence the development of weekend sports fixtures with the pavilion used at most twice a week.

1 *Part of Bracknell Sports Centre, Berks. Changing rooms on right serve outdoor pitches and running track*

2.02 Floodlighting is expensive and can be associated with more than one playing area only with considerable trouble. If this area is laid using a hard porous surface, however, the use factor rises sixfold. Pavilions which previously needed to accommodate, say, ten teams on a Saturday afternoon, can be built smaller as games can be spread throughout the week—leaving players free for weekends with the family. On a town scale the saving in land allocation and capital cost would be appreciable, especially if it is accepted that one floodlit hard porous soccer pitch is the equivalent of up to six grass pitches.

2.03 This would have a considerable effect on the forty-five year-old 6 acre (2·4 hectare) standard for play space suggested by the National Playing Fields Association, which has so strongly influenced the planning of our immediate post-war new towns. *Planning for sport*[4] suggests that an area of 2·4 acres per 1000 people (approximately 1 hectare) might be more appropriate, but sensibly adds that no standard is capable of universal application. Obviously this latter figure would be more applicable to a central London borough than to a new town, but even the six acre standard could be pared to 4·5 acres (1·8 hectares) without detriment, providing a balance is established between indoor and outdoor facilities, grass and non-grass surfaces, and floodlit areas.

2.04 Pressure on urban space has led to the increasing provision of shared facilities, the best example being the sports centre. Thought of as a 'stadium' in the late fifties, ideas have progressed to the present arrangement of one large indoor nucleus surrounded by a number of outdoor playing facilities—on the lines of Bracknell **1**. Even these have altered in the space of the last three years to indoor-only provision of the kind now in use at Poole, Dorset (the Arndale Centre), and Basingstoke where facilities are part of the central area shopping precinct.



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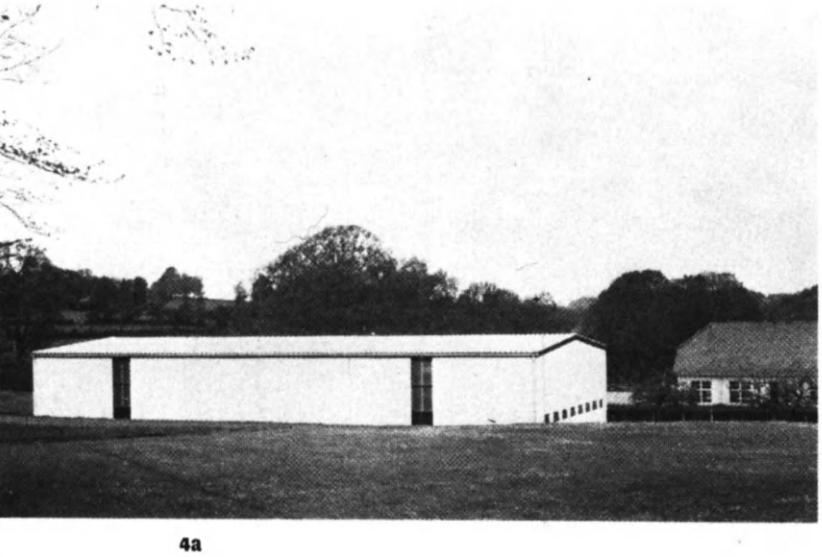

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3 Future provision

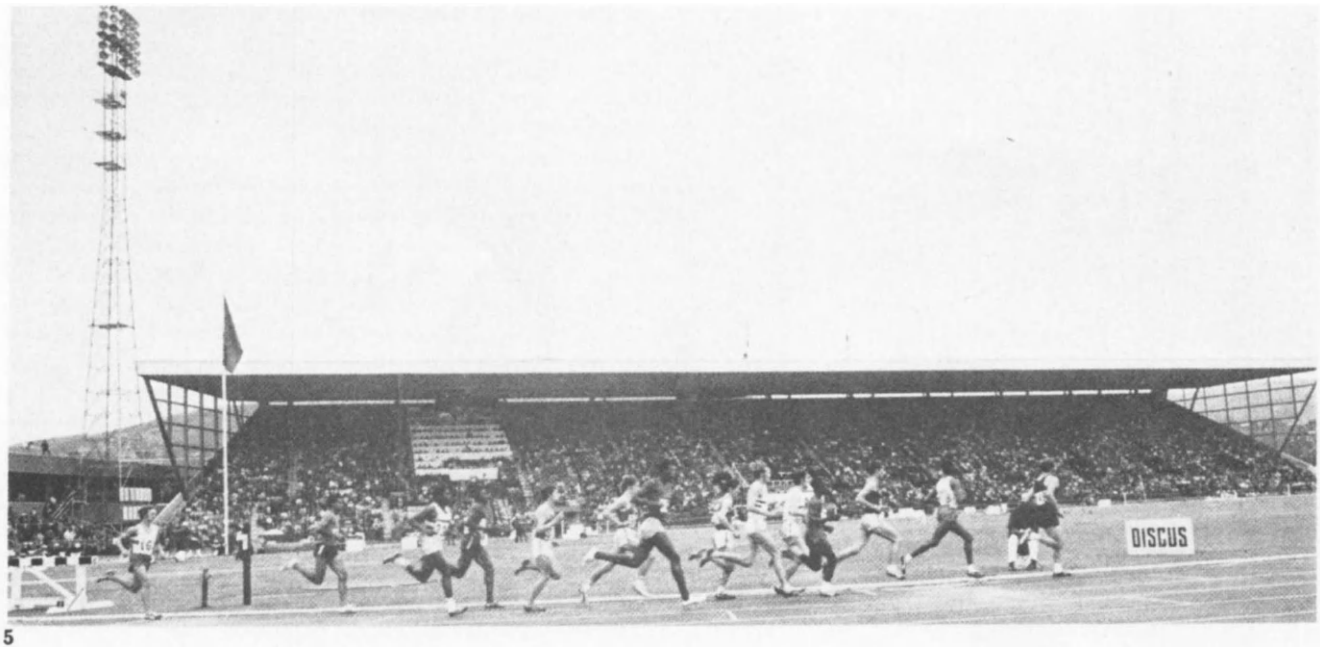
3.01 Should Basingstoke set the pattern for future major indoor recreational provision, what is likely to be the future pattern of outdoor provision?
Better use of school facilities is one major area for reappraisal in this respect. The Sports Council has for many years been trying to persuade education and local authorities to combine their resources to make more effective use of land and capital. Bingham joint use school in Nottinghamshire **2** is one of the first examples where the public may use the school's excellent facilities after school hours **3**. This should not be considered an alternative in every case (especially in larger towns) to the 'town' sports centre which can be used in off-peak hours by schools. Many countries are now considering joint use of community schools, with extra facilities attached at an additional cost of between £50 000 and £60 000, and open to outside public use after school hours. Totnes Grammar School **4** is a typical example; others are coming into use in Hampshire and Essex.

3.02 Thus we are beginning to see the realisation of the three-tier planning forecast in community sports halls, published by the NPFA in 1965. Edinburgh is a good example of this on a city scale[6], with primary schools, secondary schools and town facilities in that order, providing overall sports coverage **5**. With the growth in popularity of some games—golf, water sports such as sailing and fishing, and climbing—the need has also arisen for practice and performance facilities—the former available in the home town, the latter probably some distance away. Consequently regional patterns are becoming established with the emergence of 'importing' and 'exporting' authorities: some with outdoor facilities enabling people to sail, climb, pony-trek, or play golf; others with good indoor provision for training purposes.

3.03 This arrangement could be a means of revitalising many seaside towns and holiday areas affected in recent years by society's increasing mobility, especially to other countries. The places around Lake Leman (Geneva), the Dolder open-air sports park in Zurich **6**, **7**, the Gruga Park in Essen **8**, **9**, **10**, **11**, the parks and water sports areas around Amsterdam, or even the ubiquitous Tivoli Gardens in Copenhagen, must inevitably influence the UK if this movement continues.

4b

2 *Site plan of Bingham comprehensive school joint use buildings* (1:7500)
3 *The gymnasium forming part of a £200 000 + sports complex at Bingham, available to the public after school hours*
4a 4b *Another smaller scale example of joint use school facilities, the sports hall at Totnes Grammar School.*



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3.04 What many of these examples illustrate is the present obsolescence of most urban parks in this country, with their Victorian origins still firmly dictating present day use. Their only purpose has been to provide a green 'lung' in built-up areas which have failed to attract people sufficiently, The Gruga Park on the other hand, with many other Bundesgarten examples in West Germany provides a very wide range of facilities: heated outdoor 'Olympic' swimming and diving pools (including a surfing pool), tennis, miniature golf, boating pools, pony rides, an aviary, small zoo, tropical house, ice-rink, sports hall, exhibition hall, concert stand, museum, library, lakes, azalea gardens, Japanese gardens, and back-ground planting generally of the highest order **11**. Although a charge of four shillings is made for admission it is not inconceivable that there would be many in this country willing to pay for the same range of facilities.

5 *Meadowbank Sports Centre, Edinburgh, scene of the 1970 Commonwealth Games. The sports centre will eventually form the top rung of a hierarchy of provision starting at junior school level*
6 *Part of the Dolder open air sports park in Zurich*
7 *The 'surfing' pool in the Dolder Sports Park, Zurich. Artificially-made waves formed every thirty minutes during the summer are a big attraction for bathers*
8 *Children's free play area, Gruga Park, Essen*
9 *Gondola pool, Gruga Park, Essen*
10 *Concert stand, Gruga Park, Essen*

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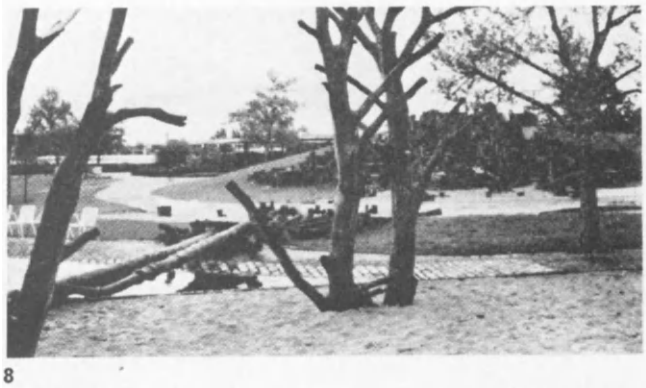

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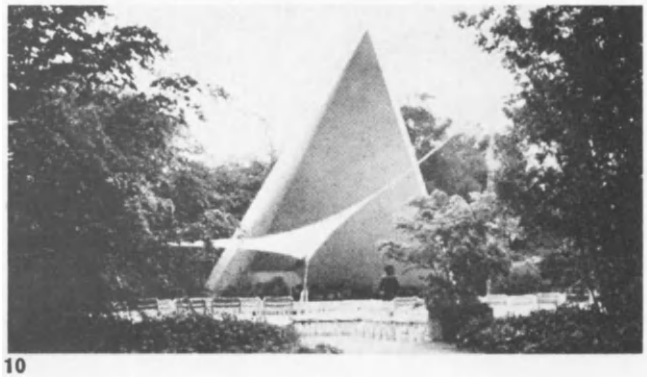

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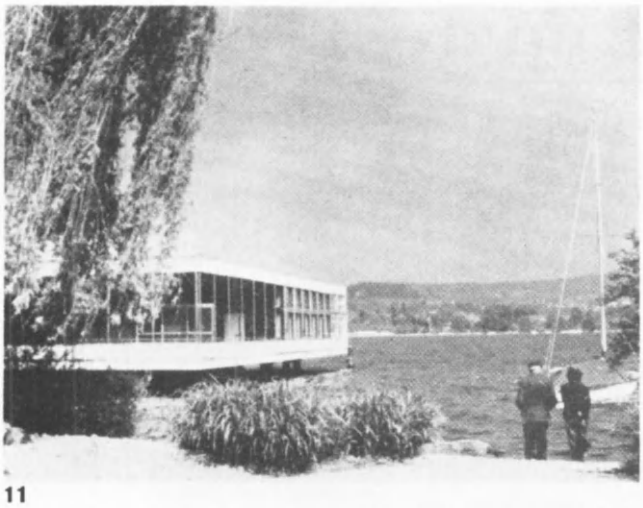

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11 *Restaurant forming part of a water sports centre in Zurich. Note the quality of the landscape treatment at the water's edge*

12 *One of several pools forming part of the Gruga Park, Essen, and constructed in the last six years*

3.05 The Canon Hill Park project in Birmingham (otherwise known as the Midlands Art Centre, see technical study LANDSCAPE 2 fig 26) probably comes closest to being the first UK example of this trend towards fully-fledged 'recreational' parks. Whatever inter-departmental barriers in local government need to be broken down to achieve similar examples, the success of Canon Hill is beyond doubt.

4 Summary

4.01 Pressure on urban space, the high capital cost of providing major recreational facilities, and the expectation of future demands, have all contributed towards a general reappraisal of resources at local and regional level.

4.02 A measure of co-ordination is being achieved by regional sports councils through whom all projects requiring central government funds must pass. Their role may be uncertain if the Maud Report is put into effect. Similarly the role of such bodies as the Technical Unit for Sport just starting its work, may be equally unclear.

4.03 The better use of school facilities on the lines of Bingham, or the Cambridgeshire Village Colleges, appears to be inevitable, although meeting with the expected resistance from many headmasters. In this respect university sports centres should not be exempt, although at present—with the notable exception of Lancaster—most operate policies of exclusive use on the lines of their American counterparts. At least a dozen are as good as any in Europe.

4.04 Park design is another area for reappraisal within the same context. As an alternative to peripheral urban provision there seems no better solution in the foreseeable future. As planned at Essen or Canon Hill parks may well be a suitable answer to the need for new 'sports' centres, and as they already exist land purchase costs are avoided.

4.05 New techniques (floodlighting), new surfaces (hard porous materials) now much used in the western and wettest side of the country, new management techniques (eg the MSc course in Recreation Management at the North-West Polytechnic), and a new look at space standards (*play space* not to be confused with *open space*), are all contributing to make the next ten years the most interesting in recent times. It must be hoped that this message is gradually percolating through to government circles, and that they accept the quality of leisure time as investment justifying.

References

1 AJ Information Library: Designing for leisure: the future of sports facilities AJ 14.10.64 p891-896 [(95) CI/SfB]
2 AJ Information Library: Community recreation: the need for a wider view AJ 5.4.67 p853-857 [(95) CI/SfB 5]
3 DEPARTMENT OF EDUCATION AND SCIENCE, Planning for Leisure. 1969, HMSO £1·75 [5]
4 SPORTS COUNCIL Planning for sport—a report. London 1968, The Council [5]
5 NATIONAL PLAYING FIELDS ASSOCIATION Community Sports Halls, London 1965. The Association, £1.5 [562]
6 AJ Information Library Building studies: Royal Commonwealth Pool, Edinburgh AJ 16.9.70 p645-662 [541] Sports Centre, Meadowbank, Edinburgh AJ 23.9.70 p705-718 [661]
7 TOWN PLANNING INSTITUTE Open space in new towns—an appraisal by F. T. Burnett. TPI *Journal*, 1969, June [083]
8 REGIONAL SPORTS COUNCIL Appraisals of demand [5]
9 TOWN PLANNING INSTITUTE Working for recreation by D. D. Molyneau. TPI *Journal*, 1968, April [5]

Section 2 **Design procedure**

Design guide Urban landscape

Scope
As explained in the introduction to this handbook, landscape work can be divided into separate types of landscape spaces in much the same way as building types. While several landscape types will be covered in the handbook, there is only one design guide, which attempts to provide a check list for the design of any landscape work which is a component of the urban scene. Although much 'urban' landscape will be executed as a subcontract to a building or civil engineering contract, this design guide follows the pattern of a main contract.

Form
The main stages of this guide are based upon the RIBA Plan of work, amended for landscape contracts and subcontracts, and shown in information sheet LANDSCAPE 2. The left-hand column is intended as a checklist; advice, information and cross references are given on the right.

References
References in the body of the guide are given a shortened title only. Full details are given in appendix C. References in SMALL CAPITALS are to AJ design guides, technical studies and information sheets. References of a more general nature and books for further reading are included in appendix C.

Brief and feasibility study

1 Inception and primary brief

The object of this stage (which corresponds with stage A of the RIBA Plan of work) is to establish sufficient information about client's overall requirements to allow feasibility of project to be assessed (see stage 2) and to set the broad framework within which architect and consultants are to work
Although the landscape designer should be appointed in time to contribute to the earliest thinking on the project, a feasibility study for a building or civil engineering project may have already been carried out, in which case such a study would form a large part of the primary brief

1.01 Scope of project

Physical scope

At this stage some assessment of size and character of project is needed, even though no brief has been given. Area of site plus client's financial commitment will probably be adequate. A preliminary visit, or even study of maps and air photographs, will be adequate to assess physical character

Functional scope.

If project is for use of land for a clearly defined purpose (eg sports centre, town park, and so on) preliminary studies can be based on similar projects executed recently, and on published critiques of such projects which analyse areas, accommodation, cost and so on

Is project
- improvement of existing land only?
- extension of existing land use?
- new use for the land?

Aesthetic considerations:

Is project
wholly compatible with surrounding landscape?
reasonably compatible, so that new landscape work can be easily married in?
incompatible?

If project is incompatible, client must be warned that site is unsuitable; or that scheme may be rejected on planning grounds; or that extensive and expensive treatment involving land beyond limits of actual site may be necessary

1.02 Client

Type of client:

There are four general types of client, as shown in left-hand column below:

private	Usually for gardens and small work, but including private groups such as sports clubs
developer	Usually intends to develop land for such uses as speculative housing, office buildings, industry or recreation
'corporate body'	An impersonal committee or board of an organisation which finds itself with a 'land' problem incidental to a property project
public	Acting at every level through central and local bodies, requiring the landscape treatment of schools, hospitals, public buildings, new towns, and so on

Relationship with client

Relationship may be direct, but is frequently through another professional adviser, staff member (eg estates officer, surveyor, engineer) or committee chairman. In dealing with a large organisation it is helpful to have a 'liaison officer' formally made responsible for external works

Client's brief

One is fortunate if the briefing comes through another professional, as some definite guidance may then be expected. If not, then brief might be negligible. Apart from specific uses (eg sports pitches, car parks) clients are notoriously vague about their need for, and use of, external space. In the majority of jobs the architect may have to write his own brief

Client's interest in site:

Once type of client has been established, client's interest in site may be determined:

absentee landlord	Investment interest only
owner occupier	Direct user and financial interest
tenant	Temporary user interest owner

Client's financial capacity

Determine at early stage whether client has financial capacity and intention to adequately finance project. If not, inform client that:
project is likely to be more expensive than he anticipated;
or whole of project cannot be done for anticipated expenditure;
or desired standard cannot be achieved

Client's management capacity

Client should be made aware that landscape work (even more than building work) needs competent maintenance for scheme to reach expected standard. Determine whether he has (or is prepared to recruit and pay for) suitable staff both to supervise and carry out maintenance work after completion of contract

1.03 User requirements

Determine uses to which external space is to be put

Physical

Determine physical restraints on such open space uses eg length and width (sports pitches); area (car parking); number of participants (swimming pool)

Aesthetic

Determine client's desires and taste (colours, plantings)

Other determinants

Eg client's interests (gardening, swimming); client's needs (privacy, social life); orientation, security, paid admission etc

Maintenance limit

Following on from client's management capacity above, determine precise design limitations imposed by capacity of client's resources to maintain project after completion

2 Feasibility

2.01 Appointment of consultants

Obtain client's agreement to the appointment of specialists, eg landscape architect (unless already running the project), civil engineer, quantity surveyor, hydrologist ecologist, forester, horticulturalist, economist, traffic engineer, sociologist, soil scientist

Fees and services

Agree extent of services to be provided, and application of ILA, RIBA, or other scale of charges

Directory

Make directory list of: client's officers and staff concerned with project; all professional staff engaged; planning departments, service companies, control boards, legal agencies, and personal contacts, together with addresses, telephone numbers

2.02 Site investigation

Preliminary data

Obtain plans, maps, published data, and extract data from reference libraries, ministries and other organisations. See information sheet LANDSCAPE 1

Investigations made on site

Collect data from site by observations, photographs, measurements and testing procedure by own staff or specialists. See information sheet LANDSCAPE 1

Record data

By plotting or updating maps, plans etc, and by written reports and record data collected on site

2.03 Legal requirements

Ascertain constraints imposed on site (or on project) by legal requirements. See information sheet LANDSCAPE 2

2.04 Available areas

Study space standards laid down by statutory and/or advisory bodies, and exact space sizes required for various uses (see 1.03 above) and compare with availability of space on site. Decide on viability of brief

2.05 Preliminary planning decisions

Discuss with consultants, and with officers of local planning authority, likelihood of project meeting local planning regulations; note constraints to be taken into account in order to meet planning requirements. See information sheet LANDSCAPE 2

2.06 Early cost studies

Make approximate estimates (in consultation with qs, if appointed) on available project data, and collected cost analysis data, to initiate cost studies. See information sheet LANDSCAPE 3

2.07 Programming

Commence programming of project ('office' stages in detail and 'contract' stages in outline) by means of bar or network charts, critical path analysis or other management technique taking into account: availability of site; client's occupation date commitment; work load; staff capacity; phasing of project; re-locating areas within site to make other areas available for reconstruction; relations with other professions and specialists; labour supply; supply of materials; weather and planting season

2.08 Appraisal report

See information sheet LANDSCAPE 1

Evaluation

From preliminary data and site investigations (see record data above) evaluate site in relation to the project

Assets and liabilities

Establish which site elements are assets, to be kept, and which are liabilities, to be dealt with

Design potential

Evaluate design potential (genius loci) of the site and its application to the particular project

Report to client

Write report to client: appraising the site; appraising the problem; giving conclusions on relationship of site to problem; stating intended methods of proceeding with project; and appraising financial and management situations; expectation of planning approval; and probable programme. State, finally, summary opinion on feasibility of project

2.09 Metrication

Consider desirability of carrying out whole project in metric units. The official programme for the change to metric suggests that there should be very few new projects designed and documented in imperial terms after 1971. Type and suitability of project, availability of metric-sized products and components, and financial effect on client are factors which will influence decision

3 Secondary brief

At this stage brief is updated by client's reaction to feasibility report 2.08, and by receipt of more precise information on user requirements, by consultants' demands and by results of research into particular problems revealed by feasibility study

3.01 Detail user requirements
3.02 Further site investigation data
3.03 Programme demands from other specialists
3.04 Other constraints brought to light

Because these stages refer to specific sites, and specific project-types, it is not possible to detail them in this general design guide. Much of the thinking will, however, be found in the information sheets covering various landscape spaces later in this handbook

Design stage

4 Outline proposals

At this stage a definite scheme begins to take form, even though in broad pattern only. It is important not to go on to stage 5 *Scheme design* until agreement has been reached with client, and all consultants, on the suitability of these outline proposals

4.01 Zoning

The site appraisal 2.08 will have revealed certain areas of the site which are suitable, because of levels, climate, location etc, for certain purposes. By relating these to the user requirements 1.03, outline zoning plan can be produced for site

4.02 Site planning

Communications

Apply user requirement data 1.03 to site appraisal conclusions to produce communication pattern linking the areas on the zoning plan

Access

Ensure that layout meets access requirements for deliveries, furniture removal, ambulances, refuse collection and fire fighting services

Checks

Use association chart, string diagram or linear programming to check and confirm the relationship of zones to each other, and validity of flow pattern

Buildings (where landscape layout is associated with a building project)

Agree with architect on relationship of site zoning and circulation diagrams to outline building proposals to ensure unity of internal and external flow patterns

Services

Agree with civil and mechanical engineers on relationship of zoning and circulation diagrams to outline proposals for services, drainage, roadworks, river works, bridges etc

Other activities

Ensure adequate allocation of space for clothes drying, children's play areas, telephone kiosks, and similar ancillary items

Other factors

Study likely effects of noise, overlooking etc and adjust proposals to mitigate their effects

4.03 Revisions

As a result of 'give and take' process with other professionals and specialists, amend outline proposals to co-ordinate spaces, routes, levels, drainage, services

4.04 Statutory approvals

Submit for outline planning approval at this stage, unless already obtained

5 Scheme design

5.01 Creation of spaces

Masses and voids	If project incorporates buildings or civil engineering structures, consider: 1 siting of individual buildings or structures, in relation to existing topography; contours; existing trees and other vegetation; drainage pattern; enclosure, shelter and screening 2 siting of groups of buildings or structures in relation to each other to define external spaces; to create vistas and close views; to avoid wind tunnels, frost pockets etc

5.02 Circulation

Examine site	Movement of vehicles, pedestrians and objects between zones, between individual building units, and between building units and site entrance. Consider volume of flow, intensity and periodicity
Select form of horizontal traffic channels	Eg roads on, above or below ground level; paths on, above, or below ground level; paved areas (adjacent to or separate from vehicle routes); conveyor systems
Select form of vertical traffic channels	Eg slopes, ramps, parking elevators for vehicles; ramps, steps, staircases, elevators, escalators for pedestrians
Consider junctions and interchanges	Eg crossings, branches, gyratory intersections, overpasses and underpasses
Consider static areas	Eg parking spaces, paved areas, loading bays
Determine sizes of traffic channels	Consider: flow; direction; junction capacity; emergency use; peak loading; control points Determine: minimum widths; radii; gradients; levels; height clearances
Plan control elements	Eg surface controls, fences, screens, rails, gates, doors, lifting barriers, cattle grids, hazards; signals and notices

5.03 Visual linking

Some spaces to be visually linked	Consider vistas, views
Some spaces to be visually separated	Consider privacy, concealment and surprise

5.04 Ground modelling

Consider features needing attention to ground shaping	Eg pools and reservoirs, tanks, spectator banking, flyovers, underpasses
Consider existing topography	Consider using: rising ground for views; hollows for privacy, concealment, water; slopes for seating, changes of level Consider existing site water levels
Determine new ground modelling	For circulation gradients; essential changes of level; meeting building levels; controlling surface water run-off; offering or restricting views; creating interest on flat sites

5.05 Surface treatments

Decisions to be taken 'in principle' only at this stage

To encourage movement	Hard, near-level surfaces to vehicular standards Hard surfaces to pedestrian standards Semi-hard surfaces for casual walking (including grass) Concealed hard surfaces, eg fire paths
To discourage movement	Hard, rough surfaces: ridged, stepped, cobbled Semi-soft surfaces: ballast fill, thick gravel, sand Soft surfaces: rough grass and planting

5.06 Enclosure

Decisions to be taken 'in principle' only at this stage

Consider need for enclosure	Eg physical boundary; legal boundary; privacy, security, control; demarcation only; wind shelter

Consider degree of enclosure	Eg complete, partial or slight enclosure; physical but not visual enclosure; visual but not physical enclosure; filtering; aural
Consider permanency of enclosure	Eg permanent, temporary, ephemeral
Consider character of enclosure	Eg insuperable, domestic, psychological only
5.07 Shelter	Some forms of 'shelter' are large enough to be considered as separate building types, in which case reference should be made to the appropriate AJ design guides
Consider need for shelter	Staff shelter (eg ticket office, booth) Players' shelter (eg changing rooms, clubhouse) Spectators' shelter (eg grandstand, covered seating) Animal shelter (eg aviary, kennels) Public shelter (eg bus shelter, park shelter) Vehicle shelter (eg garage) Materials, equipment store Pedestrian shelter (eg pergola, covered way) Casual shelter (eg awning, blind etc)
Consider degree of shelter	Eg against wind, rain, sun, view; overhead only or total
Consider degree of permanency	Eg permanent, temporary, ephemeral
Consider character	Eg fully private, domestic, open for view, public, functional, ornamental
Select location	According to need, purpose, pedestrian access, vehicle access, levels; avoid 'undesirable' locations in public areas
5.08 Planting (structural)*	Planting design is an art which does not lend itself easily to classified procedure; the following is intended only as a general checklist
Consider purpose of planting	Eg space enclosure; space division; boundary enclosure; linking buildings; punctuation; focal point; shade; shelter; screening; windbreak; acoustic filter; filter to dust
Decide form and density of structural planting	Eg woodland; shelter belts; screens; avenues; hedges; copses; clumps; groups; single trees; covert
5.09 Statutory approval Building regulations	Submit for approval to appropriate bodies If applicable
Planning approval	Always needed unless gardens and site improvements only, with no structure above 2ft (610 mm) high, and no change of use
Other authorities	As relevant to particular project type, eg county fire service, river board; alkali inspector
6 Detail design	This stage deals with the preparation of working drawings for detail design and construction. Where they are specific to a particular landscape type, they will be dealt with in later information sheets. The design guide is only a brief check list of items common to all landscape work
6.01 Surfaces Hard surfaces	Select materials and construction for surfaces to drive on; to walk on; or to discourage walking. Select combinations of different materials for large and small scale surface patterns
Soft surfaces	Consider materials and construction for soft surfaces
Junctions	Consider junction of each surface material with each adjoining surface Consider insertion of objects and materials into various surfaces
Trim	Consider which surface materials need edge trim; which materials need edge protection
Margins	Consider which surfaces need margins and mowing margins

*Non-structural planting is dealt with in para 6.08, which also gives more detailed guidance on plant selection than para 5.08

6.02 Changes of level

Construction	Consider method of changing level (eg ramps, steps)
Drainage	Consider levels with relation to surface water drainage
Slope surfaces	Consider face-surface of level-change (eg ramps, revetments, rock walls)

6.03 Enclosure

Construction	Consider form which enclosure will take (eg walls, fences)
Levels	Consider enclosure in relation to ground slopes
Openings	Consider openings in enclosure and means of closing them
Juxtaposition	Consider detail construction in changing from one form of construction to another
Space-division	Consider form of enclosure construction to act as space division
Planting-enclosure	For planting as a form of enclosure see information sheet LANDSCAPE 36

6.04 Shelter

Siting	Consider exact siting of sheltering elements; consider also in relation to levels
Materials	Consider materials in relation to function, durability, colour and so on
Construction	Select method of construction Consider possibility of ready-made, or prefabricated construction

6.05 Artefacts and site furniture

Focal points	Consider location, form and construction or purchase of fountains, sculpture, plant containers, masts, flag poles
Site furniture	Consider location, form and construction or purchase of seats, tables, litter baskets, signs

6.06 Water and rock work

Location	Consider location in relation to levels, function, access, water supply, drainage, overhanging trees
Shape	Decide shape in relation to available space, function, appearance
Construction	Select method of excavation and soil disposal; method of construction Consider method of marrying edge to levels, and detail of edge treatment
Water supply	Consider inlet, outlet, water supply, circulation, aeration, natural balance, maintenance
Rockwork	Study suitability of site for natural rockwork or constructed rockwork Consider type of rock, location, form, method of construction, levels, marrying in to surroundings, vehicle and crane access

6.07 Services*	The following is a check list of main points to discuss with the appropriate specialists
Drainage	Modify surface levels to fall to collection points Consider effect of gulleys, manholes and so on upon surface pattern Consider effect of any other drainage elements upon surface pattern Investigate needs for subsoil drainage. Design subsoil drainage system
Water supply	Investigate possible sources of supply Consider needs for wells, pumping, tank storage Determine head, pressure, consumption, maximum demand storage capacity needed Prepare circuit layout

*Further information and guidance on the planning of these services may be found in the various sections of the AJ Handbook of building services and circulation (collectively classified under CI/SfB (5–)), published in the AJ between 1.10.69 and 7.10.70

Electricity supply	Consider electricity requirements for lighting, floodlighting, power take-off, pumps, fountains, and so on Determine voltage and phase supply needed Consider intake cable route, substation position Consider internal circuit layout; overhead and underground
Gas supply	Consider any requirements for gas supply Consider intake point and meter housing Consider internal pipe layout and outlet positions
Telephones	Consider telephone requirements Consider intake point and private branch exchange (if needed) Consider extent to which overhead wires are acceptable Consider underground duct circuit Consider effects of junction chambers on paving layout
Other services	Consider the effect of other services either to the site or crossing the site, upon the landscape layout
Maintenance areas	Decide size of maintenance area(s) needed Select location with reference to aspect, access, concealment Plan working yard, buildings, frames, lights, staff quarters, storage bunkers, glasshouses Include for all supply services and drainage, heating and ventilation

6.08 Planting (non-structural)*

Consider purpose of planting above eye-level	Eg area demarcation; space division; small scale screening, shelter, windbreak
Consider purpose of planting below eye-level	Eg underplanting; low covert; ground cover; pattern, colour, seasonal interest
Decide location of non-structural planting	
Decide form and density	Eg main shrub planting; shrub groups; shrub beds; specimens; borders (shrub, heather, herbaceous perennials, biennials, annuals); climbing, trailing, and wall plants; alpine and rock planting; water and waterside planting; bulbs; indoor planting
Prepare planting plan	Select plants according to factors given in information sheets LANDSCAPE 5 to 10. It is essential to check plants chosen for availability and cost against nurserymens' catalogues. The Institute of Landscape Architects publishes a list of recommended plants for landscape work
Grassing	Allocate grass areas Adjust width and levels to suit mowing Decide whether to seed or turf

*For structural planting see 5.08

Documentation and subsequent stages

7 Documentation

7.01 Working drawings

7.02 Specifications

See information sheet LANDSCAPE 3. Plants are usually included in specifications in the form of schedules stating number, genera, species and variety; height; and particular habit desired, with priced rate per 1000, per 100, per dozen or each

7.03 Bills of quantities

Required for landscape contracts of value of £4000 and over, and would be useful for contracts of £2000 upwards. Should follow elemental classification order described for specifications (information sheet LANDSCAPE 3)

8 Tender and contract stage

8.01 Tender procedure

See checklist in information sheet LANDSCAPE 4

8.02 Contract procedure

See checklist in information sheet LANDSCAPE 4

8.03 Subcontract procedure

Checklist on contract procedure describes situation in which the landscape work itself is the subject of a main contract. In many instances, however, the landscape work is a subcontract to a building or civil engineering main contract. When this is so, adopt following procedure:
1 Compile list of suitable firms, including client's and main contractor's nominations; check financial status and references, and visit nursery
2 Send out letters of invitation and receive acceptances
3 Send out tender documents, including drawings, specification, bq, form of tender, return envelope and covering letter
4 Receive back tenders, reject late submissions and those which fail to meet tender requirements
5 Pass to qs for cost check; notify unsuccessful tenderers
6 If value of tenders modifies total value of contract, inform client; if necessary negotiate revised figures with lowest tenderer
7 If desirable, place advance order with successful subcontractor to enable plants to be reserved, but warn that he must be willing to enter into a subcontract with main contractor, in the same terms as the main contract (enclose copy of relevant clauses)
8 Instruct main contractor to enter into contract with subcontractor
9 Agree dates for commencement and completion of work, and length of defects liability period

8.04 Plant supply

It is sometimes felt desirable to have a separate nominated supplier for plants, or a separate subcontract for 'supply and plant' as a way of ensuring that plants will be available in the right numbers and quality, and obtained from a reputable grower. It is desirable to visit the nursery and select personally the larger specimens—particularly of on-grown trees in large sizes

Appendixes

A Definitions

While the work of the BSI subcommittee on landscape work and definitions is not complete, there are about 650 terms defined in BS 3975 Parts 4 and 5 which are relevant to this design guide.
A few technical terms which are essential to the understanding of this guide are:

Genus (pl genera)
A group of closely related species possessing certain morphological characters in common, by which they are classified and distinguished from all others.

Species
A subdivision of a genus consisting of plants which have the same constant and distinctive characters, and which have the capacity to interbreed.

Variety
A subdivision of a species, consisting of plants which differ in some heritable characters such as form, colour or season, from what is regarded as typical of the species. It is also applied to a member of a hybrid group.

Cultivar
An internationally agreed term for a cultivated variety.

Perennial
Any plant which lives for more than two years (including trees and shrubs).

Herbaceous perennial
A plant with herbaceous stems and foliage and perennial roots.

Half-hardy annual
An annual, or a plant commonly treated as an annual, which cannot be grown in the open before the warm season of the year; usually of plants raised from seed under glass for summer display in the open.

Hardy
Able to thrive in a given climate all the year round without special protection.

True to type
Having all the characteristics typical of the original plant.

True to name
Consistent with the name under which it is described.

Hydroponics
The method of growing plants without soil in water to which the necessary nutrients are supplied (loosely applied to all forms of soilless cultivation).

Containerised
Of plants, having been transferred at some stage of development into containers for purposes of sale, transport or decorative effect.

Tilth
The state of the upper layers of the soil, in respect of size of aggregations, resulting from cultivation and/or weathering.

Firming
Any method of lightly consolidating the surface of the soil.

Lifting
The loosening and raising of the root ball of a tree or plant by the action of frost (FROST HEAVE), or wind (WIND ROCK).

Habit
The natural mode of growth and the general appearance of a plant.

Spread
The diameter of the head of a tree or shrub.

Feathered
1 Having lateral growths on the main stem. Used of a young tree with a single main stem.
2 Having lateral growth on the main stem, some or all of which have been shortened back to stimulate growth.

Standard
A plant with an upright clean stem supporting a head. Plants in standard form are described, in descending order according to height of the clear stem, as TALL STANDARD, STANDARD, ¾ STANDARD, and ½ STANDARD (INTERMEDIATE STANDARD and SHORT STANDARD are deprecated).

Large standard
A standard tree which has been grown several years beyond the size normal for nursery sale.

Topping
Of grass, lightly mowing. The first cut on newly sown or newly turfed grass areas.

Gapping up
Filling gaps in planted areas by replacing plants that have failed to thrive.

Beating up
Replacement of failures in a newly planted tree crop, normally done at yearly intervals after planting.

Tree work
The care and repair of trees.

Guying
The securing of a tree in an upright position by means of ropes or wires fastened to supports driven into, or buried below, the ground. Usually of newly transplanted trees.

Root bracing
The securing of a tree in an upright position by means of wire ropes and boards, or scaffold poles, tensioned across the root-ball below ground level, and fastened to supports buried in the ground. Usually of newly transplanted trees which cannot be secured by normal guying methods.

Modified forestry planting
The planting of larger-than-normal size transplants by forestry methods for the rapid establishment of woodland and belts.

B Organisations

Institute of Landscape Architects, 12 Carlton House Terrace, London SW1

Town Planning Institute, 26 Portland Place, London W1

Royal Institute of British Architects, 66 Portland Place, London, W1N 4AD

Royal Institute of Chartered Surveyors, 12 Great George Street, London SW1

Institution of Civil Engineers, Great George Street, London SW1

Institute of Park and Recreation Administration, The Grotto, Lower Basildon, nr Reading, Berks

Forestry Commission, 25 Savile Row, London W1

Nature Conservancy, 19 Belgrave Square, London SW1

Countryside Commission, 1 Cambridge Gate, London NW1

Building Research Station, Garston, Watford, WD2 7JR

Arboricultural Association, The Secretary, 36 Blythwood Gardens, Stansted, Essex

British Waterways Board, Melbury House, Melbury Terrace, London NW1

Civic Trust, 18 Carlton House Terrace, London SW1

National Playing Fields Association, 57b Catherine Place, London SW1

Association of British Tree Surgeons and Arborists, 11 Wings Road, Upper Hale, Farnham, Surrey

Association of Swimming Pool Contractors, 75 Marylebone High Street, London W1

Association of Tree Transplanters, Secretary, 100 Colney Hatch, London N10

British Association of Sportsground and Landscape Contractors Ltd, 76 Marylebone High Street, London W1

Horticultural Trades Association, Roman Wall House, 1 Crutched Friars, London EC3

National Association of Agricultural Contractors, Garden Section, 140 Bensham Lane, Thornton Heath, Surrey

National Association of Groundsmen, 108 Chessington Road, Ewell, Surrey

C Selective bibliography

Essential references

WEDDLE, A. E. Techniques of landscape architecture. London, 1967, Heinemann, £4·50 [08]

BEAZLEY, E. Design and detail of the space between buildings. London, 1960, Architectural Press, £2·10 [08·90]

NATIONAL PLAYING FIELDS ASSOCIATION Selection and layout of land for playing fields and playgrounds. London. Out of print [085]

MINISTRY OF EDUCATION Building bulletin 28: playing fields and hard surface areas. HMSO, 1966, 2nd edition [560]

MINISTRY OF HOUSING AND LOCAL GOVERNMENT Design bulletins 10 and 12: Cars in housing 1 and 2. 1966/67, HMSO [810]

Design bulletin 5: landscaping for flats. 1963, HMSO [08·816]

Trees in town and city. 1958, HMSO, £1·00 [Yx1]

Background reading

COLVIN, B. Land and landscape. London, 1970, Murray, 2nd edition [08]

FAIRBROTHER, N. New lives, new landscapes. London, 1970, Architectural Press, £3·75 [08].

HURTWOOD, LADY ALLEN OF Planning for play, London, 1968, Thames & Hudson [083]

BROOKES, J. Room outside. London, 1969, Thames and Hudson [084]

CROWE, S. Garden design. London, 1968, *Country Life*, £2·63 [084]

HURTWOOD, LADY ALLEN OF, and S. JELLICOE The new small garden. London, 1956, Architectural Press [084]

GIBBERD, F. Town design, 5th edition, London, 1970, Architectural Press, £4·20 [05 (G)]

INSTITUTE OF LANDSCAPE ARCHITECTS The urban scene; symposium report 1960
Organisation of space in housing neighbourhoods; symposium report 1961 [06: 8]
Private enterprise housing and landscape design; symposium report 1962 [08: 8]
Landscape maintenance; symposium report 1963 [08 (W1)]

MONO CONCRETE LTD Paved areas (current edition) [08]

CEMENT AND CONCRETE ASSOCIATION Paving patterns. London, 1959, *Concrete Quarterly*, vol 43, 1959, Cement and Concrete Association [90]

DAWSON, R. B. Lawns. London, 1960, Penguin/Royal Horticultural Society [(90·42)]

MANLEY, G. Climate and the British Scene. London, 1962, Fontana [(E7)]

RUSSEL, E. The world of the soil. London, 1961, Fontana [00 (E4)]

Specialist references

CABORN, J. M. Shelterbelts and windbreaks. London, 1965, Faber & Faber [083]

AIR MINISTRY Climatological Atlas of the British Isles. London, 1952, HMSO O/p [(E7) (Abr)]

E & OE Planning. London, 1959, Illiffe, 8th edition [(E1)]

MORLING, R. J. Trees in towns. London, 1954, *Estates Gazette* [Yx1]

CONOVER, H. S. Grounds maintenance handbook. New York, 1958, Dodge Corporation, 2nd edition, £4·18 [087 (W1)]

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD Leaflet 44: Mole drainage for heavy land. HMSO, 1960 [(11)]

MINISTRY OF AGRICULTURE AND FISHERIES FOR SCOTLAND Administrative leaflet 5: Shelterwoods or belts. HMSO, 1959 [083]

CENTRAL ELECTRICITY GENERATING BOARD Design memorandum on the use of fences. London, 1966, The Board [(90·21) (A3)]

INSTITUTE OF LANDSCAPE ARCHITECTS Plant. London, 1967, *ILA Journal* [Yx]

SUDELL, R. and WATERS Sports buildings and playing fields. London, 1957, Batsford [56]

COOPER, T. Practical land drainage. London 1965, Leonard Hill [(11)]

TURNER, A. L. Sports field drainage. Ewell, 1962, National Association of Groundsmen [560 (11)]

NATIONAL PLAYING FIELDS ASSOCIATION Playgrounds for blocks of flats. London, 1961, The Association [528]

MINISTRY OF HOUSING & LOCAL GOVERNMENT Caravan parks. 1962, HMSO [87]

Memorandum on the preservation of trees and woodlands. 1966, HMSO [087]

MINISTRY OF TRANSPORT Technical memorandum T2/65 Instructions on the establishment and maintenance of grass side slopes, verges and central reservations. 1965, HMSO [(90·42)]

FORESTRY COMMISSION Bulletin 14: Forestry practice. 1964, HMSO [161]

Bulletin 29: Shelter belts and microclimate. 1957, HMSO [083]

FEDERATION OF COATED MACADAM INDUSTRIES Model specification for school playgrounds. Model specification for roads and footpaths on housing and factory estates and parks. Recommendations for the construction and surfacing of paved areas for recreation and sport [528]

COLVIN, B. and BADMIN S. R. Trees for town and country. London, 1961, Lund-Humphries [Yx1]

ASHWORTH Car parks, Civic Trust for the North West. Undated [122]

D List of British Standards applicable to landscape work

(listed according to the sections of an Elemental Specification).

Note: BS = British Standard
CP = Code of Practice
* = Still in preparation

General

BS 3975 Glossary for landscape work. part 4 1966 Plant description. Part 5 1969 *Hort. & grounds maint. forestry and treework
BS 892: 1967 Glossary of highway Engineering terms
BS 1377: 1967. Methods of testing soils for civil engineering purposes
CP 2001: 1957 Site investigations
CP 2010: part 1 1966 Installation of pipelines in land

Major grading

CP 2003: 1959 Earthworks (mainly civil engineering)

Subsoil drainage

BS 1194: 1969 Concrete porous pipes for under-drainage
BS 1196: 1944 Clayware field drains
CP 303: 1952 Surface water and subsoil drainage

Hard areas

BS 340: 1963 Precast concrete kerbs, channels
BS 368: 1956 Precast concrete flags
BS* Precast concrete flags for landscape work
BS 435: 1931 Granite and whinstone kerbs, channels
BS 706: 1936 Sandstone kerbs, channels
BS 76: 1964 Tars for road purposes
BS 802: 1967 Tarmacadam with crushed rock or slag aggregate
BS 1241: 1959 Tarmacadam and tar carpets (gravel aggregate)
BS 1242: 1960 Tarmacadam for "tar paving" for footpaths, playgrounds and similar works
BS 594: 1961 Rolled asphalt
BS 1447: 1962 Mastic asphalt for roads and footways
BS 1690: 1962 Cold asphalt
BS 1621: 1961 Bitumen macadam, rock or slag aggregate
BS 2040: 1953 Bitumen macadam with crushed rock or slag aggregate
BS 3690: 1970 Bitumen for road purposes
BS 1014: 1961 Pigments for cement and concrete
BS 4008: 1966 Cattle grids on private roads
BS 4132: 1967 Winkle clinker for landscape work

Hard construction†

BS 1485: 1948 Galvanised wire netting.
BS 1222: 1945 Battery operated electric fences
BS 1722: Fences; part 1: 1963 Chain link; part 2: 1963 Woven wire; part 3: 1963 Strained wire; part 4: 1963 Cleft chestnut pale; part 5: 1963 Close boarded (incl. oak pale); part 6: 1963 Wooden palisade fences; part 7: 1963 Wooden post and rail; part 8: 1966 Mild steel or wrought iron cont. bar fences; part 9: 1963 Mild steel or wrought iron inclimable; part 10: 1963 Anti-intruder chain link; part 11: 1965 Woven wood
BS 4102: 1967 Steel wire for fences
BS 3470: 1962 Field gates and posts
BS*: Steel palisade fences
BS 3854: 1965 Farm stock fences
BS 4092: Domestic gates; part 1: 1966 metal; part 2: 1966 wooden
BS 3178: Playground equipment for parks; part 1: 1959 General requirements; part 2A: 1959 Static equipment (except slides); part 2B: 1960 Slides; part 3A: 1960 Pendulum see-saws; part 3B: 1962 Plane swings; part 4: 1965 Rotating equipment; part 3C: 1964 Plank swings; part 3D: 1964 Swings; part 3E: 1964 Rocking boats; part 3F: 1964 Rocking horses
BS 4324: 1968 Litter bins

†Common building materials (eg cement, concrete stone) not included in this list.

Services and drainage

See AJ Handbook of Building Services [(5–)]

Grass areas

BS 3882: 1965 Top soil
BS 3969: 1965 Recommendations for turf
BS 4428: 1969 Landscape operations

Planted areas

BS 4156: 1967 Peat
BS 3882: 1965 Top soil
BS 3936: Nursery stock: part 1: 1965 Trees and shrubs; part 2: 1966 Roses; part 3: 1965 Fruit; part 7: 1968 Bedding plants; part 9: 1968 Bulbs, corms and tubers
BS 4428: 1969 Landscape operations

Individual tree planting

BS 3936: Nursery stock: part 1: 1965 Trees and shrubs; part 4: 1966 Forest trees
BS 4428: 1969 Landscape operations

Large tree planting

BS 4043: 1966 Transplanting semi-mature trees

Forestry and woodland areas

BS 3936: Nursery stock: part 4: 1966 Forest trees

Tree work

BS 3998: 1966 Tree work
BS*: Tree wound dressings
BS*: Safety equipment for tree work

Maintenance

BS 1831: 1969 Recommended common names for pesticides
BS*: recommendations for grounds maintenance
BS 3746: 1964 Pvc hose
BS 3716: 1964 General purpose rubber water hose

Section 3 **Surveys and contract management**

Information sheet Landscape 1

Site investigation and appraisal

This information sheet has been prepared by CLIFF TANDY *to describe the procedure for appraisal of all sites, urban and rural, in three stages: preliminary investigation, on-site investigation and an assessment of results. The guide to site surveying*[1] *will complement this sheet and deal generally with sites in the context of building*

1 Preliminary research

1.01 Preliminary research into regional setting, location and character of a site should always be undertaken before carrying out site investigations. This allows limited survey time to be used to greatest advantage, and minimises risk of important omissions.

Location of site

1.02 Ordnance Survey 1in (1:63360) and 2½in (1:25000) sheets are particularly useful for making rapid appraisals of the site's regional and local significance. More detailed information on field and parish boundaries and spot heights is shown on 6in (1:10560) and 25in (1:2500) sheets, though these are not available for *all* rural areas.

Topography and survey

1.03 Base maps for site survey work should be produced, as far as possible, on the same scale as proposed final drawings. Depending on size of site, scales most commonly used are 1:63360, 1:25000, 1:10560 and 1:2500. Where accurately contoured plans are required, showing contour intervals of less than five feet, it may be necessary to have data plotted on an existing map using aerial photogrammetric techniques. This service is normally provided only by commercial firms, but sometimes existing photographs can be obtained from local authorities or DOE (formerly MHLG). Where possible, aerial photographs of the site should be examined stereoscopically; this reveals many surface features which are obscured on standard prints.

Site boundaries and ownership

1.04 Some general information on farm boundaries and land ownership is given on small scale sheets, but for precise details about site deeds, leasing contracts, easements, public rights of way, etc, the client's solicitors or Land Registry should be consulted. For information about water, gas and electricity mains, consult the appropriate utility board. For information about sewers, consult the local authority.

Geology

1.05 Geological maps are available for most parts of the country and are published on ¼in (1:250000 and 1in 1:63360) OS sheets. Two series exist, showing drift (any geologically recent strata deposited above the solid geology below) and solid geology separately, but in some areas only a combined edition is available. The maps are produced by the Geological Survey, together with descriptive memoirs, and can be obtained through OS agents.

Dyeline and photographic copies of some unpublished 6in (1:10560) National Grid geological maps are also available through the Geological Survey regional offices of the Institute of Geological Sciences.

Other sources of geological data include bore hole records made in the course of mineral, geophysical and hydrological surveys. Further information can be obtained from the Institute of Geological Sciences, Exhibition Road, South Kensington, London SW7.

Climatic data

1.06 Monthly and annual summaries of climatic data can be obtained from the Director General, Meteorological Office, Bracknell, Berks, for some thirty regional meteorological stations. In addition, one year climatic averages of temperature and rainfall for selected stations are published in the Climatological Atlas.[2]

A far more comprehensive service can be provided by the Meteorological Office if required. Existing climatic data for the area in question is analysed to produce daily and monthly forecasts of weather conditions likely to affect particular types of construction.

In some areas the incidence of air pollution is, or has been, sufficiently high to inhibit the growth of certain crops and other plant species. Information should be sought on current levels and trends of air pollution for the area round the site. Air pollution statistics are given in the investigation of air pollution annual reports.[3] Further details on smoke control zones, black areas (non smoke control areas), and sources of air pollution can be obtained through local public health and public analyst's departments.

Soil data

1.07 The Soil Survey of England and Wales[4] is gradually producing memoirs and 1in (1:63360) maps on the soils of various districts. Very little of the country is covered and the information is highly technical. Similar work for Scotland is being produced by the Macaulay Institute for Soil Research, Craigiebuckler, Aberdeen.

Land capability

1.08 Land classification maps (agricultural classification) are published by the Ministry of Agriculture, Fisheries and Food.[5] These are overprinted on 1in OS maps, the whole country being covered rapidly. The system gives a broad classification of land quality, based on cultivable crops **9**.

Land capability maps[6] (agricultural potential) of the Soil Survey in association with the Macaulay Institute are now being produced on an experimental basis. These are based on physical character of the soil, and although produced in collaboration with MAFF they do not use the same system of classification.

Land use

1.09 The second Land Utilisation Survey of Great Britain[7] is on 2½in (1:25000) maps. Much of the UK has been covered. Recording is done largely by schools and information is correct at time of observation only.

Water and drainage

1.10 Preliminary plotting of stream and river routes and of watersheds (by contours) on 1in (1:63360) or 2½in (1:25000) OS maps indicate the particular hydrographic area in which the site is located. The appropriate river authority will provide data on river flows, liability to flooding, seasonal variations, washlands (waterside land liable to flooding) and water pollution.

Archaeological and historical remains

1.11 Locations of many valuable archaeological and historical sites are recorded only in library archives. Often their presence is discovered during first phases of excavation, with insufficient time to carry out a detailed investigation. Therefore, the existence of such remains should be checked on early editions of the OS and in local historical records. Advice can be obtained from county planning offices and county archivists. One should also consult the Nature Conservancy and county naturalists' trusts to discover if the site has significance in terms of plant and animal life.

2 Site investigations

2.01 Topographical maps and plans should be checked on site for accuracy and additional information on landscape, such as sharp changes of slope, rock exposures, wet flashes, tree stumps, and changes made by agriculture.

Microclimate

2.02 Microclimate is loosely used to refer to precise climatic conditions within a single site, between groups of trees, inside topographical features or between buildings. As published meteorological data is only general such specific information must be sought on site (see para 1.06). Ideally, instrument readings should be taken within the site, but in practice readings taken for less than a year are of little value. One is therefore left with subjective estimates of site conditions, preferably based upon several site visits at different seasons and in varying weather.

The following situations can usually be identified:

North-facing slope with low *insolation*

Warm south-facing slope with high *insolation*

Bad air drainage (flat low-lying land)

Impeded air drainage

Frost pockets

Damp hollows

Sheltered localities and wind-speed reduction by various features

Exposed localities and wind-speed increase by topographical features of buildings

Wind funnels

Fohn wind (warm down-valley wind) situations

Tendency to hold fog, mist, humidity, etc

Particular coastal conditions of on- and off-shore winds, salinity and salt-spray

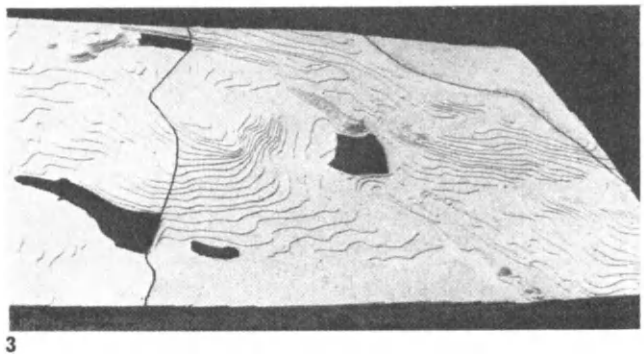
For additional guidance see references 8, 9, 10 and 11.

Soil

2.03 Soil tests **1** may be made with small trial pits 250 mm square by digging or with a 30 mm or larger hand soil auger. Samples (usually about 750 mm deep) should be taken in several places, preferably not less than one to each acre.

1

2



3

1 *Soil investigation with hand augers and chemical pH testing kit*

2 *Counting species within square metre quadrat, for an ecological plot*

3 *Contour models of polystyrene sheet or thin cork are almost essential aids to landscape appreciation. They are also basis for design of ground modelling*

Top soil and subsoil should be kept separate.

The following information should be recorded:

Depth of each horizon (layer): top soil, sub-soil, intermediate, bedrock

Soil's cohesive character (ie heavy, medium or light to dig)

Texture by hand test of top soil, sub-soil, etc

Larger physical components of soil (eg cobbles, flints, gravel) stones, chalk)

Moisture content*

Level of water table*

Type of bedrock

Plants which indicate soil type and fertility

* Note should be made if due to recent rain or drought.

Soil investigation techniques, including digging pits and making trial borings are described in AJ Information sheets 1357, 1358, 1359, 1360 (AJ 27.10.65). While being more elaborate than normally necessary, these techniques are relevant to landscape work. The information taken, however, is related to *engineering* classification of the soils and its bearing capacity. In landscape work, soils must be classified according to biological qualities.

Land use

2.04 Being subject to changes due to growth, season, and husbandry, land use information should be checked on site. Long term or 'permanent' use of land should be distinguished from temporary leys, fallow periods or catch crops (sown and raised between two main crops).

Water and drainage pattern

2.05 The present visual form of the landscape has been almost entirely created by water (or ice) erosion and the present drainage pattern is the key to the topographical form.

The depth, apparent quality, speed of movement and origin of water—in rivers, streams, ditches (even when dry), pools, lakes, springs, canals, wet flashes, badly drained or flat marshy land, outfalls, culverts, dams and drainage falls—should be noted and added to published data (see para 1.10) for the site and its vicinity.

Artefacts and local materials

2.06 Data from topographical maps should be supplemented by descriptive notes including height, materials (including condition and quality) and potential for reuse of such artefacts as:

Roads, paths, paved areas
Fences, walls, gateways
Steps, ramps, retaining walls, changes of level
Bridges, sluices, culverts, dams
Stables, barns, huts and other small buildings
Windpumps, poles supporting cables

Site vegetation

2.07 Although the *total* pattern of vegetation on a site should be examined, it is convenient in practice to record the various layers separately:

Top layer

2.08 The top layer, tree cover, is fairly straightforward, as the nature of trees enables them to be precisely surveyed. Woodland and large tree groups can be classified on a general basis, identifying the mixture of species in the group. However, when woodland is going to be cut into for roads, buildings or lines of drains, cables, etc, it is essential that individual trees on and near routes are fully surveyed. The following information should be recorded about each tree, and each tree in an avenue, formal pattern, or small group:

Location
Family and species (also variety if needed to distinguish character)* eg *Fagus sylvatica pendula*
Approximate height
Approximate spread
Diameter of bole (if over 150 mm)
Approximate height of lowest branch
Form of growth (habit)
Condition (faults obvious from ground level)

*See select lists in information sheets LANDSCAPE 6, 7, 8 and 9

Middle layer

2.09 The middle vegetation layer consists of multi-stemmed shrubs, in the form of bushes, scrub coverts and thick undergrowth, and individual shrubs, with young tree growth, hedges, and larger flowering plants. These can usually be recorded in mass on the basis of area of ground occupied, only large single shrubs of significant appearance and value being recorded individually.

The following information should be recorded:

Location and extent (usually by roughly plotting perimeter)
Height
Density of planting (usually stem to stem spacing or number of plants to the square metre)
Family and species of the principal plants
Form of growth (habit)
Condition

Lowest layer

2.10 The lowest layer is ground cover, which may be grass, herbaceous plants and low shrubs. In landscape work which must relate to the natural ecology, or which must become self-maintaining, a full ecological study of plant communities, based on a count within a square metre quadrat **2** is essential. Such a study is rarely done on urban sites, or sites which are to become urban and artificially maintained.

Where the site is extensive, its vegetation pattern should be classified according to recognised plant communities. A check list of these on a world scale is given in Peterken[11].

Visual analysis

2.11 A *visual* record of the site is essential. This can be done by mentally absorbing its spatial form while walking over it several times. Retention can be assisted by sketches and photographs. But this is not enough. An analysis of the character of the spaces, and relationships between them should be made, sufficient to enable one to refer to it during the design process and to convey something of the site's spatial qualities to people who have not seen it.

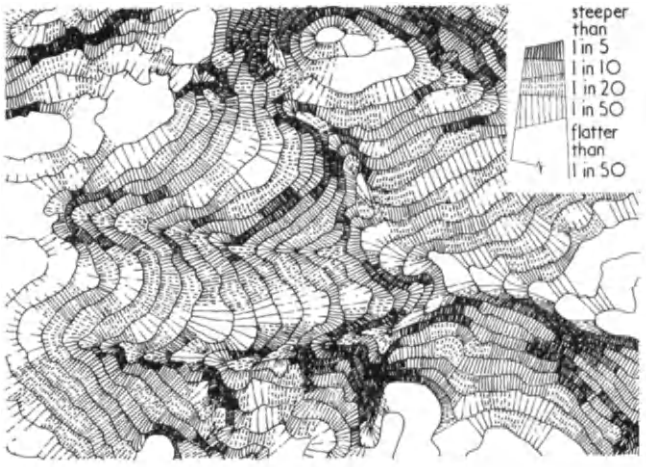
A convention for recording such an analysis—known as 'Isovists' **11** was described in a Landscape Research Group symposium. Briefly it entails recording on a series of plans, edges of objects forming boundaries to one's vision from selected positions in each separate space zone. Lines which are boundaries of 'dead-ground' and those forming visual watersheds between one zone and another are also recorded. By careful initial selection and modification, if necessary on a trial and error basis, the sequence of zones which make up the total space of the area can be defined and their character from 'extroverted' to 'introspective' identified. Barriers between zones, links between them, and 'windows' out to surrounding scenery can be precisely determined.

3 Appraisal

3.01 This is carried out on return from the site. It begins with up-dating preliminary data (para 1) on the basis of information gained on site (para 2) and continues with plotting other data in an easily-appreciated form, eg maps **4** to **11** to show the site's slopes, microclimate, land use, plant ecology, geology, agricultural uses, drainage pattern, and a visual analysis **11**. Contour models **3** of the site are almost essential aids to appreciation of its landscape.

Vegetation

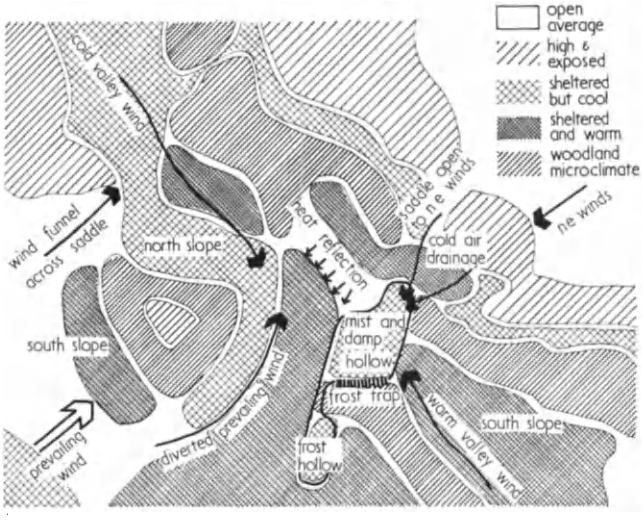
3.02 Vegetation can be plotted on a site plan incorporating an assessment of the worth of trees, shrub groups, grass and other plants. Assessment can take the form of recommendations:



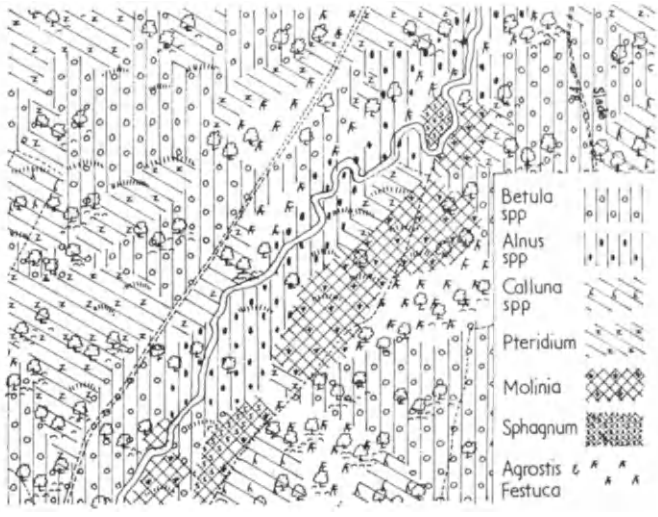
4 *Slope analysis: steepness of slope shown by density of hatching*

Key
1 Hay
2 Wheat/barley
3 Rough grazing
4 Derelict land
5 Market gardening
6 Heathland
7 Industry

6 *Land use map*



5 *Climatic analysis*



7 *Ecological plot of plant associations. (In complex plots such as this, the services of an ecologist are often required)*

1 Essential—to be kept at all cost
2 Desirable—to be kept unless retention makes the project unworkable
3 Inessential—may be kept or not, as planning requirements dictate.
4 Undesirable—should be removed because of disease, danger, overcrowding or similar reason
(1, 2, 3 or 4 may be indicated by symbol or colour: green, yellow, brown, red)

Slope analysis

3.03 A slope analysis plan **4** should be prepared from a (checked) contour plan. About five grades of slope are selected and identified on the contour map by the ratio of contour interval and distance between contour lines (eg on any scale of map 0·5 m contours on a 1 in 10 slope will be 5 m apart). The map is then shaded by hatching between the contour lines with greater density of hatching representing steeper slopes.

Visual zones

3.04 Visual analysis plans should be summarised into a single diagram **11** identifying the different visual zones into which the site can be divided and indicating their character and features which link or separate them.

Interacting factors

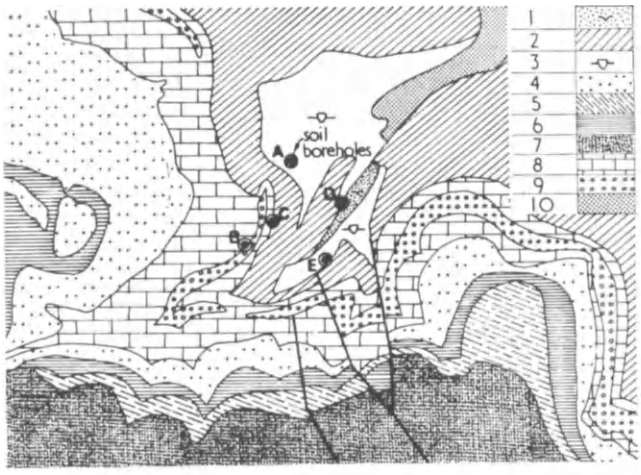
3.05 The next stage of appraisal is to study factors which interact and would be affected if changes were made to one of them. Examples of these are:
Climate/slope
Slope/drainage
Soil/slope
Vegetation/climate
Visual analysis/slope
Visual analysis/vegetation

Communications

3.06 Means of access and communications between the site and its surroundings play an important part in determining the nature and intensity of its present and future uses. Consequently, detailed information may be required on the carrying capacity of local roads, on proximity to centres of population, adequacy of existing car parking facilities and reliability and frequency of public transport services. Much of this information can be shown graphically on 'spheres of influence' or 'real distance' maps which convey the facts more effectively than a series of tables.

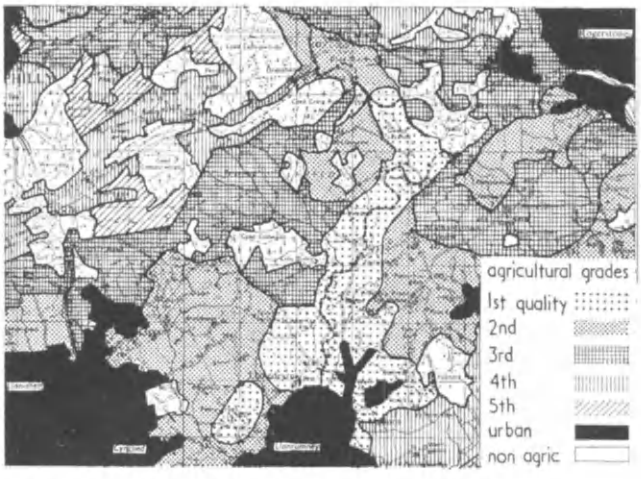
Sociological aspects

3.07 If future development of the site is likely to include

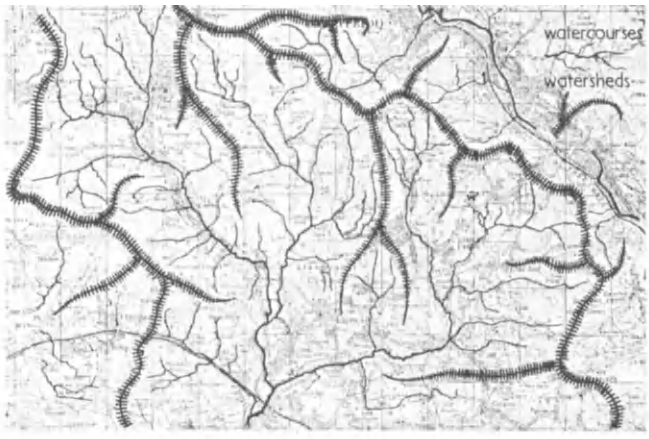


Key
1 Alluvium
2 Red sandstone
3 Boulder clay
4 Conglomerate
5 Millstone grit
6 Shale
7 Coal measures
8 Limestone
9 Oölite
10 Sand and gravel

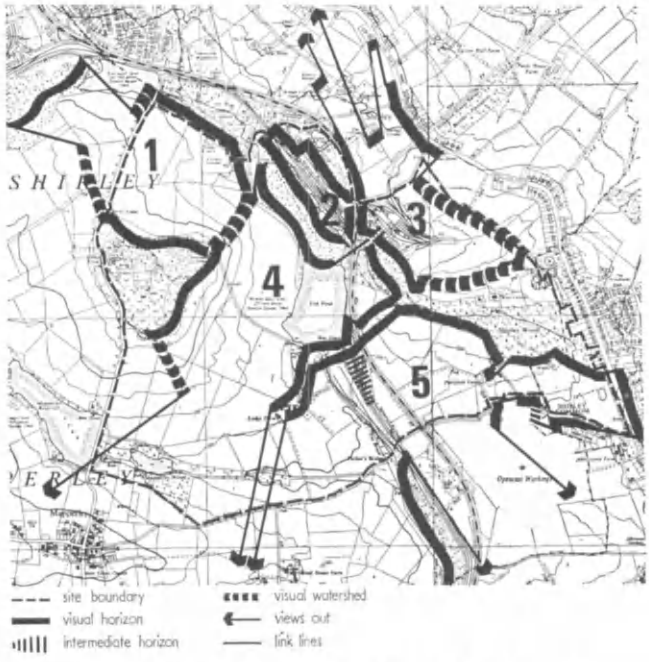
8 *Geological plan*



9 *Agricultural land classification, see para* 1.08



10 *Drainage pattern and watersheds*



11 *Visual analysis by 'Isovists' methods. (Numbers refer to space zones—see para* 2.11)

some aspect of public use, a study of population trends, and size and age structure in neighbouring settlements should be undertaken. (Population statistics are produced by the General Register Office and published by HMSO.)

By considering this information with that of para 3.06 on site accessibility, and making assumptions about the relative mobility of the population, some prediction of potential size of the site's catchment area can be made.

Assets and liabilities

Studying the data with the project's user requirements in mind will reveal which site characteristics can be classified as assets and which as liabilities.

Conclusion

3.10 The final stage of appraisal is a mental process of synthesising the data (para 1 and 2), the nature of the intended project and the various decisions made on the data (para 3) into an appreciation of the site as a total entity; and should lead to conclusions on the *suitability of the site for its purpose* and on its *landscape potential*.

References

1 HEWITT, R. Guide to site surveying, 1972 Architectural Press, London [(A3s)]

2 METEOROLOGICAL OFFICE Climatological Atlas of the British Isles. HMSO [(E7) (Abr)]

3 MINISTRY OF TECHNOLOGY The investigation of air pollution (annual). HMSO [00 (E2f)]

4 SOIL SURVEY *Maps of 1in scale*, HMSO or Librarian, Rothamsted Experimental Station, Harpenden, Herts [(L4) (Abr)]

5 MINISTRY OF AGRICULTURE, FISHERIES AND FOOD Land classification maps, HMSO, or Publications department, Ministry of Agriculture, Tolcarne Drive, Pinner, Middx [OD (Abr)]

6 MINISTRY OF AGRICULTURE, FISHERIES AND FOOD Land capability maps. HMSO or Librarian, Rothamsted Experimental Station, Harpenden, Herts [00 (Abr)]

7 LAND UTILISATION SURVEY OF GREAT BRITAIN Maps available from Miss A. Coleman, Geography Department, King's College, Strand, London WC1 [00 (Abr)]

8 AJ Handbook Building environment, section 1 Climate and topography (AJ 2.10.68 and 9.10.68) [(E6)]

9 MANLEY, G. Climate and landscape architecture, ILA *Journal*, 1966, May [08 (E7)]

10 GEIGER, R. Climate near the ground, Harvard University Press, 1966, Cambridge, Mass. [(E7)]

11 PETERKEN, G. F. Guide to the check sheet for international biological programme areas. IPB Handbook No 4 1967, Blackwell, London [08 (E4)]

Information sheet Landscape 2

Section 3: **Surveys and contract management**

Check lists: user, legal and planning requirements

Believing that 'it is good discipline to insist that all *external space must have a use',* CLIFF TANDY *has compiled a check list of user requirements and factors affecting them, followed by a comprehensive list of legal and planning requirements. (Notes on abbreviations for readers unfamiliar with the responsibilities of the new government departments:* DTI *Department of Trade and Industry;* MTI *Ministry for Transport Industries;* MLGD *Ministry of Local Government and Development;* MHC *Ministry of Housing and Construction)*

1 User requirements

1.01 As clients seem unable to brief architects properly about their requirements for areas and conditions of indoor space, they are even less likely to be able to state their open space needs. So far this subject has barely been considered and very little guidance is available. It is quite unreasonable to present a client with a comprehensive questionnaire and expect it to be completed. The designer may use a check list as an *aide memoire*, but he himself must draw the information from the client by well-chosen probing questions.

1.02 Most laymen—and unfortunately many architects—regard external space as a bonus which is pleasant as a setting for the building, but is of no real use once car parking and sports needs are met. It is good discipline to insist that *all* external space must have a use, always remembering that aesthetic enjoyment may be a valid use.

The accompanying outline check list for user requirements is divided into 'activities'; and 'factors' which may or may not affect any or all of the activities. As this handbook applies to all types of landscape spaces, specific uses appropriate to particular projects may have to be added.

Note: Each activity in check list 1 *may be affected by some or all of the factors in check list* 2

Check list 1: user requirements

Activity	**Check, for example . . .**
Existing uses (perpetuated)	
(specify)	Public right of way
Active uses	
VEHICLE CIRCULATION:	
Through traffic	Public road
Direct access	Visitors' cars, fire appliances
Waiting	Taxis
Car parking	
Loading and unloading	Deliveries, Refuse collection
Leisure	Driving for pleasure
Cycling	To work or for pleasure
Cycle parking	
Motor cycle parking	
PEDESTRIAN CIRCULATION	
Direct	Visitors, shopping
Casual	Walking for pleasure
Leisure direct	Access to sport
CIRCULATION OF EQUIPMENT	
(specify)	Fork lift trucks, mowers
CIRCULATION OF GOODS	
Non-vehicular	
(specify)	Conveyor belt or cable
OUTDOOR WORKING	
Personnel only	Parades or drill
With vehicles	Car assembly, Aircraft servicing

Check list 2: factors affecting activities

Factor	**Check, for example . . .**
Users:	
Number	Persons, cars
Classification or category	Workers, visitors, tourists
Segregation:	
By rank or grade	
By sex	
Age groups of users	
Special categories	Old people, disabled, blind, Infected (hospitals)
Groups and clubs	
Frequency of use:	
Continuous	
Intermittent	Daily, weekly
Periodic	
Seasonal	Winter months only
Hours of use	
Area:	
General area	(Known or estimated)
Fixed size requirements	Games pitches, car spaces
Number of areas	Games pitches, car spaces
Tolerances	Sports control boards
Margins	Side and end shift (pitches), Turning spaces
Levels:	
Maximum grade tolerated	Vehicle ramp, games pitches
Minimum grade tolerated	Drainage falls
Relative levels needed	Stage height

Activity	**Check, for example . . .**
(*outdoor working cont'd*)	
With equipment	
(specify)	Container loading
	Machinery testing
SERVICE AREAS	Car washing
GROUNDS MAINTENANCF YARDS	
SPORT:	
Organised	Football, rugby, cricket
Casual	Camping
Water	Swimming, fishing
GENERAL RECREATION:	
Free play	Ball games
Exercise	Strolling on grass
(Or specify)	dancing, garden party
CHILDREN'S PLAY:	
Playgrounds	
Casual play areas	
Passive uses	
SITTING:	
Formal	Cafe tables
Casual	Lunching on grass
Spectator	For sport, music, theatre, pageant etc
Instruction	Open air classrooms
AGRICULTURAL OR HORTICULTURAL USE:	
Allotments	
Plant nursery	
Glasshouses	
Crop growing	
Grazing	
CLOTHES DRYING	Clothes line; rotary drier
STORAGE (OUTDOOR)	Container storage
	Assembled cars
	Heavy steel goods
VISUAL ENJOYMENT:	
Specific	View from certain room
General	
CONSERVATION:	
Plant species	
Wild life	
Archaeological	Historical remains

Factor	**Check, for example . . .**
Locality:	
Adjacent to . . .	
Enclosure:	
Boundary definition	Marked, fenced, walled
Privacy	
Screening	
Wind shelter	
Safety and security	
Access:	
In from . . . out to . . .	
Vehicle—through	
Vehicle—delivery	
Vehicle—refuse collection	
Vehicle—maintenance access	
Vehicle—fire appliances, ambulances	
Pedestrian—through	
Pedestrian—emergency exit	
Security access	Gate control for security, paid admission
Safety precautions	Public gateways
Services needed:	Electric, water, gas, telephone
Location	
Number of points	Hose outlets
Night use	Floodlighting
Height clearance	Overhead cables
Orientation:	
To sun	Sports pitches
To view	Spectator seating
To wind	Sailing club
Conditions:	
Wind shelter	Shelter belt planting
Screening	Cricket screen
Shade: full	
semi	
intermittent	Greenhouse blinds
Overhead cover	
Lighting	Daylight, sunlight, glare
Acoustic privacy	
Furniture	Tables and chairs
	Park benches
Fixed equipment	Flagpoles, bollards
Movable equipment	Goal posts

Check list 3: statutory, legal and planning requirements

Note: this list attempts to be comprehensive; many items will not necessarily apply to every project

Item	**Authority**	**Consent needed**
Site land	Owners, landlords	Yes
	Tenants and lessees	(Notify)
	Estate surveyor or architect	Yes
	Insurance company	(Possibly)
	Building society	(Possibly)
	Holders of easements *over* site	Yes
(Site land cont'd.)	Holders of wayleaves (including gas, electricity and water boards, post office)	Yes
Adjoining land	Owners, landlords	Notify if affected
	Holders of rights of way or rights of light	Notify if affected

Item	Authority	Consent needed
(*Adjoining land cont'd*)	Holders of rights of air	Notify if affected
	Holders of rights of support	Notify if affected
	Owners having an interest in easement *from* the site	Notify if affected
Party walls or fences	Owners/lessees	Yes
Restrictive covenants	Client's solicitors	
GRANTS:		
Housing improvement	Local authority	
Industrial development	DTI	
Agricultural improvement	Ministry of Agriculture, Fisheries and Food	
Forestry grants	Forestry Commission	
Historic buildings (maintenance)	Local authority (district and county) and MLGD	
Derelict land restoration	MLGD	
Recreation in countryside	Countryside Commission	
Office development permit	MLGD	Yes
Industrial development certificate	DTI	Yes
Building licence	MHC (limited control)	Yes
Building regulations	Local authority surveyor	Yes
Means of escape	Local authority surveyor or fire prevention officer (as appropriate)	Yes
Drainage	Local authority surveyor	Yes
Private system connection to public sewer	Local authority surveyor	Yes
Connection to watercourse	River authority	
Oil storage	Local authority surveyor	Yes
Petroleum Acts regulations	Local authority surveyor	Yes
Water supply	Water board	Apply for service
Electricity	Area electricity board	Apply for service
Gas supply	Area gas board	Apply for service
Telephone	Post office	Apply for service
Previous consents	Local planning authority	
Use-zoning	Local planning authority	Yes
Planning approval	Local planning authority	Yes
Plot ratios/density	Local planning authority	Yes
Listed buildings	Local planning authority and MLGD	Yes
Tree preservation orders	Local planning authority	
Building lines	Local planning authority	Yes
Improvement lines	Local planning authority	Yes
Height limitations	Local planning authorty and DTI (aircraft)	Yes
Aesthetic control	Local planning authority and Royal Fine Art Commission	Yes Yes (if applicable)
Ancient monuments	MHC	
Royal palaces and parks	MHC	
External advertising	Local planning authority	Yes (if applicable)
Fire precautions	County fire service	Yes
Tree felling	Forestry Commission or local planning authority	Yes
Overhanging trees	Local highways authority	
Dangerous trees	Local surveyor	
Adjoining roads	Local highways authority	
Future road proposals	Local highways authority	
Trunk roads or motorway proposals	MTI (through local highways authority)	
Site roads:		
Widths Loading Surface Sight lines Crossovers Construction	Local surveyor or highways authority	Yes
'Bad neighbour' type development	Public advertisement and control by planning acts	

OTHER REGULATIONS

Public health Acts
Factory Acts
Commons Act
National parks etc Act
Offices, shops and railway premises Act
Local employment Acts

OTHER AUTHORITIES POSSIBLY CONCERNED

Harbour board
Catchment area board
Public transport authorities
Licensing authority: liquor, music, dancing
Public health inspector
Alkali inspector
Ministry of Agriculture, Fisheries and Food
British Transport Docks Board
British Waterways Board
Countryside Commission
Nature Conservancy
Water resources board

Information sheet Landscape 3

Specifications and estimates

In this article CLIFF TANDY *explains the advantages of elemental specification in landscape work and shows the use of* area *as a reliable basis for preliminary estimating and cost planning*

1 Introduction

Elemental specification

1.01 Traditionally, landscape specifications were written 'by trades' as in building specifications. Today it is usual to apply *elemental* classification to landscape work, with consequent advantages in cost-planning, taking off quantities and pricing. For example, in the case of a bed of planting, a single area measurement would be applied to the following items:

Cut, rake and burn and clear rubbish
Cut, lift and stack on site turf in good condition
Excavate top soil and set aside for re-use
Excavate to reduce levels and get out, wheel and deposit . . .
Fork over bottom of planting bed
Supply stable manure at . . . (rate) . . . and dig in
Supply, spread and level . . . (depth) . . of top soil
Set out in position, plant and firm-in . . . (number . . . plants per m^2)
Fork, rake and weed, firm-in and water five times (maintenance, provisional)

Such a group of items would comprise a single element 'planted area', and could be given a single all-in rate per unit area.

Plants to be supplied are listed in a separate schedule by name and number.

1.02 One difference between landscape work and building work is that few landscape materials are 'imported'. Most of the specification consists of *labours* executed upon the site as it exists. Since over 80 per cent of these labours are carried out on one material—the soil—elements must sometimes overlap. Specifications—and more particularly bills of quantity—must therefore show clearly whether an element applies to virgin soil or to soil already worked in a previous element. The effect of this is that, for instance, 'major grading' and 'sub-soil drainage' become separate elements in their own right, measured separately and overlapping, but not necessarily coinciding with areas of other elements.

For practical reasons, a contractor cannot leave small islands of soil untouched in the middle of a large sweep of cultivation. The element 'individual tree planting' is therefore measured as extra to the general shaping and cultivation of the area in which the trees occur.

Check list 1 (sections in landscape sub-contract specifications and bills) is typical, but does not attempt to be exhaustive.

2 Preliminary estimating

Diversity of landscape work

2.01 In early stages of *architectural* projects, estimating can be fairly precise, as rates 'per sq ft' or 'per cu ft' of well recognised building types have evolved. This is not so easy in landscape work. 'Types' of project are not distinct and no regular measured rates are published. Even for tender purposes estimating is not so close and accurate as in building, and so data are less useful. But above all, since landscape work is so diverse and is related to existing conditions rather than to standardised imported materials, costs of different projects are rarely comparable. Despite these difficulties, ways of making preliminary estimates of landscape work do exist, and they *can* be highly accurate.

Unsatisfactory estimating methods

2.02 It is necessary to dismiss analyses of building costs showing costs of external works as a unit rate on the area of the *building*, as they can be misleading. They are useful only where a large number of almost identical jobs are planned, all occupying sites similar in area, slope, and geographical location—a very rare occurrence.

Because of an assumed parallel with allocation of money for sculpture and other works of art, landscape work is often estimated as a *percentage* of the building costs. This is equally subject to gross error as it ignores the size and character of the site. It perhaps has some merit as a very approximate cost allocation method for jobs with a fairly constant cost/area ratio such as schools, hospitals, prisons. Systems based on 'cost per place' or 'cost per bed' often used for institutional buildings, can be extended to external works, though landscape work is likely to be the most variable element in the whole project.

Methods based on area

2.03 It is obvious from the objections above that estimating should begin with the factor which varies most from job to job; this is undoubtedly *area*. It has therefore been common practice to estimate landscape work on a 'rate per acre' basis. A single rate would be too approximate, and on large projects at least three different rates should be taken: the highest for intensive landscape treatment near buildings and within the building complex; the lowest for 'fringe areas' where low cost forestry planting, improvement of existing grass or planting, or change from agricultural cultivation to amenity cultivation is all that is required; and the middle rate for the remainder of the site.

2.04 Even in using three different unit rates, site abnormalities should be allowed for. Five common abnormals which influence prices by a serious amount are:
1 Steeply sloping land
2 Absence or shortage of top soil (eg hard surfaced sites)
3 Large scale reshaping, involving excavating in rock
4 Need for extensive land drainage
5 Remote locations involving exceptional transport of materials and labour problems

Proposed unit of area: the 'are'

2.05 In spite of its popular use, the acre is too large a unit for successful estimating, while the square foot and square yard are too small. The change to metric makes the situation worse. A square metre is negligibly larger than a square yard, while a hectare is 2·4 times the size of an acre. There is a movement within the landscape profession to adopt, for estimating and cost planning, the unit of 100 m^2 called the *are*, though the name is not yet in common use.

Approximate quantities

2.06 The most accurate method of approximate estimating is to take off approximate quantities, usually on an 'elemental' basis for use with 'all-in rates' (see para 1.01) and comparing it with data from previous projects.

3 Cost planning

3.01 A well organised method of this kind is the first stage of a full cost planning system. Cost planning for landscape work is quite feasible and depends only on selecting a suitable unit, and adopting *elemental* breakdown of specified items. For the former, the 100 m^2 unit—the *are*—is suitable. The second stage is to set or adopt cost-limits for the landscape component of a project. These may be imposed by the client, authority, or government department responsible for financing the project. Otherwise they may be set by the original preliminary estimate or adopted by the project designer as a reasonable proportion of the external works. On urban sites with no large attached land holdings, landscape costs often average between 1½ per cent and 2½ per cent of total project cost.
The remaining stages of the process consist of checking the various areas at different cost rates against the adopted cost-limits (at each design stage).
If a landscape design is largely two-dimensional, it is possible to simplify its cost planning by means of a 100 m^2 grid at the scale of the layout drawing, on which the number of units of each different element can be counted. Multiplying the number by the unit rate gives the cost of the particular element. It is then possible to choose whether to use a large number of 'cheap' units or a smaller number of more expensive units to meet the cost plan.

References

1 NISBET, J., AND OTHERS Cost planning studies AJ 7.2.62 and 9.5.62 [SfB (1961): CI/SfB (A4)]
2 NISBET J. Cost planning and cost control guide AJ 3.11.65 to 24.11.65 [SfB (1961): CI/SfB (A4)]
3 NISBET, J. Estimating and cost control. London, 1961, B. T. Batsford, 35s [(A4)]
4 LICHFIELD, N. Economics of planned development. London, 1969, *Estates Gazette*, 52s 6d [00 (Y)]

Check list 1: sections in landscape subcontract specification and bills

0 Preliminaries and general

1 Major grading	Stripping top soil Grading and earthmoving
2 Subsoil drainage and water	Mole drainage Perforated pipe drainage Water supply
3 Hard areas	Flexible paths Pavings Margins Edgings and rails Drainage to hard areas
4 Grass areas	Existing grass areas to be improved and maintained New grass areas (*a*) On virgin soil: cultivation turfing or seeding (*b*) On areas stripped and graded: top soiling turfing or seeding Special grass areas, eg cricket square
5 Planted areas	(*a*) On virgin soil: excavating 300 mm top soiling planting (*b*) On areas stripped and graded: excavating further 200 mm top soiling planting Schedule of plants
6 Individual tree planting	Excavating and back filling Tree planting Schedule of trees
7 Large tree planting	Excavating Planting and supporting Schedule of large trees
8 Forestry and woodland areas	Forestry planted areas (*a*) On virgin soil: cultivation planting (forestry, modified forestry) (*b*) On areas stripped and graded: top soiling planting (forestry, modified forestry) Schedule of forestry transplants
9 Treework	Felling Thinning and pruning Tree surgery
10 Summary	Provisional sums Summary

Information sheet Landscape 4

Section 3: **Surveys and contract management**

Procedure and control

Being a working combination of modern methodology and traditional routines, the RIBA *plan of work (as published in the* RIBA *Management Handbook) is equally appropriate to landscape work, with minor changes. This version by* CLIFF TANDY *is appropriate to a landscape project run as a sub-contract to a building contract*

Check list 1: organisation and management

Stage	Work	Personnel
A Inception	Briefing of all professionals	Architect; civil engineer; landscape architect; client
B Feasibility	User requirement studies Site investigations Landscape appraisals	Landscape architect; client
C Outline proposals	Studies on requirements and technical problems of layout; cost studies	Architect; civil engineer; landscape architect; qs; client
D Scheme design	Final sketch layout, cost plan and report; submission for approvals	Architect; civil engineer; landscape architect; qs; client; statutory authorities
E Detail design	Design of all elements of landscape which go into main contract; inter-professional agreement; cost check	Landscape architect; architect; civil engineer; qs
F Production drawings	Working drawings of layout, constructional details, planting plans	Landscape architect; architect; civil engineer
G Bills of quantities	Preparation of bqs and final estimate of sub-contract provisional sum to go into main contract	Landscape architect; qs
H(1) Main contract tender	Selective tender action on main contract	Architect; qs; client; contractor
H(2) Sub-contract tender	Selective tender action on landscape sub-contract	Landscape architect; qs; architect; client; contractor; sub-contractor
J Project planning	Initial project management operations including progress chart; site conservation proposals	Landscape architect; civil engineer; contractor; sub-contractor
K Site works	Execution of the work and supervision	Landscape architect; sub-contractor; c of w
L Completion	Physical completion and inspection; defects liability period; final account	Landscape architect; architect; qs; contractor; sub-contractor
M Maintenance	Handover for future upkeep; maintenance plan and programme; feedback after use	Landscape architect; architect; maintenance officer; maintenance contractor

Check list 2: tender procedure

(applied to landscape sub-contracts)

Action	Subsidiary action
Compile list of general landscape contractors	Ask client for nominations
Compile list of contractors for: sports grounds treework and forestry	Ask main contractor if he wishes to tender or to nominate
Check status of contractors	Ask for references Investigate financial status Ask to see examples of work
Make select list for the project	
Send out letters of invitation to tender	Record invitations
Prepare tender documents and covering letter	Include: drawings, specification, bills of quantities, form of tender, return envelope

Action	Subsidiary action
Make sure that necessary information is included with (or in) tender documents	Eg: location of site; means of access; where main contract drawings may be inspected; where contract conditions may be inspected; phasing of work (if any); bond—if required; date, time and address for return of tender; name and address of main contractor
Send out letter and documents to all tenderers on final list	Copies to: client; architect; qs; main contractor. (Record)
Receive and reply to queries on tenders	Keep record of queries and answers. Circulate answers
Receive tenders	Reject tenders arriving late
Open tenders; with client, architect, present (or other procedure as agreed)	Schedule results
Qs to call in priced bqs of successful tenderer	If mistakes found, tenderer to confirm or withdraw
Inform other tenderers that they have been unsuccessful	Later, send list of prices received
Advise architect to instruct main contractor to place order	

3 Contract procedure

3.01 Tender and contract procedures for landscape work are so similar to those used in building contracts that there is need to mention only the few minor differences. On large projects landscape work may be a main contract in its own right. However, it is frequently a sub-contract and is treated as such in this handbook.

There are benefits and disadvantages in any sub-contract, but landscape work has a particular problem with regard to completion date. The landscape sub-contractor needs a clear site to complete his work, which means that the main contractor must virtually have left the site. Strictly speaking all sub-contractor's work should be completed by the main contract completion date, but a main contractor rarely finishes his own work far enough ahead of schedule to give the landscape sub-contractor a clear site, and a clear period of several weeks or months to do his work before completion date. Even though this is theoretically possible, landscape work is tied to limited planting seasons, and subject (even more than building work) to the vagaries of weather. It may therefore be quite impossible for a landscape sub-contractor to meet a main contract completion date. There are various expedients for dealing with this situation, such as an agreement to take the landscape work out of the main contract at a late stage, or allowing the landscape work to be done *after* the main contract, thus having two different 'defects liability periods'. In fairness, all retention money except that due for the landscape work should be released when the main defects liability period has expired. Neither of these is good contract practice and the only way to meet this situation in the early stages of organisation seems to be to divide the work into phases with separate completion dates, the landscape sub-contract being the final phase.

3.02 There is great variation in the kind of landscape contractor, from small local nurserymen to the few 'national names'. Some firms specialise, eg in forestry, plant supply, maintenance work, or in a particular type of work such as sports fields or private gardens. Others may be basically civil engineering contractors or muck-shifters. Because a landscape contract is labour-intensive, tenderers must be carefully chosen to ensure enough tenders being received while yet being restricted to firms of equal quality, size and reputation. Choose firms suitable for the type of project, and if necessary split the work, making separate sub-contracts for items such as forestry planting.

3.03 As a provisional sum for landscape work will be put in the main bqs it is not essential to go out to tender at the same time as the main contract. Because of uncertainty of stocks of nursery material from year to year it may even be advantageous not to put the sub-contract out to tender until the summer of the final year of the contract.

Check list 3: contract procedure

(*Note* If landscape work is a sub-contract, acceptance of the tender is by the main contractor; this check list is therefore prepared for a project in which landscape work is itself a main contract.)

Action	Subsidiary action
Advise client of imminent contract signing and point out client's obligations	Ie insurances, honouring certificates; instruction procedures; variations
Prepare contract documents	
1 Form of contract	Select from: RIBA standard form with/without quantities. ILA standard form with/without quantities. 'Works of civil engineering construction' form. Government contract forms CCC/Wks/1 and local authorities' own forms
2 Drawings (on which tender was based)	Minimum two sets (on linen or other durable materials, if necessary)
3 Specification	Minimum two copies
4 Contract bqs	Minimum two copies
5 Schedule of rates	Minimum two copies
6 Copies of letter agreeing to amendments of tender figure (if necessary)	
Insert figures and dates in form of contract	Ie Contract sum Periods of: final measurement; defects liability; interim certificates; for honouring certificates Dates for possession and completion Values of damages, retention percentage, limit of retention fund Any other agreed figures

Action	Subsidiary action
Arrange for signing of all documents at a meeting or by circulation	
Check signing and initialling of alterations	
Send for stamping (if necessary)	1970 Finance Act abolished 6d stamp duty for signatures 'under hand' If 'under seal' send to Inland Revenue stamp office within thirty days
Lodge contract documents where agreed	
Advise unsuccessful tenderers and send copies of list of tenders	
Check insurance cover	Ie existing building (if any) —by client. Employees (including sub-contractors), other persons, damage to property, new works, materials and goods on site
Invite quotations from sub-contractors	(Procedure as on 'Tender procedure check list')
Invite quotations from suppliers (Note: Selection of plant material very often depends upon visiting a nursery. Large-grown trees, being in short supply can be the subject of single tender only)	Send out to select list of suppliers: letter specifying location, delivery dates, discounts, specification clauses, drawings Allow main contractor to tender for supplying if he is able to do so, and get his agreement to list of suppliers
Receive quotations and select	
Instruct main contractor to place an order with approved suppliers	By variation order omitting pc sum in bqs and adding back the tender figure
Inform unsuccessful suppliers, giving list of quotations received	
Issue copies of all documents for use on the project	Ie minimum two copies of: all drawings; unpriced bqs and specification Copies of all approvals, licences, building notices, etc Copies of invitations for sub-contracting or supplying materials, made in advance

Check list 4: job control and site supervision

Action	Subsidiary action
Request contractor to prepare his programme—preferably in the form of a bar or network chart	Supply any necessary or additional information for contractor's programme, eg dates of specialists' work
Make provision for adequate supervision of project	
Call initial progress meeting	Invite: client, architect or civil engineer (of associated contract), consultants (if any), qs, c of w, contractor's site agent or foreman
Set up programme of regular site meetings	
Open a site diary	
Issue report forms for c of w	
Discuss contractor's draft programme	
Issue drawings to site supervisory staff	
Order samples of materials and of work	
Establish 'chain of command' and procedure for issuing orders and variations	Discuss verbal instructions and written confirmation. Discuss method of handling queries
Arrange entry upon site and date	
	Assistant-in-charge, qs, c of w, contractor's site agent, foreman, grounds maintenance officer
Establish final programme	
Have signboards erected	
Confirm that materials have been ordered	
Confirm that notices have been sent	
Agree upon: routes of services, location of huts and working areas, date for approval of setting out, areas for stacking top soil, areas for stacking subsoil, protection of existing trees and other plants, permanent and temporary fencing	

Action	Subsidiary action
Agree measurement, re-measurement and daywork procedures	
Continue day-to-day supervision by c of w and regular (fourteen days or less) visits by professional-in-charge	Examples of items to be noted in supervision: Clean stacking of top soil and other materials; storage of materials liable to deterioration.
Inspect and approve samples*	
Inspect and approve samples* in-situ (eg plants, turf, examples of workmanship)	
Study of c of w reports	Take progress photographs
Make reports of own visits	
On receipt of valuations by qs, issue interim certificates	Copies of interim certificates to: client, contractor, qs, file
Keep client informed on progress	

Check list 5: completion procedure

Action	Subsidiary action
Prepare maintenance drawing and notes to accompany drawings	
Submit to grounds maintenance officer	
In advance of completion date, instruct contractor to be ready for inspection	
Inform client of date for handover meeting	Insurance by client from handover date
Arrange pre-handover inspection	Contractor's agent, foreman, c of w to attend Inspect; list defects and outstanding work
Instruct contractor to rectify defects and deficiencies and complete outstanding work by date of handover	
Hold handover meeting	Client, contractor, grounds maintenance officer attend Inspect site; client takes keys. Agree on maintenance by contractor or by client or his grounds maintenance officer, or by maintenance firm appointed by client
Issue maintenance drawing and notes to grounds maintenance officer	
Agree date of expiry of defects liability period	Agree dates for takeover of maintenance functions
Instruct contractor to remedy any defects noted at handover meeting	
Issue certificate of practical completion	Copies to client, contractor, qs, file
Agree with client, then contractor, on payment of bonus, or claim for liquidated damages	
Receive confirmation from qs that all outstanding accounts have been paid to sub-contractors, suppliers, etc	
Issue interim certificate for the release of part of retention fund	
If maintenance work is by the contractor, supervise this work at regular intervals (probably monthly)	(Eg watering, weeding, firming in, grass cutting, pruning, hedge cutting)
Before end of defects liability period make a preliminary inspection	Client and c of w to attend Make a list of defects
Inform contractor of date of final inspection and send list of outstanding work and list of defects held to be his responsibility	Plants which have *died* should be listed for replacement. If plants are *missing*, establish whether or not contractor is responsible
Carry out final inspection to ensure that all outstanding work is complete and all defects made good	
Qs to prepare final account	
On confirmation by qs that no bills are outstanding, issue certificate releasing rest of retention fund	
Instruct contractor again (if necessary) to make good	
Receive final account and final valuation from qs	
Issue final certificates	Copies to client, contractor, qs and file

* Plants should be supplied *certified* as true to name and quality as this can only be checked when they begin to grow.

Section 4 **Basic plant data**

Information sheet Landscape 5

Physical conditions affecting plant selection

In this sheet ALLAN HART *notes climatic conditions and site characteristics which limit selection of trees, shrubs and plants. Suitable types are listed in Information sheets* LANDSCAPE 6 *to* 9

1 Climatic conditions

Wind

1.01 Prevailing winds stunt growth on windward side of plants by reducing or killing new leaves and shoots. A sacrifice line of planting should be used to protect tender species. Sycamore, ash, and austrian pine are wind-hardy.

Frost

1.02 Many attractive shrubs and exotic tree species are more subject to frost attack when planted in areas other than south and west England*. Ground hollows and pockets of land between buildings trap frost; this inhibits less hardy species, but they can be grown if sheltered by walls or south-facing buildings.

Shade

1.03 Very heavy shade—either from buildings or dense foliaged trees—inhibits many plants, particularly discouraging flowering. Periwinkle and ivy provide ground cover and evergreen colour in shade. Box, holly and elder will form a shrub layer. Partial or dappled shade is beneficial for species such as rhododendrons, azaleas. Small or fine leaved trees (birch, rowan, false acacia) are ideal for providing light and shade, and cool, airy conditions for underplanting. Branch and leaf arrangement of certain trees allows sunlight through, eg indian bean, which has large leaves, but open angular branching.

Atmospheric pollution

1.04 Smoke, fumes and town grime restrict plant growth. Sycamore, ash, plane and poplar tolerate some pollution*. Conifers and evergreens are not recommended.

2 Soil type and natural drainage

General guide

2.01 Types of trees growing locally are usually a wise guide as certain trees have affinity with certain soils. This applies less to cultivated shrubs, but the soil's composition and chemical reaction are important*.

Where soil conditions are extreme (very dry, waterlogged, acid or shallow) seek expert advice before final selection. (See Information sheet LANDSCAPE 10.)

3 Water requirements and root systems

Water requirements

3.01 Poplar, ash, elm and willow are 'greedy-rooted', probably consuming at least 50 000 litres of water a year. On shrinkable clays in south and east England, these trees may endanger buildings by depleting ground water. Other trees (willow and alder) have been adapted to growing near or in water. Small-leaved trees generally require much less water.

*Refers to tables in Information sheet Landscape 6 to 8 for details on tender planting, suitability in conditions of atmospheric pollution and planting soil type requirements.

Root systems

3.02 Each tree species has a distinctive root system, usually of 1 m maximum depth. Poplars on clay may send out roots 90 m to tap water during drought. Upward branching (fastigiate) varieties of oak, beech, false acacia can be planted nearer to buildings than common varieties, but some fastigiate trees are unsuitable (lombardy poplar with greedy roots, cypress with dark, dense foliage).

4 Proximity of buildings, roads and services

Damage

4.01 Trees and shrubs have a continuing growth change, above and below ground. Damage to buildings, roads and drains may be caused by roots of certain species.

Shrinkable clay

4.02 On shrinkable clay, faster growing species (poplar, elm, ash) should not be planted within 60 m, and all other trees within 9 m of buildings and roads. On heavy soils in south and east England avoid poplar, ash, elm within 15 m of buildings and roads. After removing trees from clay, ground may absorb water slowly and swell for many years. At least one whole winter should elapse before building begins, to avoid uplift and distortion. There may also be subsidence through decay of old roots.

Damage to drains

4.03 Allow for maximum future root spread when planting trees and shrubs near drains. Otherwise, encase the length of drain in concrete at least 75 mm thick.

Nuisance

4.04 Nuisance from trees close to buildings and roads through shading and leaf fall is often exaggerated. Trees form wind breaks and filter dust and noise, which compensates for any nuisance. Common and red-twigged lime trees should be avoided adjacent to paving and roads as they become heavily infested with aphids which excrete 'honey dew' onto the ground beneath.

Sight lines

4.05 Only low growing shrubs and slender clear stemmed trees should be planted within road sight lines.

Information sheet Landscape 6

Section 4: **Basic plant data**

Trees

In this sheet ALLAN HART *discusses the functions and uses of trees; describes their maintenance and techniques for preserving them during building operations; and lists readily available trees with their characteristics in a select list. Techniques for planting semi-mature trees will be found in Information sheet* LANDSCAPE 10

1 Introduction

Function of trees

1.01 Tree planting should fulfil a specific purpose based on a predetermined plan.

Uses

1.02 Trees have many uses:

1 To relate building to the site and to each other, and to link external spaces

2 To demarcate boundaries and areas

3 To accommodate changes in level and ground modelling

4 To give privacy, screening and visual barrier **1**

5 To shelter from wind, dust, strong sunshine and—to some extent—from noise

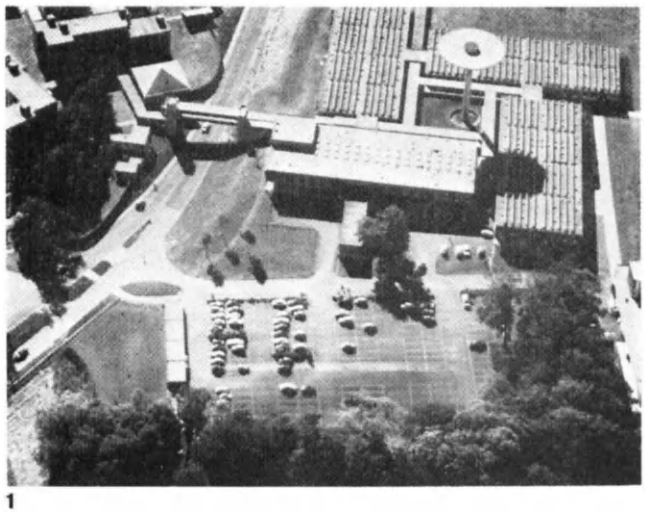
6 To create external spaces by enclosing or breaking up areas and giving verticality

7 To direct pedestrian circulation

8 To channel views to or away from buildings or object **1**

9 To provide contrast in form texture or colour, with buildings, pavings or water

10 To contrast with or complement sculpture



1

1 *Trees screen car park from one approach, and, by accentuating vista from the other, channel view away from it*
2 *Selected trees retained to provide visual axis at haphazard series of road junctions. Clear-stemmed trees do not obscure road sight lines*

2 Trees generally

Layout

2.01 Trees can be used as woodland in small groups or singly. A formal layout is justifiable only if it is in keeping with the rest of the site. Trees should be planted in an avenue only where there is a sufficiently interesting vista, or if required for some ceremonial reason. Then there must be enough space for full development of the trees to give a sense of grand scale. To avoid duality or row effects tree groups should consist of odd numbers and of only one species or variety.

It is essential that sufficient space for large trees be left at the planning stage; all too often, available space is only suitable for small trees. When planted as single specimens trees must be given room to develop to mature spread, and groups positioned to grow together forming a canopy. Planting distances vary with species and variety: 3 m to 9 m is usual depending on spread. The closer the planting the quicker the effect, as nursery standard trees have little bulk or character. Trees should not be laid out just to provide clear mowing runs over grass between them.

Large trees

2.02 Large trees are those in excess of 6 m high and 1 m caliper stem. They provide an immediate mature result—giving scale, height and visual effect, particularly to less

2

3

3 *Isolated, large trees retained to relate building to site*
4 *Strongly coloured tree contrasting with background*
5 *Trees can be chosen to allow good light penetration while affording some shelter*

4

5

urban sites. In densely built up hard environments they give visual emphasis or contrast, especially where nursery stock size trees would be out of scale **3**.

Colour

2.03 Strongly coloured trees (purple maple, copper beech, golden false acacia) should be sited with caution and preferably singly, contrasting with a background and set forward from it **4** and not dotted in and around lines or groups of other trees. The colours of these dominating trees can complement buildings, making excellent focal points when used with discrimination.

Nature's green ranges in tone from yellow-green (indian bean) to black-green (certain conifers, evergreen oak). In some species, the basic green is also modified by yellow, white and silver leaf variegations; by flower colour in season, eg white acacia and pink and white horse chestnut, and by colours of winter stems and twigs, eg white and grey birch and yellow-red willows. Trees such as sweet gum, tupelo, scarlet oak, maples, elm, mespilus have vivid colourings of yellow, orange and red in the autumn and can be contrasted vividly with the dark evergreens of conifers. Colour is present all the year round in some species and varieties (golden: willow, poplar, false acacia, honey locust, dark red-purple: beech, maple, crab, plum, blue: cedar, cypress, certain mountain ash).

Height

2.04 Trees should be in scale with their surroundings. If space permits large scale forest type trees 12 m to 24 m high should be used. If site is limited flowering trees are best planted *en masse* to emphasise their seasonal effect.

Character

2.05 The general forms of trees are as shown in **6**:
1 broad (oak, beech) **a**
2 round (horse-chestnut, silver maple) **b**
3 square (english elm, lime) **c**
4 tapering (false acacia, elder) **d**
5 conical (holly) **e**, can be distinguished from tapering by their upsweeping branch configuration which is more closely related to columnar:
6 columnar (lombardy poplar) **f**—these require discriminate use, eg as a screen in restricted spaces, they would tend to draw the eye towards the object being screened, but can be used successfully as punctuation and for focal effects.

Tracery

2.06 Trees can be selected for the tracery effect of their delicate branching and foliage. These trees are generally round to broad in form.

Foliage density

2.07 Trees can be selected for density of foliage:
heavy foliage (horse-chestnut, beech)
those with large leaves that still allow good light penetration **5** light foliage (birch, false acacia, ash, rowan); these cast a lighter shadow, are graceful, less troublesome at leaf-fall and therefore good for circulation areas.

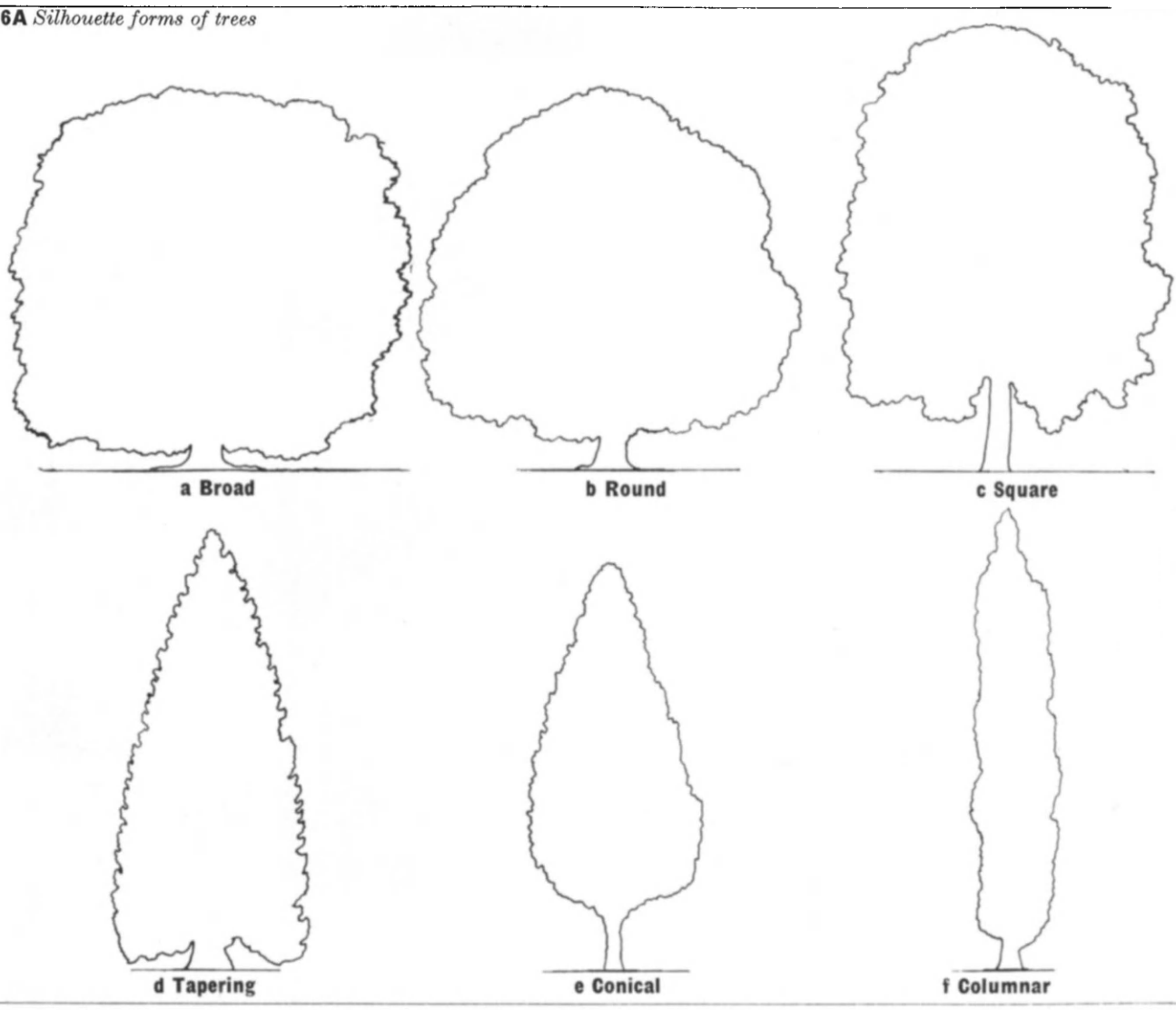
Picturesque

2.08 Trees of strong individuality—*picturesque*—are best used as single specimens with planty of space around them. They have distinctive characteristics:
7 weeping (varieties of birch, willow, elm, lime) **g**
8 horizontal branching (cedar of lebanon) **h**
9 angular branching (maidenhair tree) **j**
10 spreading (strawberry tree, indian bean) **k**
11 contorted (varieties of hazel, willow, southern beech) **l**
12 arrow (atlantic cedar, larch) **m**
Smaller growing species are useful in courtyards.

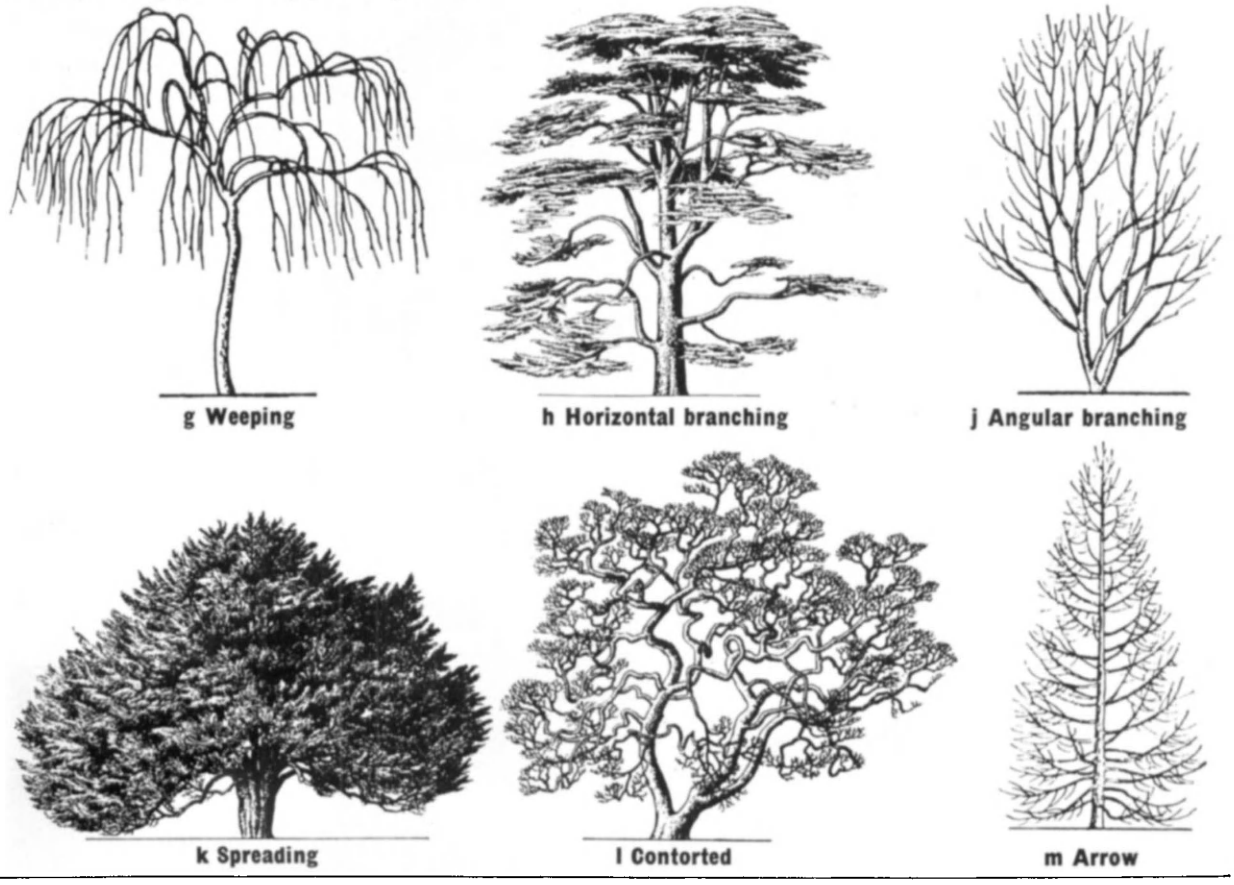
Conifers

2.09 Pines with a rounded appearance relate more happily with rounded shapes of deciduous trees than spike shaped dense, dark green foliage conifers (spruce ie Christmas tree firs, some cedars). Certain deciduous conifers (larch, dawn redwood, swamp cypress) with light green foliage, are more acceptable than horizontal flat topped varieties (scots pine) that are best suited to open heathlands.

6A *Silhouette forms of trees*



6B *Branch configurations of picturesque trees*



3 Maintenance of trees

Annual inspection

3.01 All trees should be subject to an annual inspection to ensure that:
1 Tree ties are properly adjusted
2 Stakes are intact
3 Soil is kept clear of weeds and grass for 600 mm all round, either by hoeing or chemical spray.
4 There is an application of a general type fertiliser.

Pruning

Generally

3.02 If pruning is necessary, each tree should be considered separately and be pruned in relation to its age, shape, size, character and condition. Aim of all pruning should be to leave trees with well balanced normal growth and a natural appearance. Any dead, diseased or broken wood should be removed.

Young trees

3.03 Pruning of young trees is usually limited to thinning, shaping and preserving the leading shoot (or encouraging another to form should it be damaged).

Established trees

3.04 Older established trees should be pruned only if dead, diseased, broken, or crossing branches are to be removed; or when double leading shoots need removing to preserve the shape of the tree.

Pruning obstructions

3.05 Tree branches can be removed from the trunk to give it a greater height to clear windows, traffic etc. If pruning is done unskilfully, new growth can produce a thick mass of twigs blotting out even more light **7**.

Pruning of conifers

3.06 Only remove dead or damaged branches. If the leading shoot is damaged, shape of the tree will be destroyed, as it is only rarely that another shoot will replace it.

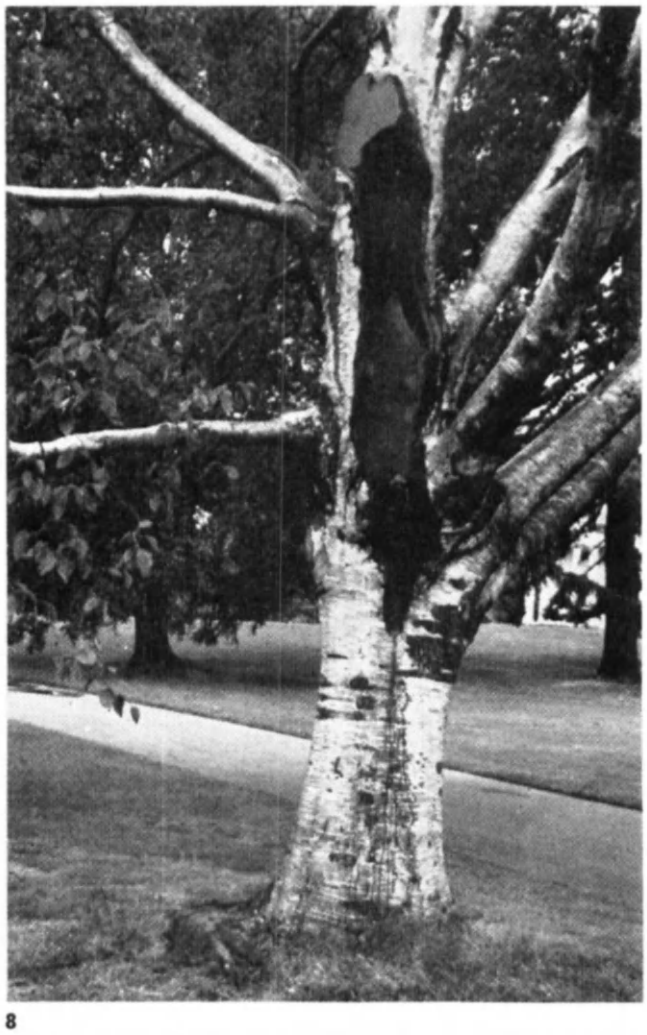
Tree surgery

3.07 Tree surgery should only be given by trained and experienced operators, and preferably by those who are members of the Association of British Tree Surgeons and Arborists. All work should comply with British Standard 3998:1966 *Recommendations for tree work*, which gives details of workmanship, seasons of work, treatment of wounds, pruning repair, restoration work, reducing and shaping, bracing of branches, feeding, tree removal.
Skilled tree surgery can often extend the useful life of a tree by the removal of top heavy branches, bracing old and brittle branches, removing diseased portions and filling in holes and cleaning out cavities **8**.

Watering

3.08 Newly planted trees need lots of water during their first few seasons, and regular watering during periods of drought.

7



8

9

7 *Lower branches of mature beech removed from trunk to allow light to houses*
8 *Tree surgery to trunk of birch, treated with fungicidal sealant to prevent rotting while bark grows over wound*
9 *Dying trees; roots disturbed by change in water table*

Paving should slope towards the planting pits and paving under the future spread of branches should be open jointed to allow new feeder roots to take up water. Where drainage of subsoil is poor, tree pits must not become drainage sumps.

Vandalism

3.09 Few urban areas escape some degree of vandalism, and designers of urban landscape must be realistic when choosing plant material and be prepared to replace damaged plants immediately and perhaps several times before vandalism stops. Planting is particularly vulnerable in the establishment years and should be temporarily protected with tree guards or other fencing. Trees are best planted with a clear stem of 2 m to 2·5 m and an overall height of 4 m to 5 m which puts branches out of reach for all but the most determined vandal.

4 Preserving trees during building operations

4.01 Many trees can be retained as building operations are carried out. Every building contract should ensure their protection with chestnut pale or similar fences erected to the full spread of the trees, and there should be a penalty clause for any damage caused by the contractor. Established trees will have adapted themselves to local soils, ground water etc and should these conditions be changed, the trees could be affected to the extent that they may die.

Roots

4.02 Roots are essential to trees for food, water and support —care should be taken in cutting them. Those more than 75 mm thick should not be cut at all, all others should be correctly cut and treated with sealing compound (eg Arbrex 805). Where possible, work round large roots in trenches, protecting them with damp hessian. Roots can be concreted in when over 75 mm diam.

Root spread

4.03 It is recommended that root spread should be taken as the height of the trees, plus one-third. A general rule recommends that only 5 per cent of a tree's roots should be removed. In no circumstances should any excavation or root cutting be closer than 4·5 m to the bole of the tree.

Stability

4.04 If ground has to be lowered around a tree, it should not be done within the spread of the branches, as the root system within this area is required to support the growth and stability of the tree.

Exposure

4.05 If a building or structure which has been protecting a tree is removed, it is possible that the tree will suffer from exposure, resulting in dieback of the branches or death. Such trees should be screened with polythene sheet until redevelopment is complete.

Water table

4.06 Alteration to the water table **9** can be effected by:
Excavation, which even at some distance, can lower the water table
Raising the ground level which can raise the water-table
If this is essential the trunk should be enclosed with a circle of honeycomb brickwork at least 2 m diameter. Foundations should be stepped over main roots. Soil outside of this is best raised in 150 mm to 225 mm layers, with a 150 mm layer of coarse ballast on top of existing soil.

If back fill near trees is not replaced in correct geological sequence and at the earliest possible moment, a temporary flooded trench or parched water table could develop, which might lead to damage from waterlogging or drought **9**.

Health

4.07 Strict control should be maintained over activities of contractors on site to ensure that:
1 compaction of soil around trees is avoided
2 no materials are stored within the root spread
3 there is no spillage of fluids of any nature
4 bases of site buildings are elevated above ground level to allow air circulation
5 buildings are not sited closer than 5 m to tree boles
6 substantial barricades are erected
7 branch thinning is carried out to balance any reduction in the root system
8 soil round trees is properly cultivated to ensure that an adequate supply of air and water gets to the roots
9 the site is drained in periods of heavy rainfall and irrigated during periods of drought

Mulching older trees

4.08 Although feeding of established trees is seldom justified, it is often necessary to restore the natural condition of the soil after completion of construction. Careful cultivation should be carried out and followed by a good mulch.

5 Select lists

Notes to tables I, II and III

5.01 It is important that these lists are not regarded as a substitute for professional knowledge of plants and plant groupings. They should be used only for preliminary selection, or as an *aide-memoire* on which the final selection, having considered suitability for site conditions, purpose, grouping etc, can be made by a member of the landscape design team. Plants listed have been chosen for tolerance, hardiness, good growth without much pruning, and to be commercially available at reasonable cost.

Key to abbreviations

Soil types:
1 medium loam (neutral)
2 light alkaline
3 light sand (acid)

Notes:
T suitable for town smoke or industrial fumes
S suitable for coastal conditions and salt spray
W suitable for waterside planting (ie definitely needs a moist soil)
E Evergreen
t Tender (to be grown south of a line from Aberystwyth to Thames Estuary only, unless specifically sheltered)
f fast growing
g having greedy roots, or invasive
Plants entered in brackets ( ) are not wholly suitable for the conditions shown, but *may* be used where no other fits the requirements.
Foliage:
PG pale green
MG mid green
DG dark green
AC bright autumn colouring

Common name	Botanical name	Spread m	Soil type	Notes	Foliage
Table I. Large trees: Height 12.5m plus					
Broad					
oak	*Quercus robur*	18	1		MG
	Quercus sessiliflora	18	3		MG
beech	*Fagus sylvatica*	30	1 2 3		MG (very PG in spring)
purple beech	*Fagus sylvatica purpurea*	18	1 2 3		purple
copper beech	*Fagus sylvatica cuprea*	18	1 2 3		copper
black walnut	*Juglans nigra*	30	1 2		MG
Round					
silver maple	*Acer dasycarpum (Syn. A. saccharinum)*	18	1 3	f T	PG—red-yellow in autumn
pin oak	*Quercus palustris*	18	1 3		MG—red-brown in autumn
horse chestnut	*Aesculus hippocastanum*	27	1 3		DG (white flowers)
sweet chestnut	*Castanea sativa*	21	1 3		DG (white flowers)
hornbeam	*Carpinus betulus*	18	1 2 3		MG
tree of heaven	*Ailanthus attissima (Syn. A. glandulosa)*	24	1 3	t f T	DG
plane	*Platanus acerifolia*	27	1 3	T	MG (yellow in autumn)
Square					
english elm	*Ulmus procera*	18	1 2		DG (yellow in autumn)
wych elm	*Ulmus glabra*	30	1 2 3	S	DG (yellow in autumn)
turkey oak	*Quercus cerris*	27	1 2 3	S	MG
norway maple	*Acer platanoides*	27	1 2 3	T	DG (golden yellow in autumn)
purple norway maple	*Acer platanoides var. Goldsworth purple*	18	1 2 3		
poplar—black italian	*Populus serotina*	24	1	f g t	PG
golden poplar	*Rs. Aurea*	24	1	S T	
lime	*Tilia euchlora*	21	1 2	T	DG
Tapering					
alder	*Alnus glutinosa*	9	1	f w	DG
lime (red twigged lime)	*Tilia platyphylloscultivar 'Rubra'*	21	1 2	T	MG
white poplar	*Populus alba*	21	1	f g	white
grey alder	*Populus canescens*	21	1 2	f g	grey
cricket bat willow	*Salix caerulea*	15	1 3	f w	blue-grey
huntingdon willow	*Salix alba*	24	1 3	f w	white
false acacia	*Robinia pseudo-acacia bessoniana*	18	1 3	T t	PG (white flowers in summer)
Conical					
(Broadly fastigiate)					
wheatley elm	*Ulmus sarniensis var. wheatleyi*	9	1 3		DG (yellow in autumn)
hornbeam	*Carpinus betulus pyramidalis*	9	1 2 3		DG
false acacia	*Robinia pseudo-acacia fastigiata*	9	1 3	t T	PG (yellow in autumn)
poplar	*Populus eugenei*	12	1	f T	DG (yellow in autumn)
oak	*Quercus pedunculata fastigiata*	9	1		DG
alder	*Alnus cordata*	9	1 2 3		MG
dawyck beech	*Fagus sylvatica fastigiata*	9	1 2 3	f	DG
Columnar					
lawson's cypress	*Chamaecyparris lawsoniana*	6	1 2 3	(E) f	DG
leyland's cypress	*Cupresso cyparis leylandii*	6	1 2 3	f	DG (fastest growing conifer)
lombardy poplar	*Populus nigra italica*	4·5	1 3	f g t	DG
Tracery					
box elder	*Acer negundo*	9	1 2 3		PG (yellow in autumn)
false acacia	*Robinia pseudo-acacia*	18	1 3	t T	DG (white flowers in summer)
ash	*Fraxinus excelsior*	24	1 2	f g t	DG
ash (fine leaved)	*Fraxinus angustifolia*	24	1 2	f g t	DG
glaucous ash	*Fraxinus oxycarpa (Reywood's variety)*	24	1 2	f g t	MG (purple in autumn)
birch	*Betula pendula (Syn. B. verrucosa)*	12	1 2 3		MG (yellow in autumn)
Picturesque					
Weeping					
silver line	*Tilia petiolaris*	24	1 2 3		PG (silver)
weeping beech	*Fagus sylvatica pendula*	24	1 2 3		MG
weeping willow	*Salix alba cultivar 'Tristis'*	24	1 2 3	f w	PG (golden stems)
Horizontal					
cedar of lebanon	*Cedrus libani*	30	1 2 3		DG
scots pine	*Pinus sylvestris*	12	1 3		DG
Angular					
maidenhair tree	*Ginkgo biloba*	45	1 2 3	T	PG
Arrow					
atlantic cedar	*Cedrus atlantica*	18	1 2 3	(E) f	green-black
deodar cedar	*Cedrus deodara*	24	1 3	(E)	MG
larch	*Larix decidua*	12	1 2 3		PG (yellow in autumn)
Table II. Medium trees: Height 7.5m plus					
Round					
manna ash	*Fraxinus ornus*	12	1 2 3	f T	MG
double gean	*Prunus avium plena*	15	1 2 3		MG (white flowers in spring)
bird cherry	*Prunus padus watereriana*	12	1 2 3		
whitebeam	*Surbus aria majestica*	12	1 2 3	T	grey-green
red horse chestnut (conkerless)	*Aesculus carnea cultivar 'Brioti'*	12	1 3		DG (no conkers)

Common name	Botanical name	Spread m	Soil type	Notes	Foliage
Conical (Broadly fastigiate)					
elm	*Ulmus viminalis*	9	1	T	DG
holly	*Ilex aquifolium*	6	1 2 3	(E)	DG
poplar	*Populus alba richardii*	9	1		PG
whitebeam	*Sorbus aria*	12	1 2		grey-green
mountain ash	*Sorbus discolor*	9	1 2 3		DG (berries in autumn)
Columnar (Narrowly Fastigiate)					
blue lawsons cypress	*Chamaecyparis lawsoniana alumii*	6	1 2 3	(E)	blue green
golden lawsons cypress	*Chamaecyparis lawsoniana lutea*	6	1 2 3	(E)	golden
crab	*Malus trilobata*	6	1 2 3		MG (white and pink flowers—fruit in autumn)
Tracery					
gold bark ash	*Fraxinus excelsior aurea*	15	1 2 3	f T	MG
swedish birch	*Betula pendula dalecarlica*	9	1 2 3		MG
rowan (mountain ash)	*Sorbus aucuparia*	45			DG (berries in autumn)
willow	*Salix vitellina britzensis*	12	1	f	PG (red bark)
swedish whitebeam	*Sorbus aria intermedia*	12	1 2 3	T	grey-green
honey locust	*Gleditschia triacanthos*	7·5	1 3	t T	PG (spring—yellow in autumn)
japanese pagoda tree	*Sophora japonica*	24	1 3	t T	DG (yellow in autumn)
laburnum	*Laburnum vossii*	6	1 3		MG (poisonous seeds—yellow flowers in spring
Picturesque					
Weeping					
weeping elm (grafted)	*Ulmus glabra pendula*	6	1 2		DG
weeping ash	*Fraxinus excelsior pendula*	7·5	1 2		MG
Spreading					
strawberry tree	*Arbutus unedo*	15	1 2 3	(E) t S	DG (white flowers)
indian bean tree	*Catalpa bignonioides*	18	1 2 3	t T	PG
golden indian bean tree	*Catalpa bignonioides aurea*	18	1 2 3	t T	golden leaves
mulberry	*Morus nigra*	18	1		DG
yew	*Taxus baccata*	18	1 2 3	(E)	DG

Table III. Small trees: Height 4.5m plus

Round					
almond	*Prunus amydalus*	7·5	1 2	T	DG (pink flowers in spring)
siberian crab	*Malus baccata*	9	1 2 3		MG (pink and white flowers in spring)
winter cherry	*Prunus subhirtella autumnalis*	6	1 2 3		MG (white flowers in autumn)
snowy mespilus	*Amelanchier laevis*	6	1 2 3		MG (white flowers in spring—AC)
hawthorn	*Crataegus oxyacantha plena*	7·5	1 2 3		DG (red flowers in spring—AC)
Columnar (Narrowly Fastigiate)					
yew (irish)	*Taxus baccata fastigiata*	3	1 2 3	(E)	DG
golden irish yew	*Taxus baccata fastigiata aurea*	3	1 2 3		yellow
juniper	*Juniperus communis hibernica*	3	1 2 3	(E)	blue-green
cherry	*Prunus Ama-no-gawa*	3	1 2 3		MG
Tracery					
willow leaved pear	*Pyrus salicifolia*	7·5	1 2		silver-grey
japanese maple	*Acer japonicum*	7·5	1 2 3		MG (AC)
willow	*Salix daphnoides*	6	1 2 3		blue-grey
golden box elder	*Acer negundo auratum*	9	1 2 3		
silver box elder	*Acer negundo variegatum*	9	1 2 3		white-green
mountain ash	*Sorbus vilmorini*	7·5	1 2		DG (berries in autumn)
Picturesque					
Weeping					
willow leaved pear	*Pyrus salicifolia pendula*	6	1 2		silver-grey
birch	*Betula pendula youngii*	4·5	1 2 3		MG
willow	*Salix purpurae pendula*	6	1 2 3		blue-grey
Angular					
corkscrew hazel	*Corylus avellana contorta*	6	1 2 3		DG
judas tree	*Cercis siliquastrum*	9	1 2 3		MG (purple flowers in spring)
Spreading					
sumach	*Rhus typhine (female)*	7·5	1 2 3	f g T	(AC)
fig	*Ficus carica*	6	1 2 3	t	MG (yellow in autumn)
cockspur thorn	*Crataegus crus-galli*	6	1 2		DG (AC)
strawberry tree	*Arbutus unedo rubra*	6	1 2 3	(E)	DG
mop-head	*Robinia pseudoacacia inermis*	4·5	1 2 3		MG (yellow in autumn)
Open and arching					
cherry	*Prunus subhirtella pendula*	4·5	1 2 3		MG (pink flowers in autumn)
scotch laburnum	*Laburnum alpinum*	4·5	1 2 3		MG (yellow flowers in spring)
ash	*Fraxinus mariesti*	6	1 2		MG
flowering dogwood	*Cornus florida rubra*	4·5	1 2 3	t	MG (flowers in summer)
cotoneaster	*Cotoneaster frigida*	6	1 2 3	(E)	DG (berries in autumn)
	Cotoneaster cornubia	6	1 2 3		DG (semi-evergreen)

Information sheet Landscape 7

Section 4: **Basic plant data**

Shrubs, ground cover and grass

In this sheet ALLAN HART *discusses the functions and uses of shrubs, ground cover and grass; describes their maintenance; and lists readily available species and varieties*

1 Introduction

Functions of shrubs, ground cover and grass

1.01 Shrubs, ground cover and grass should always be used in accordance with a predetermined plan.

Uses

1.02 Shrubs, ground cover and grass have many uses:

1 To cover ground not covered by hard materials
2 To relate buildings to the site and to each other, and to link external spaces
3 To demarcate boundaries and areas **1**
4 To accommodate changes in level and ground modelling
5 To give privacy, screening and visual barrier
6 To shelter from wind, dust, strong sunshine and to some extent—from noise
7 Structurally to create external spaces by enclosing or breaking up areas
8 To direct pedestrian circulation
9 To channel views to or away from buildings or objects **1**
10 To pr ovide contrast in form, texture or colour, with buildings, paving or water
11 To contrast with or complement sculpture **2**

2 Shrubs generally

Planting

2.01 Shrubs are best planted in groups or massed together either informally laid out, in or adjoining grass, or formally, against walls, in raised boxes or in paving patterns.

Few shrubs have sufficient character to be used as single specimens. For maximum effect and to avoid duality or row effects, groups should consist of odd numbers and of only one species or variety, with single plants included only for special emphasis or contrast.

Width of shrub beds is important when viewed from above. The 'gardenesque' planting detail of smallest plants in front, rising in height to the rear should be avoided in larger scale planting; bold massing is needed to contrast with open areas or buildings. Changes in height are more effective when infrequent and between large groups of similar height plants.

Planting distances

Shrubs should grow to cover all bare soil. To achieve this quickly, spacings of 1 per sq m should be aimed at for most species, and even closer spacings for less vigorous lower growing types. It is possible that stronger growing shrubs could be thinned and transplanted to other sites as they develop. For ease of maintenance, shrub beds should not exceed 6 m across and rarely less than 2·5 m.

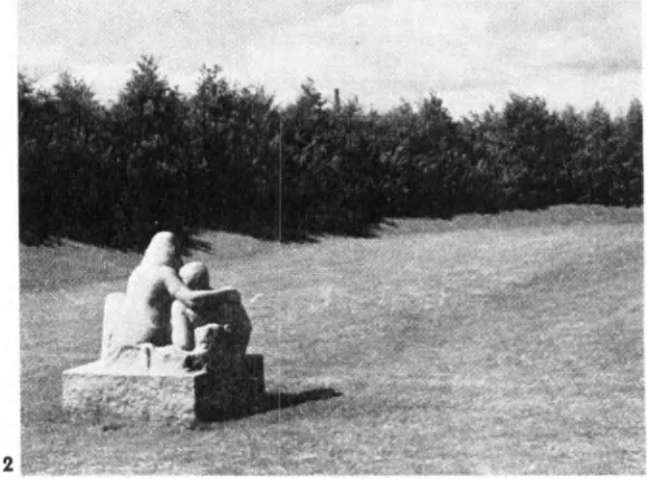
Height

2.02 The critical height is related to eye level. Plants which reach above eye level form a visual barrier enclosing space; planting below eye level is seen as either additional surface pattern or as a directional hazard if dense and prickly.

Shrubs vary in height from prostrate to 4·5 m to 5 m and may include those smaller trees which are many stemmed from the base (japanese maples, willows, mespius).

1 *Shrubs, ground cover and grass in formal layout demarcating boundaries between areas and channelling view*
2 *Grass and background shrubs complement sculpture*

1



2

Character

2.03 Because of the wide range of character, factors such as habit, flowering effects, breadth (in proportion to height) and whether foliage is evergreen or deciduous, help to distinguish different species and varieties of species. There are ten basic characteristics of shrubs and some species combine several characteristics **5**:

1 Bare stems **a**—all foliage and flowers are carried at the top of the plant in the light. These can appear gawky but stems can be hidden by

2 Facers **b**—shrubs with a complete cover of foliage from base to top (barberry, ceanothus, cotoneasters).

3 Stems with character **c** are very useful for vertical effect, bamboo, jew's mallow, flowering nutmeg, all with vertical green stems, and dogwoods with green, yellow and red stems.

4 Bushy spreading shrubs **d** which form a complete dome of foliage are useful. Planted singly or in small groups in confined areas (rock rose, broom, plumbago, daphne).

5 Shrubs with a distinctive arching habit **e** (tamarisk, *Rosa rubrifolia*) are best planted singly or in groups with underplanting of low growing species.

6 Columnar **f** shaped shrubs are best treated as scaled down columnar trees and used with discretion; similarly

7 Picturesque **g** shrubs (corkscrew hazel—with contorted branches, *Hydrangea villosa* with spreading lush foliage, the weeping *Buddleia alternifolia* and angular chinese juniper are best used as a single specimen, at a focal point of interest.

8 Large leaf shrubs **h** can be used for exotic effect, make an excellent foil against plain surfaces (fig, fatsia, aralia). Certain tree species if stooled at ground level will produce very large leaves eg false acacia, pawlonia, indian bean tree.

9 Prostrate **j** and creeping shrubs are useful for covering ground as they spread round stems etc (periwinkle, rose of sharon). Some prostrate growing shrubs (creeping junipers, fish-bone cotoneaster) are good as individual specimens.

10 Shrubs grown specially for large flowers **k** (hydrangeas, hybrid rhododendrons, azaleas) are best kept for massing with similar species and preferably 'contained' by walls or hedges.

Colour

2.04 In naturally occurring species and many cultivated plants, colours blend, but hybrid varieties often have harsh unsubtle primary colours. Stronger colours may be used successfully by grouping similar varieties and planting grey and white foliaged plants between giving a background for the bright colours. Very strong colours should not be allowed to interrupt vistas and should be used only sparingly in carefully chosen situations **3**. Flower colour is subject to seasonal change, weather and sunlight—conditions of infinite variety.

Carefully chosen shrubs can provide colour in various forms throughout the year. These range from different shades of evergreens, which may be variegated with silver or gold edging, gold, white spots or blotches (holly, aucuba), to deciduous species (deutzia, veronica, kerria), which can also be variegated, but these should be used with restraint and for effect. In addition to all shades of green, leaf colour includes red, purple, copper, brown, grey, and blue (glaucous).

Stems can also be coloured and can be effective in winter (dogwoods, brambles, birch, willow have stems of red, yellow, white and orange). Berries (firthorn, cotoneaster, viburnums) add winter colour with flowers (wychhazel, wintersweet, jasmine) supplementing green and gold evergreens.

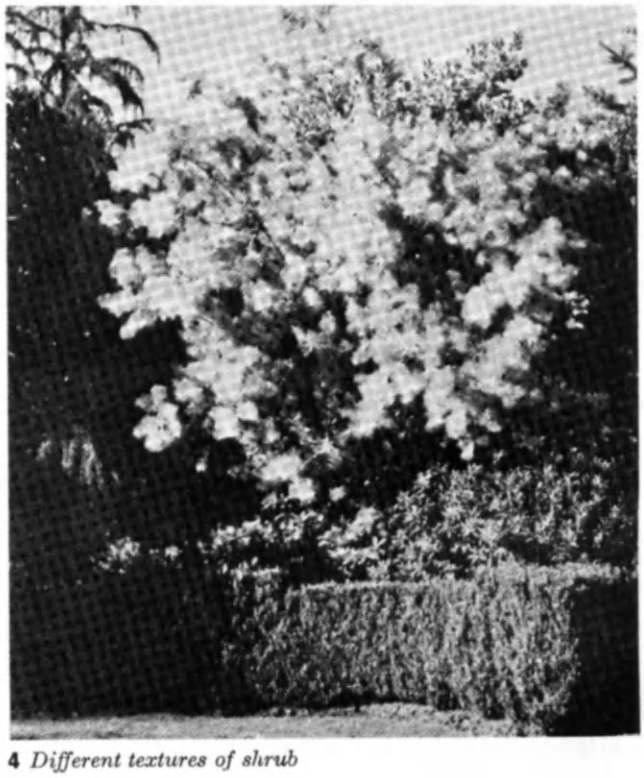
Texture

2.05 At close quarters different textures of shrub can be used to complement and contrast with different species, hard paving and walling **4**. Texture can apply to stems and branches as well as leaves.

Ground cover planting

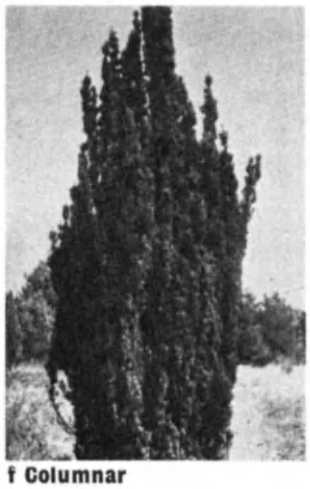
2.06 Ground cover plants can be used under taller shrubs or as low growing carpet. Essentially they are ground hugging species whose growth helps to suppress weeds. However, it is essential that before any planting begins, the soil is free of weeds, particularly perennial, strongly rooted types (thistle, couch grass). There should be a thorough maintenance of bare ground between individual plants, until a complete cover is formed. These types of

3 *Strongly coloured shrubs used in grass area for visual effect*



4 *Different textures of shrub*

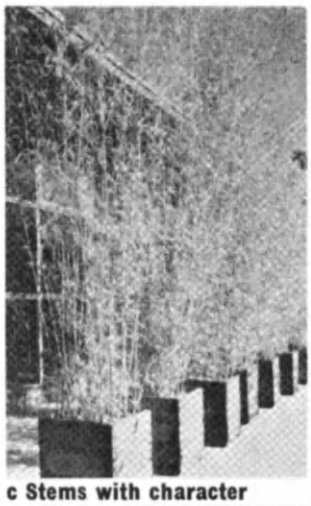
a Bare stems



f Columnar

g Picturesque

b Facers

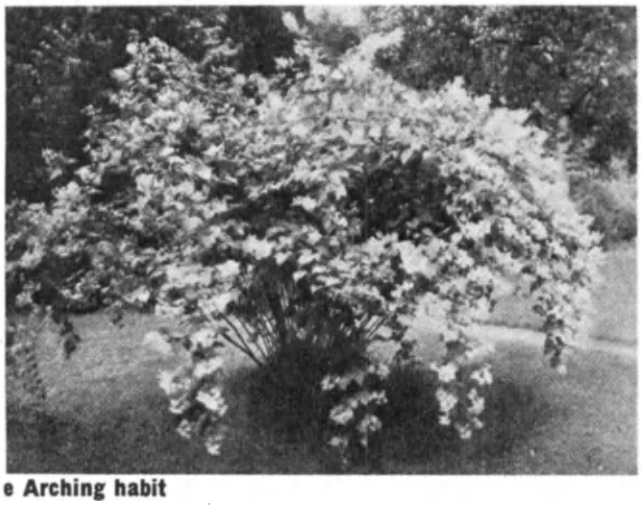


c Stems with character

h Large-leaved-shrubs

d Bushy spreading shrubs

j Prostrate



e Arching habit

k Large flowers

5 *Basic characteristics of shrubs*

6 *Ground cover suppress weeds, while costing less to maintain than grass*

plants (rose of sharon, cotoneaster, periwinkle, ivy, pachysandra) have to be planted closely together—as many as nine per square metre and therefore the initial cost is high, but once established should cost little to maintain **6**.

Plants for specific purposes

2.07 Shrubs are commercially obtainable for:
hot and dry sites (lavender, rosemary, heathers)
chalky soil (quince, daphne, barberry)
sunless positions (ivy, holly, jasmine, dogwoods)
moist ground (bamboos, willows, golden elder)
scent (lilac, lavender, mock orange, honeysuckle)

Planting for temporary effect

2.08 To produce a mature effect quickly, it may be necessary to introduce temporary measures:
1 Planting at greater densities for thinning out later. The success of this method depends on ensuring that subsequent thinning is carried out. It is expensive unless thinnings can be used elsewhere.
2 Positioning cheaper plants between the permanent planting, to be cleared at a later stage. Cheap plants are usually vigorous though coarse and difficult to remove.
3 Quick growing plants can be used as a background for permanent planting which will eventually obscure them. This method can be very effective, but care must be taken to ensure that the slower growing plants do not suffer through competition for light and nutrition.
4 Quick growing climbers will scramble over metal and timber fences giving vertical emphasis and screening.
5 Some quick growing tree species (leyland's cypress, lombardy poplar, willows) can be planted in large tubs to give temporary height. It is vital that they should receive ample water, preferably by some form of irrigation.

Planting on a temporary site

2.09 When a site is available for a limited time and will be put to some other use in the future.
Most of this type of planting should be recoverable for further use. To facilitate subsequent shifting it should be grown in large boxes or wire cages preferably sunk below ground to conserve moisture. Smaller growing ornamental trees can also be used in this way, care being taken to turn them round every year to prevent roots forming outside the container. Herbaceous plants can be planted directly into the soil as they are normally lifted, divided, and replanted every three or four years like turf. Topsoil can be lifted and relaid for further use if additional fertilisers are added.
Good seasonal colour can be gained with annuals and half-hardy bedding plants, which can be grown in tubs or other containers, particularly where little topsoil is available. This type of planting is relatively expensive owing to the plants short life. Success depends on the displays being changed as soon as the flowering period is finished.

3 Maintenance of shrubs

3.01 During the first years of establishment, it will be necessary to keep planting weeded and watered during periods of drought. Soil around plants should be firmed after periods of high winds or frosts, and given an annual feeding with a general fertiliser at the rate of 120 g/m².

Pruning

3.02 The select list of shrubs has been chosen to exclude those which need skilled, detailed pruning—any pruning needed should be for the following reasons only:
1 Removal of dead, diseased, damaged branches
2 Removal of shoots alien to the character of the plant
3 Removal of old or weak growth
4 Removal of dead or damaged shoots
Immediately after planting, it is good practice to reduce shoots by one half to help to compensate for loss of roots during lifting and transplanting.
Where old shrubs have outgrown their area, branches should be systematically removed, perhaps by a third annually.
Suckers should be removed from the base of roots or they will grow again.

Maintenance programme

3.03 Future maintenance programmes should encourage shrubs and ground cover planting to spread as quickly as possible to reduce competition from weed growth.
Ground-cover planting should be weeded and watered. Most planting requires mulching with weed-free compost and ericaceous plants (genus of plants including heather) require mulching with peat. Plants such as ivy and periwinkle should have their new growths pegged to the soil with galvanised wire pins to encourage them to cover bare ground. Dead flowers should be removed annually.

4 Select list

Notes to tables I, II and III

4.01 It is important that these lists are not regarded as a substitute for professional knowledge of plants and plant groupings. They should be used only for preliminary selection. Plants listed have been chosen for tolerance, hardiness, good growth without much pruning, and to be commercially available at reasonable cost.

Key to abbreviations

Soil types
1 Medium loam (neutral)
2 Light alkaline
3 Light sand (acid)

Notes
T suitable for town smoke or industrial fumes
S suitable for coastal conditions and salt spray
N suitable for waterside planting (ie needs moist soil)
E Evergreen
t Tender (to be grown south of a line from Aberystwyth to Thames Estuary only, unless specifically sheltered)
f fast growing
Foliage:
PG pale green
MG mid green
DG dark green
AC bright autumn colouring

Common name	Botanical name	Soil type	Notes	Foliage
Table I Tall to medium shrubs: Height 2.5m to 4.5m				
Arching				
barberry	*Berberis stenophylla*	1 2 3	semi-E	
buddleia	*Buddleia alternifolia*	1 2	t	grey-green (mauve rosy-flowers)
cotoneaster	*Cotoneaster salicifolia floccosa*	1 2 3		MG (berries in autumn)
	C. dielsianus	1 2 3		
	C. simonsi	1 2 3		MG (berries in autumn)
escallonia	*Escallonia pink pearl*	1 2 3	E	MG (berries in autumn)
forsythia	*Forsythia suspensa*	1 3	f	MG (yellow flowers in spring)
weeping pear	*Pyrus salicifolia pendula*	1 2		
sorbaria	*Sorbaria aitchisonii*	1 2		grey-green (white summer flowers)
stephanandra	*Stephanandra incisa*	1 3		MG
rose	*Rosa rubifolia*	1 2 3		blue-green (pink flowers in summer)
tamarisk	*Tamarix pentandra*	1 3		PG (pink flowers in summer)
Stems				
buckeye	*Aesculus parviflora*	1 2 3		MG (white flowers in summer)
dogwood	*Cornus alba*	1 2 3		MG (red stem)
	C.a. gouchaultii	1 2 3		MG (yellow stems)
	C.a. sibirica Westonbirt variety	1 2 3		MG (red stems)
	C.a. spaethii	1 2 3		MG (gold variation in leaves)
	C.a. variegata	1 2 3		MG (white variation in leaves)
	C.a. stolonifera flaviramea	1 2 3		MG (yellow stems)
haze	*Corylus maxima atropurpurea*	1 2 3		purple (white flowers in spring)
chokeberry	*Aronia arbutifolia*	1 2 3		DG (red stems)
nutmeg plant	*Leycesteria formosa*	1 2 3	f	MG (sea-green stems)
jew's mallow	*Kerria japonica*	1 2 3	f	DG (yellow-green stems)
Picturesque				
corkscrew hazel	*Corylus avellana contorta*	1 2		PG
corkscrew willow	*Salix matsudana tortuosa*	1 2 3	W	PG
sumach	*Rhus typhina*	1 2 3	f	DG
japanese maples	*Acer japonicum*	1 3		MG
judas tree	*Cercis siliquastrum*	1 3		PG
fig	*Ficus carica*	1 2 3		MG
mahonia	*Mahonia japonica*	1 3	E	MG (yellow flowers in spring)
Bushy				
barberry	*Berberis darwinii*	1 2 3	Ef	DG
	B. Barbarossa	1 2 3		MG
	B. thunbergii	1 2 3		MG
	B. t. atropurpurea	1 2 3		red
deutzia	*Eleagnus discolor major*	1 2 3		variegated
eleagnus	*Eleagnus commutata*	1 2 3		silver
	E. pungens		E	
spindle	*Euonymus europaeus*	1 2		
veronica	*Hebe. Midsummer Beauty*	1 2	E	MG (blue flowers in summer)
daisy bush	*Olearia haastii*	1 2 3	E T	grey-green
firethorns	*Pyracantha angustifolia*	1 2 3	E T	(orange berries)
	P. atalantoides	1 2 3	E T	(crimson berries)
	P. coccinea lalandii	1 2 3	E T	(orange-red berries)
buckthorn	*Rhammus alaternus*	1 2 3	E T	MG
	R. cathartica	1 2 3		DG
viburnum	*Viburnum carlcephalum*	1 2 3		DG (fragrant)
	V. henryi		E	DG
guelder rose	*V. opulus*	1 2 3		GM (red berries)
	V. rhytidophyllum	1 2 3	E	DG
laurustinus	*V. tinus*	1 2 3	E	DG
snowy mespilus	*Amelanchier canadensis*	1 2 3		MG
Table II Low shrubs: Height 1.5m				
Bushy				
barberry	*Berberis candidula*	1 2 3	E	PG
	B. x. erwinii	1 2 3	E	P to MG
	B. thunbergii atropurpurea nana	1 2 3		red
caryopteris	*Caryopteris clandonensis*	1 2 3		grey
rock roses	*Cistus silver pink*	1 2 3		grey-green
herringbone	*Cotoneaster horizontalis*	1 2 3		MG (berries in autumn)
cotoneaster	*C. rotundifolia*	1 2 3		MG (berries in autumn)
spanish gorse	*Genista hispanica*	1 3	E	grey-green
dyer's greenwood	*G. tinctoria*	1 3	E	DG
veronica	*Hebe pageana*	1 2 3	E	
	H. Marjorie	1 2 3		MG
st john's wort	*Hypericum patulum henryi*	1 2 3	E	PG
lavender	*Lavandula spica and varieties*	1 2		blue-grey
shrubby potentilla	*Potentilla arbuscula*	1 2 3		PG
	P. fruticosa beesii	1 2 3		silver
	P. f. farreri	1 2 3		PG
bramble	*Rubus cockburnianus*	1 2 3		grey-green (white stems)
	R. thibetanus	1 2 3		grey-green (blue-white stems)
rue	*Ruta graveolens*	1 2 3		glaucous blue
david's viburnum	*Viburnum davidii*	1 2 3	E	DG
Picturesque				
juniper	*Juniperus sabina pfitzeraina*	1 2 3	E	PG (branches at 45° angles)
chinese juniper	*Juniperus chinensis*	1 2 3	E	DG
european scrub pine	*Pinus mugo pumila*	1 2 3	E	DG

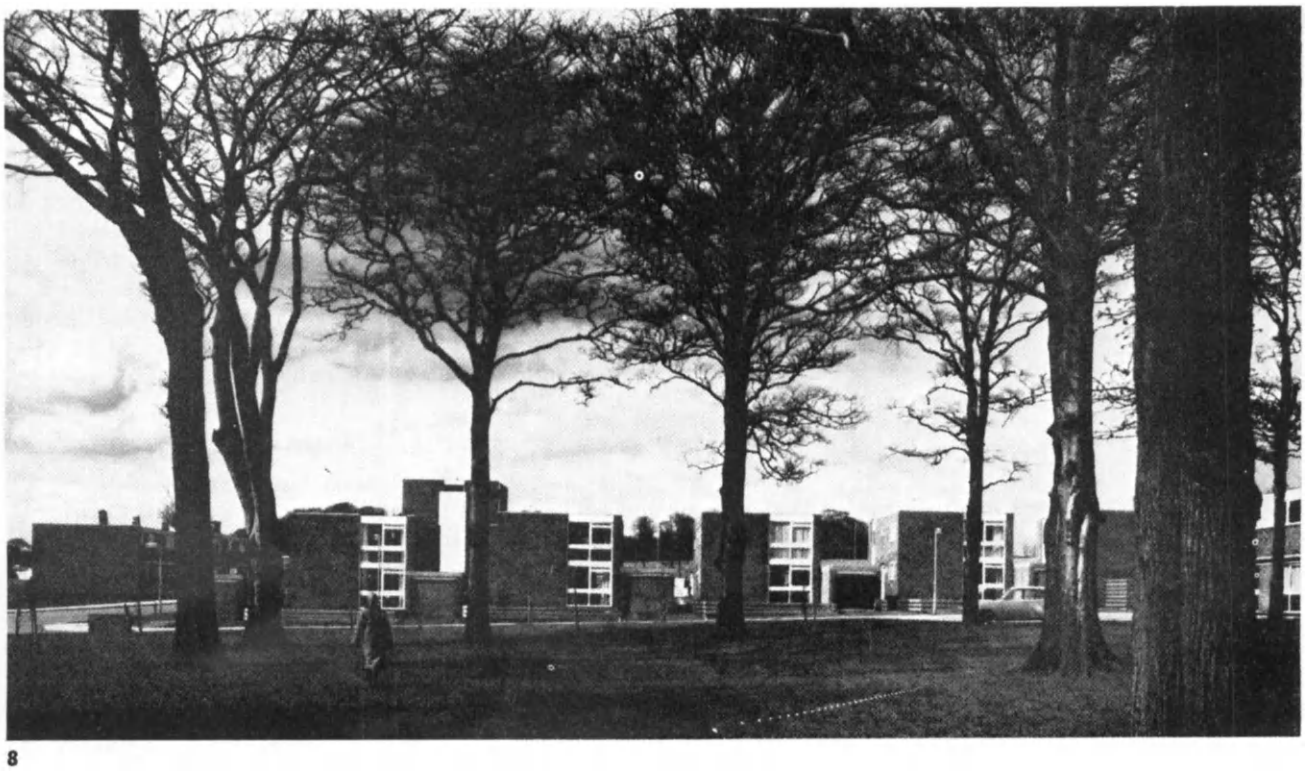
Table III Ground cover plants

The term ground cover planting used here refers to plants which naturally creep over ground and cover all bare soil to exclude future weed growth. Plants chosen are the 'easiest' of this group of plants which contains many hundreds of species, both shrubby and herbaceous

Common name	Botanical name	Soil type	Notes	Foliage
himalayan cotoneaster	*Cotoneaster congesta*	1 2 3	E	PG (berries in autumn)
bearberry C.	*C. dammeri*	1 2 3	E	DG (berries in autumn)
small leaved C.	*C. microphylla*	1 2 3	E	DG (berries in autumn)
willow leaved C.	*C. salicifolia*	1 2 3	semi-E	DG
	Herbstfeur	1 3	prostrate form f	
wintergreen	*Gaultheria procumbens*	1 3	E	DG
ivy	*Hedera helix and varieties*	1 2 3	E	DG
st john's wort	*Hypericum calycinum*	1 2 3	semi-E	MG
creeping juniper	*Juniperus horizontalis and varieties*	1 2 3	E	DG
tamarix juniper	*J. sabina tamariscifolia*	1 2 3	E	
oregon grape	*Mahonia aquifolium*	1 2 3	E	DG
pachysandra	*Pachysandra terminalis*	1 3	E	PG
dwarf periwinkle	*Vinca minor*	1 2 3	E	PG
creeping spindle	*Euonymus fortunei*	1 2 3	E	
	E. radicans		E	variegated
arrow broom	*Genista saggitalis*	1 3	E	DG
heathers	*Erica in variety*	1 3	E	certain species can be grown in alkaline soils; shades of grey, yellow and red

7

7 *Grass areas, with varying degrees of maintenance to demarcate path*
8 *Clear stemmed tree trunks allow easy access for mowing*



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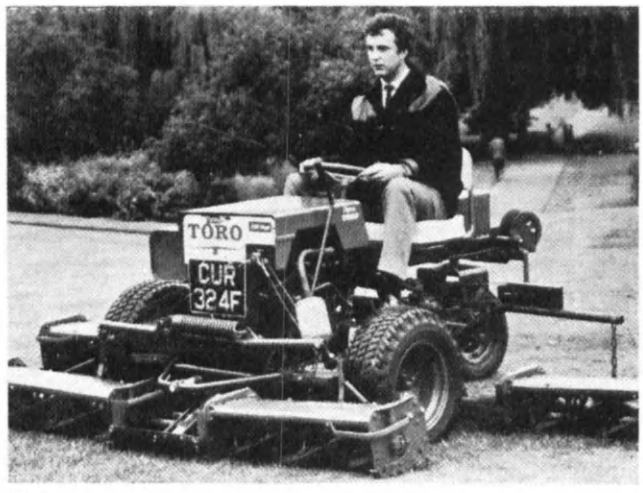

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9 *Formal cutting regime to grass on hill—rough maintenance by pond*
10 *Grass 'naturalised' with daffodils*
11 *Power driven gang mower*

8 Grass

General

8.01 Grass as a surfacing material should be fully exploited, and not regarded merely as a convenient finish for space left unplanned. Because British climatic conditions are very favourable for the growth of grass, and because it is comparatively cheap as a surface material and for maintenance, it has developed as a major element in landscape design.

Use

8.02 Grass can be used either naturally in large areas with varying degrees of maintenance **7**, or as an uninterrupted spread of close-mown turf with neat edges clearly defining the area in relation to other surfaces. Its smooth texture emphasises land form and contouring, though care must be taken not to destroy the flowing character of the land form and the eye should be allowed to pass freely over the surface without interference from obstructions such as signs, structures, isolated beds of shrubs or plants cut into the grass. Clear stemmed tree trunks allow grass spaces to flow around them **8**.

Colour and texture

8.03 Grass colour and texture can give a restful effect, picking up all the nuances of light and shade, shine of raindrops, effect of breezes blowing over it. Colour and texture are dependent, as are the species of grass, on soil type and cutting regime **9** eg the pale blue green of fescue on well drained chalk soils, with harebell, orchid species, sheep's bit scabious, forming a well knit short turf, compared with the leafy appearance of meadow grasses on heavy damp soils.

Mowing and obstructions

8.04 Generally grass appears very smooth when closely mown and this can be effectively contrasted with less frequently mown grass, especially when wild flowers and bulbs are naturalised **10**.

For efficient mowing, multi-gang machines are used **11**. They are about 2·66 m wide, and need a turning circle of 10 m. Grass areas should therefore be not less than 3 m wide and there should be 3 m between obstructions. Where spaces are necessarily confined, a 750 mm motor mower

may be used; these need about 2·5 m in which to turn.
To allow entry of tractor drawn mowing machines, grass surrounded by fencing, trip rails, or other enclosures should have an opening, removable bar, or gate—not less than 3 m wide.
As it is impossible to mow closely up to buildings or obstacles, a mowing margin of at least 230 mm must be left finishing 40 mm below the level of the grass. This can be of paving bricks, in situ concrete, precast slabs, or gravel contained by an edging.

Avoidance of wear

8.05 Casual walking or sitting down does not harm grass. Damage occurs when entry is restricted, or when regular short cuts develop. Damage can be prevented by providing hard surfaces where wear is expected, and by preventing or deflecting short cuts with walls, fences, trip rails, shrub planting, changes of level etc.

Adverse conditions

8.06 Light wells, small bays between buildings, under dense foliaged trees, and areas where there is a strong likelihood of shade, reduced rainfall and dampness are all conditions conducive to growth of moss and weeds to the detriment of grass, and should be treated with some hard surfacing.

Slopes

8.07 Strictly formal lawns are usually flat—but when used informally, grass should rarely be completely level. Ground falling in more than one direction requires 'modelling' to gently rolling contours, so that there are no ridges (see information sheet LANDSCAPE 32). Changes in level in grass should be brought about by the gentlest possible slope, and in an ogee or lamb's tongue profile. Banks which curve on plan and vary slightly in gradient look less mechanical than a bank that is a simple inclined plane. Slopes should not exceed 1 in 3.

9 Grass maintenance

Generally

9.01 Good turf depends on a realistic maintenance programme based on availability of labour, materials, machinery and their economic deployment.

Mowing

9.02 Frequency and height of cut—cutting regime—determines appearance of grass. Adjacent grass areas, of identical constituents, but subjected to different cutting regimes can be quite different in character. The greater the frequency and lower the cut, the finer the turf—leafier, harder wearing grasses in extensively trafficked areas, should be cut less frequently and with blades set to cut higher.
It is best to cut 'little and often' to avoid giving a shock to the grass. Generally once or twice a week. On fine lawns, remove the clippings as they encourage earthworms which are responsible for bringing weed seeds to the surface.

Aeration

9.03 This is done to aid moisture, air and fertiliser to penetrate to the grass roots; carried out either by slitting the surface fibre on fine turf or pulling a spiked and smooth chain harrow over to break up divots, matted grasses etc. Deeper slitting and hollow tines are used to penetrate in depth, before applying fertilisers etc.

Rolling

9.04 This is best avoided. If used at the wrong time eg in wet weather, it causes the surface to become impervious. It should not be used to level off bumps and hollows, which should be done either by gradually adding soil or top dressing for major faults or by lifting turves with hand tools and filling or lowering under them when faults are minor.

10 Selection of grass

Grass mixtures

10.01 Grass is usually a mixture of different species of grasses. The choice of grass mixture depends on:
1 soil type
2 moisture content
3 climate
4 type of turf required for a particular use
5 cost of maintenance
6 shade from trees and buildings
Mixes can contain ten different species but usually only three or four. Those listed have been selected for:
1 persistence
2 disease resistance
3 recovery from wear
4 hard wearing
5 winter hardiness

Fine grass	*General areas*	*Shade*
Medium loam soil (slightly acid to neutral)		
10% oregon browntop 50% creeping red fescue 10% rough stalked meadow grass 30% smoothed stalked meadow grass	5% oregon browntop 25% S.S. meadow-grass 30% perennial rye 35% creeping red fescue 5% timothy	50% smoothed stalked meadow grass perennial 25% rye grass 25% crested dogstail or sheeps fescue
Light soils (acid and alkaline)		
10% oregon browntop 50% creeping red fescue 10% rough stalked meadow grass 30% smoothed stalked meadow grass	20% creeping red fescue 20% S.S. meadow grass 50% perennial rye 5% crested dogstail 5% timothy	40% sheeps fescue 20% fine leaved fescue 10% S. 59 fescue 30% browntop
Heavy clay soils (slightly alkaline to neutral)		
10% creeping bent 10% browntop 50% chewings fescue 30% S. 59 fescue	20% creeping red fescue 20% S.S. meadow grass 50% perennial rye 5% crested dogstail 5% timothy	50% perennial rye grass 30% rough stalked meadow grass 20% creeping red fescue

Information sheet Landscape 8

Section 4: **Basic plant data**

Screens and hedges

In this sheet ALLAN HART *discusses the function and uses of screens and hedges, describes their maintenance and lists readily available species and varieties*

1 Introduction

Functions of screens and hedges

1.01 All planting should fulfil a specific purpose based on a predetermined plan.

Uses

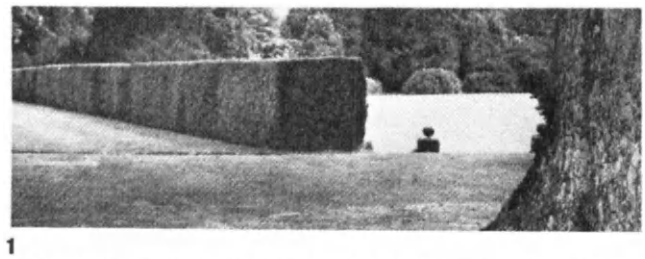
1.02 Screens and hedges can be used as follows:

1 to relate buildings to the site and to each other, and to link external spaces
2 to demarcate boundaries and areas
3 to accommodate changes in level **1** and ground modelling
4 to give privacy, screening and visual barrier and security
5 to shelter from wind, dust, strong sunshine and—to some extent—from noise
6 to form spaces by enclosing or dividing areas **2**
7 to direct pedestrian circulation
8 to channel views to or away from buildings or objects
9 to provide contrast in form, texture or colour, with buildings, pavings or water
10 to contrast with or complement sculpture

2 Generally

Shelter belts

2.01 Trees as shelter belts **3** should be planted at right angles to prevailing winds. Open textured planting filters wind, reducing its force **4**—the broader the planting belt, the more effective the filtering effect—solid planting creates turbulence on the leeward side. Shelter belts give wind reduction for a distance of ten times the height of the trees.



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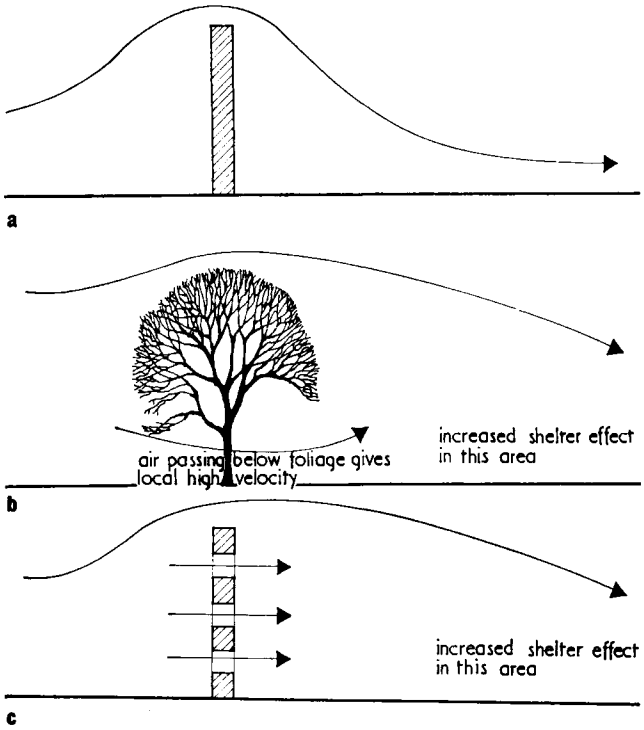
1 *Hedge used to mark change in level between adjacent lawns*
2 *Hedge used at one side of garden to delineate space. Low hedge material used as ground cover and to demarcate boundaries of areas in garden*
3 *Shelter belt on chalk farmland*



4 *Comparative effect of solid and perforated screens as wind breaks:*
a *Solid screen gives shelter for a limited distance as shown*
b *Trees act as wind screen. Air passing below foliage gives local high velocity but the general effect of this arrangement is to give shelter further downwind than would be the case with a solid screen*
c *Perforated screen. Effect of air passing through perforations is to increase the downwind distance for which wind velocity is reduced*

Common name	Botanical name	Soil type	Notes	Foliage
Plants for hedges and screens				
Tall screen: height 12·5 m				
norway maple	*Acer platanoides*	1 2 3		DG
wheatley elm	*Ulmus stricta wheatleyi*	1		DG
dawyck's beech	*Fagus sylvatica fastigiata*	1 2 3		MG (PG in spring)
hornbeam	*Carpinus betulus pyramidalis*	1 2 3		MG
lime	*Tilia euchlora*	1 2		PG
lawson's cypress	*Chamaecyparis lawsoniana*	1 2 3	E	DG
arbor-vitae	*Thuya plicata*	1	E	DG
spruce	*Picea excelsa*	1	E	DG
corsican pine	*Pinus laricio var nigricans*	1 2 3	E	DG
japanese larch	*Larix leptolepis*	1 3		PG
lombardy poplar	*Populus nigra italica*	1 3	fg	MG
poplar	*P. robusta* (short lived) for temporary use in shallow soil		fg	MG
Medium screen: height 7·5 m				
willow	*Salix alba*	1 3	fg	PG
whitebeam	*Sorbus aria*	1 2 3	T	MG
box elder	*Acer negundo*	1 2 3	fg	PG
field maple	*A. campestre*	1 2		MG
wildpear	*Pyrus communis*	1 2 3	t	MG
thorn	*Crataegus grignoniensis*	1 2 3		DG
Rustic hedge: height 4·5 m				
blackthorn	*Prunus spinosa*	1 2		MG (white flowers in spring)
hawthorn	*Crataegus monogyna*	1 2 3		MG
dogwood	*Cornus sanguinae*	1 2 3		MG (AC)
hazel	*Corylus avellana*	1 2 3		MG
elder	*Sambucus nigra*	1 2		MG (yellow in autumn)
buckthorn	*Rhamnus cathartica*	1 2		DG
spindle tree	*Euonymus europaeus*	1 2		MG (red in autumn with berries)
Tall (boundary) hedge: height 4·5 m				
laurel	*Prunus laurocerasus*	1 2 3	E	DG
portugal laurel	*P. lusitanica*	1 2	E B	DG
plum	*P. cerasifera*	1 2		MG
thorn	*Crataegus monogyna*	1 2 3	T	MG
hornbeam	*Carpinus betulus*	1 2 3		MG
tamarisk	*Tamarix vars*	1 2 3	t S	PG (pink flowers in summer)
rhododendron	*R. ponticum*	1 3	E	DG (purple flowersin spring)
cypress (gold)	*Chamaecyparis pisifera plumosa aurea*	1 2 3	E t	
cypress (blue)	*C.p.p. squarrosa*	1 2 3	E t	
cypress (green)	*C.p.p.*	1 2 3	E t	
Tall (formal) hedge: height 4·5 m				
holly	*Ilex aquifolium*	1 2 3	E	DG
holm oak	*Quercus ilex*	1 2 3	E t S	DG
yew	*Taxus baccata*	1 2	E T	DG
beech	*Fagus sylvatica*	1 2 3		MG (PG in spring)
purple beech	*F.s. purpurea*	1 2 3		
copper beech	*F.s.cuprea*	1 2 3		
bay	*Laurus nobilis*	1 2 3	E t S	DG
firethorn	*Pyracantha atalantoides*	1 2 3	E	MG (berries in autumn)
privet	*Ligustrum ovalifolium*	1 2 3	E fg T	MG
golden privet	*L. o. aureo variegatum*	1 2 3	E fg T	
lawson's cypress	*Chamaecyparis lawsoniana*	1 2 3	E	
cypress (blue)	*C. l. Triomphe de Boskoop*	1 2 3	E	DG
	C. l. allumii		E	
cypress (gold)	*C. l. lutea*	1 2 3	E	
Medium (informal) hedge: height 1·2 to 2·5 m				
barberry	*Berberis darwinii*	1 2	E	DG (orange flowers in spring)
barberry	*B. stenophylla*	1 2 3	E	MG (orange flowers in spring)
cotoneaster	*C. lactea*	1 2 3	E	PG (berries in autumn)
escallonia	*Escallonia macrantha*	1 3	E S	MG (pink flowers in spring)
escallonia	*E. Donard Seedling*	1 3	E S	MG (pink flowers in spring)
briar rose	*Rosa rugosa*	1 2	S	MG
elaeagnus	*Elaeagnus pungens*	1 2	E t S	grey-green
daisy bush	*Olearia macrodonta*	1 2 3	E t S	MG (white flowers in summer)
Medium (formal-clipped) hedge: height 1·2 m to 2·5 m				
holly	*Ilex aquifolium*	1 2 3	E S	DG
yew	*Taxus baccata*	1 2 3	E T	DG
box	*Buxus sempervirens*	1 2	E	PG
box	*B. s. handsworthensis*	1 2 3	E	PG
lonicera	*Lonica nitida fertilis*	1 2 3	E	MG
beech	*Fagus sylvatica*	1 2 3		MG
purple beech	*F. s. purpurea*	1 2 3		
copper beech	*F. s cuprea*	1 2 3		
privet	*Ligustrum ovalifolium*	1 2 3	E f g	MG
golden privet	*L. o. aureo variegatum*			
firethorn	*Pyracantha watereri*	1 2 3	E	MG (berries in autumn)
cotoneaster	*Cotoneaster franchettii*	1 2 3	E	MG (berries in autumn)
Dwarf (informal) hedge: height 1 m				
barberry	*Berberis verruculosa*	1 2 3	E	MG
barberry	*B. candidula*	1 2 3	E	PG
st john's wort	*Hypericum patulum*	1 2 3	E	PG
lavender	*Lavandula nana Hidcote*	1 2 3	E	blue-green
jerusalem sage	*Phlomis fruticosa*	1 3	E t	grey-green
rosemary	*Rosmarinus officianalis*	1 2 3	E	MG
pernettya	*Pernettya mucronata*	1 3	E	DG
Dwarf (formal-clipped) hedge: height 1 m				
box	*Buxus sempervirens*	1 2	E	PG
box	*B. s. suffruticosa* (edging)	1 2	E	PG
lavender	*Lavandula nana hidcote*	1 2 3	E	blue-green

5 *Hedge correctly pruned for stability*

Shelter belts should be from 15 m to 4·5 m wide in exposed situations. A mixture of hardwoods and conifers can be used for good screening effect.
When used as visual barriers as well, narrow screens, particularly single rows, make it difficult to obtain the texture necessary for effective shelter **4**, and often accentuate the object being hidden.

Defining spaces

2.02 Screens and hedges can be used to define spaces. Eye level view is a critical height when linking buildings to site and defining areas of different activities. Evergreen plants give the densest form of enclosure, but deciduous plants, if loose enough in character, can hint at enclosure.

Physical barriers

2.03 These need to be of plants which are quick growing and thorny (hawthorn, quickthorn). If trespass is serious, hedges can be reinforced at their centres with barbed wire or chain link fencing.

Decorative or flowering hedges

2.04 Hedge plants can be chosen for autumn colour, flowering effect, coloured stems in winter, coloured leaves etc. Such hedges are best kept to garden layouts and not introduced into broader landscape. Plants which are slow to shed their leaves in winter (beech, hornbeam) perform the same functions as evergreen hedges (yew, holly, box, privet).

3 Maintenance of screens and hedges

Generally

3.01 During the first years of establishment, it will be necessary to keep planting weeded and watered during periods of drought. Soil around plants should be firmed after periods of high winds or frosts, and given an annual feeding with a general fertiliser at the rate of:
120g per tree for screens
60g per linear yard for hedges

Pruning

3.02 Trees as screens need only light pruning to keep their shapes.
Hedges need more detailed pruning to develop a thick effect. Leading shoots should be lightly trimmed and side shoots should be pruned hard several times a year until shape and height have been reached. Following that, pruning or clipping should be carried out at intervals to maintain shape and size of hedges
To maintain the thick growth at the base, hedges should be trained so that the base is broader than the top **5**. Large-leaved plants (laurel, rhododendron) are best pruned with secateurs to avoid cutting through leaves which would then die back. Slow-growing plants (beech, hornbeam, yew, holly) are best clipped in August. If a crisper look is wanted, then clipping should take place at the end of May and again in September. Fast-growing plants (privet, thorn) should be clipped in June and then at six to eight-week intervals.
Hedges of flowering shrubs are best pruned after flowering and with secateurs to avoid a rigid line.
If hedges become bare at the base, they should be hard pruned to a broad base—narrow top shape again, the soil at the base forked over, and compost or fresh soil and fertiliser added to provide extra growth.

4 Select list

Notes to table 1

4.01 It is important that this list is not regarded as a substitute for professional knowledge of plants and plant groupings. It should normally be used only for preliminary selection, or as an *aide-memoire* on which the final selection for suitability for site conditions, purpose, grouping etc can be made by a member of the landscape design team.
Plants listed have been chosen for tolerance, hardiness, good growth without much pruning, and to be commercially available at reasonable cost. It should not be necessary to use plants outside this range except in very unusual circumstances.

Key to abbreviations

Soil types
1 medium loam (neutral)
2 light alkaline
3 light sand (acid)

Notes
T suitable for town smoke or industrial fumes
S suitable for coastal conditions and salt spray
W suitable for waterside planting (ie definitely needs a moist soil)
E evergreen
t tender (to be grown south of a line from Aberystwyth to Thames estuary only, unless specifically sheltered)
f fast growing
g having greedy roots, or invasive

Foliage
PG pale green
MG mid green
DG dark green
AC bright autumn colouring

Information sheet Landscape 9

Section 4: **Basic plant data**

Water plants

In this sheet ALLAN HART *discusses the functions of ponds and water gardens describes, their maintenance and lists readily available plants with their characteristics*

1 Introduction

Functions

1.01 Ponds and water gardens should fulfil a specific purpose, based on a predetermined plan.

Uses

1.02 They have many uses:

1 to relate buildings to the site and to each other
2 to demarcate boundaries and areas
3 as a barrier
4 as part of a building's mechanical plant
5 to create external spaces by enclosing or breaking up areas
6 to direct pedestrian circulation
7 to channel views to or away from buildings or objects
8 to provide contrast with buildings or pavings
9 to contrast with or complement sculpture

2 Ponds and water gardens

Layout

2.01 Water is best sited in the open as any shade encourages foliage growth at the expense of flowers. Overhanging trees are a disadvantage when leaves fall. Protection from prevailing cold winds by buildings, hedges, shelter belts, extends flowering season at both ends.

Water surface should be covered with specific groupings of floating plants, either complementary or contrasting and in scale with surface area. Waterside planting can be chosen for different height and foliage effects, but in groups of odd numbers of plants to avoid duality and row effects. To obtain the different depths of water required by certain species, bottom and sides of pools may be stepped.

1 *Upper lake, York University; 'naturalised' pond contrasting with 'hard' surfaces of buildings and paving*

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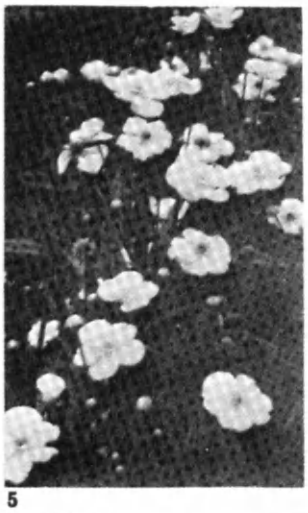

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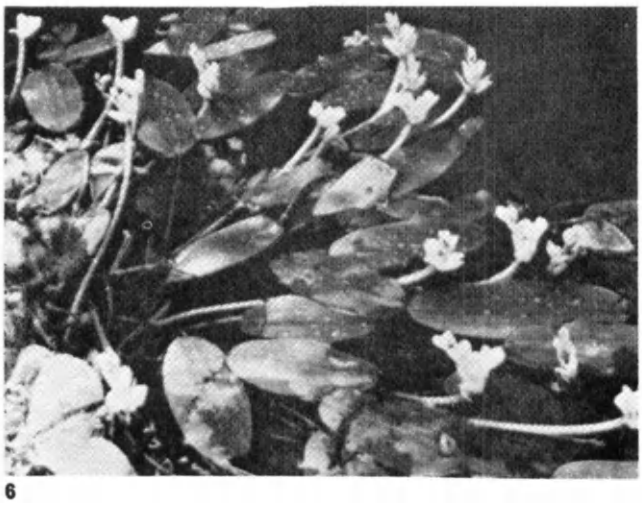

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Basic types

2.02 There are five basic plant types associated with water and its banks:
Waterside plants—those suitable for growing in moist soil beside water which may dry out at times **1**. Marsh plants—requiring moist conditions at all times **2**. Marginal plants—those with roots requiring up to 500 mm deep water cover **3**. Submerged plants which oxygenate water **4**. Floating plants with roots in the bottom of pools **5**.

3 Maintenance

Discoloured water

3.01 Discoloured water is caused by algae (tiny unicellular plants) feeding on dissolved mineral salts in water. Oxygenating and floating plants help to deny them these mineral salts. Algae also need plenty of light, but water lilies etc, help shade out algae. Water fleas (*Daphnia*) quickly rid pools of algae, but these in turn are eaten by fish. Blanket or flannel weed is another form of algae which produces tangled webs or green strands. This is best treated by continued removal until water is covered by other plants.

Weed control

3.02 In large bodies of water, some aquatic plants grow too vigorously and cover too much water surface, crowding out other species. It is possible to clear by hand, but on a large scale it is expensive. Chemicals now being used are:

CHEMICAL	QUANTITY	CONTROLS
Simazine	3-6 parts/million	duckweed
Monuron	4-12 parts/million	underwater vegetation
Sodium arsenate	10 parts/million	underwater vegetation
Dalapon	1 kg/litre of water sprayed onto weeds	rushes, reed mace, bur-weeds etc

General maintenance

3.03 Once a pool's planting is established, the only annual maintenance necessary should be clearing away dead plants and fallen leaves.

Vandalism

3.04 Few urban areas escape some degree of vandalism. Designers of urban landscape must be realistic when choosing plant material, being prepared to replace damaged plants immediately and perhaps several times before vandalism stops. Planting is particularly vulnerable during establishment years and should be temporarily protected with chestnut pale or other fencing where necessary. Pools and planting sited across natural desire lines are constantly subject to vandalism, and this could be avoided at an early planning stage.

2 *Waterside plants;* Ligularia clivorum desdemona
3 *Marsh plants;* Peltiphyllum peltatum
4 *Marginal plants;* Astilbe astilboides
5 *Submerged plants; great spearwort* Ranunculus lingua grandiflora
6 *Floating plants; water hawthorn* Aponogeton distachyum
7 *Floating plants; water lilies;* Marliacea carnea

Tables I to V and the list of waterlilies indicates main types of plants of which there are many varieties.

Table I Water side plants

Common name	Botanical name	Notes
goat's beard	*Aruncus sylvester*	Massive plumes of creamy white flowers. June-July
spiraea	*Astilbe* in variety	White, pink, red plumes June to August
plantain lily	*Hosta fortunea*	Large blue-green leaves pale mauve flowers
plantain lily	*H. Sieboldii*	Strong growing grey-green foliage
day lily	*Hemerocallis* in variety	Mainly deep gold-amber July to September
siberian iris	*Iris sibirica*	Grass-like ieaves. Purple-blue flowers
giant groundsel	*Ligularia Desdemona*	Large heart shaped leaves with large orange daisies
giant groundsel	*Senecio clivorum*	Loose corymbs yellow flowers

Table II Marsh plants

marsh marigold	*Caltha palustris*	Single yellow flowers May-July
double flowered marsh marigold	*C.p. plena*	Double yellow flowers May-July
globe flower	*Trollius. spp.*	Large buttercup flowers May-June
japanese water iris	*Iris kaempferi*	Clematis like flowers, white, blue or purple
	Filipendula venusta	Feathery foliage with plumes of rose crimson flowers. Late summer
	Rheum palmatum	Red large toothed leaves on fleshy stalks
giant rhubarb	*Gunnera manicata*	Large dark green leaves up to 1 ·2 m on thick fleshy stalk. Needs protection during winter
	Peltiphyllum peltatum	Large round leaves pale-mid green. Pale pink flowers before leaves appear in April

Table III Marginal Plants

sweet flag	*Acorus calamus*	Iris-like leaves
	A.c. variegatus	Leaves, striped green and white
flowering rush	*Butomus umbellatus*	Heads of pink flowers May to July
	Lysichitum americanum	Large green leaves. Broad yellow flower spathes
true bullrush	*Scirpus lacustris*	Slender dark green stems
red mace	*Typha augusti folia*	Brown cat-tail spikes

Table IV Submerged plants

milfoil	*Myriophyllium verticillatum*	Feathery foliage much dissected
water crowfoot	*Ranunculus aquatilis*	Buttercup like leaves
canadian pondweed	*Elodea canadenis*	Dense dark green fronds
water violet	*Hottonia palustris*	

Table V Floating plants

water hawthorn	*Aponogeton distachyum*	Strap-shaped leaves 150 mm long (White fragrant flowers in spring to autumn)
frogbit	*Hydrocharis morsus-ranae*	Small lily-like leaves about the size of a shilling. Small white flowers
water soldier	*Stratiotes aloides*	Spiky rosettes of leaves like a pineapple top. Small white flowers

List of readily available waterlilies (Nymphaea)

Key

V = Vigorous varieties 225 mm to 1200 mm depth of water with surface spread of 1200 mm diam

M = Medium varieties 225 mm to 600 mm depth of water with surface spread of 1000 mm diam

S = Small varieties 150 mm to 300 mm depth of water with surface spread of 600 mm diam

White varieties

Alba: yellow centre. V

Albatross: apple green leaves. M and S

Gladstoniana: large flowers suitable for lakes. V

Marliacea albida: similar to Alba but less vigorous. M

Yellow varieties

Marliacea chromatella. M

Odorata sulphurea grandiflora: flowers remain open in the evening. M

Red and crimson

Escarboucle: bright red—free flowering, one of the best water lilies. M

Froebeli: similar qualities for small pools

Rose and pink

Marliacea carnea: large pale pink—free flowering. V and M

Odorata turiensis: soft rose-petals elongated, rounded scented. S

Tuberosa rosea: shell pink—scented. M.

Information sheet Landscape 10

Section 4: **Basic plant data**

Site planting techniques

In this information sheet ALLAN HART *describes soil types and how to improve and prepare them for planting; where plant material can be obtained, how it should be prepared and planted; and discusses specialist after-care treatment that some planting requires*

Identification of soils by their physical characteristics

Generally

1.01 Soils originate through disintegration of parent rock under the effects of weather and bacteriological action, and are a combination of rock particles, microscopic animal and plant life and vegetable matter. Soils vary in depth from about 100 mm to a few metres with physical characteristics derived from parent rock. Only the top 100 mm or so of the soil layer are generally inhabited by plant life. Soil on sites should be conserved either in-situ or, if for re-use, by being carefully stripped to its full depth and stacked in heaps not exceeding 1 m high by 3 m wide. Both soil heaps and soil in-situ should be fully surrounded by protective fencing to prevent vehicular access and contamination from chemicals etc. Heaps could be sown with grass to prevent weed growth and improve appearance.

Physical characteristics

1.02 Physical characteristics of soil are associated with particle size, water content, water and nutrient (plant food) retention, ease or difficulty of cultivation and temperature. Of these factors, particle size is the most important. Other factors, to some degree, depend on and are affected by this. The main divisions of particle size are sand (large) silt (medium) clay (small). Most soils contain particles of all sizes, but there is a tendency for one range of sizes to predominate, characterising the soil as a whole; thus: sandy or light soils, loamy medium soils and clay or heavy soils. Other characteristics could be due to the presence of flints, stones, gravel, boulders, chalk or peat.

Particle size

1.03 Particle size has a primary effect on water and air content of soil. The smaller the particles the more tightly they pack together, leaving less room for air. Most clays contain no air, and inter-particle spaces are entirely filled with water. Relative proportions of water and air in soil affect its nutritional value for plants. These conditions influence:

1 Amount of water available to plants for nutritional needs.
2 Amount of oxygen for roots to breathe.
3 Ready decomposition of organic matter.
4 Entry into soil water of toxic substances, eg ferrous salts.
5 Temperature of soil.
6 Ease with which roots extend into soil.

pH

1.04 This denotes degree of acidity or alkalinity of a soil. It is based on a logarithmic scale to the power of 10, so that pH5 is ten times more acid than pH6.

pH0 Absolute acidity
pH5 Slightly acid
pH7 Neutral
pH9 Slightly alkaline
pH14 Absolute alkalinity

Certain plants have adapted to living in very acid soils (heathers), and will not grow in lime/chalk soils. These are known as *Calcifuge* plants. Similarly, lime loving plants (thyme) are known as *Calciole* plants. The vast majority of plants are happiest in a neutral soil.

Elementary classification

1.05 A brief classification of soils and their characteristics:

Light	sand	Loose soil particles allow movement of air and water giving free drainage, but with a likelihood of drought during spring and summer. Generally tends to be low in plant nutrients; supports birch, broom, false acacia, sweet chestnut, pine, gorse.	Acid
Heavy	silty loam	Medium to poor drainage.	Acid to neutral
Heavy	clay	Poorly drained and difficult to cultivate; supports oak, ash, field maple, willow.	Alkaline to neutral
Heavy	clay loam	Cracks in dry conditions. Rich in nutrients when texture is improved to enable roots to penetrate. Supports hornbeam.	Alkaline to neutral
Medium	medium loam	Drainage and moisture retention good, holds nutrients; supports horse chestnut, maple, lime, plane, elm and most other trees and shrubs.	Neutral

Light	chalky	Free draining results in poor water retention and little nutrient value. Generally shallow due to leaching; supports beech, ash sycamore and members of rose family (cherries, crabs whitebeams).	Alkaline
Light	peat	Can contain 60 per cent organic matter or humus. Water retentive so drainage may need improving; supports birch, heather, rhododendrons, azaleas.	Acid
Light	stony	Free draining, poor fertility.	

Some soils contain gravel or flints. Loam contains a mixture of clay, silt, sand and humus in varying proportions. Light soil: relatively large primary particles allow free draining and are consequently easy to work, but low in fertility as nutrients are quickly washed out. Heavy soil: shows exactly opposite characteristics.

Hand test for classification by texture

1.06 An elementary classification of soil types by texture is done by working a handful of moist soil in fingers:

Sand	Gritty and does not soil fingers
Sandy loam	Gritty, can be pressed roughly into a ball and soils fingers
Clay loam	Sticky, easily moulded in fingers and quickly polished by sliding between finger and thumb
Clay	Sticky, becomes polished and stiff, but plastic enough to be rolled into long flexible 'worms'
Silty loam	Not sticky and can't be polished, but feels 'silky' or 'soapy'; is not cohesive, but can be moulded
Medium loam	Not gritty, sticky, or silky.

2 Improvement of soils

Generally

2.01 Soil improvement can be made only to a relatively small degree. In more extreme conditions of heavy, hungry, acid or badly drained soils, it is essential to select only those types of plants known to tolerate them. Conditions of soils can be modified and ameliorated within certain limits by:

Drainage

2.02 Improving poor natural drainage by land drains.

Heavy clay soils

2.03 Heavy clay soils can be lightened with the addition of coarse sand, peat, strawy manure, compost. Addition of lime and chalk causes soil particles to group together, forming larger particles, enabling air and water to move through them more freely.

Light sandy or chalky soils

2.04 To make light sandy or chalky soils more retentive of moisture and plant nutrients, bulky organic manures can be added (heavy farmyard manure, seaweed, compost, peat).

Acid soils

2.05 Acid soils can be improved by the addition of lime to raise the pH.

Fertilisers

2.06 Soils deficient in nitrogen, phosphates, potassium (the three main constituents for successful plant growth) can be improved by organic and chemical fertilisers.

3 Preparation of soils

Generally

3.01 Ground is prepared in order to:

1 Bring the soil to its best physical condition.
2 Incorporate fertilisers and manures.
3 Improve texture to enable new roots to find water and nutrients easily.
4 Enable soil to drain in winter and take up underground water in summer.

Existing ground

3.02 Sites should be first cleared of all unwanted vegetation, grass, weeds etc; all roots grubbed out and all materials burnt with resultant ash spread over site.

Ground unaffected by machinery or building operations can be cultivated by plough, rotovator or digging to a depth of 250 mm to bury all grass and annual weeds. All rubbish should be removed. Trafficking by machinery can compact ground to a considerable depth. Ground should be cultivated by a tractor drawn subsoiler. Croplands have few weeds or grass; a disc plough or a rotary cultivator is generally all that is necessary to prepare such ground.

Cultivation

3.03 Cultivation, on a large scale can be done by ploughing, disc harrows or rotavator, all machine powered or tractor driven. On a smaller scale, hand cultivation by digging, forking or raking, will suffice.

Imported topsoil

3.04 Imported topsoil should be similar to existing soil eg chalky alkaline. If the area has previously been stripped of topsoil, it should be cultivated to break up any compaction, before spreading and levelling new topsoil. Over-consolidation should be avoided. After topsoil is spread, the surface should be cultivated in preparation for planting. Disc or chain harrowing for large areas intended for grassing, and forking over for shrub beds.

Certain soils stored for long periods, smell when spread. This is because of anaerobic bacteria (those not needing air) feeding on dead vegetation. This condition diminishes quickly once the soil is spread over the ground and cultivated. (see BS3882*)

3.05 Minimum recommended topsoil depths after light consolidation **1** are:

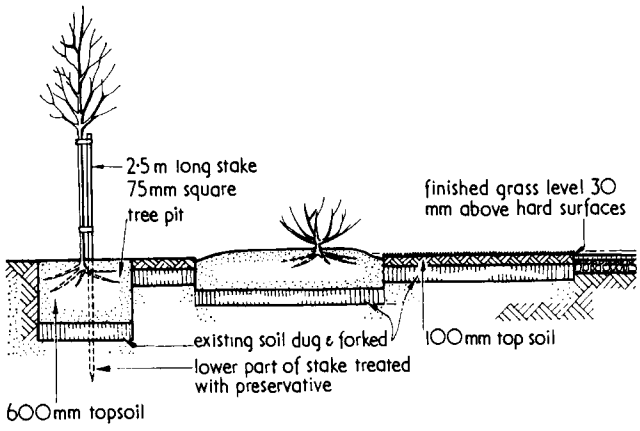
Grass banks	75 mm to 100 mm
Lawns etc	100 mm
Sportsfields	150 mm
Shrub areas	400 mm
Tree pits	600 mm

(Trees and shrubs on banks need their full required depth of topsoil).

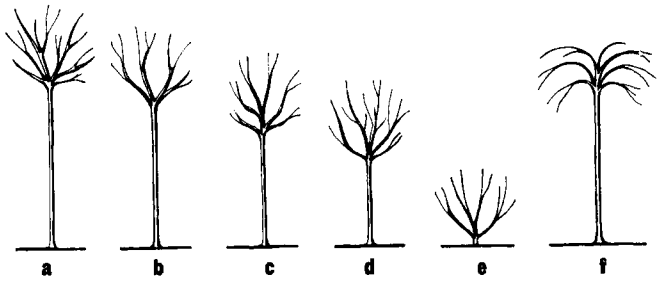
Manures, fertilisers, ameliorants

3.06 Soils in urban situations, particularly where depth and

* See appendix D, Design guide urban landscape



1 *Minimum recommended topsoil depths after light consolidation for tree pits, shrub beds and lawns*



2 *Nursery stock standards* (**a**) *tall standard;* (**b**) *standard;* (**c**) *three quarter standard;* (**d**) *half standard;* (**e**) *bush;* (**f**) *weeping standard* (*see para* 4.02 *for heights*)

area are restricted, quickly have their nutrients used by plant growth. These nutrients must be replaced periodically to maintain healthy growth. This may be done with:

Bulky organic manures
Bulky organic manures eg farmyard or stable manure, compost, seaweed. Each providing several nutrients in small quantities and improving the following physical properties of the soil: soil structure, aeration, water retention, soil flora and fauna.

Concentrated organic manures
Concentrated organic manures (eg hoof and horn, and bone meals) which release nutrients over a long period of time and are useful because overgenerous quantities do not harm plants.

Inorganic fertilisers
Usually concentrated and to supply a specific chemical in which the soil is deficient (eg sulphate ammonia for nitrogen deficiency). Such fertilisers can cause trouble if used in excess.

Soil ameliorants

3.07 Added to poor soils to improve the physical property of texture. In addition to farm yard manure and seaweed there are:

Peat
Peat is 60 per cent humus and therefore has great water retaining qualities useful on light soils or for texture improvement on heavy soils.

Hop manure
Usually spent hops from breweries, acting in the same manner as peat. Hop manure requires a light dressing of sulphate of ammonia to assist bacteria needed to break down the hops.

Dried sewage sludge
Dried sewage sludge can be used, but is liable to be toxic when from industrial areas, an excess of zinc being specially critical.

Mushroom manure
This is a mixture of farmyard manure, peat or wood shavings, with fertilisers and gypsum. As latter contains lime its use near calcifuge plants (heathers, rhododendrons) should be avoided.

4 Source of plant material

4.01 Plants may be obtained from:

Wholesale trade nurseries
Advantages: Large variety of species available in quantity, and generally cheaper.
Disadvantages: Tend to be sited where good conditions of soil and climate are found, to produce suitable plants quickly —these conditions will probably be very different to those where plants are to be finally grown. Nurseries usually have a strict rota system for lifting and customers have to wait their turn.

Local nurseries
Advantages: Same soil and climatological conditions as site. Arrangements can usually be made to collect direct from nursery, ensuring completion of planting programme on time.
Disadvantages: Relatively small numbers of plants produced, restricted varieties. Tend to grow the type of plants demanded by local trade.

Specialist nurseries
Eg roses, aquatics, heathers. May be wholesale or local trade with advantages and disadvantages of both.

Site nurseries
Should the site development be large enough and planning far enough in advance, it is possible that:
1 Plant material required can be ordered and reserved in advance from a trade nursery or:
2 Consideration might be given to setting aside land for growing stock. In this way plant material may be bought at wholesale prices and grown in local soil and climatic conditions for a period to acclimatise; plants can be root pruned etc and lifted exactly when needed; and it is possible to ensure that the correct species are available. Such nurseries should be managed by skilled horticulturists and fully protected from stock, rabbits and vandalism.

Specification

4.02 All plant material should comply with requirements of BS 3936 Nursery Stock. Part 1.
Plants should be true to type, of reasonable size and shape, free from any pests, diseases or physical defects. There should be no persistent weeds in root-balls. More important than size is the quality, both of roots and branches. It is vital when specifying plant material that the following details are supplied:

Name of plant
Full botanical name with generic specific names and varietal or cultivar if applicable (see BS 3975: part 4 1966 Glossary for landscape work). Each plant supplied should be true to type. The botanical name (latin name) ensures that suppliers are quoting for the same plant, because the same common names are often given to more than one species.

Sizes and forms

Form	*Heights (from ground level to lowest branch)*	*Stem diam at ground*
Specification for nursery stock trees **2**		
Bush	0·3 m to 0·75 m	
Half standard	1·1 m to 1·6 m	20 mm
Three-quarter standard	1·5 m to 1·6 m	20 mm
Standard	1·7 m to 1·8 m	20 mm
Tall standard	1·8 m to 2 m	25 mm
Weeping standard	min 1·7 m	20 mm

For shrubs: See BS 3936: part 1 Nursery Stock for recommended sizes (A good wholesale catalogue will give nursery stock sizes generally available). All heights should be measured from ground level. Plants should be well furnished from the base.

Shrubs

4.03 Shrubs may be open ground, ie grown out of doors direct into the soil and transplanted at intervals to promote fibrous roots, or pot grown. Usually those shrubs or climbing plants which do not transplant readily from the open ground are pot grown. Size of pot should be stated.

Container grown plants

4.04 Trees, shrubs and ground cover are usually grown in pots or containers from seedling or cutting stage, being transplanted into larger containers as they develop **3**. Advantages are that planting can be transplanted with little root disturbance in any season and can be used to give a finished effect to schemes which would otherwise have to wait the normal planting season. It is essential that arrangements be made to water plants planted during spring and summer.

5 Planting and establishment

Planting seasons

5.01 Deciduous trees and shrubs: end of October to end of March. Conifers and evergreen shrubs: end of September to early May (best results if planted when soil is warm). Container and pot-grown plants: end of September to early May. Water lilies, marginal plants and aquatics: mid March to early June.

Planting is best delayed:

1 When soil is wet or waterlogged
2 When frost is in the soil
3 During periods of drought
4 During periods of drying winds

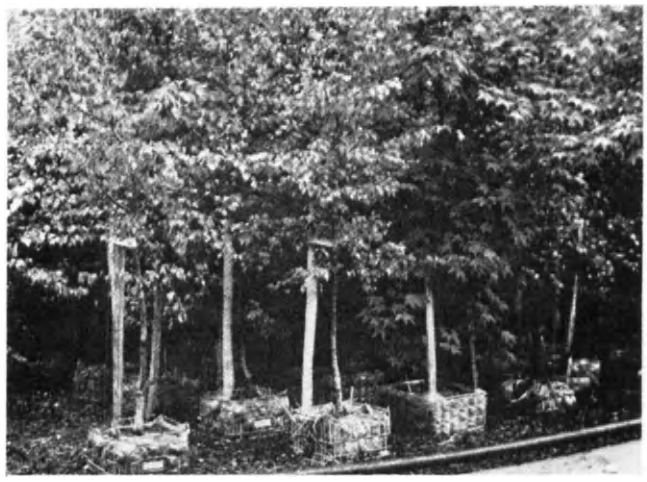
To avoid spring droughts on light soils, and in drier parts of the country, it is best to plant in autumn so that roots become established and make maximum use of any available ground water in the following spring and summer.

On heavy soils and in wetter colder areas, spring planting is recommended, since new root growth is encouraged as the soil becomes warmer. Roots may rot in wet winter soil.

Treatment of plants on arrival

5.02 Evergreen shrubs and conifers should be protected by hessian or plastic sheet from drying winds. Spraying with s600-Latex transplanting spray helps to reduce transpiration.

Any plants delivered during periods of hard frost or waterlogged soils should either be placed in an unheated frost-proof shed: for a short period—the package can remain unopened; for a long period—open the package loosely to allow air to circulate. Alternatively they could be placed in a sheltered spot and heeled in until conditions improve.



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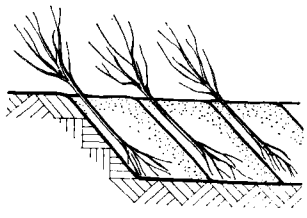


4

3 *Nursery stock is usually grown in containers which allow transplanting with little root disturbance*
4 *Heeling in: for maintaining material on site before planting: layers of plants are laid against a prepared 45° bank and covered with soil which is firmed by foot*

Heeling in

5.03 This consists of digging an open trench deep enough to hold all the plant roots, with one side at 45°, which plants lie on **4**. Bundles of plants are opened, roots spread out and covered over with fine soil which is well firmed by foot. Any roots appearing to be dry should be soaked before placing in trench. If the soil in the trench is very dry, it should be watered after the plants are heeled in. Care should be taken when lifting plants.

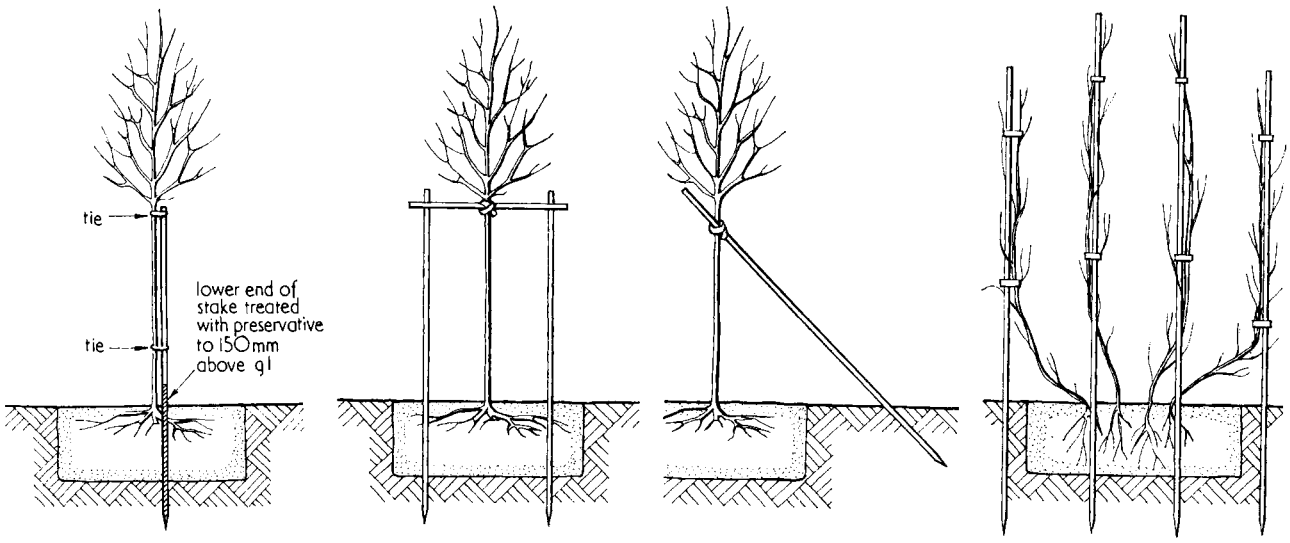
Planting and after-care

5.04 Planting beds and tree pits should be prepared well in advance of plants being delivered. Planting should be in this sequence: trees, shrubs, ground cover. It is important that plants should be put in at the same depth as when growing in the nursery. This can be determined by soil marks on necks of plants. After planting, lightly fork over the soil, breaking up surfaces to allow water and air to penetrate.

6 Planting nursery stock

Roots lifted without soil

6.01 Many trees and shrubs are lifted from the nursery with no soil attached to roots, to facilitate packing and transport. Any such plants which are dry at the roots should be soaked for a couple of minutes before planting. Remove any dead, diseased or damaged roots. Break up topsoil removed from hole and sprinkle over roots, shaking plant gently to allow the soil to filter through roots excluding air pockets. Firm soil layer by layer, avoiding damage to roots, but not over compact soil.



5 **6** **7** **8**

5 *Single stake, used for normal conditions*
6 *Two stakes and cross bar, used in exposed positions*
7 *Single stake angled at 45° against prevailing winds*
8 *To achieve multi-stemmed effect, several trees can be planted in a single pit with their stems trained to stakes to achieve the effect*
9 *Birch sappling planted three, five and seven to a pit to create a multi-stemmed effect*

Root-balls

6.02 Root-balls of conifers, rhododendrons, azaleas etc contain a mass of fibre, and it is usual for these to be lifted with soil attached, protected with hessian, to keep root-balls intact. It is good practice to soak root-balls in water, wetting them right through. The hessian need only be cut away from the outside roots as it will soon rot.

Pot and container grown plants

6.03 Soil in pots must be moist. If dry, roots will stick to the sides and break off when the plant is removed. If the plant is pot-bound with roots packed tightly, sticking through the hole in the bottom, the pot should be broken to avoid root damage. Roots should then be gently loosened to enable them to be spread out.

Staking

6.04 Newly planted trees and large shrubs should be fastened to stakes to prevent rocking by wind, which can break new roots and make a pocket at the base of stems. Sides of these pockets become polished and will hold water which rots bark. Stakes should be of hardwood eg oak, sweet chestnut, or softwood eg larch. Bark should be removed and one end pointed before being treated with a non-injurious wood preservative. Allow 300 mm to 1200 mm of treated timber so that at least 150 mm remains above ground level after planting. Any rough snags should be removed and tops of stakes shortened to be below the crotch of the trees after planting.

Trees may be secured by: single vertical stake in normal conditions **5,** by two stakes with a cross bar **6,** useful for housing estates and exposed positions; stakes planted at an angle of 45° against the prevailing wind **7** in very exposed positions. Overlarge nursery stock trees require a system of adjustable guy ropes.

Tree ties

6.05 Ties are used to secure the tree to the stake, preventing excessive movement. Proprietary ties are available in plastic, rubber and hessian and can be adjusted to allow for increased growth in the girth of stems. There should be a buffer between stem and stake to prevent chafing **16**. Ties should be placed just below the lowest branch and again just above ground level.

7 Semi-mature trees

Size

7.01 These can range in height from 6 m to 15 m and weigh from 250 kg to 10 tonne. Transporters and lifting tackle usually need access to planting positions. Trees for transplanting are either grown specially and are transplanted at regular intervals to encourage production of fibrous roots, or selected from an area of woodland and the roots are pruned over two to three years to encourage formation of fibrous roots. The diameter of root ball can vary from 1 m to 3 m and from 0·5 m to 1 m deep.

Semi-mature trees are expensive, so it is worth selecting trees individually. Generally trees from heavy shallow soils are best as the roots are near the surface and the soil holds together.

Planting seasons

7.02 Generally as for trees and shrubs.

Availability

7.03 Availability is improving as specialist nurseries set aside plants which are to be grown on to large sizes. The demand for this type of material is great, and it is advisable to reserve plants at nurseries well in advance of site planting dates.

9

Transplanters

7.04 Types of tree transplanters are:

Newman trailer **10**
This is tipped against the tree in a prepared trench, clamped on to the main stem and, when towed away, lifts the tree from the hole into a horizontal position ready for transporting to site. Total weight of root-ball and trailer is about 4 tonne and several can be towed in convoy by land rover.

Michigan transplanter **11**
This is essentially a tractor-mounted, large hydraulically operated trowel, which cuts around the tree on all sides, lifting the tree on the third and final cut. The trowel is raised and the tree is transported bodily to the site where a similar shaped hole has been dug ready for root-ball to be inserted. Ratio of distance to time is a limiting factor, but large numbers of trees can be transplanted this way if they are relatively close to the site.

Crane **12**
Used for lifting trees from the ground to a low loader used to transport trees to the site. If distances are great, it is often economical to have a crane at both site and nursery. The largest sized trees can be moved with this method.

Site preparation

7.05 Holes should be prepared in advance and protected from rain and frost. To allow new roots to penetrate and help trees re-establish quickly, bottoms of pits should be broken up to a min depth of 250 mm and if any soil on sides of pits is 'polished' this should also be forked to loosen it. Bottoms of the pits should be domed lightly to assist drainage. If site drainage is poor, a layer of coarse gravel or crushed stone should be placed on the bottom with a clay tile drain outlet to a sump or existing site drainage **13**. It is also possible to plant trees on a mound above waterlogged areas, providing it is graded to the ground contours.
Pits should be a minimum of 600 mm wider and 250 mm deeper than the root-ball.

Back filling

7.06 Back filling should be with a compost of good soil, peat and leaf mould with sand and a well-balanced fertiliser. Soil should be the same as the local soil type. This mixture will hold moisture, but drain freely and allow development of new roots.

Planting

7.07 Trees should be placed to the same depth as when growing in nursery. All damaged roots should be pruned. Back-fill should be in 150 mm layers, taking care to eliminate air pockets and to avoid damaging roots. The compost should be well firmed at the lower levels, gradually reducing in firmness towards the top of the hole. Water before the final layer is applied—the tree should be well soaked—the final layer will act as a mulch. Remove any damaged branches and repair any bark wounds.

Guying

7.08 Guying is necessary until trees become wind firm and may be by:

Underground guying
Success depends on the root-ball being sound with heavy soil holding it together. A frame of boards is put over the root-ball to protect it, then strong wire is passed over the frame, each wire being anchored to the bottom of the pit by: deadman of timber or concrete buried below ground **13** or by stakes of wood or metal driven in at an angle **14**. This method is favoured in hard paved areas where guys would be an obstruction and is difficult to vandalise.

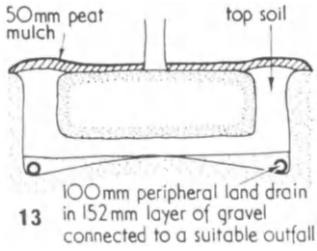
Overhead guying
This is the most common method, being cheaper to erect


10


11


12

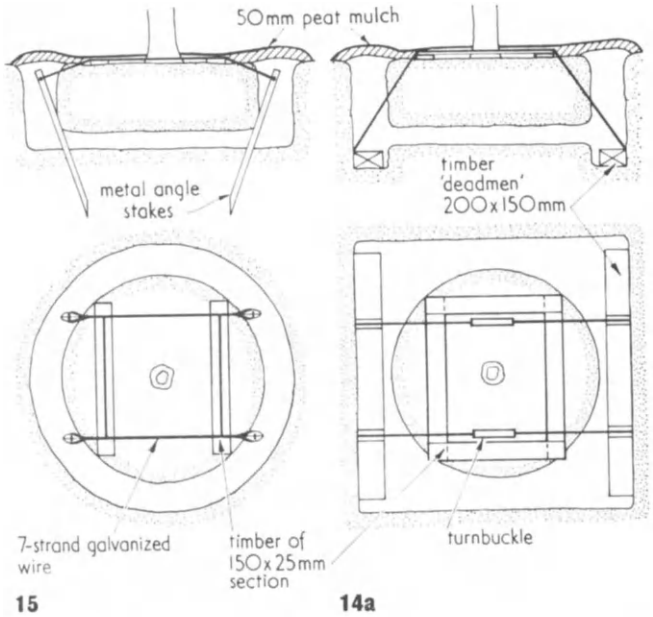
10 *Newman trailers are used to remove trees from prepared holes and for trailing them to sites*
11 *Michigan transplanters cut around trees on all sides lifting them on the third and final cut, ready for transplanting to a prepared pit*
12 *Cranes can be used for lifting trees from low loaders into prepared pits*



13 *When site drainage is poor, tree pits can be prepared with land drains with outlets to existing drains—or to a sump—to prevent waterlogging*

14a *Underground guying for transplanted semi-mature trees using timber deadmen*

14b *Underground guying for transplanted semi-mature trees used when overhead guying would be a hazard*



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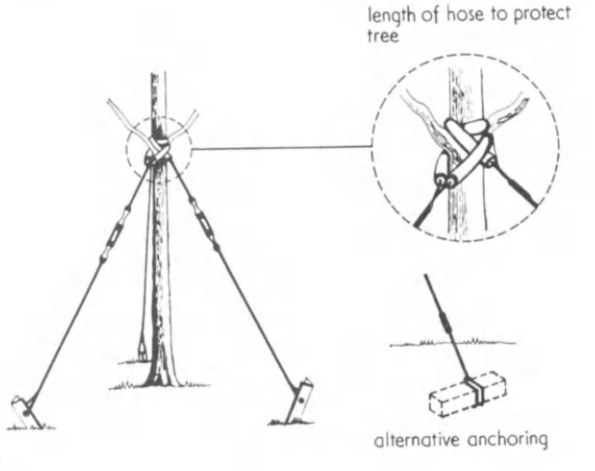
14b



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and easier to adjust. It is best used away from public areas. Three to four wire guys are placed halfway up the tree and attached to stakes to deadmen sunk into the ground. Guys should be at an angle of 45° when tight and threaded through hosepipe passing over a branch or crotch **16**.

Guying is usually necessary for four to five years depending on how quickly transplanted trees re-establish themselves.

Maintenance

7.09 A maintenance programme should be arranged for a two-three year period after planting. This should cover:

1 Watering
2 Weed control
3 Fertiliser application
4 Mulching
5 Adjusting of guys

Extra heavy nursery stock

7.10 If semi-mature trees are not readily available, consideration should be given to the use of extra heavy nursery stock. These are trees with an average height of 4 m to 5·5 m and, when correctly root pruned at the nursery, have a good fibrous root system. These trees are relatively young and generally adjust quickly to the shock of transplanting. After a year of producing roots, growth recovers to normal and often the trees catch up with semi-mature trees which take longer to settle down.

They should be given a generous sized tree pit. Say 2 m × 2 m × 1 m deep, filled with a compost of three parts good quality fibrous loam and one part damp coarse peat to which is added bonemeal, hoof and horn. Stakes or guys will be required.

Multi-stemmed trees

7.11 Certain trees naturally occur with a clump of three or more stems from ground level (silver birch, hazel, alders) while others have their form expressed from ground level, and if they are grown on a 'leg' or stem, they lose much of their quality (japanese maples, styrax, mulberry). These forms of plant material are not normally grown by conventional nursery techniques as it involves more hand labour. If after-care and maintenance are sympathetic then plants in shrub form and sizes can be planted and pruned to achieve this effect, but the technique can take several years.

It is possible in the case of multi-stemmed trees to plant more than one tree per tree pit **19**. To do this feathered trees are arranged with their stems touching together at the root and the stems trained to stakes, to obtain the desired shape **8**. Roots have to be carefully arranged within the pit. To exclude air pockets it is best to place one set of roots and cover these with soil and then add another set of roots until the total number have been accommodated. If any tree dies it should be cut off at the base. No attempt should be made to replant into a group.

15 *Alternative underground guying for transplanted semi-mature trees using metal stakes instead of timber deadmen*

16 *Overhead guying for transplanted semi-mature trees is cheaper and easier to adjust than underground guying, but can be a pedestrian hazard and is subject to vandalism*

8 Grass

Seeding of grass areas

8.01 General procedure for seeding grass areas:

Lightly and uniformly firm the surface by foot or roller
Rake or chain harrow to provide a fine tilth
Remove all large stones greater than 50 mm
One to two weeks before seeding, apply pre-germination fertiliser at 90 g/m² lightly raked in. This enables rapid establishment of grass seedlings
Sow grass seed at rate of 20 g to 30 g/m² for fine sward
Sow grass seed at rate of 15 g/m² in general areas
Sow equal quantities of seed from two directions
Rake or chain harrow. Roll and cross roll with lightweight roller on light sandy or chalk soils.

Seeding seasons

8.02 Seeding season is best in late summer when soil is warm, air temperature is high and there is plenty of moisture available. This enables grass to become established before winter. Grass is an evergreen and will continue to grow slowly during mild spells in winter. Observe the following seasons for best results: North England and Scotland: mid August. South and West of Britain and coastal districts: end of August to early September. Spring sowings—generally April to May—often suffer from drought or drying winds which reduce resistance to pests and diseases.

Turfing

8.03 Turfing is more expensive than seeding but provides a quicker effect. Turf is sometimes used, in single rows, to provide an edge to perimeters of seeded areas. The level of the seed bed should be married into that at the turf edging. The component grasses of the turf should approximate those of the seed mixture eg fine or coarse.
All turf should be to BS 3936. Areas for turfing should be well firmed and have 75 g/m² of fertiliser containing bonemeal, sulphate of potash and superphosphate raked in.

Laying turves

8.04 Turves should be laid with broken joints in stretcher bond **17** with finely sifted topsoil well brushed into joints. Unevenness caused by local formation levels and differences in thickness of adjacent turves is best adjusted by raking or packing with fine soil. Do not roll humps and hollows. Standard size of turves: 300 mm × 900 mm (S. England), 300 mm sq (N. England and Scotland).

Turfing season

8.05 Turfing is best carried out in autumn to early winter, if it is to become established. Do not lay turf during frosty weather, drought etc.

Turfing to banks

8.06 Turves should be 60 mm thick if possible and laid horizontally or diagonally in stretcher bond etc as described, and secured with wooden pegs 200 mm long or with galvanised bent wire pins 200 mm long. On very steep slopes, wire or hessian netting can be laid over the turf and pegged down.

9 Waterlilies and aquatics

Planting waterlilies and aquatics

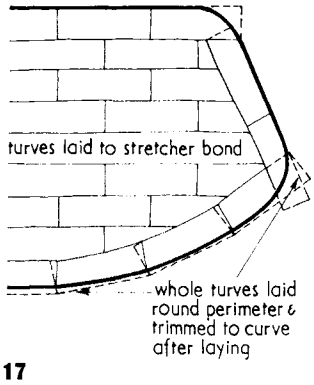
9.01 These are grown in soil which must be contained in order to:
1 Make planting easier
2 Enable plant groupings to be easily rearranged
3 Control growth
4 Reduce amount of soil needed
5 Prevent fish from stirring up mud on bottom of pool
Containers must be porous to allow soil to remain moist.

Preparing container or plant bed

9.02 Plant bed or container should be lined with turf, grass side outward, coarse hessian or plastic netting. This is then filled with good garden soil, fibrous loam chopped turf, clay and heavy soil **18.** Do not add any fertilisers, peat, leaf mould etc which are likely to cause discoloration of the water, also avoid acid sandy soils and chalk soils. Leave 25 mm to 50 mm between top of soil and top of container. Plant firmly and cover with 25 mm to 50 mm of gravel to prevent soil washing away.

Water level

9.03 If the pool is empty, gradually raise water level as the leaves of waterlilies etc develop. If full, lower container gradually so that the leaves are never completely submerged. This can take up to a couple of months **19.**



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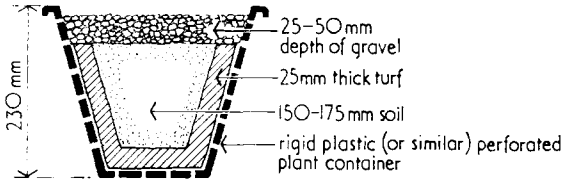

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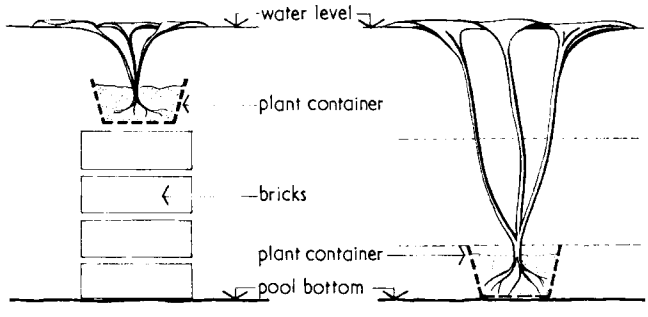


19a **19b**

17 *Turves laid to stretcher bond are not likely to be disturbed and, on steep banks, they can be further secured with metal or wooden pegs*
18 *Method for preparing planting containers to be submerged*
19 *Foliage of most aquatic planting cannot be submerged:*
a *If the pool is full, the container, on bricks, should be lowered gradually as the leaves develop*
b *If the pool is empty, the water level should be gradually raised as the leaves develop*

10 Compost for plant containers

10.01 Planting in containers, window boxes, planting beds in courtyards etc usually suffer from lack of water during dry spells, unless arrangements are made for irrigation to be carried out. A prepared compost which will hold moisture and still drain freely should be used. Depth of compost should be a minimum of 400 mm and as deep as 800 mm for trees. The following specification meets the requirements for water retention and is also solid enough to stabilise plant roots.
A lightly consolidated bed of compost consisting of:
Seven parts by bulk of good fibrous loam top spit soil
Three parts by bulk of coarse peat
Two parts by bulk coarse sand or grit.

All materials should be free of weeds and other extraneous matter. The topsoil should be within the pH range for the plants to be grown. After planting 120 g hoof and horn and 120 g bone meal should be added to the surface and lightly forked in.

11 Hydra seeding

11.01 A technique used to establish grass or other vegetation on steep banks, poor soils or inaccessible areas. It is also used to control erosion.
Seed and fertilisers are mixed with water and sprayed on to the soil by high-pressure hoses **20**, the surface is then sprayed with either wood pulp or chopped straw, mixed with bitumen, to form a thin mulch on the surface. Alternatively the area can be sprayed with latex, emulsion or glass fibre, all of which bind soil particles, fertiliser and seed together. Moisture is absorbed, but transpiration is reduced by the protective layer.
It is preferable to carry out normal cultivations before the mixture is sprayed on. If possible this enables plant roots to develop into the ground material more easily.

20 *Hydra seeding bank too steep for conventional seeding techniques. In this illustration, seeded surface is being sprayed with a mulch of chopped straw*

12 References

The following are recommended as further reading for Urban Landscape Section A, Basic plant data:

BEAN, W. J. Trees and shrubs; hardy in the British Isles. London. John Murray. 8th edition in 4 volumes. £8·00 each

THOMAS, G. S. Plants for ground cover. London. 1970 Dent (J. M.) & Sons Ltd. 1st edition. May. £3·00

GREENFIELD, I. Turf culture. London. 1962, Leonard Hill Books. 1st edition. £4·10

PERRY, F. Water gardening. London. *Country Life*. Out of print.

LE SEUR, A. D. C. Hedges, shelterbelts and screens. London. *Country Life*. Out of print.

Section 5 **Parks and open spaces**

Information sheet Landscape 11

Parks and open spaces: General

Many existing parks and sports centres are under-used at present, and represent poor value for money on highly priced urban land. In this sheet GERRY PERRIN *and* TIMOTHY COCHRANE *briefly sketch the historical background to Britain's urban parks and then go on to examine new planning trends and new methods of increasing the attraction of parks and open spaces. They analyse three examples of urban open spaces to illustrate the principles involved, and conclude with a list of key points for future design*

1 Historical background

1.01 Except in new towns, Britain's parks and open spaces are largely the legacy of urban evolution in the late nineteenth and early twentieth centuries. Central area parks in particular owe much to Victorian and Edwardian leisure patterns, tending to be places for Sunday afternoon perambulation, picnics, and boating, where people could observe nature (often their only chance to do so) and other people.

1.02 Between the two world wars suburban growth mushroomed, leaving pre-1914 parks to ossify, and creating a need for subsidiary parks, amenity spaces and—for the first time—organised play space.

1.03 Play space areas have for almost 40 years been based on an empirical standard of 2·43 hectares of play space per 1000 population, including 0·20 hectares for children's playgrounds. Such standards have been partly responsible for the loose-knit structure of the first eight new towns built around London after the second world war.

1.04 Recently, however, the increasing use of hard surfaces and floodlighting for outdoor sports areas and the increasing use of indoor recreation facilities, all of which tend to lead to more intensive use of space, have caused the appropriateness of these figures to be questioned. Some authorities have even advocated the abandonment of such standards altogether, believing that provision should be related to individual circumstances instead.
Studies[3] indicating (*a*) frequency and patterns of use in urban parks, (*b*) time and money spent, and (*c*) catchment areas, are likely to become increasingly important as a basis for future provision, in place of the old empirical standards.

Future trends

1.05 With the value of land at a premium, attention needs now to be directed towards improved usage of open space; increasingly parks, play spaces, amenity space, and school grounds will be regarded as part of an integrated pattern of provision.

1.06 Co-ordination of management bodies and rationalisation of land use will be essential to avoid wasteful duplication of facilities. Where existing open spaces in central areas permit, leisure parks will be combined with intensive recreation areas (indoor and outdoor) providing maximum choice of activity—recreational, cultural, entertainment, social.
Such facilities will require spaces suitable for a large number of activities and, even more important, spaces within which new activities and impromptu happenings can be generated when the demand arises. In town centres, land values may often preclude large areas of open space, and indoor leisure centres in the town centre could be complemented by outdoor facilities in outer areas.

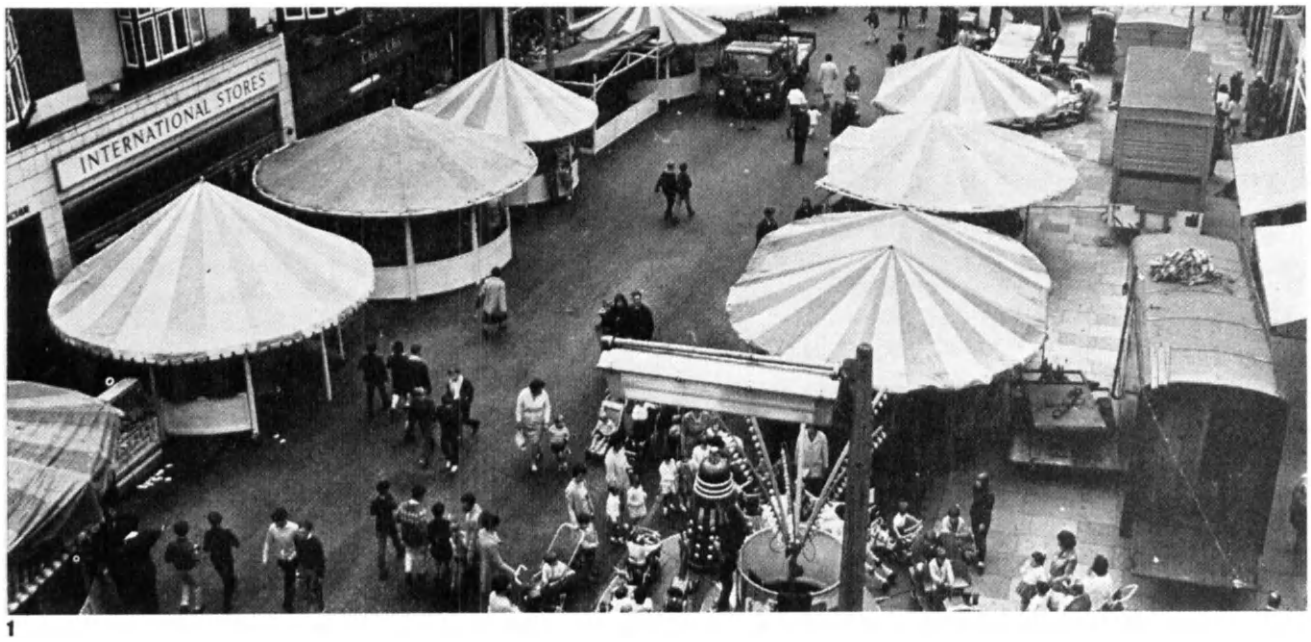
1.07 Industrial concerns are also beginning to combine with local authorities to provide facilities for the whole community whereas before they provided, on their own, facilities for their own employees. Surveys show that people apparently prefer to spend their leisure time at places which are open to all.
Similarly, universities are beginning to encourage sports associations to make use of their sports centres. Community schools are under-used assets with great scope for accommodating a wide range of leisure pursuits, but their management and organisation are not geared to developing their full potential as evening and weekend leisure centres.
However, there are some examples of this idea working, especially in Scotland; in such cases the schoolchildren have access to better standards of provision than they could normally expect.

2 Leisure in towns

2.01 The main types of open space in and around towns are the following*:

2.02 *Linear recreation spaces* Parks must be accessible from and linked to the rest of the urban area. The old concept of parks with finite boundaries is being replaced by that of a series of linear parks, for both active and passive recreation, linking all outdoor and indoor recreation facilities together like beads on a chain—shops, social facilities, recreation centres, and peripheral open spaces. Old railway lines, rivers, streams and canals offer natural routes for linear ways. Water has strong visual attraction, and can be used for boating and fishing, while disused railway lines can be used for footpaths, cycle tracks and bridleways.

* See also fig 1, information sheet LANDSCAPE 1



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2.03 *Central open spaces* Shopping malls, squares and so on. These should be capable of accommodating multi-usage **1**—eg symphony concerts held in Mondawmin shopping centre, near Baltimore, Maryland; and demonstrations in Trafalgar Square. Covered shopping areas facilitate such use of space, while multi-level centres for intensive use of space in centres are coming in (eg Cumbernauld, and The Cannery, San Francisco).

2.04 *Recreation orientated housing developments* Housing grouped around recreation facilities such as a lake or golf course is a growing trend for first as well as second homes—eg Reston, US. Each group of houses has a distinguishing feature giving it its own separate identity. On a smaller scale, too, the sharing of communal recreational facilities by near neighbours gives a more positive unit than merely sharing a patch of open space.

2.05 *Sports centres* contain a number of indoor and outdoor games facilities grouped together. Usually include a sports hall with hard-porous floodlit games and training area.
The following are the main types:
1 Commercially sponsored leisure centres—high entrance charges (eg Aviemore and Isle of Man).
2 University sports centres (eg Exeter).
3 School sports facilities.
4 Community sports centres (eg Harlow **5**).
5 National recreation centres (eg Crystal Palace **2**, **3**, and others specialising in particular sports).

Water sports centres are a special category and must be as versatile as possible to cater for both active and passive recreation. Such centres could either combine their natural competitive function with that of a holiday centre (eg Cotswold water park) or have a local and regional catchment (eg Holme Pierrepont—see information sheet LANDSCAPE 20, AJ 13.1.71). Notice that at both of these places activities are diversified and not confined to water sports.

2.06 *Rest and leisure parks* Combined sports, arts and social centres originated in West Germany (eg Gruga Park in Essen—see para 3.04). The idea is to give people the widest possible choice of things to do, **7** to **11**. If there is something to attract everyone the park will be more intensively used. The main requirements are:
Informal open spaces with children's play areas.
Indoor and outdoor sports, cultural and social facilities.
Spectator/audience viewing facilities with refreshment facilities and ancillary accommodation.
(See 4.03-4.06 for details)

1 *Multi-usage is becoming increasingly important in urban open spaces, where land value is at a premium. For example shopping street used for fair (Harrow)*
2, 3 *Parks are no longer restricted to catering for activities such as perambulation and picnicking. Cities also need recreation centres such as Crystal Palace, which can accommodate for example, dry skiing and motor racing*

2

3

This idea has been partially put into practice in the UK at Billingham Forum indoor leisure centre[4], while the Midlands arts centre, Birmingham, set in a park with a lake, is designed to counteract the bias towards the sport and recreational side of leisure, by giving young people an opportunity for an early introduction to the arts.

3 Comparative analyses

3.01 The foregoing principles can be put into perspective by comparing three existing examples of open space provision.

Southampton

3.02 For a city which is gradually becoming a city region, Southampton has relatively few urban parks and little advantage has been taken in post war redevelopment proposals to create any new open space.

Its main feature is a sports centre of approximately 24 hectares to the north-west of the city centre, linked to a 73 hectare golf course. Sports pitches and courts **4** have been formed in terraces on both sides of a well-wooded valley. Access is uncontrolled (ie there are no turnstiles or ticket offices) and the grounds are used by the general public in the same way as they would a park.

Use is entirely seasonal and mainly at weekends as there are no hard porous surfaces, floodlighting, or indoor sports facilities. (For a fuller appreciation see Design guide 'Swimming bath buildings' AJ 14.6.67, and Briefing guide 'Indoor sports and social recreation spaces' AJ 23.9.64.)

Conclusions

The site is at present obviously under-used and would benefit by the installation of indoor facilities, floodlighting and so on. Mature landscaping and an interesting land form represent a valuable amenity which could, with selective planting, be converted into an urban park similar to the Gruga Park in Essen, described in para 3.04. The average number of visitors to Gruga Park approaches 2½ million a year, compared with under 100 000 at Southampton.

Harlow

3.03 One of the eight post war new towns around London, Harlow has developed much in accordance with open space standards referred to in para 1.03. (The master plan of 1952 stipulated a total provision of 3·44 hectares of open space per 1000 population. A survey has shown that about 3·24 hectares had been provided by 1969, of which 1·82 hectares were sports grounds, and 1·41 hectares parks and parkways.)

Many existing features have been adapted for active recreational usage (bridle paths from old footpaths, golf club headquarters and riding schools from farmhouses; occasionally town centre car parking used as a cycle racing course).

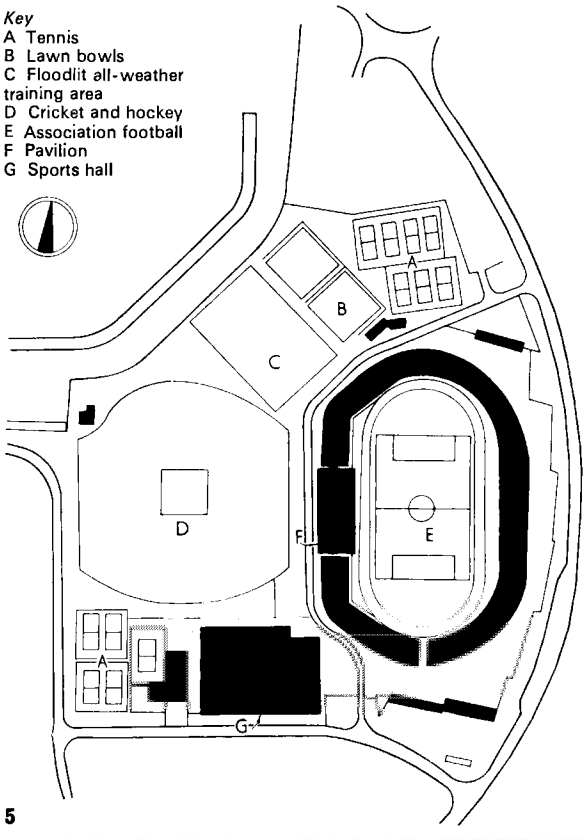
Two major areas developed over the past ten years are of interest—the sportcentre **5**(AJ 30.9.64 and 26.4.67), and the town park. Together they cover less area than the Southampton sports centre, but they are used by approximately 800 000 visitors each year (of which over 200 000 use the sportcentre).

The majority of park users have been attracted by the indoor swimming pool, outdoor paddling pool **6**, outdoor pop concerts, the town show and town festivals, circuses, pets corner and floodlit roller skating rink.

Conclusions

Collectively the park and sportcentre represent the gone valuable recreational amenity in the town, and have most

4 *Southampton sports centre is a valuable amenity, but under-used, partly because there is no floodlighting, no significant provision of indoor facilities, and there are not enough uses. Annual attendance is under 100 000. Harlow sportcentre* **5** *and park* **6**, *by contrast, are well attended because provision has been made for variety of recreation uses*



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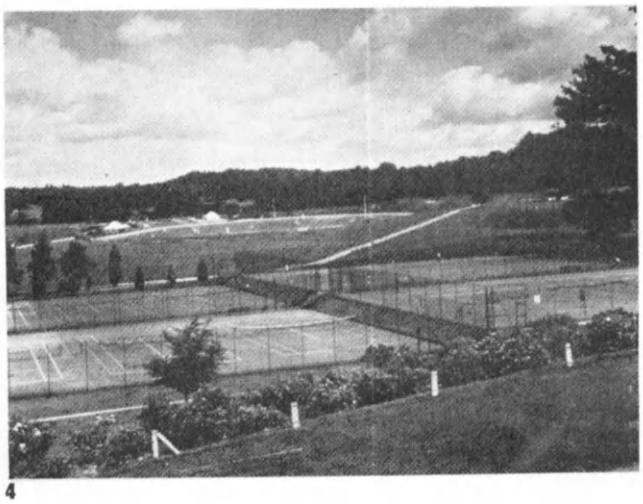

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6

a long way towards establishing new trends in recreation elsewhere in the country.

Although separated by a main feeder road to the town centre the two units may be considered as one: in which case they come close to the West German idea of leisure parks.

Criticisms include: diversified sponsorship (sportcentre by a sports trust; indoor pool by the baths department; outdoor park facilities by the parks department); lack of continuity between the various main elements, particularly separation of swimming pool and sports hall; typical new town planting—inexpensive, and highly susceptible to vandalism.

Gruga park, Essen

3.04 The 81 hectare site **7** is similar to those at Southampton and Harlow and is within 20 minutes walking distance of the homes of 120 000 people.

The botanical gardens date back to 1929 and three more gardens were added by 1938 when it became the Reich Exhibition garden. All were completely destroyed during the war, yet were established again by 1952. In its present form the park dates from the 'Bundesgartenschau' of 1965. Average attendances since have been 2½ million a year.

Design philosophy has been based upon research into user behaviour patterns in parks carried out by Carl Diem, who originated the 'rest and leisure' movement in Germany in the 'sixties. Areas have been allocated for 'learning' (ie the tropical house; aquarium; museum; library; terrarium giant chess boards; and the alpine and water gardens); for 'strolling' and 'observing' (ie lakes, complete with flamingoes and many species of duck; lawns interconnecting coloured terraces of flowers, rhododendrons, and alpine gardens); and 'active' recreation (heated outdoor swimming pools **9**, open all year round; sport, film-shows, ice skating and large—10 000—spectator events; exhibition hall, tennis courts, roller skating rink, and several children's play areas **10**).

Entry is controlled by ticket office and turnstile, and further charges are made for use of individual elements within the park (eg pony rides, trampolining, miniature golf).

Most of the landscaping met has been established since 1963 and shows the wisdom of planting mature trees and shrubs. It is claimed that the extra cost is justified if compared with replacement and maintenance costs of smaller and less expensive plants.

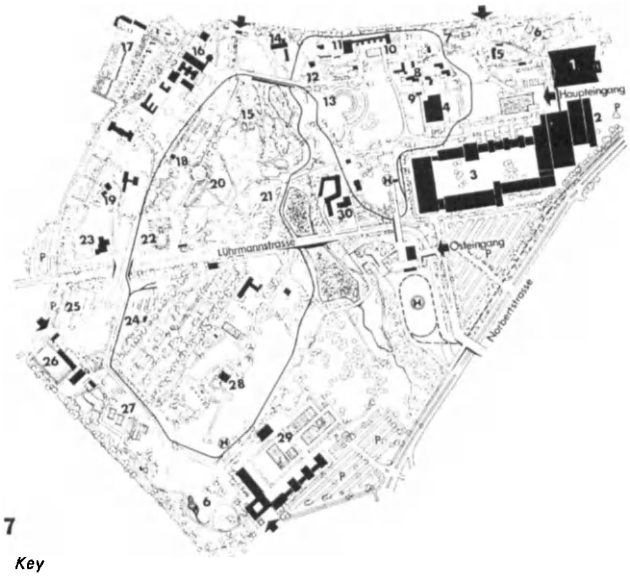
Care has been taken to create special effects of colour, texture, form and height. For example; trees with brightly coloured leaves were planted beside those with decorative berries, alpine plants and conifers. Flowers were planted on sloping beds to improve their massing. Tall trees with small leaf form (birch, beech, and so on) were planted in clumps along main circulation paths **8**.

Facilities are linked by hard and soft surface treatments, including textured paving (setts, cobbles, bricks); smooth paving (bitumen, asphalt); lawns and low planting.

Conclusions

Many of the philosophies behind the development of this park are applicable to UK requirements. People are looking for interesting things to see and do, and provided the facilities are attractive enough, they will pay to attend. Whether entry ought to be free or not is debatable. It could be argued that such revenue could pay for non-revenue earning parts of the park.

The use made of the terrain and the linkage of the old and new parts of the park is an object lesson worth close study. The miniature train **11** which takes visitors and the disabled about the inner parts of the park is another



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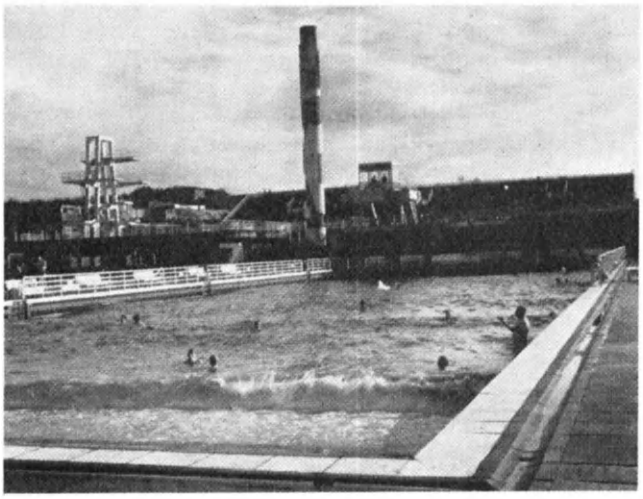
Key

1 Gruga hall
2 building school
3 exhibition hall
4 flower garden restaurant
5 milk bars
6 playground
8 tower
11 terrarium
12 concert pavilion
13 rotunda
15/21 shrub garden
16 hot house
17 small sample gardens
20 lake
23 school gardens
24 cemetery and memorial
26 roller skating rink
27 playgrounds
28 leisure gardens
29 baths

8



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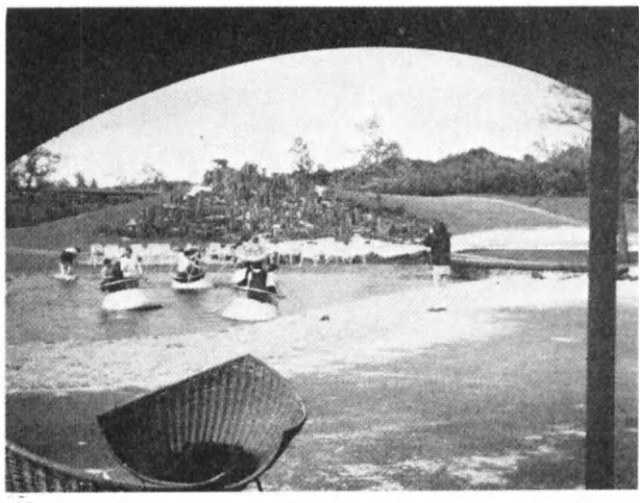

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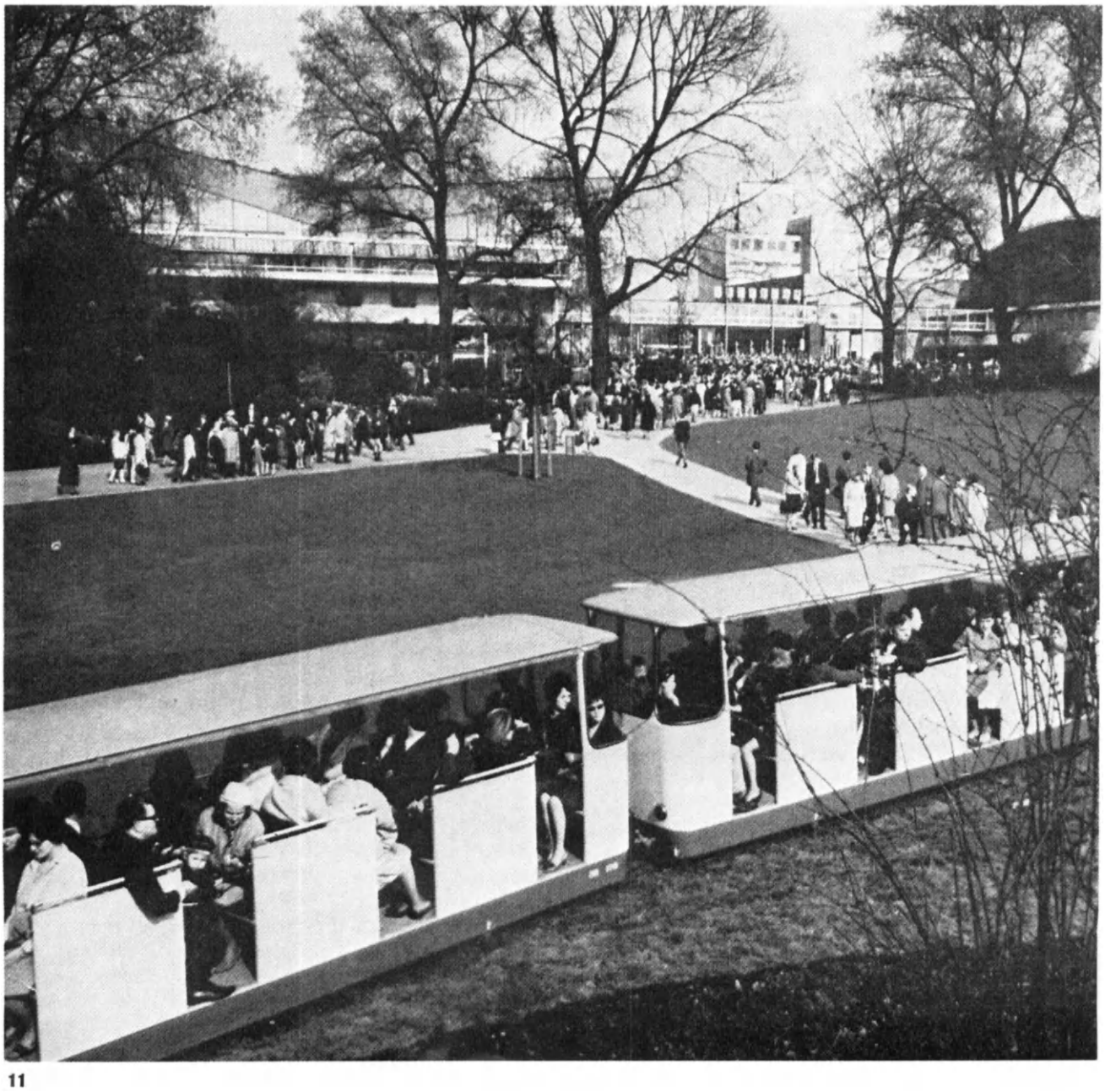
7 *Gruga park, Essen, draws 2½ million visitors annually, and is in many ways a model for future 'rest and leisure' parks*

Gruga Park caters for both rest and activity, combines beautiful landscaping **8** *with the provision of sophisticated facilities such as a swimming pool equipped with wave machine* **9**, *gondola pool* **10** *and miniature train* **11**



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feature worth studying (but not if it degenerates into showground theatricality). On the other hand the slightly 'clinical' atmosphere of certain areas associated with learning could well be avoided.

4 Guide lines for the future

4.01 The comparative analysis and preceding review of trends indicate certain key action points worth noting for future design and briefing guides. A summary of these is given below.

(*a*) New materials, techniques and land use methods suggest a reduction in future scales of provision associated with *active** recreation space. Flexibility should be allowed for future play space demands which may well be on artificial surfaces or indoors.

(*b*) Demand for more *passive** recreation space is growing' particularly for weekend use.

(*c*) Many existing parks and sports centres (eg Southampton) are under-used at present, and represent poor value for money of what is an extremely valuable asset—open urban land.

(*d*) With the trend during the 'sixties for sports centres to go indoors (Billingham Forum, Basingstoke, Poole, Guildford), arguments in favour of amalgamation with parks have increased.

(*e*) As previously stated, many parks have become little more than central area backwaters. Where difficulty is experienced in providing new recreation space—passive or active—an existing park may be modified to form new types of provision on the lines of Essen's Gruga Park.

4.02 Suggestions for a site of 18 to 25 hectares are set out below, and include a 'shopping list' of facilities.

4.03 Active recreation

Indoor sports centre (with sports hall, swimming pool, indoor bowls hall and ice rink—eg: Billingham Forum—large, Bingham sports centre—small). Outdoor, heated pool(s), preferably one with artificially-made waves.

Artificial ski/toboggan slopes (eg Crystal Palace sports centre).
Hard porous floodlit training area.
Riding school.
Tennis courts (floodlit).
Climbing walls/towers (eg Eastleigh sports centre; 'Old man of Hoy').
Rebound practice walls.
Bowls greens (possibly floodlit).
Golf course (18/9 hole); clock golf; miniature golf; pitch and putt.
Archery green.
Sailing/boating (full size or model).
Fishing.
Rowing (practice; indoor training).
Roller-skating.
Curling.
Movement: dancing; rhythm and movement; folk dancing.
Car/cycle racing track (problem of noise and incompatibility can often be resolved by good programming).
Sport for the disabled.
Trampolining.
Children's playgrounds—see Gruga Park.
Areas for 'strolling' and 'observing': amenity planting; lakes; towers.

4.04 Passive recreation

Exhibition hall.
Museum.
Art/sculpture gallery or garden (ideally based on the 'workshop' principle).
Film theatre.
Theatre; theatre workshop (eg Canon Hill Park).
Puppet theatre.
Zoo: animal/safari park (eg Basle).
Aviary.
Aquarium.
Terrarium.
Ornamental pools/gardens.
Bandstand: concert area; happenings.

4.05 Linking facilities

Car parks: examine possibility of the motorised park.
Miniature train; monorail; cable cars.
Refreshment facilities.
Creche.
Information office.
Lavatories.
Hard and soft landscaping.

4.06 Priorities

(listed in order of precedence)
Basic planting (preferably tall/mature specimens).
Ground modelling (see information sheet LANDSCAPE 32) if existing terrain lacks interest; development of artificial lakes.
High-intensity use facilities: hard porous training area(s), tennis courts, indoor facilities (active and passive).
Refreshment facilities (can be part of general indoor accommodation).
Information centre.
Low intensity use facilities.
Long-term amenity features; ornamental pools/gardens.

Note When choosing priorities, a balance should be struck between amenity considerations, features which arouse public interest and those which are going to be high revenue producers. These are decisions which the architect can only work out with a composite client committee.

References

1 NATIONAL PLAYING FIELDS ASSOCIATION Hard porous all-weather surfaces for outdoor recreation. London, 1970, The Association [5(90·41)].
2 NATIONAL PLAYING FIELDS ASSOCIATION Floodlighting of outdoor sports facilities, London, 1970, The Association [560(90·63)].
3 GREATER LONDON COUNCIL Research paper no 2. Use of open spaces. London, 1968, The Council £1.50 [00(E25)].
4 Billingham sports forum. Building study, AJ, 1967, November 11, p1313–1328 [SfB(95): CI/SfB 561].
5 MOLYNEUX, D. D. Working for recreation. *TPI Journal*, 1968, April. [(E2p)].

* A useful description of active and passive leisure is given in [5]

Section 6 **Recreation: sport**

Information sheet Landscape 12

Sports centres: Priorities and planning strategies

In this information sheet GERRY PERRIN *briefly notes the problems inherent in providing adequate sports facilities. He describes various types of sports centre, with particular reference to the advantages of large central sports centres and proposes a series of long-term, staged planning strategies for different sizes of population*

1 Present situation

1.01 Shortage of funds is seen to be responsible for the low priority with which the government rates sport and recreation. Our current annual expenditure of £5m on capital works for indoor sports centres—compared with that of West Germany (£48m), France (£35m) and Sweden (£21m) is in need of revision.

Regional sports councils and the DES technical unit for sport

1.02 Until 1 April 1971* all projects requiring loan sanction or grant aid will be 'priority-graded' according to need by the appropriate regional sports council[1]. Plans are then assessed in detail by the Technical Unit for Sport, a department within the DES, before going to the Department of the Environment for capital assistance.

2 Dispersal or centralised centres?

Dispersal system

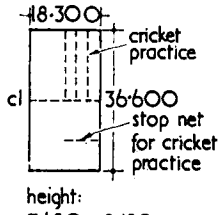
2.01 *Planning for sport*[2] is a document closely followed by regional sports councils when assessing projects, and in it a case is argued for small facilities—a 25 m indoor swimming pool and a one-court sports hall **1**—which is interpreted as a pattern of dispersion on the assumption that many small centres thinly distributed over the country are more effective than a few larger centres. The report also strongly supports the provision of 'dual/joint use' projects, based on school complexes, shared by the public after school hours[3].

Implementation of dispersal system

2.02 This policy has been implemented in a number of counties, with sports centres costing about £250 000 serving basic needs of a catchment area of about 25 000 population. These normally contain a 25 m indoor swimming pool, a one-court sports hall for badminton, tennis, netball and basketball, refreshment/social accommodation, and often provide some indoor and outdoor 'specialist' features such as squash courts, an athletic track, diving facilities, or additional outdoor tennis courts, with grass pitches a low priority.

For a population approaching 100 000 at least two such units would be required, and they would be supported by about six small units (see para 3)—ie with a one-court sports hall and a training pool—costing under £50 000 each **3**. Before the second large unit could be implemented, there would be an interim period of limited facilities, possibly for 10 years.

* The Department of the Environment Circular *2/70* (HMSO 2s 6d) states that as from 1 April 1971 all projects (apart from the very large) will receive consideration for loan sanction at county council, not ministry, level.



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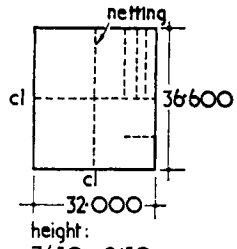

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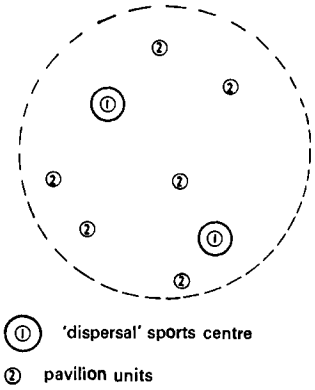
1 *One-court sports hall.*
Called a one-court hall because it can accommodate to tournament standard either one tennis court, one basketball court, one netball and one volleyball court, or four to five badminton courts. (Netting positions normally seen in practice are shown dotted.) It is worth noting that the French equivalent is 44 *m* × 24 *m* × 9 *m, and the German* 42 *m* × 26 *m* × 7 *m*

2 *Two-court sports hall.*
Doubles the number of courts listed for the one-court sports hall. Top class competition is normally staged in centre of hall with seating (usually of the bleacher variety) arranged around as required

Disadvantage of dispersal system

2.03 Studies of costs in use indicate several weaknesses in this policy. Most units report severe overcrowding within a year of opening, with no hope of expansion for up to ten years. Capital costs are two-thirds of those for facilities twice the size, yet the smaller centres require the same



① 'dispersal' sports centre

② pavilion units

3 *Decentralised system of sports facilities for a population between* 50 000 *and* 100 000 *in a town catchment area of about* 10 *km diam. System would have two sports centres, each with a* 25 *m indoor swimming pool, a one-court sports hall and a limited range of outdoor facilities; and up to six pavilion units, each of which possibly serving a dual use function with local schools, and contain a training pool, a one-court sports hall and grass pitches*

amount of support area (car parks, circulation space and services), and as many staff, as the larger units. Pre-contract work (mainly committee procedure in negotiations between regional sports councils, ministries, client committees, and other authorities) is repeated for each project (see para 2.07).

Many small units operate at a considerable loss, whereas a number of larger units make a profit. Also, the favourable impact of large units on the public should be considered in conjunction with the general reluctance, where alternative facilities are available, for people 'to go back to school to play'.

Centralised system

2.04 An alternative approach already in practice[4] has been to build one large unit (a 25 m or $33\frac{1}{3}$ m indoor swimming pool, a two-court sports hall **2** and a range of outdoor facilities that would include up to six grass pitches) to act as a 'generator' servicing a catchment area in excess of 50 000. As overcrowding occurs, or if the catchment area approaches 100 000, the 'generator' facilities would be relieved by about six small units (with a one-court sports hall and a small indoor training pool—see para 3) costing under £500 000 each, scattered within a 5 km radius of the 'generator' **4**. Such an example is Harlow with a population of 90 000[4]; a similar approach on a city scale is now being implemented by Edinburgh[5]. However, comparison should be made with West Germany where, for example, Bochum with a population of 370 000 has one international size sports centre, four district sports centres (each containing a 25 m indoor swimming pool and a '$1\frac{1}{2}$ court' sports hall) 28 local sports centres, and 56 very small, school-based facilities.

Running costs

2.05 The difference between the two strategies described in para 2.01 to para 2.04 is the annual running cost. This is over ten years (by which time new projects may be at the point of construction), the 'dispersal' method could cost up £250 000 more than the centralised 'generator' type of approach.

Other factors which should be considered at the pre-planning stage are as follows.

Land purchase

2.06 Land purchase for a double unit dispersal system is considerably more expensive than the purchase for one large unit.

Committee procedure

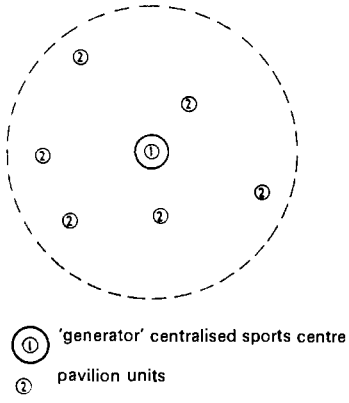
2.07 Each centre can occupy many months of pre-contract negotiations with regional sports councils, county councils, local council and related subcommittees (recreation, parks, education, baths and so on), the ministry, and other bodies such as sports organisations, neighbouring authorities and so on. The average time between inception of primary brief and completion of contract is up to five years.

User participation

2.08 Sociological research indicates that large centres generate a more intense atmosphere than smaller units. This seems to be partly responsible for the greater degree of participation that occurs in larger centres.

Planning for individual circumstances

2.09 The centre should suit individual requirements of the catchment area it is to serve. Difficulties occur when planning norms or ministry strategies dictate a particular approach whatever the catchment area, growth rate or socio-economic situation. Therefore each factor must be weighed against the other (in the form of a feasibility study if possible) before a formal presentation is made to the client committee.



4 *Central or 'generator' system of sports facilities is for a population between* 50 000 *and* 100 000 *in a town catchment area of about* 10 *km diam. System would have a 'generator' or central sports centre with a* 52 *m or* $33\frac{1}{3}$ *m indoor swimming pool, a two-court sports hall, outdoor training facilities, grass pitches and some specialised facilities; and up to six pavilion units, each of which possibly serving a dual use function with local schools, and contain a training pool, a one-court sports hall and grass pitches*

3 Sports pavilions

Function

3.01 Sports pavilions are intended as support units for the major sports centres of a central or dispersal sports facilities system. These units could be coupled with local schools and provide a dual use function until the schools or the recreation authority receive more money.

Description

3.02 (*a*) A typical sports pavilion described in table II item 1 would contain a two-badminton-courts-sized multi-purpose sports hall (18 m × 12 m approx), two squash courts, a cricket practice gallery, refreshment/social accommodation, floodlit hard porous training area, up to four grass pitches and optional tennis courts.

(*b*) A typical sports pavilion described in table II item 2 would contain a one-court multi-purpose sports hall, two squash courts, a cricket practice gallery, refreshment/social accommodation, an optional training pool, floodlit hard porous training area, up to six grass pitches and optional tennis courts and bowls greens.

4 Indoor only sports centres

4.01 Some recent sports centres have sacrificed outdoor facilities in preference for a location in the heart of the town centre[6].

Advantages

4.02 The advantages of indoor only centres are accessibility from most parts of the town by car and public transport; late closing hours (23.00—24.00) can generate activity in a part of the town which very often 'dies' after 17.30; and services (heating, drainage and public utilities) can be shared with other town centre buildings.

Disadvantages

4.03 Central areas are the most expensive to develop; if it is difficult for sports centres built there to expand to meet future demands; and there is the problem of car parking at weekends when town centres are at their busiest.

5 Recreation parks

5.01 The trend for urban recreation space to become more difficult to acquire in the centre of towns, favours the concept of indoor-only facilities, or those combining indoor provision with existing open space on the lines of the Gruga Park example referred to in Information Sheet LANDSCAPE 11 para 2.06. This new form of 'recreation park' could well supersede the more 'traditional' concept of dispersal or centralised sports centres, especially in urban areas where the only available space is in large existing parks, which are usually close to town centres.

There is also a case for providing commercial facilities such as dancing, eating, drinking and gambling to offset 'loss leaders', publicly financed, recreation facilities provided as a non-profit making service.

References

1 CENTRAL OFFICE OF INFORMATION The sports council—a report. 1966, HMSO [E2p]

2 CENTRAL COUNCIL OF PHYSICAL EDUCATION Planning for sport—a report. 1968, CCPR bookshop [E2p] *Price 25p*

3 Comprehensive school at Bingham. Building study, AJ, 1969, June 18, p1645-1662 [SfB (87): CI/SfB 713]

4 Sports hall at Harlow. Building study, AJ, 1964, September 30, p769-780 [SfB (95): CI/SfB 562]. Building revisited, AJ, 1967, April 24 [SfB (95): CI/SfB 562]

5 Sports centre at Edinburgh. Building study, AJ, 1970, September 23 [561]

6 Billingham forum. Building revisited, AJ, 1969, August 27 [561]

Table I Cost comparison between dispersal and centralised systems

Dispersal system	Costs (£)	Centralised system	Costs (£)
For catchment area of 100 000, capital cost for two large sports centres (equivalent to one generator or centralised unit) costing about £250 000 each	500 000	For catchment area of 100 000, capital cost for one centralised 'generator' sports centre (varies between £350 000 and £580 000)	500 000
Increase in building costs over, say, five years before second centre is implemented at 10 per cent pa	125 000		
Capital cost for six small sports centres at £50 000 each	300 000	Capital cost for six small sports centres at £50 000 each	300 000
Total capital costs	**925 000**	**Total capital costs**	**800 000**
Annual running costs for two large centres at £30 000 + per unit		Annual running costs for generator unit (varies between £30 000 and £35 000)	
Annual running cost for six small centres at £1000 per unit		Annual running costs for six small centres at £1000 per unit	
Total annual running costs	**65 000**	**Total annual running costs**	**40 000**

Table II Planning strategies

Type of community	Population	Capital cost of facilities proposed (£)	Facilities and comment
1 Local community centre or village sport centre	1000—5000	30 000—50 000	Pavilion unit (see para 3.02)
2 Large village or growing suburb	5000—15 000	75 000—100 000	Pavilion unit (see para 3.02(*b*)) or two pavilion units as described in item 1
3 Small town, neighbourhood or large suburb	15 000—25 000	250 000	Pavilion unit (see para 3.02(*b*)) and a 25 m indoor swimming pool
4 Average town or small new town	25 000—50 000	350 000	One pavilion unit and indoor pool as described in item 3 and up to four pavilion units as described in item 1
5 New town or expanding town	54 000—65 000	350 000—500 000	Two-court sports hall, indoor pool and up to six grass pitches as described in para 2.04
6 Large town or town with expanding suburban catchment area	65 000—100 000	45 000—600 000	As for facilities described in item 5, (or double the facilities described in item 3) and up to four pavilion units described in item 1
7 Large town or new city	100 000—250 000		Up to four times the facilities described in item 3 (or double the facilities described in item 5) and up to eight pavilion units as described in item 1

Information sheet Landscape 13

Section 6: **Recreation: sport**

Sports centres: Planning and costs

In information sheet LANDSCAPE 12, GERRY PERRIN *dealt with long-term programming and types of facilities. In this information sheet he describes those facilities in greater detail, paying particular attention to costs*

1 Planning

Demand for indoor facilities

1.01 After the 'stadia period' following the 1948 Olympics, the need for running tracks and grand stands has decreased. Demand for further similar centres has been small, and present needs are mainly for more training facilities, particularly those associated with field events and sprinting. The demand for indoor facilities, however, has increased considerably. As provision for floodlit hard porous training areas has greatly extended the use of outdoor facilities, and the development of minimal maintenance surfacing materials allows their economical inclusion with proposals for indoor sports centres (indoor swimming pools and sports halls), such centres invariably receive a high priority grading when being considered by regional sports councils.

Function of indoor sports centre

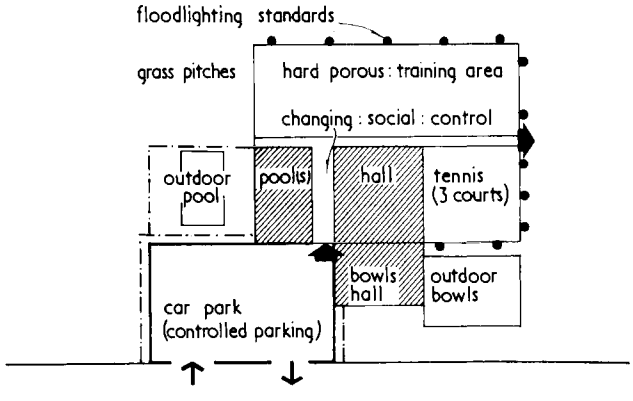
1.02 The indoor sports centre provides the nucleus for management of all subsequent facilities and around it other playing units will grow. It should eventually become the focus for all major sports fixtures in the town and be required to liaise with other sports organisations such as schools, private clubs, the services etc.

1.03 Indoor facilities usually consist of a 25 m swimming pool, a training pool, a two-court sports hall, squash courts, secondary activity spaces, and refreshment/social accommodation.

Planning sports centres

High-intensity use facilities with floodlighting

1.04 Hard porous training areas (tennis, basketball, netball courts) should be closely related to the indoor centre **1**.



1 *Hard porous training areas should be closely related to the indoor centre for control and changing. Floodlighting is essential for optimum use*

Ancillary facilities

1.05 These usually consist of:

1 Groundstaff quarters, equipment and plant storage, and repair depot.

2 Secondary pavilion(s) for additional changing and showering provision.

3 Amenity areas—grass banks, surrounds, general planting and landscaping, children's play area, car parking and water facilities.

Grass pitches

1.06 Provision is usually made for grass pitches in 'traditional' sports centres, though indoor-only centres and indoor centres with only limited outdoor facilities as noted in para 1.04 have proved, after cost in use analysis, to be economically viable as well as desirable—see information sheet LANDSCAPE 12 para 3.

1 Two soccer pitches—one for training and minor league fixtures (in addition to the hard porous training area referred to in para 1.04).

2 Two hockey pitches—in many cases these are positioned on either side of a cricket table.

3 One cricket table—this should be large enough for one game a day to be played throughout the season.

4 Space for lacrosse, croquet, pitch-and-putt.

5 Two bowling greens.

Athletic training facilities

1.07 These facilities are often associated with a floodlit, hard porous training area (see para 1.04).

1 Two high jump areas and pits.

2 Two long jump areas and pits.

3 One triple jump area and pit.

4 One sprint straight.

5 Hammer, discus and shot-put circles, nets, cages. See information sheets LANDSCAPE 14 and 15 for details of sizes, construction and layout.

Facilities based upon local demand

1.08 These are often arbitrary, but frequently include the following:

1 Artificial ski slope(s).

2 Outdoor climbing facilities.

3 Water-based activities.

4 Outdoor pool(s).

5 Riding—including stabling and an indoor riding school.

6 Outdoor roller and ice skating (usually on the Continent).

Space requirements

1.09 Table I gives approximate land areas required for types of sports centres listed.

Table I *Land areas required*

Type of facility	Hectares
Indoor-only centre	
25 m swimming pool, a training pool, a two-court sports hall, squash courts, secondary activity spaces and refreshment/social accommodation	0·4
Car parking and support areas	0·8
Indoor centre with minimum outdoor facilities	
As for indoor-only centre, but with a three-tennis-court sized hard training area	0·8
Car parking and support areas	0·8
'Traditional' sports centre	
As for indoor-only centre, but with a hockey pitch sized, loose topped, high-intensity use area; three-tennis-court sized, hard topped, training area; 400 m running track, two hockey pitches and cricket table combined, one or two soccer pitches and some ancillary facilities as described in para 1.08	9·6
Car parking and support areas	1·2

Table II *Guide to capital costs*

Item	
Indoor facilities	
Usually comprising a 25 m swimming pool, a training pool, a two-court sports hall, squash courts, secondary activity spaces and refreshment/social accommodation	350 000–500 000
Outdoor facilities	
Hard porous training area—'redgra', 'dripla' etc. usually 100 m × 65 m with floodlighting to 200 lux included	24 000–28 000
Tennis courts—red shale	800–1200
'tennisquick' etc. (non-maintenance)	1500–2200
floodlighting	800–1200
Running track—seven-lane cinder	5000–10 000
Field events	2000–3000
Barrier fence	1000–1500
Water jump	1000–1200
Athletic equipment	3000–3500
Centre grass pitch	1500–1800
Synthetic track (non-maintenance)	60 000–80 000
Bowls green—sea-washed turf	3500–5000
seeded	3000–4000
Grass pitches—without drainage	150–300
with drainage (per 0·4 hectare	350–400
with grading	£0·20 per m³
Car park—400 to 500 cars per hectare	£4 to £6 per car

Table III *Typical annual running costs*

Item	£
Cricket square and outfield	
Materials	135
Plant depreciation	50
Staff	1500
Water	50
Hockey (say two pitches)	
Materials	80
Plant depreciation	80
Staff	1500
Soccer (one pitch)	
Materials	150
Plant depreciation	100
Staff	1500
Hard porous training area	
Materials	80
Plant depreciation	150
Staff	1500
Water	80
Running track (international 400 m)	
Materials	240
Plant depreciation	50
Staff	2400
Water	50

Table IV *Comparative costs of tennis courts*

Item	£	Item	£
Red shale court		**'Tennisquick' court**	
Initial cost including nettings and fittings	1100	Initial cost	2100
Maintenance:			
Staff, five years, £500 pa	2500		
Water installation	1000		
Equipment purchase	100		
Equipment depreciation over five years	100	Subsequent cost	0
Total	**4800**	**Total**	**2100**

2 Costs

Capital and running costs

2.01 The relationship between capital and running costs applies as much to sports fields as to sports halls or swimming pools. Current attitudes are generally concerned with initial capital expenditure, and rarely take into account subsequent costs in use. Feedback on the latter, however, indicates that the original priorities would have now been considerably influenced by running costs had they been known at the time. For example, grass pitches and cinder running tracks require considerable maintenance if they are to be kept in good condition, but compared with maintenance-free surfaces and tracks, which cost a good deal more initially, they are poor revenue-earners, usually operated at a loss. The cost of outdoor facilities, their maintenance and their degree of use compared with that of indoor facilities have influenced the development of the indoor-only sports centre to the point where many sports centres no longer maintain outdoor facilities.

Cost comparisons

2.02 Comparisons in cost between one centre and another are always suspect unless all the circumstances associated with development are known. For this reason close check should be kept on AJ appraisals, and cross-reference made to yardsticks, from the Technical Unit for Sport DES.

Capital costs

2.03 Table II may be used as a guide to the capital costs involved in developing the type of centralised 'generator' unit referred to in information sheet LANDSCAPE 12.

Cost in use

2.04 Table III is an indication of typical running costs involved in maintaining outdoor facilities to full county requirements.

Each item is inter-related in terms of staff and equipment, making individual costs difficult to itemise. For a sports centre covering approximately 9·6 hectares, the number of staff employed full-time (as allowed for in table III) would be five, and the annual running costs including their salaries, would be approximately £6000 to £7000.

Maintenance-free materials

2.05 Although the capital costs of maintenance-free materials are much greater than those of conventional surfaces, there are considerable savings in running costs. Installation costs of 'tennisquick' tennis courts, for example, are twice that of conventional shale courts but the latter requires constant watering and rolling after every playing session by a groundsman whose salary (after proportioning among the other facilities) is about £500 per annum per court. Over five years (the period for which maintenance-free courts are guaranteed) the comparative costs would be as in table IV.

A similar comparison can be made between a cinder running track and a synthetic track (ie 'tartan'). Over a 20-year cycle the difference in combined capital and maintenance costs becomes negligible, and the present high cost of synthetic tracks is likely to be reduced by a competitive market.

References

1 Comprehensive school at Bingham. Building study, AJ, 1969, June 18, p1645-1662 [SfB (87): CI/SfB 713]

2 Sports hall at Harlow. Building study, AJ, 1964, September 30, p769-780 [SfB (95): CI/SfB 562]. Building revisited, AJ, 1967, April 24 [SfB (95): CI/SfB 562]

3 Billingham forum. Building revisited, AJ, 1969, August 27 [561]

Information sheet Landscape 14

Section 6: **Recreation: sport**

Sports pitches, tracks and training areas: space requirements

This information sheet by GERRY PERRIN, *based on material supplied by the National Playing Fields Association, sets out space requirements for athletic activities and for pitches and courts for the most popular field games. Standard metric dimensions have been agreed by the governing bodies concerned, apart from bowls and hockey, for which metric equivalents are shown (Standard space requirements for sports and swimming are listed comprehensively in* AJ metric handbook.) *Dimensioned, annotated drawings of pitches and tracks are obtainable from* NPFA

1 Athletic arena

Layout

1.01 Layout for field events may be varied to suit local requirements. Where space allows, it is an advantage for training purposes to site additional throwing facilities outside the track. There must be due regard for proper control and supervision and for the safety of other users and the public.

If the central area is not required for winter games, distances from shot circle to inner edge of track and javelin runway should be increased to 10 m. Safety radius for throws should be related to the likely performance of competitors. Where space and funds permit, width of landing areas for triple-jump can be increased to 3·35 m.

Orientation

1.02 Pole vault and all jump approaches should be sited so that jumpers do not run towards the declining sun. In the UK the arc to be avoided for these events is south-west to north-west (225° to 315°). This also applies to grandstand siting.

Safety precautions

1.03 For detailed specification and safety rules for field events see the AAA handbook*.

**Amateur Athletic Association handbook, part* II. London, 1970, AAA, 35*p*.

Discus and hammer circles

1.04 Hammer throwers prefer a smoother finish to the concrete than discus throwers. For this reason and to allow simultaneous training in both events, separate circles are often provided, but each should be protected by a cage.

Javelin runway

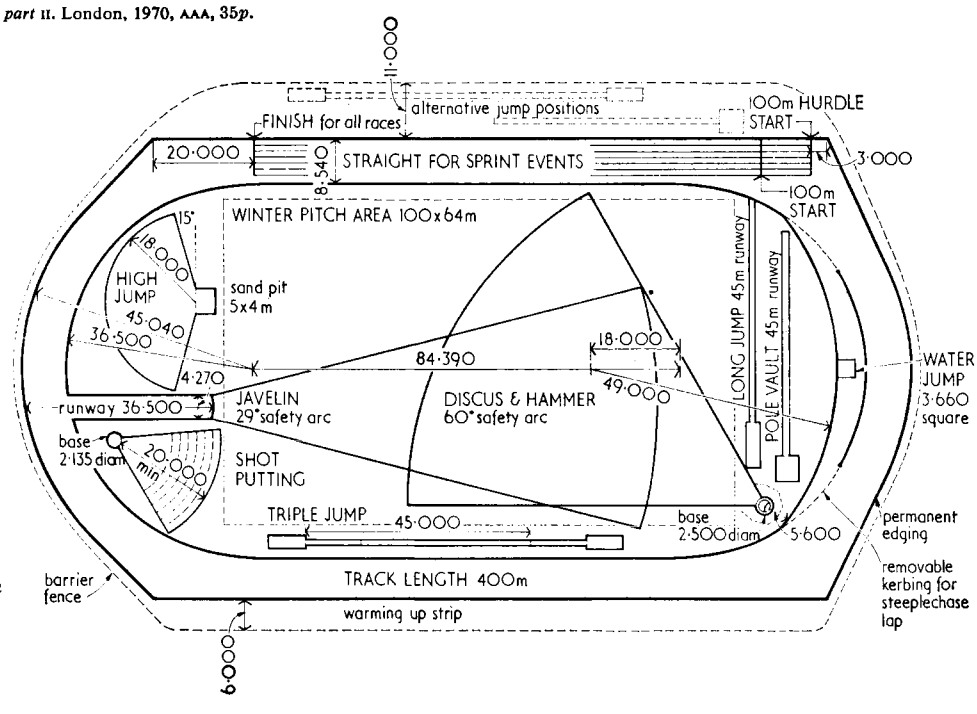
1.05 So as not to restrict use of running track, runway should wherever possible be laid down clear of track by extending further into the arena. This necessitates reinstating turf on winter games pitch.

Tracks without a raised border

1.06 Where a track is marked out on grass or on a hard porous area without a raised or flagged border, track length must be measured along a line 100 mm from the track side of inner edge instead of 300 mm. In the example shown **1** this would increase radius to inner edge from 36·5 m to 36·6 m and reduce width of first lane to 1·12 m.

Alternative surfacing for D-shaped areas

1.07 If D-shaped areas at each end of winter games pitch are hard surfaced to same specification as track, advantages are: simplified maintenance and runways need not be separately constructed and edged.



1 Running track 400 m
Overall size including clearance —179 *m* × 102 *m*

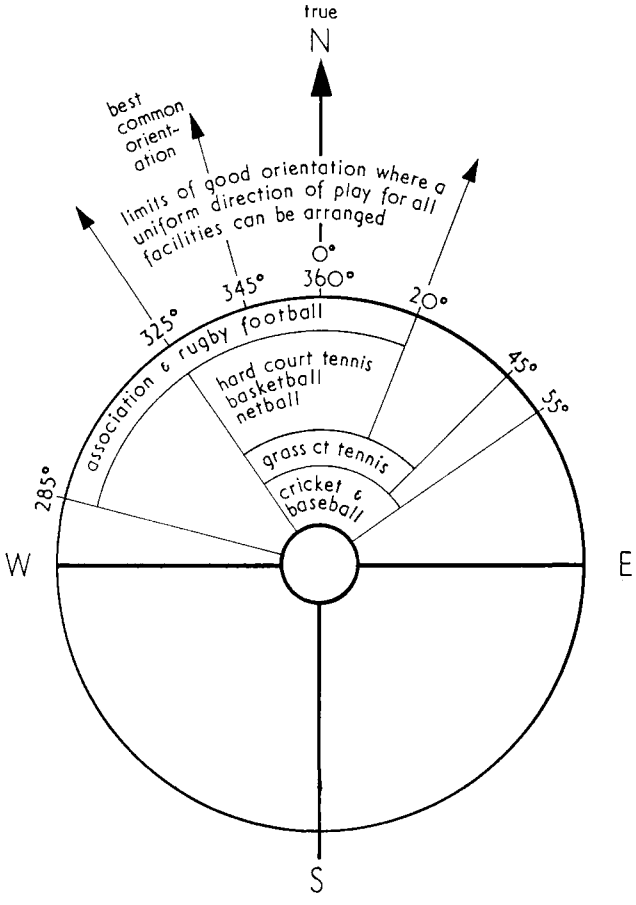
Formula for other track proportions

1.08 Where a track of wider or narrower proportions or of different length is required, dimensions can be calculated from the formula

$$L = 2D + 2\pi (R + 0{\cdot}30)$$

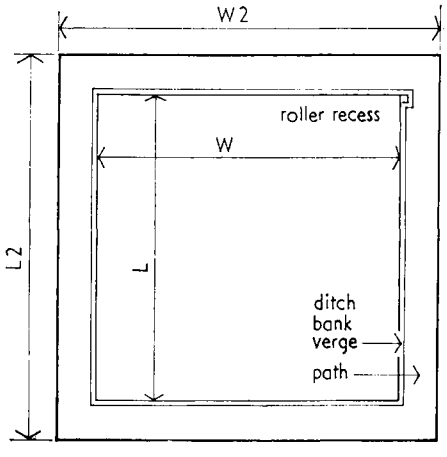
where L = length of track in metres
D = length of parallels or distance apart of centres of curves in metres
R = radius to track side of inner kerb in metres
π = 3·1416 (not 22/7)

Recommended radius of semi-circles: not normally less than 32 m or more than 42 m for a 400 m circuit.



2 Orientation of sports fields and courts

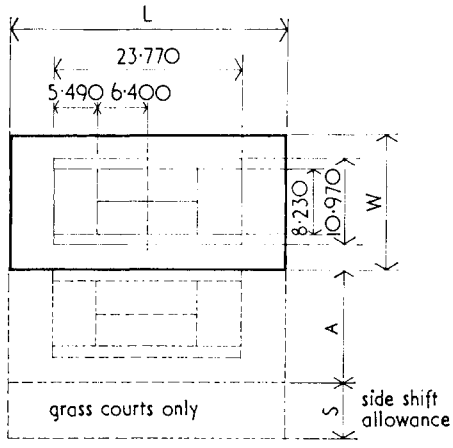
Note: Hockey pitches may be sited in any direction as the ball rarely rises high enough for the sun to be a nuisance



3 Bowling green

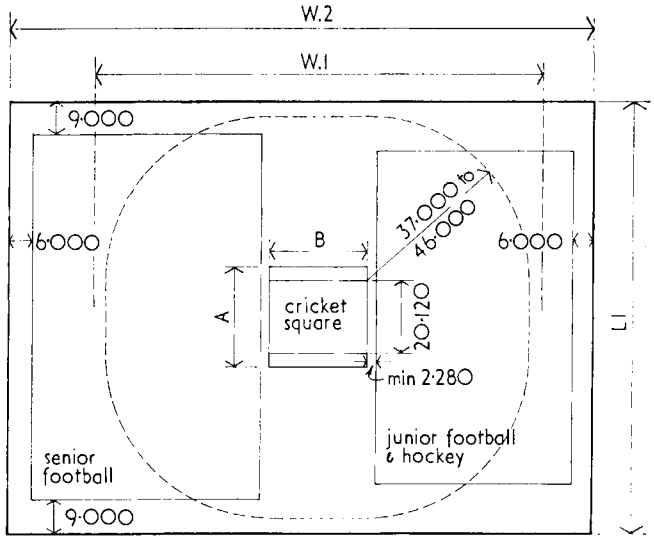
Flat rink type shown (crown green is **36·57** *m square).*

	W	L	W2	L2
Three rinks	22·400	38·400	32·760	48·780
Six rinks	38·400	38·400	48·780	48·780



4 Tennis

	L	W	A	S
Tournament	36·580	18·290	14·630	7·310
Public	33·540	17·070	14·020	7·310
Public hard courts	34·740	17·070	14·020	7·310



5 Cricket only (maximum and minimum dimensions)

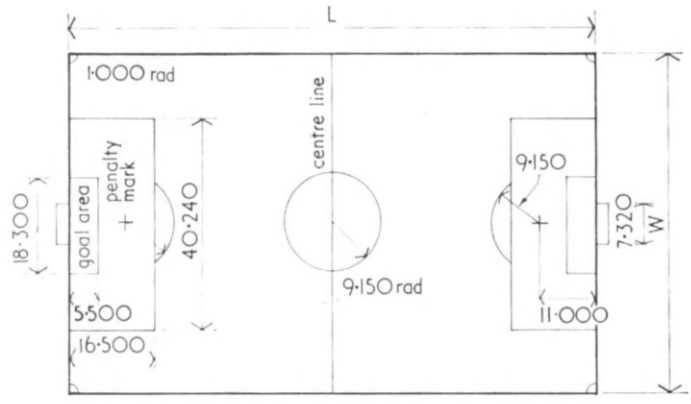
	Cricket table A	B	W1	L1
Seniors with 46 m boundary	27·440	27·440	125·00	119·00
	27·440	18·290	116·00	119·00
Juniors with 37 m boundary	27·440	27·440	107·00	99·00
	27·440	18·290	98·00	99·00

Cricket and winter games (maximum and minimum dimensions)

Cricket square	Senior football	Junior football or hockey	W2	L1
27·440 × 27·440	100 m × 64 m	90 m × 55 m	164 m	119 m
18·290 × 18·290	96 m × 60 m	82 m × 46 m	146 m	114 m

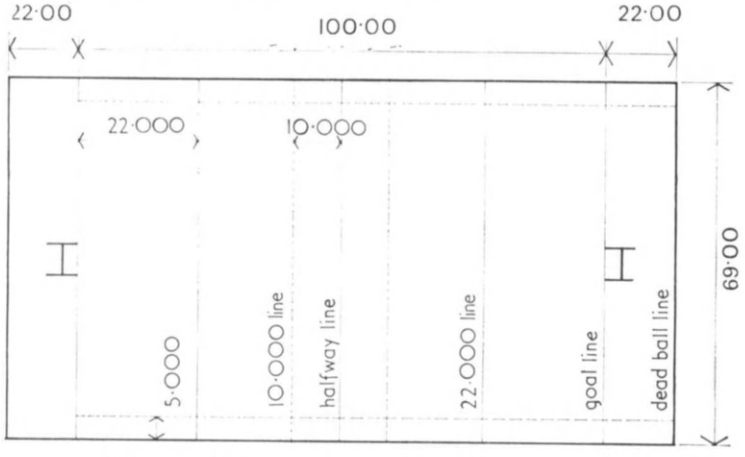
General training area

Useful for general training purposes is a hard porous surfaced area (see information sheet LANDSCAPE 15 para 2) 100 m × 64 m, provided with floodlighting and with runway and pits for high jump, long jump and pole vault.



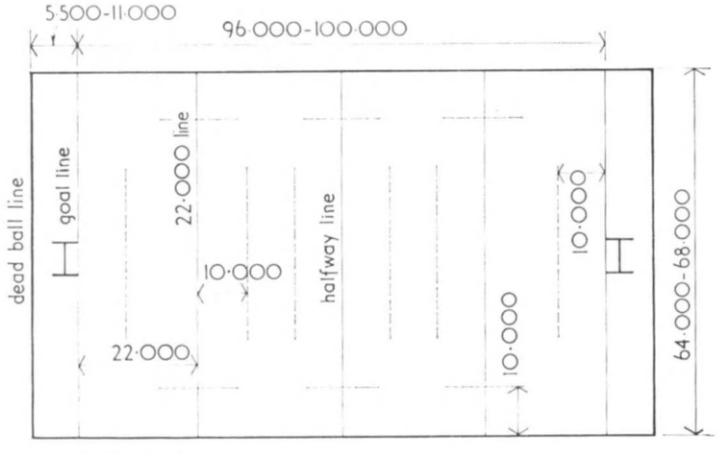
6 Association football

	L	W	Marginal sides	Clearance ends
Seniors	96—100 m	60—64 m	6 m	9 m
Juniors	90 m	46—55 m	6 m	9 m



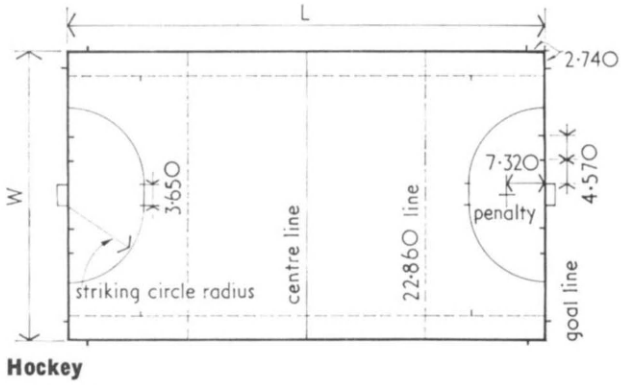
7 Rugby Union

Marginal clearances ends and sides 6 m



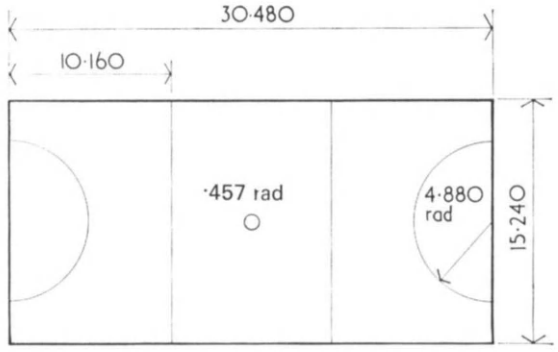
8 Rugby League

Marginal clearances for sides and ends 6 m. All broken lines to be minimum 13·72 m length



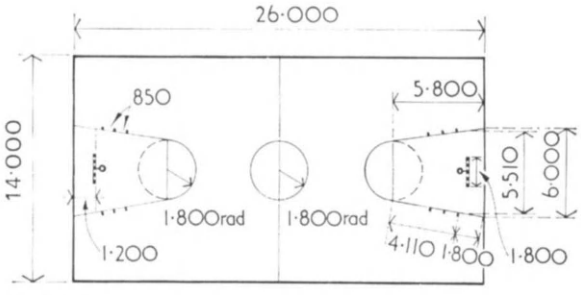
9 Hockey

See table at right



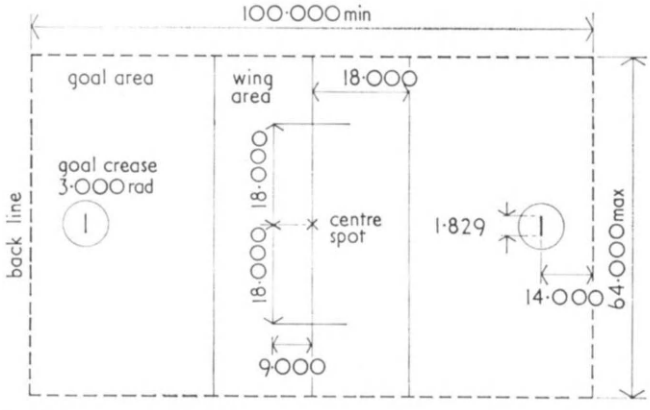
10 Basketball

See netball

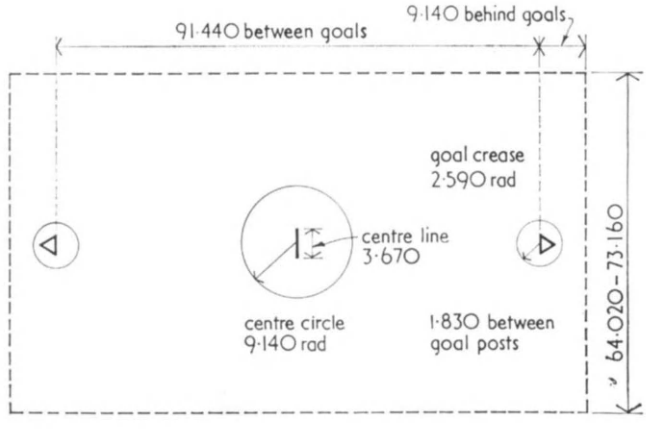


11 Netball

Netball and basketball are normally played indoors but outdoor hard courts and training areas under floodlight are frequently used



12 Lacrosse (men)



13 Lacrosse (women)

Hockey	L	W	Marginal clearances sides and ends
Men	90 m	50—55 m	3—4·5 m
Women	90 m	55 m	3—4·5 m
	Distance in of broken line		Striking circle radius
Men	6·4 m		14·630
Women	4·5 m		13·700

Information sheet Landscape 15

Section 6: **Recreation: sport**

Sports pitches, tracks and training areas: materials and surfaces

Information sheets LANDSCAPE 12 *and* 13 *drew attention to the value of high intensity use outdoor facilities. In this sheet* GERRY PERRIN *discusses non-turf surfacing materials now available for these areas*

1 Present situation

1.01 Grass has been traditionally used for training areas or running tracks, but it is difficult to maintain and use in all weathers, and with good weather it will take only a limited amount of use. As high intensity use of facilities in sports centre has increased, it has become standard practice to provide non-turf surfaces. In the UK these surfaces are broadly classified as being either 'hard porous' or 'all-weather' depending on construction.

1.02 Compared with turf their capital cost for construction is high, but this is offset by in-use savings:
1 They can be used far more frequently than grass (building regulations provide that a pitch of this kind may be deemed to be 'three times' its actual area).
2 Cost of land acquisition for use as a non-turf surface could be less than one-third the expenditure required for turf areas providing the same facilities (or the facilities may be more centrally—and expensively—sited).
3 Maintenance staff can be generally reduced to half and those required for turf facilities almost completely dispensed with in some circumstances.
4 Economic exploitation of these surfaces occurs when floodlighting is installed for after-dark use, when weekday use is at its highest.

2 Hard porous surfaces

2.01 In the UK, non-turf surfaces are installed most frequently as the hard porous variety. They are suitable for most normal outdoor activities apart from rugby. The surface is slightly abrasive but for sports other than rugby only superficial scratches have been recorded. These surfaces are built up of layers of crushed stone or blaes, graded to ensure a good mechanical bond and satisfactory drainage; with the last 40 to 50 mm finely ground to pass a 3 mm to 5 mm sieve.

2.02 Good drainage is essential if the surface is to be used during wet weather, and is usually achieved with concrete surface channels connected to site drainage system. Maximum falls for the surface should not exceed 1 in 150.

2.03 General maintenance requirements are as described in information sheet LANDSCAPE 17, but it should be noted that play is usually impossible immediately following a thaw or prolonged heavy rainfall. Perimeter fencing is usually required to prevent trespass.

3 Non-resilient all-weather porous surfaces

3.01 Although more expensive than water-bound surfaces (see information sheet LANDSCAPE 13) these require little or no maintenance and are consequently an attractive long-term financial proposition particularly for areas about the size of three tennis courts in association with indoor sports centres **1** (see information sheet LANDSCAPE 12).

3.02 Total thickness of the material is between 200 mm and 230 mm, and is built up in layers of washed broken stones, no-fines concrete and a 25 mm thick proprietary topping; the whole designed to ensure permanent porosity.

3.03 Cross falls of 1 in 400 are normal and on porous subsoil conditions the material can be laid without falls. Sites must be levelled by cut only, as the surface cannot be laid on fill. To protect the surface from unnecessary trespass it should be enclosed with fencing (usually 3·5 m high). Effectiveness of the surface as a high intensity use area can be ensured with the installation of floodlighting.

4 Resilient impervious surfaces

4.01 Resilient impervious surfaces are generally used as all-weather tracks **2**. Records made on them have been accepted by the Amateur Athletic Association since 1964 and a synthetic resilient track was used in the Olympic

1 *Non-resilient all-weather porous surface in use at Harlow as a three-tennis-courts sized floodlit training area*

1

games held in Mexico City. Though these surfaces are often used in the US and West Germany, their very high cost (see information sheet LANDSCAPE 13) generally precludes their use in this country except for Olympic-standard facilities, eg Meadowbank, Edinburgh, and the Crystal Palace National Recreation Centre, London.

However, they already exist in athletic training areas subject to high-intensity use, eg run-up and take-off areas to long, high and triple jump and pole vault, and to sprint practice straights. They have potential in commercial ventures such as soccer and cricket pitches, bowls greens and horse racing tracks.

4.02 These surfaces consist of a sub-base of broken stone blinded with fine ash; a 30 mm base course of asphalt on 40 mm bituminous macadam and topped with a proprietary surface matting **3** or topping.

4.03 On running tracks, crossfalls must not exceed 1 in 100 and longitudinal falls must not exceed 1 in 1000. Good drainage of tracks and their foundations is essential and a perimeter drainage channel should be provided for surface and subsoil water. Edges of tracks should be sealed to prevent frost damage.

5 Synthetic grass

5.01 Synthetic grass has not reached a general level of acceptance in this country, although it is widely used for outdoor bowls and American football in the US **4**. Major criticism concerns ball bounce, skin burns and uniformity of play (the latter tends to rule out seasonal variations traditional to UK games).

6 Artificial ski slopes

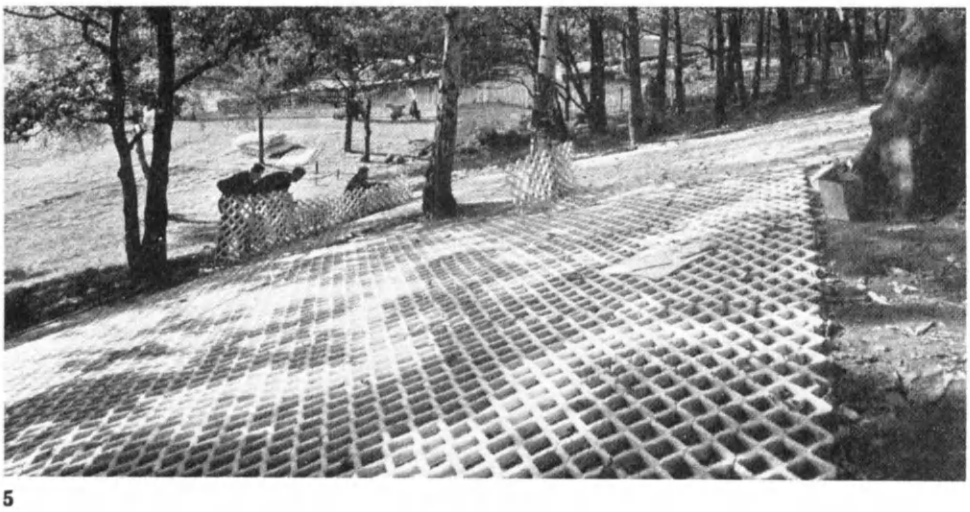
6.01 Artificial ski slopes are becoming very popular (the one at the Meadowbank Sports Centre is the longest in Europe). The most commonly used type consists of white plastic monofilaments set in zigzag diamond mesh pattern **5** (see information sheet LANDSCAPE 18).

2 *Resilient impervious all-weather surface running track*
3 *Resilient impervious all-weather surface matting being laid*

4 *Synthetic grass, though widely used in the* US *for American football, has yet to gain popularity in the* UK
5 *Artificial ski slope being laid at Crystal Palace*

2

3



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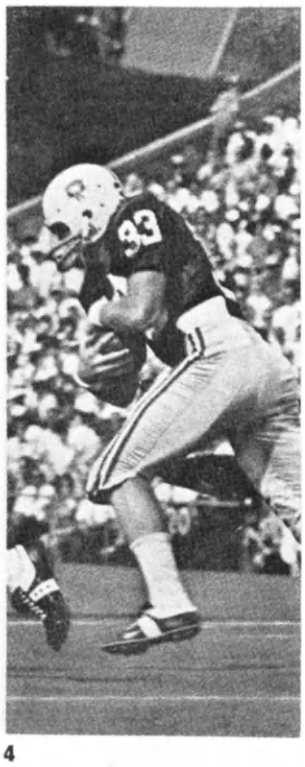

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Information sheet Landscape 16

Section 6: **Recreation: sport**

Sports areas: detailed requirements

In this information sheet GERRY PERRIN *lists various urban sport activities and their requirements for space, lighting, plant and equipment stores, and for special provisions such as car parking, changing facilities, ground modelling etc*

1 Schedule of requirements

Floodlighting

1.01 Floodlighting is necessary to achieve the high intensity of use many urban facilities are now designed for. Supply services should be laid underground deep enough to ensure their not being disturbed during the normal course of surface maintenance.

Electricity sub-stations

1.02 A sports centre with an indoor sports hall and swimming pool, two floodlit training areas and a floodlit soccer pitch would probably require a small sub-station. Consultation should be carried out with local electricity boards to determine requirements.

Plant accommodation

1.03 A sports centre similar to the one described in para 1.02, but with six pitches, a 400 m running track, various amenity spaces, flower beds, mounds etc, would require about 150 m² of covered plant storage and a similar sized area of hard standing for tractors, rollers, waste disposal etc.

Access and security fencing

1.04 Access to sports centre sites should be controlled, preferably by means of a single entry (see information sheet LANDSCAPE 13 fig 1) to minimise trespass over pitches and training area surfaces. Perimeter fencing of black plastic coated nylon can be reinforced with 'back-up' planting of small trees or shrubs, preferably evergreen.

Soil tests and drainage

1.05 Good drainage is essential for playing/training areas if high-intensity use or quality play are required. To determine sub-soil conditions and characteristics, tests should be carried out at an early stage of site investigations. Most adverse soil conditions can be compensated for, but considerable economies can be made by careful positioning of facilities once sub-soil conditions are known. Position of foul sewage outlets also often affect the positioning of facilities.

1 *Proposal for a sports centre that shows how activities can be sited to take advantage of existing contours*

Key
1 cricket table
2 hockey pitch
3 cricket pitch
4 tennis court
5 soccer pitch
6 sprint track
7 400 m running track
8 seating
9 hockey pitch
10 car parking

1

2 *Floodlighting to athletics sprint track with multi-unit floodlight standard in the background*

2

Natural features

1.06 Natural features such as site contours and existing planting can be used functionally to demarcate boundaries between pitches, to provide sight screens, assist drainage etc. Ground modelling can be carried out to enhance natural features and improve level sites.

Car parking

1.07 It is difficult to specify car parking requirements as peak demand may be too infrequent to justify full provision. It is more important to allow for future expansion. A sports centre as described in para 1.03 would require approximately 200 to 300 car parking places.

Table 1 Specific requirements relating to urban sports activities

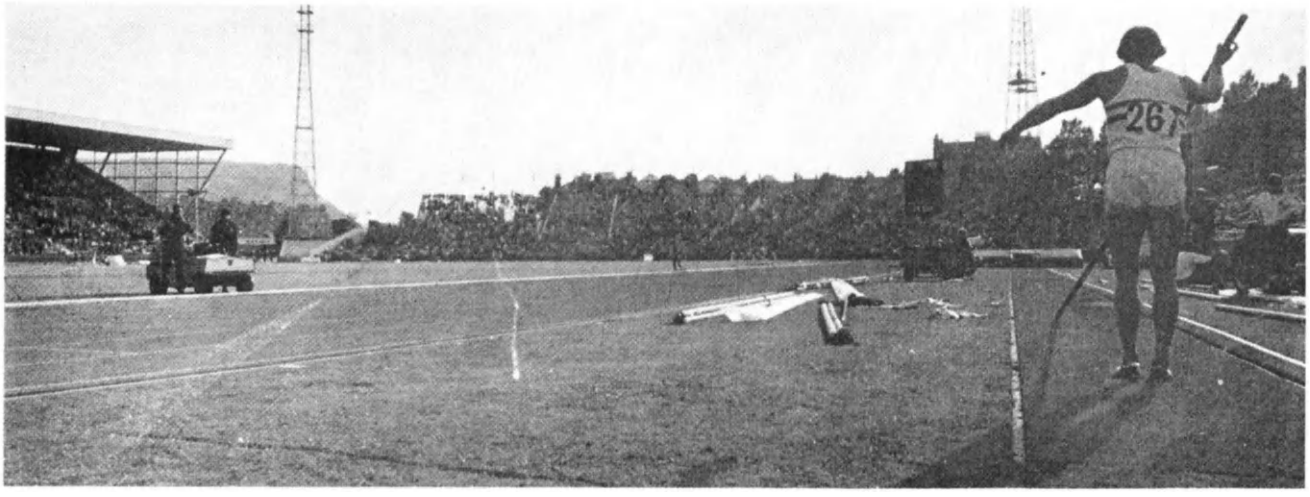
Sports activity	Area required	Floodlighting requirements	Stores	Comments
1 Archery	Club standard: 95 m × 45 m County or sub-regional standard: 120 m × 95 m		For butts	Area should be self-contained or have controlled access
2 Athletics	175 m × 90 m Allow extra for circulation space round arena	Ten 17 m high standards each with eight to ten 1500 W tungsten halogen floodlights Four standards to each long side and one to each short side	Maintenance plant	Changing facilities Optional stand 30 place carpark Perimeter fencing to prevent trespass Optional bank at perimeter for spectator seating Normal to use centre of arena for rugby, soccer or hockey
3 Basketball	18 m × 13 m; an area of 52 m × 41 m (three tennis courts) will serve as a practice area usually associated with indoor sports centres	For practice area: two 12 m high standards at each narrow end, each standard equipped with three 1500 W tungsten halogen floodlights	For posts and back boards When as a practice area: for netball and tennis equipment too	This area is normally associated with hard porous training area of sports centres
4 Cricket	Table: 27 m square Pitch: 64 m from perimeter of table		Maintenance plant Boundary demarcation equipment	Site screens usually required Boundary fencing optional Score-board optional Practice net optional (usually close by) Changing facilities 30 place carpark
5 Bowls	38·4 m square allow extra for circulation space	One 9 m high standard to each corner not closer than 3 m to ditch, each standard equipped with two 1500 W floodlights	Maintenance plant	Hedging round perimeter Changing facilities Optional viewing terrace 10 place carpark
6 Hockey	95·4 m × 59 m (includes circulation)	Eight 15 m high standards (four to each long side) each with three 1500 W floodlights	Maintenance plant Goal posts and netting	Changing facilities 30 place carpark
7 Soccer	Between: 90 m × 45 m to 120 m × 90 m (average: 100 m × 64 m) allow extra for perimeter circulation space	Eight 15 m high standards (four to each long side) or: four 15 m high standards (one to each corner) each with eight to twenty-four 1500 W floodlights	Maintenance plant Goal posts and netting	Changing facilities Optional stand Floodlighting for semi-professional and amateur league standard play 40 place carpark Mounds or shelter belts to improve sense of enclosure (contact between spectators and players helps develop community spirit in new towns)
8 Tennis	36·6 m × 18·3 m Three-court unit: 52 m × 41 m is usually associated with the practice area of indoor sports centres	As for item 3	Maintenance plant Posts and netting	3·6 m high perimeter fencing Changing facilities Optional rebound wall 52 m × 41 m area is suitable for netball, basketball and five-a-side football; this area would require a 40 place carpark during peak use Six place carpark for one court
9 Golf		High-intensity illumination at greens, but only minor lighting along fairways Standards 5 m to 6 m high	Maintenance plant	
10 Ski slopes		Four 12 m to 15 m high standards for slopes up to 30 m long		

Information sheet Landscape 17

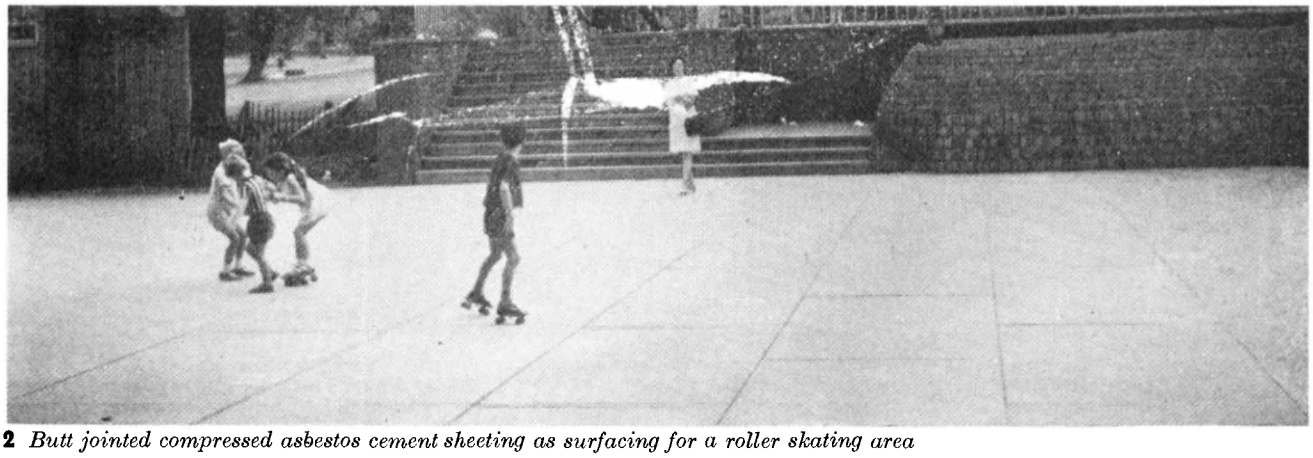
Section 6: **Recreation: sport**

Sports areas: maintenance

In information sheets LANDSCAPE 12 *to* 15. GERRY PERRIN *drew attention to the importance of non-turf surfaces. This information sheet consists of one table in which a suitable surface for each sport activity is specified with notes on plant, services, staff and any special provisions necessary to maintain the surface*



1 *Resilient impervious matting in use on a jump runway. Some of the surfacing materials noted in the table are illustrated in information sheet* LANDSCAPE *15*



2 *Butt jointed compressed asbestos cement sheeting as surfacing for a roller skating area*

Table showing maintenance requirements for sports areas

Sport activity	Surface	Plant	Services	Staff	Comments
1 Hockey, association football, five-a-side football (both match play and training), athletics, basketball, tennis, netball, tug-of-war (training only)	Hard porous water-bound	Tractor-drawn link mat, whale bone brushes, light roller, rake scarifier, hose pipes, stand pipes (six per pitch)	25 mm diam water supply (sufficient pressure for 35 m radius spray)	For first 12 months, approx two staff for every four pitches; later one staff using tractor	Early consolidation is essential, with daily maintenance for the first twelve months, then twice weekly. Watering should be to saturation (30 min approx); full maintenance should require about 90 min per hectare
2 As for item 1 and particularly athletics training	Semi-porous	Tractor-drawn link mat, whalebone brushes, rake scarifier, roller		Approx one staff for every eight pitches	Requires brushing and rolling twice weekly; full maintenance should require about 60 min per hectare. Vehicle access should be provided for floodlighting maintenance, but surface must not be used for overflow car parking as it cuts and stains easily

Sport activity	Surface	Plant	Services	Staff	Comments
3 Tennis, five-a-side football, netball, basketball (match play and training)	All-weather, hard-top, porous, in situ, no-fines concrete with coloured topping				No-fines mix ensures good porosity—falls of 1 in 300 are usual. Surface requires no special attention other than sweeping
4 Athletics and athletics field events (competition and training)	Non-resilient permeable—ie cinder-topped loose surface	Tractor, trailer, spike roller, light roller, hose pipes	25 mm diam water supply	For maintenance to county standard, two staff for athletic season (March to October)	Take-off positions on run-ways to jumps, areas round starting blocks and inside lane all wear badly. Maintenance for athletics arena requires two full-time groundsmen
5 As for item 4	Resilient impervious—ie matting surface				Very expensive to install, but requires no maintenance other than sweeping. Requires perimeter channel to drain surface water
6 As for item 4	Resilient porous—ie compound surface				Very expensive to install, but requires no maintenance other than sweeping. Requires land drains and perimeter channel to drain surface water
7 Outdoor swimming pools	As for indoor pools*	Generally as for indoor pools*	Generally as for indoor pools*	Two full-time staff	Generally as for indoor pools but requires considerable attention during leaf-fall
8 Outdoor roller skating	Butt-jointed compressed asbestos sheeting; or monolithic in situ concrete, carborundum dusted			One full-time staff	Asbestos surface has a life of about five seasons before failure at joints. Carborundum dusted monolithic surface has a life of at least ten seasons. Both require perimeter channels to drain surface water. Both surfaces require no special attention other than sweeping
9 Outdoor ice skating	Chemical ice-forming agents or a thin layer of water	When using water, a refrigeration plant to assist air temperature freezing is necessary	Water supply	One full-time staff	Perimeter channels to drain surface water
10 As for item 9	Plastic				Requires no special maintenance other than sweeping. Requires perimeter channels to drain surface water. Cheaper to install than either of surfaces in item 9. Life-to-date exceeds five seasons
11 Bowls greens Lawn tennis Pitch and putt Cricket tables (all high-intensity use)	Bowls green turf Tennis turf Putting turf Cricket pitch turf	Motorised gang mower, trailer rollers, spiked rollers, stop cocks, hose pipes, rotary sprinklers	25 mm drain water supply	Refer to cost analysis in tables in information sheet LANDSCAPE 13	All require land drains maintenance geared to standard of play—ie optimum maintenance and quality of staff for county standards. Surfaces should be protected from trespass. Cricket tables should be sufficiently large to allow one match a day. Full maintenance normally requires one groundsman per sports activity per day
12 Football Hockey Cricket (all low-intensity use)	Grass pitch turf	Tractor-drawn gang mower; trailer; spiked roller; rollers		Depending on intensity of use and standard of play, normally one groundsman for up to six hectares of grass pitches	Good practice to provide land drains. Pitches should be protected from unnecessary trespass

*See briefing guide *Indoor swimming bath spaces, fixtures and equipment*, AJ 21.10 64 [CI/SfB 541 (A3)] design guide *Swimming bath buildings*, AJ 14.6.67 [CI/SfB 54 (A3)], and associated information sheets.

Section 7 **Recreation: general**

Information sheet Landscape 18

General leisure facilities

After a brief survey of trends in leisure today, TIMOTHY COCHRANE *describes the various types of facilities required to satisfy these needs. Relevant legislation is listed in an appendix*

1 Trends in leisure

1.01 Leisure (christened the 'Fourth wave' by Michael Dower in his article in AJ 20.1.65) is one of the greatest growth industries of modern civilisation. The following definition has been proposed by the International Study Group on Leisure and Sciences:
'Leisure consists of a number of occupations in which the individual may indulge of his own freewill—either to rest, to amuse himself and improve his skills disinterestedly or to increase his voluntary participation in the life of the community after discharging his professional, family and social duties.'

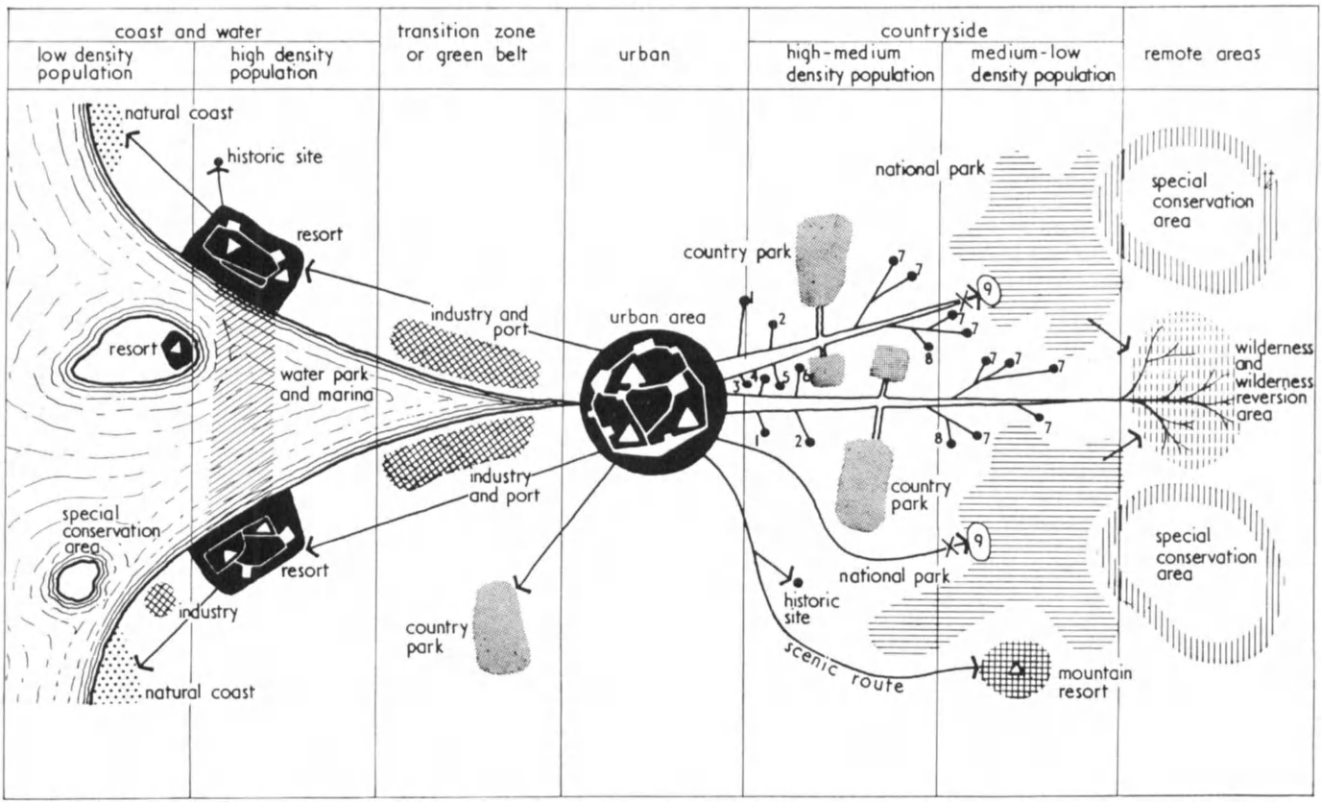
1.02 More spare time and more money generate more leisure; and the scope of leisure activities is constantly being increased by the growth of mobility and education.

1.03 Increasing mobility also means that accessibility is now becoming time-based rather than distance-based; many of the activities noted in para 3 are well within reach of weekend, day, or even evening trippers, even though being some distance away from population centres.

1.04 There is a great unfulfilled need for recreational spaces accessible from urban areas, for both passive and active recreation, not only to satisfy user demand, but also to ease the pressure on vulnerable rural areas **1**.

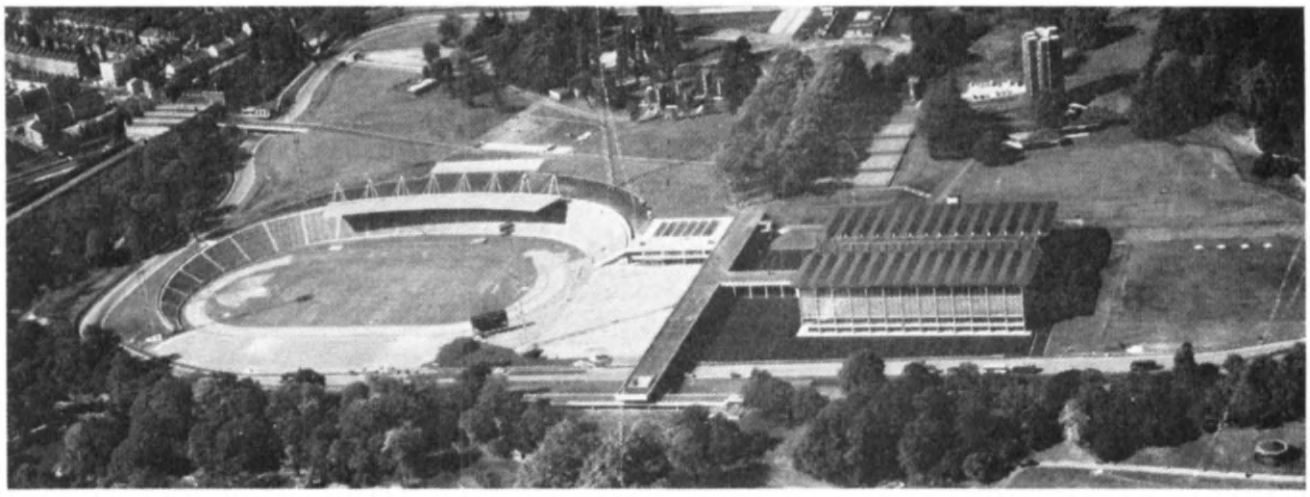
1.05 An indication of the kinds of recreation demanded by people may be gained from the ORRRC report[1] published in the US. which noted that driving for pleasure topped the preference chart, followed closely by picnicking, climbing, riding and birdwatching, camping and caravanning, and the more expensive winter sports. The popularity of traditional

1 *Types of recreational supply needed to serve urban region. Intensively used local facilities within city (eg linear recreation spaces), and sub-regional facilities in and around city (eg sports centres; rest and leisure parks), absorb largest number of people. Regional country parks, picnic sites and so on absorb most of remaining demand; national parks, conservation areas and wilderness areas are therefore relieved of excessive pressure. See also table* I



1. playing fields 2. golf 3. race course 4. water sports 5. show ground 6. athletics 7. picnic spot 8. beauty spot 9. car park

△ indoor recreation centre X access control point



2 *Crystal Palace sports centre, example of subregional centre which attracts large numbers of users because it offers varied facilities and activities*

team recreations (eg football, cycling and cricket) is fairly static. The BTA note in their predictions for the future that golf and sailing have the greatest unsatisfied demand, while swimming, riding and fishing also have great growth potential[2, 3].

1.06 The increasing popularity of active forms of recreation, requiring a lot of room, is exerting great pressure on regional and rural recreation spaces. This pressure can to some extent be lessened by the use of artificial recreation aids such as climbing walls, golf driving ranges and practice machines, rowing and canoe tanks, artificial ski slopes and so on, which enable recreational activities not previously associated with the urban scene to become part of it (see para 4).

1.07 Many of those preferring more passive kinds of recreation, such as driving out into the country, would also be happy to keep near the town if there were attractive places to go to. These need not necessarily be spectacular—as demonstrated by the depressingly ordinary places where the motorised hordes choose to picnic.

2 Financing and organisation of leisure

Commercial leisure facilities

2.01 These have to include revenue-earning activities such as gambling, eating, drinking and dancing, to balance losses made by other facilities such as swimming pools, which help to attract people to the centre as a whole but lose money ('loss leaders'). Private developers may be eligible for grants from the Exchequer, under the Countryside Act, for the development of country parks or picnic sites.

Publicly financed leisure facilities

2.02 These could learn valuable lessons from commercially financed facilities on how to pay their way, or at any rate defray costs. Savings can result if sports and cultural facilities can be combined, and joint planning by local and education authorities can help maximise the use of facilities*. Also several local authorities may join together to finance a project for the use of their communities, particularly where a development in a rural area is intended primarily for use of the adjoining urban area. Local authorities in rural areas are comparatively poor and can hardly be expected to pay for the recreation of their urban neighbours.

* See MHLG circulars 31/66 and 42/55.

3 Supply of leisure facilities

3.01 Leisure facilities can be grouped broadly into a hierarchy of four categories, as shown in table 1. These categories overlap, and clear definitions or classifications are not possible except theoretically. This does not matter as long as a hierarchy of recreation areas of varying intensities of use is established.

Local spaces

3.02 The main types of local open spaces for leisure and recreation are the following. They are described in more detail in information sheet LANDSCAPE 11.

1 *Linear recreation networks:* parks, recreation centres, social centres, peripheral open spaces and so on linked together in a continuous, easily accessible chain of varied facilities **3, 4, 9.**

2 *Central open spaces:* parks, shopping malls, squares etc.

3 *Recreation-orientated housing developments:* a rapidly growing trend.

4 *Playgrounds and playing fields:* See information sheets LANDSCAPE 12 to 17.

Subregional spaces

3.03 Subregional open spaces include the following types:

5 *Sports centres:* Complexes containing several indoor and outdoor games facilities grouped together **2.** See information sheets 11 to 17.

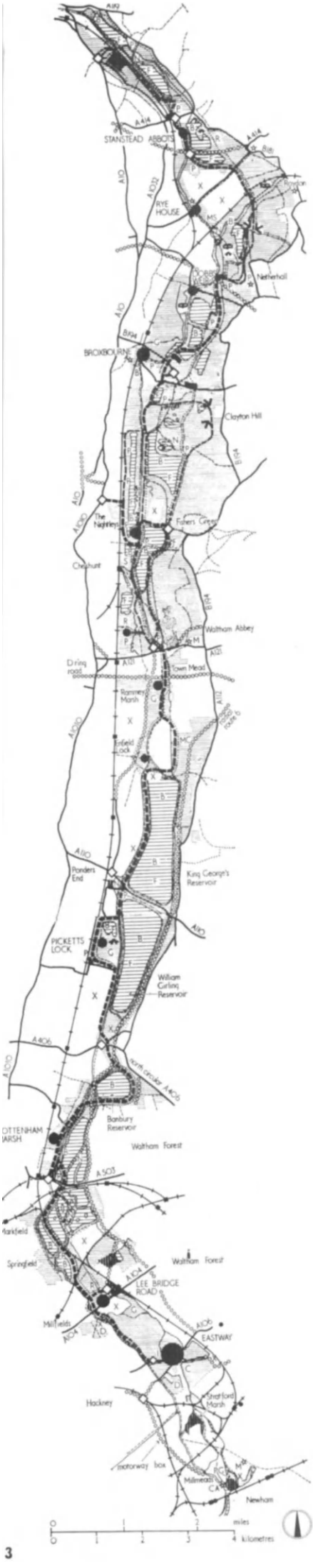
6 *Rest and leisure parks:* Combined sports, arts and social centres catering for interests of wide variety of users. Gruga park in Essen is a good example; the idea has not yet been fully put into practice in this country. See information sheet LANDSCAPE 11.

Regional spaces

3.04 Regional leisure facilities include open spaces such as country parks and picnic sites, regional parks, and weekend and annual holiday areas, situated on or near the urban periphery. For example:

7 *Country parks and picnic sites*

Detailed criteria are outlined in the Countryside Commission's booklet[14] setting out policy on park and picnic sites. Country parks are loosely defined as sites over 10 hectares; picnic sites are under 10 hectares. The purpose of *country parks* is to draw off recreation seekers who might otherwise



3

3 *Proposals for Lee Valley regional park, an attempt to provide wide spectrum of outdoor recreational facilities within easy reach of city dwellers*

4 *Lee Valley already provides Londoners with some opportunity to enjoy riverside relaxation; such facilities will be made available to many more as development proceeds*

5 *Intensive and quiet uses at Elvaston Castle Country Park are buffered by dense existing woodland*

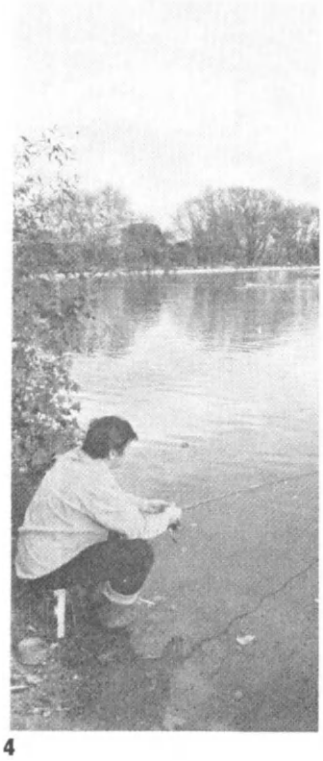
Table 1 Hierarchy of spaces for recreation

Category	Types of space	Examples
Local (urban)	Linear recreation networks Central open spaces Recreation orientated housing developments	Craigavon Dronton Agora Reston, Va. USA
Sub-regional (urban and semi-rural)	Sports centres Rest and leisure parks	Harlow Gruga park, Essen; Bos park, Amsterdam
Regional (urban-rural)	Country parks and picnic sites Regional parks	Elvaston country park Lee valley
National (urban-rural)	Weekend and annual holiday areas	Aviemore
National (rural)	National parks Forest parks Nature conservation areas	Not covered by Handbook of Urban landscape

drive out into the countryside, adding to rural congestion, and focus them into areas designed to absorb them. This eases the pressure on more remote recreation facilities as well as on agricultural or other rural interests.

Associated with the 'growth sports' (see para 1.05) and therefore often with water areas, country parks can provide for intensive outdoor recreation and education in the use of the countryside. Exchequer grants of up to 75 per cent of approved expenditure can be obtained.

An example is Elvaston Castle Country Park, **5**, which opened in March 1970, attracting 4500 visitors in the first four days. Close to Derby (with ½ million people in a 16 kilometre-radius catchment area) this country park comprises 77 hectares of park and woodland with 81 hectares of agricultural land. A riding school, field studies centre and countryside museum are proposed for the future. Established landscaping allows a large influx of people without generating feelings of overcrowding.



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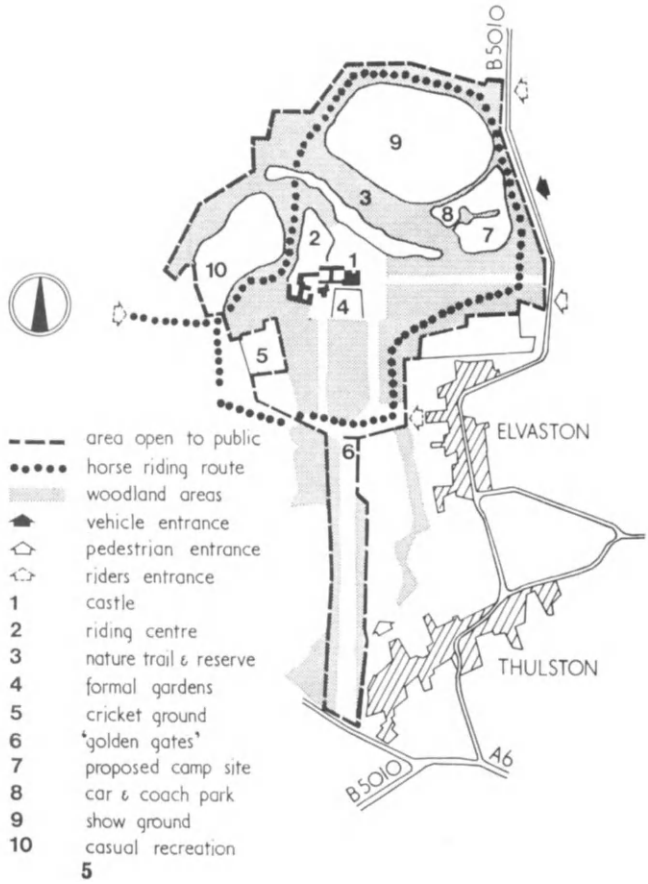

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Another example is Emberton Park, Olney, Bucks. The original derelict wet gravel pits were converted into a recreational area in 1965-69 at a cost of £100 000. It was designed on a rather *ad hoc* basis, and on a shoe string, but its new status as a country park will probably attract grants for a proper realisation of its undoubted potential. The policy is to encourage those who want to picnic and wander freely, while also making provision for boats in the large lake.
London has many such areas—Hampstead Heath, Epping Forest, Wimbledon Common, Putney Heath and Richmond Park, for example, though none of these has as yet been much developed to provide for more intensive recreation and therefore to absorb more people.

Picnic sites can be classed in two groups. Transit sites provide for short breaks (half an hour or so) near the roadside; recreational sites provide a destination for day-trippers, often forming part of a larger recreational complex. Car parking should allow for picnicking away from, as well as close to the cars.

8 *Regional parks*
The Lee Valley Regional Park is the first and classic example of this category **3**, **4**. Covering an area of 4000 hectares and 37 kilometres in length, it will provide for a broad spectrum of activities linked by the river Lee and a proposed new link road. It is more fully described in AJ 23.4.69.

9 *Weekend and annual holiday areas*
These are, in general, not urban areas, and therefore fall outside the scope of this handbook. See, however, information sheets LANDSCAPE 19 and 20.

4 Specialised recreation facilities

4.01 It has already been stated in para 1.05 that active forms of recreation are increasing in popularity. Data on the design of sports facilities is given in information sheets LANDSCAPE 14 to 17. The following paragraphs give planning data on a few other facilities which could form part of the urban landscape.
A comprehensive list of recreation facilities forms appendix C to this information sheet, this lists the facilities required for each recreation type, and gives the name of the relevant National Association to be consulted for further information.

Riding centres

4.02 Basic criteria for a covered riding school are outlined in *Basic requirements for a riding centre* (published by the British Horse Society) from which the following data has been abstracted:
1 Access should be available to countryside and bridle-paths; and buildings should include stables and associated facilities, offices, lavatories, car park and accommodation for night guard.
2 Minimum size of track is 30 × 15 m; 60 × 25 m for dressage and show jumping.
3 Outdoor menages should have an all-weather surface (sand and wood shavings) and be fenced all round; minimum size 40 × 20 m.
4 Grass paddocks should be ½ hectare minimum.

Artificial ski slopes

4.03 Slopes may be formed by artificial ramps (eg Thornaby Sports Centre), mounding or natural gradients, or a combination of all three. Mean incline about 1:3 (1:2 maximum to 1:5 minimum). Minimum useful length 15 metres; minimum width 8 metres plus 0·3 m for every metre of length over 15 m.
The slope should not achieve length at the expense of width. Ideally, it should be wider at the bottom than the top. If it is very long a number of starting points should be arranged. A startpoint (consisting of an adequate area of level ground, or platform) must be provided at the top, with easy access for people carrying skis. Main ski-ing area gradient should be about 1:3, with steeper gradients at the upper end and with the lower end levelling off to the horizontal finish area. Changes of gradient should not be too severe. Slope margins, particularly in the centre and lower sections, should allow for a smooth turf pull-out area free from solid obstructions. On the upper section where speeds are low a barrier, not less than 1 metre high, can be used.
A resilient surface such as turf is necessary as a foundation. Rock, sand, cinder, gravel or fresh soil are not suitable. Excessive growth can be inhibited by laying the matting on pvc sheet or hessian.
Severe irregularities in the natural profile should be graded out, filled or artificially bridged.
Finally, the slope should be protected from pedestrians, children and livestock and sited away from deciduous trees; and features such as floodlighting, partial weather protection, changing accommodation, equipment store and mechanical hoist will be required.

6 *Orienteering: a fast-growing sport which taxes both mind and body and ideally requires undulating wooded country*

Artificial climbing walls

4.04 These can be outdoor (preferably) or indoor. Outdoor climbing walls need some sort of security to prevent access by unauthorised persons. They can be portable or form part of a structural wall. Proprietary climbing towers are available for use on outside walls.

Appendix A: legislation

Civic Amenities Act 1967

Strengthens previous legislation dealing with preservation of areas and buildings of architectural or historic interest. It also makes it obligatory for developers to preserve and protect trees, and gives compulsory powers to clear rubbish (such as old cars) away.

Countryside Act 1968 (Scottish version of Act passed 1967) Sets up Countryside Commission to replace the National Parks Commission. Extends rather than supersedes previous legislation. Makes it possible for local authorities to

set up 'country parks' (over 10 hectares), to provide picnic sites (under 10 hectares) and camping sites, and generally to provide for better enjoyment of the countryside.

Town and Country Planning Acts—relevant legislation:

1962 Act	Major Act governing planning today.
1963 & 1969 Acts	Planning control etc.
1968 Act	Covers acquisition of land—also covers conversion of 'highways' to footpaths or bridleways for amenity purposes.

Appendix B: Organizations

Bodies concerned with recreation and tourism

Countryside Commission 1 Cambridge Gate, Regents Park, London, NW1

Countryside Commission for Scotland Battleby, Redgarton, Perth

They were formed from the old National Parks Commission and are the central source of reference and advice for local authorities setting up Country Parks, picnic sites and camping sites. They select and designate National Parks and areas of outstanding national beauty, and draw up proposals for long distance footpaths and bridleways. They also publish Research Registers which list all research with countryside and leisure problems.

The English Tourist Board 26 Chapter Street, SW1

The Scottish Tourist Board 2 Rutland Place, Edinburgh

The Welsh Tourist Board High Street, Llandaff, Cardiff

The boards encourage people within their respective countries to spend their holidays there. They are not concerned with promotion overseas, but they are concerned to establish a framework within which the tourist industry can function and develop, including provision and improvement of appropriate tourist amenities and facilities and to ensure that future demand and supply in the tourist industry are kept in balance.

The British Tourist Authority Queen's House, 64 St James's Street, SW1

Works closely with the Tourist Boards. It handles all promotion overseas (i.e. the Beefeater image!) and advises the government on all matters to do with the UK as a whole. It also conducts research and development projects (ie Pilot National Recreation Surveys—see bibliogr.).

Bodies concerned with sports

The international working group for the construction of sports facilities (*Internationaler Arbeitskreis Sportstattenbau e. V. s.* Koln-Mungersdorf, Carl-Diem-Weg, Federal Republic of West Germany)

Research into sports facilities, exchange of results and information at international level. Publishes bi-monthly magazine on recently completed sports/recreation facilities in Europe and America.

The Sports Council 26 Park Crescent, W1N 4AJ

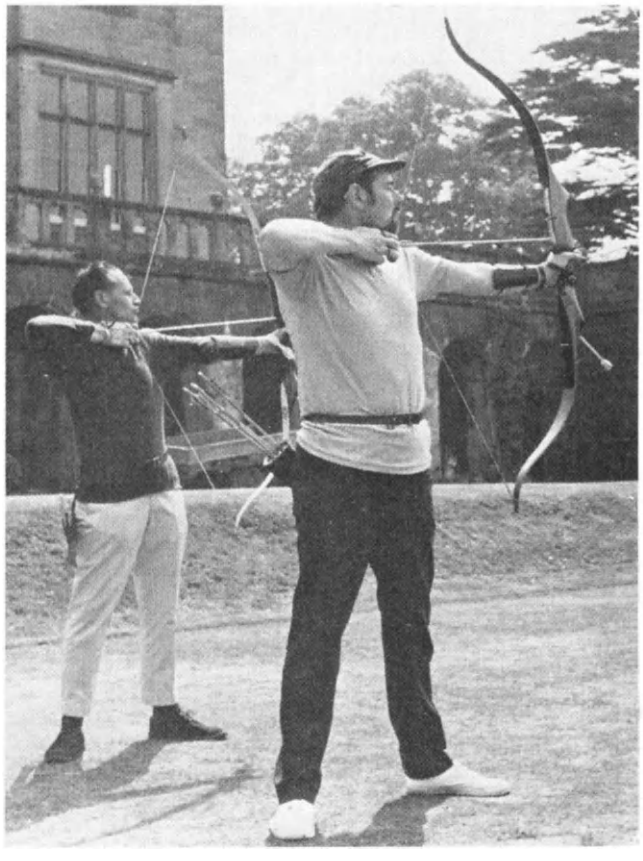
Has been given powers under a Royal Charter to take over from government depts the job of developing sport in Britain, by improving facilities and thereby increasing participation.

It is no longer an advisory but an executive body, and will be joined by the Technical Unit for Sport of the DES.

Regional sports councils

Their function is consultation and priority-grading of facilities requiring loan sanction or grant aid. They encourage local authorities to provide better facilities for sports and recreation.

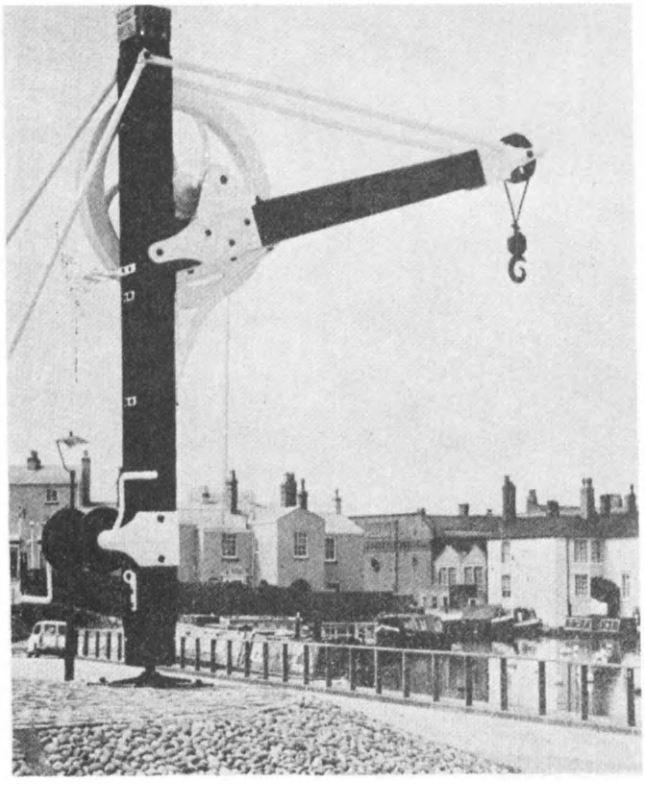
7 *A climbing wall: an urban facility for weekday practice for activities which take place in open country at weekends*



8 *Archery is typical of target sports requiring specialised ranges*

Central Council for Physical Recreation 26 Park Crescent, W1N 4AJ

Negotiations are in progress for a proposed merger of the CCPR with the Sports Council.



9 *A water and pedestrian network penetrating to the heart of a city from the country outside. James Brindley Walk, by the canal at Farmer's Bridge, Birmingham.*

Sports Council for Scotland, Edinburgh
Sports Council for Wales, Cardiff
Have similar powers in their respective territories.

School sports associations
Specialist schools sports associations are run by school teachers. The Associations aim to develop a basic interest in sport and to lay the foundations of skill in participation. National councils co-ordinate sports at school level, organise competitions and make representation on problems of school sport.

Local sports advisory councils
The councils help to co-ordinate voluntary sport and local authorities. They encourage local authorities to provide better sports facilities at town level.

Local authorities
Provide sport and recreational facilities in their areas, sometimes with other authorities and other bodies.

Local education authorities
Provide school and youth facilities.
'Dual use' provision by LEAs and LAs is becoming more common and is being actively encouraged by the Sports Council.

The National Playing Fields Association 57 Catherine Place, SW1
A voluntary organisation registered as a charity. It aims to encourage the provision of recreational facilities for all age groups, particularly with reference to village communities. To provide technical advice, information and research on planning design and construction of indoor and outdoor facilities and sporting activities. To specialise in recreation for children and young people. To raise funds and make grants and loans in furtherance of these objects. To co-operate in saving threatened recreational facilities.

Insitute of Parks and Recreation Administration
The Grotto, Lower Basildon, Berks.
Concerned with management and design of parks. Runs courses for their exams.

Bodies whose primary interest is elsewhere, but who provide for recreation

The Nature Conservancy 19-20 Belgrave Square, SW1
A grant aided body, established in 1949, it is now part of the Natural Environment Research Council. Its primary function is to advise on conservation, while it surveys sites of special scientific interest and is concerned with the protection of natural environments. It provides research and study facilities, and carries out its own research. It manages the National Nature Reserves and helps to set up local and forest nature reserves, wildfowl refuges, and non-statutory reserves to which the public have varying degrees of access.

The National Trust 42 Queen Anne's Gate, SW1
A voluntary body registered as a charity concerned with the preservation and conservation of places of historic interest and natural beauty. It owns holiday cottages and promotes cultural events at its properties.

The National Trust for Scotland
The Trust has the same functions, in Scotland, as the National Trust above. In addition it runs interpretive courses, information centres and camp sites.

The Civic Trust 18 Carlton House Terrace, SW1
Concerned with high quality of townscape and to protect countryside. Advises on trees.

Forestry Commission 25 Savile Row, W1
The Commission's primary aim is the production of timber. They have set up forest parks on their land for public recreation. These may contain information centres and museums, hides and towers, camping sites, barbecue sites, picnic sites, nature trails. The Commission also manage the New Forest—not a forest park—also arboreta.

*British Waterways Board** Melbury House, Melbury Terrace, NW1
Management of Waterways (canals). Under the Transport Act 1968 the BWB have a duty to maintain some 1780 km of cruising waterways in a state suitable for cruising, fishing and other recreational purposes.

*The Association of River Authorities** 15 Great College St., SW1
This body represents the 29 river authorities of England and Wales formed in 1963, who are concerned with the management and maintenance of rivers, the conservation of water, the maintenance of water levels and the control of pollution. Most authorities provide facilities for fishing, boating and sailing, although quantity and quality varies with the authority concerned.

Water Resources Board exercises planning and advisory powers over the River Authorities.

The Arts Council of Great Britain Hayward Gallery, Belvedere Road, SW1, and 105 Piccadilly, W1

* Negotiations are in progress for the separation of these two bodies into nine Regional Water Authorities: there is, however, strenuous opposition to the dismantling of the British Waterways Board.

10 *Pony trekking is typical of sports which need specially surfaced tracks if in or near urban areas and are intensively used*

Appendix C: Outdoor sports and recreations

This has been prepared by Timothy Cochrane with the aid of Fiona Wilton's thesis for Edinburgh University on recreation.

Selection of activities for the chart:

aims to be fairly comprehensive without getting too esoteric. It is based on the CCPR's list with additions to cover all activities which could be expected to take place outdoors in or near urban areas.

In this last context it is important to note that many country-based activities rely increasingly on urban-based training facilities i.e. climbing walls for mountaineering, many indoors, but which can be located outdoors in the urban landscape.

References are made mainly to other sources in this book; additionally three other major sources of reference are made to particular issues of the Architects' Journal. Photocopies of these should be easily obtainable from good libraries.

National Associations. For the sake of simplicity only British and English associations are shown. Many have equivalent Scottish and Welsh associations which have not been listed. Addresses—unless otherwise noted are in London.

OUTDOOR SPORTS AND RECREATIONS *Including recreational activities which can be both outdoor and indoor*

Key: ■ indoor facilities ◘ indoor/outdoor facilities ○ outdoor facilities

Recreation type	Facilities: Local	Regional and subregional	National	National Associations	Notes and Cross-references Bold nos. refer to information sheets in this book Nos. preceded by IS refer to pages of Indoor sports spaces (AJ 30.9.64) Nos. preceded by SH refer to pages of Sports halls (AJ 5.4.67)
A Casual Recreation					
Informal games	○				
Motoring	○	○	○	Automobile Association Royal Automobile Club see section G for racing	Need for scenic routes and honeypots, 15-35 km average pleasure drive, wooded sites absorb most cars and people **18**
Picnicking	○	○	○		
Sitting and sunbathing	○				
B Environmental study					
Sightseeing	◘	◘	◘	British Tourist Authority	
Photographing and painting	◘	◘	◘		
Natural history, zoos history, archaeology	◘	◘	◘	Council for Nature	
C Entertainments					
Fairs, shows, displays	◘	◘	◘		Flattish, well drained, with vehicular access
Festivals, concerts, plays, exhibitions	◘	◘	◘		215 × 130 m flat grass with banking round
Meetings and happenings	◘	◘	◘	Various clubs and societies	
Chess, draughts etc.	◘			British Chess Fed. St Leonard's, Sx	
D Social activities					
Dancing and folk dancing	◘	◘	◘	Royal Academy of Dancing English Folk Dance and Song Society Royal Scottish Country Dance Society Welsh Folk Dance Society	
Folk singing	◘	◘	◘	English Folk Dance and Song Society	Enclosed 0·40 ha with banking
Parties	◘				

OUTDOOR SPORTS AND RECREATIONS (*continued*)

Key: ■ indoor facilities ◘ indoor/outdoor facilities ○ outdoor facilities

E Children's play					
Playgrounds, adventure playgrounds	◘	◘		Various: see information sheets	**21, 27**
Model engineering	◘	◘	○		
F Activities requiring access to the open countryside					
Walking and hostelling		○	○	Ramblers' Association Youth Hostels Association	Needs green networks (old rail lines, canals, etc.)
Camping		○	○	Youth Camping Association of GB and Ireland Cheshunt, Herts Camping Club of GB and Ireland	**19** Big requirement for urban sites
Caravanning		○	○	Caravan Club National Caravan Council Ltd Motor Caravanners' Club Ltd	**19** Big requirement for urban sites
Cycle touring		○	○	Cyclists' Touring Club Godalming, Surrey	Additional networks needed away from main roads
Orienteering		○	○	English Orienteering Association British Orienteering Federation, Edinburgh	2·4-16 km course length Wooded and well configured area needed
Cross-country running		○	○		
Riding including pony trekking		○	○	British Horse Society, Stoneleigh, Wwks Pony clubs	**18** Riding centres in urban areas with access to open country
Motor rallies		○	○	Royal Automobile Club	Normal roads: public and private
Autocross		○	○	Royal Automobile Club	2 ha sufficient. Unmetalled surfaces: fields, etc
Driving tests	○			Royal Automobile Club	Any surface. 182 m max straight
Motorcycle scrambling		○	○	Autocycle Union	Rough open country, heaps, pits
Cyclocross		○	○	British Cyclo-cross Association, Solihull, Wwks	Rough tracks 16-24 km length 1·6-3·2 km circuit ideal
Hunting, shooting, stalking, beagling		○	○	British Field Sports Society	Open country and woods
Birdwatching		○	○	Royal Society for the Protection of Birds	**20** Private or controlled areas needed
Wildfowling		○	○	Wildfowlers' Association of GB and Ireland, Sandy, Beds	
G Activities requiring specially constructed facilities					
Athletics				British Amateur Athletic Board Amateur Athletic Association Women's Amateur Athletic Association Modern Pentathlon Association of GB	**13-16,** IS 1286
Archery		◘	◘	Grand National Archery Society, Chelmsford Essex	**16,** IS 1285
Shooting: small-bore rifles and pistols		◘	◘	British Field Sports Society National Rifle Association, Bisley, Surrey National Small-bore Rifle Association	**IS** 1285 100 m long Pits and quarries ideal sites
clay pigeon		○	○	Clay Pigeon Shooting Association	
Skittles		■		Amateur Skittle Association	
Tenpin bowling		■	■	British Tenpin Bowling Association	
Golf and putting		○	○	Golf Development Council, Wimbledon, Surrey Royal and Ancient Golf Club of St Andrews, Fife Ladies' Golf Union, Sandwich, Kent	**16-17** 18 holes: 40-60 ha: 6000 m course length 18 hole pitch and putt: 3 ha sufficient. Driving range: 200-250 m × 100-200 m wide
Dry skiing and tobogganning		◘	◘		15, 15, 18, IS 1285; see also skiing, section L
Motor racing		○	○	Royal Automobile Club	No minima required: existing circuits: Formula 1: 4-4·8 km Club: 1·6-4·4 km
Artificial hill climb				Royal Automobile Club	Mean of existing facilities is: 400 m-2 km × 60-300 m height
Karting		○	○	Royal Automobile Club	
Autocycle racing			○	Autocycle Association Autocycle Union	
Motorcycle speedway			○	Amateur Motor Cycle Association	
Cycle racing			○	Cycling Council of GB Godalming, Surrey British Cycling Federation	IS 1286
Horse racing: flat			○	Jockey Club Newmarket, Suffolk	
steeplechase			○	Jockey Club	
showjumping			○	British Show Jumping Association	
Greyhound racing			○	Greyhound Racing Association Ltd	
H Individual sports					
Badminton	◘	■	■	Badminton Association of England	IS 1275 (revised 26.4.67)
Batinton	■				IS 1276
Bowls	○	○		English Bowling Association Bournemouth, Hants Crown Green Bowling Association Huddersfield, Yorks	**14, 16,** IS 1283
Boxing	■	◘	◘	Amateur Boxing Association	IS 1282
Croquet	○	○		The Croquet Association	32 × 26 m
Fencing	■	■	■	Amateur Fencing Association	IS 1277
Gymnastics	■	■	■	British Amateur Gymnastic Association Slough, Bucks	IS 1287
Judo	■	■	■	British Judo Association	IS 1282
Karate	■	■	■	British Karate Control Commission	
Keep-fit	◘	◘		Keep-fit Association of England and Wales Women's League of Health and Beauty Thames Ditton, Surrey Medau Society of GB and NI	IS 1286
Padder tennis	■			Slazenger Ltd for details of rules	IS 1279
Roller skating				National Skating Assn. of GB	**17**
Squash	■	■	■	Squash Rackets Association Women's Squash Rackets Association	IS 1284, SH 1492
Table tennis	◘	■	■	English Table Tennis Association	IS 1280 (revised 26.4.67)
Tennis	○	◘	◘	Lawn Tennis Association	14, 16, IS 1280 (revised 26.4.67)
Trampolining	◘	■	■	British Trampoline Federation Northolt Middx	IS 1286
Weightlifting	■	■	■	British Amateur Weightlifting Association Oxford	IS 1282
Wrestling	■	■	■	British Amateur Wrestling Association	IS 1282

OUTDOOR SPORTS AND RECREATIONS (*continued*)
Key: ■ indoor facilities ◘ indoor/outdoor facilities ○ outdoor facilities

J Team sports					
Association football	○	◘	◘	Football Association Football League Lytham St. Anne's	**14, 16**
Basket ball	◘	◘	■	All England Basket Ball Association	**14, 16,** IS 1276
Baseball			○	National Baseball League Amateur Baseball Assn., Leeds	92m radius, quarter circle outfield with 28m² perm. diamond
Cricket	○	○	○	Cricket Council	**14, 16,** IS 1277, (indoor practice nets)
Five-a-side football	◘	◘	◘		IS 1278
Fives		■	■		
Hockey	■	◘	◘	All England Women's Hockey Association Hockey Association, Derby British Hockey Board	14, 16, IS 1278
Hurling	○	○	○	Gaelic Athletic Assn., Dublin	Particularly in Scotland
Korfball and micro-korfball	◘	◘	◘	British Korfball Association	IS 1281
Lacrosse	○	○	○	English Lacrosse Union Rickmansworth, Herts. All England Women's Lacrossa Association	**14**
Netball	◘	◘	■	All England Netball Association	14, IS 1279
Polo			○	The Hurlingham Polo Assn.	
Roller Hockey			◘	National Roller Hockey Association of GB	
Rounders	○	○		National Rounders Assn. 36-45m radius, quarter circle outfield	
Rugby Football		○	○	Rugby Football League Leeds Rugby Football Union Twickenham Middx. Rugby Fives Association	**14**
Shinty				The Camanachd Assn. Foyers, Inverness	
Softball				British Softball Fed. Newbold Vernon, Leics	
Volleyball	◘	◘	■	Amateur Volleyball Association of GB and NI Barnhurst, Kent	IS 1281
K Activities which require particular topographical features					
Land					
Hillwalking		○		Ramblers' Association	
Climbing		○	○	British Mountaineering Council	Climbing walls for practice
Caving and potholing			○	National Caving Assn. British Speleological Association	
Sand Yachting			○	British Federation of Sand and Land Yacht Clubs	Firm flat sand 1·6 km length
Water (can be subdivided into sea and freshwater, but nearly all can use indoor or urban training facilities)					
Angling	○	○	○	National Anglers' Council Peterborough, Northants	**20**
Bathing	○				**20**
Boating		○	○		**20**
Canoeing and canoe touring		○	○	British Canoe Union Canoe Camping Club, Sandy, Beds.	**20**
Cruising		○	○		**20**
Hydroplaning		○	○	Royal Yachting Assn.	**20**
Lifesaving		○	○	Royal Lifesaving Society Surf Lifesaving Association of GB, Exeter, Devon	**20**
Powerboating		○	○	Royal Yachting Assn.	**20**
Punting	○				Calm shallow water with firm bottom
Rowing		◘	◘	Amateur Rowing Association Women's Amateur Rowing Council, Hampton, Middx	**20,** IS 1284
Sailing		○	○	Royal Yachting Association	**20**
Subaqua	○	◘	○	British Subaqua Club	**20**
Surfing			○	British Surfing Association, Padstow, Cornwall	**20**
Swimming	○	◘	◘	Amateur Swimming Association	**20**
Water polo		◘			**20**
Waterskiing		○	○	British Waterski Federation, Virginia Water, Surrey	**20**
L Winter and ice sports					
Curling		◘	◘	Royal Caledonian Curling Club, Edinburgh	SH 1495
Ice hockey		◘	◘	British Ice Hockey Assn.	SH 1495
Skating	◘	◘	◘	National Skating Association of GB	**17,** Booklet in production: only outdoor rink in GB is Aviemore
Skiing		○	○	National Ski Federation of GB	15, 16, 18, IS 1285 Training can be indoors: see G above
Tobogganning		○	○		
M Airborne sports					
Ballooning			○	British Ballooning and Airship Assn.	All require flat open country facilities, but training can be done in urban areas
Flying		○	○	British Light Aviation Centre	
Gliding			○	British Gliding Association	
Parachuting			○	British Parachute Association	
N Disabled people's sport		◘	◘	British Sports Association for the Disabled Stoke Mandeville, Bucks.	

References

1 OUTDOOR RECREATION RESOURCES REVIEW COMMISSION Outdoor recreation for America. Washington. 1962. The United States Government. [083] *Price* $2.50

2 BRITISH TRAVEL ASSOCIATION/UNIVERSITY OF KEELE Pilot National Recreation Survey Report no 1. London. 1967, The Association/University. [083] *Price* £2·10

3 BRITISH TRAVEL ASSOCIATION/UNIVERSITY OF KEELE Pilot National Recreation Survey Report no 2. London. 1969, The Association/University. [083] *Price* £2·10

4 BEAZLEY, E. Designed for recreation. London. 1969. Faber and Faber. [083] *Price* £5·00

5 DOWER, M. Fourth wave: the challenge of leisure. AJ, 1965, 20 January, p122–209. [083(E2p)]

6 SCOTTISH TOURIST BOARD Firth of Clyde study phase 2, Recreation planning for the Clyde. Edinburgh. 1970. The Board. [083] *Price* £3·75

7 Leisure. Official Architecture and Planning (special issue), 1969, August. [083(E2p)]

8 SPORTS COUNCIL Sports Council Review 1966–69. London. 1969. The Council. [56]

9 COUNTRYSIDE COMMISSION Coastal recreation and holidays 1969. HMSO. [083(E2p)]. *Price* £1·05

10 SILLITOE, K. K. Planning for Leisure. 1969. HMSO. [083(E2p)] *Price* £1·75

11 NATIONAL PLAYING FIELDS ASSOCIATION Community sports halls. London. 1965. The Association. [562] *Price* £1·05

12 PERRIN, G. Building for recreation, RIBA Journal, 1968, October. [5]

13 CENTRAL COUNCIL OF PHYSICAL RECREATION Sport and the community—Wolfenden report. London. 1960. The Council. [56]

14 COUNTRYSIDE COMMISSION Picnic sites. London. 1969. The Commission. [083]

15 Leisure in the countryside—England and Wales. 1967, HMSO. [083(E2p)]

16 BOARD OF TRADE Development of Tourism Act 1969. HMSO. [85(Ajk)]

17 MINISTRY OF HOUSING AND LOCAL GOVERNMENT Departmental Committee of enquiry into allotments. Cmnd 4166. 1969. HMSO. [168] *Price* £2·10

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Section 7: **Recreation: general**

Camps and holiday homes

In this sheet TIMOTHY COCHRANE *describes types of leisure homes, from caravans to holiday villages. Site and planning requirements are outlined, with notes on facilities, services, and legislation*

1 Introduction

1.01 Increased car ownership has accelerated the trend to self-catering holidays in 'second homes'. These include tents, caravans, dormobiles, boats, chalets (sometimes in holiday camps), holiday cottages and flats.
Tented camping is growing more slowly in Britain's unstable climate (4 per cent of holidays), than in France (14 per cent) or Scandinavia (Sweden 13 per cent). But caravanning has grown to 13 per cent here, as in the US and Sweden.
Second homes proper are rare in Britain (less than 1 per cent of the population), but in Sweden 25 per cent own or rent one, while in southern France there are more second than first homes. Apart from higher standards of living, holiday home ownership appears to increase as more people live in flats.

1.02 With increasing demand on all 'getaway places' particularly by the coast, new sites for second homes must be clustered around some strong focal point of recreation to compensate for loss of privacy.

2 Caravan and camp sites

Types of site

Transit sites

2.01 Must be near trunk routes to holiday areas and on tourist routes. Caravans can be at a higher density (say 1·5 to 3 m apart) than normal, as they are exempt from control under schedule 1 of the 1960 Act (see para 6.01 to 6.05). They are usually operated by recreational organisations (ie caravan clubs) and local authorities **1**.

Recreational touring sites

2.02 May be sited in areas with high amenity value and recreational opportunities, or they may create their own attractions. Density depends on recreational facilities available.

Group camps

2.03 Permanent sites for groups (ie scouts, guides); headquarter recreational facilities with decentralised pitches.

Static sites

2.04 May be solitary caravans—the alternative to holiday cottages—and weekend parks, to highly organised holiday camps. Unfortunately, large static sites in recreational areas are most difficult to integrate with the landscape **2**.

Site planning

2.05 Tents and caravans should be integrated on the same site, with an area for tents where cars are not allowed.

2.06 More camping sites are needed in recreation areas as temporary accommodation, especially in urban tourist areas (London has only two sites, at Crystal Palace and Woolwich). Camp sites should always be in or next to existing development. To anchor sites into the scene, use existing natural features of topography or planting, or artefacts such as old quarries, walled gardens or disused buildings. Light or scrubby woodland is ideal for absorbing caravans and tents, although tents cannot be pitched directly under trees.

Slopes

2.07 Caravans can be parked on slopes, but tents and

1 *Transit/recreation site at Yellowcraigs, East Lothian*

2 *Static site at Pevensey Bay*

dormobiles need a gradient less than 1 in 15. Terracing to overcome this can also provide well articulated sites with good views.

Soil

2.08 Well drained soil is necessary and damp sites must be drained. Light gravelly and sandy soils are best.

Site density

2.09 Densities set by model standards (see para 6.01 to 6.05) for caravans are low and conducive to suburban environments. The density should be decided by the purpose of the camp. When camping is just a convenient way of living during holidays, generous space standards are not necessary. As caravans have windows on all sides they are less flexible for planning purposes than houses. (Continentals have solved the problem by venetian blinds.)

Ground surfaces

2.10 Most areas for parking and pitching tents are grass with undefined pitches. If supervision is possible, alternating tents and caravans give grass time to recover after each visitor.

Static caravans need hard-standings **3**. Hoggin, ash and gravel drain better, are cheaper and more flexible than impervious materials. Alternatively, the pitch can consist of a hard-standing for the car surrounded by a small area of grass **4, 5**. This prevents erosion as vehicles drive on and off the pitch.

Roads and footpaths

2.11 Roads and footpaths should be designed according to the turnover of the site and the number of pitches served. Single carriageways with tarmacadam surfaces are usually sufficient, widened at entrances and near administration buildings **6b**. Road access to tented areas allows cars to be used as storage spaces on wheels, but car-free tented areas are more attractive and give more privacy. Footpaths should be direct, and separated from the road system, linking pitches to local and central facilities. They must be usable in all weathers.

Car parking

2.12 A 1 : 3 ratio of cars to pitches specified in model standards is now outdated; 1 : 1 is more realistic. If cars are not parked by pitches, the site is safer for children, and a pedestrian segregated layout can be achieved, fewer roads are needed and there is less wear on the grass. But transit sites need cars adjacent to pitches. Parking areas should be screened.

Screening

2.13 The functions of screening are: 1 to integrate caravans and landscape; 2 to provide shelter and privacy for campers; 3 to divide camp into smaller enclosures, achieving higher densities; 4 to integrate security fences or boundaries.

For quick screening effect, existing features should be reinforced as far as possible—ground slopes, hollows, hedges, tree groups or woods. Graded earth banks can be used as a start and their lees can shelter quick growing hedges, shrubs and trees. Short-lived fencing (eg wattles) also gives temporary screening to campers and plants. Plants must be in sympathy with local ecology. Longer-lived plants should be introduced to take over from shorter-lived ones.

Deciduous planting can be effective on summer recreational sites where there is nothing to screen in winter. Static sites need slower-growing evergreen and other permanent screenings. But planting can be located very near static homes without fear of disturbance.

Landscaping in urban sites must not try to be 'natural'. Hard landscaping—using hoggin, screenwalls and fences with attached planting and trees—looks better in high-density, highly used urban sites than grass and flowerbeds.

Design for expansion

2.14 Design for expansion may be difficult on urban sites where land is scarce. It can be achieved by increasing density, ie more screening, sophisticated services, hard surfaces. Initially, a newly planted area may not be able to absorb many tents or caravans but as planting matures density can be increased.

Facilities

2.15 Large sites need shops, restaurants, launderettes and recreation facilities. All sites should have shelters and seats around water points, campfires, sheltered waiting areas and communal cooking shelters. Campfire sites must be hard areas of gravel or bricks. Barbecue grills or brick or stone fireplaces with cooking grills could be used. A children's playroom or a covered area for wet weather is invaluable when indoor living area is so small (see information sheet LANDSCAPE 21).

Camp office and warden's accommodation

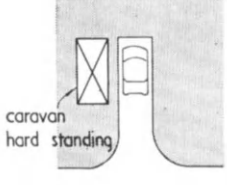
2.16 The camp office should be near the entrance and immediately obvious, with car-parking space for callers at the office. A sheltered waiting area is necessary. The warden's accommodation should be nearby; it can range from a caravan to a flat in the central complex.

Camping shelters

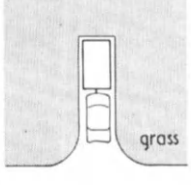
2.17 These are especially useful in highland areas subject to high rainfall, and on very exposed sites. They provide additional storage and room to move about, and also help to screen tents from wind. They should be sited to open away from prevailing wind.

3 Services

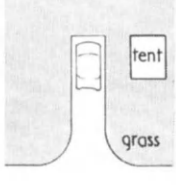
3.01 The sophistication of services depends on the type of site involved. On caravan sites it may not be much more expensive to install services on each plot, and this is essential on intensive-use and urban sites. Electricity can be supplied to all standings by overhead or underground cables.



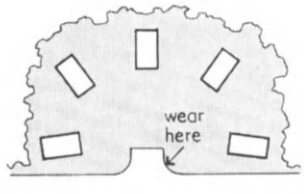
3 *Static caravan pitch*



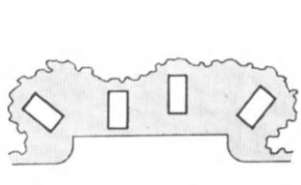
4 *Mobile caravan pitch*



5 *Tent pitch with direct car access*



6a *wrong: narrow entrance suffers wear*



6b *Wide car access prevents wear of grass*

Water supply

3.02 The publication *Caravan parks*[9] recommends water standpipes not more than 18 m from any pitch. This may not be possible on rural sites. In tented areas at lower densities this rule may not apply (see CP 310 : 1952) [14].

Drainage

3.03 Drainage is required from water points and lavatory blocks. Surface water drainage is needed on sites with non-porous surfaces and permanent buildings. Water waste disposal gulleys can be next to standpipe gulleys, but should be separate so that fetching water and disposing of waste water do not conflict.

Sewage disposal

3.04 The Water Resources Act 1963, forbids discharge of untreated effluent into underground strata where water supplies may be affected. In place of main drainage the three most common systems are as follows:

1 Septic tanks: the most common, but detergents and effluent from chemical toilets can kill off the purifying bacteria; must be large enough for peak demand and have good subsoil conditions.

2 Sealed cess pits: depend on efficient emptying service.

3 Continuous chemical process: chemical and mechanical process using non-flush lavatories; useful when water supplies are limited.

Refuse disposal

3.05 Each caravan should have a bin with tight fitting lid. For a tidier site and to facilitate refuse collection, bins can be housed in an enclosure.

Fire precautions

3.06 Fire tenders should have easy access to every caravan, without overhead or ground obstructions. Fire points should be central and easily accessible. Water hydrants or large water tanks (one for every hectare or part thereof) are required by the model standards.

Sanitary facilities

3.07 The Council of Europe report *Camping hygiene* recommends (assuming an average of 2·5 campers per pitch) 10 tap points with basins or conduits (five for males, five for females) per 100 campers; 1 wc per 20 women; 1 wc per 20 men, plus urinals. No pitch should exceed about 9 m from lavatory blocks, except where chemical closets can be used.

4 Colour

4.01 Bright colours—the vivid splashes of blue and orange tents—can be attractive on a small scale, but something more subdued is needed for units such as caravans *en masse*. A fallacy among caravan designers is that green 'matches' the countryside colours. Nature's greens are always muted and broken up by form, texture, light and shade.

4.02 Colours recommended by the ILA research committee are from BS 2660 (1955 range):

Yellow-red group	3–036	3–037	3–038		
Yellow group	4–047	4–048	4–049	4–050	4–051
Green-yellow group	5–059	5–060			
Blue-green group	7–078				
Grey group	9–095	9–099	9–100	9–101	9–103

All these are in the 'earth' range of colours. Colours chosen should tone with backgrounds against which objects are to be seen (ie blue greys on sea or skyline, yellow grey on sand dunes, and so on).

5 Leisure homes

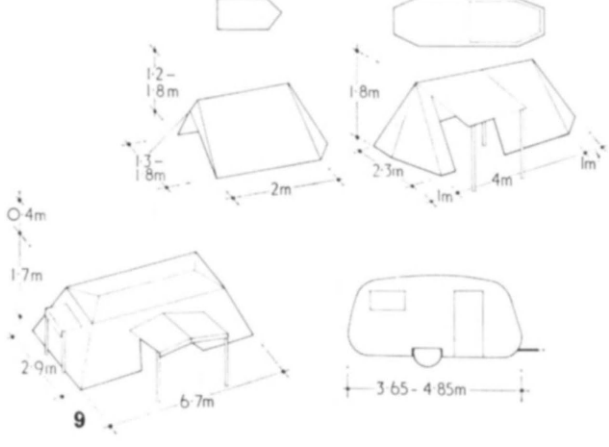
5.01 Weekend homes detract from the community in that they require heavy 'peaking' of utilities without benefiting the locality by supporting communal services such as schools. Holiday homes at least provide seasonal demand. Future trends could be towards complete holiday villages in special recreational areas, incorporating weekend homes and vacation villas in cluster developments with caravans, campsites and waterside homes **7**.

5.02 In England and Wales, summer homes have to conform to Building Regulations for normal houses, which makes costs unrealistic. Only shelter is needed, providing for cooking, eating, sleeping and a place to sit. Normal space and insulation standards do not apply, as much activity takes place outside. Leisure homes give higher

7 *Part of a holiday village in Jamtland, Sweden*

8 *Port Grimaud, southern France, retains a sense of human scale*

9 *Dimensions: Touring caravans—most popular size—* 3·650 *to* 4·850 *m* × 2·00 *to* 2·280 *m*
*Total length car and caravan—*9·750 *m average,* 11 *m maximum*
Static caravans—'mobile homes'—average 12 *to* 15 *m* × 3 *m*
Dormobiles—average 3 *m* × 1·5 *m* × 1·5 *m*
Tents—see sketches



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comfort standards than camping. Until the regulations change mobile homes will have to fill the need (a pair of wheels, however small, gives exemption from regulations.)

Type of leisure homes

5.03 *Chalets, cabins, summerhouses* Basically one room, or one room with sleeping alcove accommodation. These could be treated in much the same way as static caravan sites for 'mobile homes'.

Individual houses, cottages, bungalows Buying up existing property often excludes local inhabitants from the property market. 'Individual' houses tend to develop into a sprawling mass of holiday homes.

Holiday house developments In the past, these have been badly sited, badly planned and sprawling. New developments must be sited with care, compact and integrated into the landscape.

Flats There are many examples in high-amenity urban areas on the French coast **8**.

Open space requirements for holiday homes

5.04 *Urban holiday and recreation area* Flats, holiday houses, chalets, caravan and camping. Requirements are minimal, owing to the many alternative outdoor and indoor recreation facilities available.

Rural holiday and recreation areas. As above; there should be open space all round the development, but the development itself should be kept compact to avoid sprawl and to minimise distance from house to facilities and open space.

Remote individual holiday cottages. Much enjoyment comes merely from living in rural surroundings, providing pleasant enclosures and opp ortunities for activities completely different from urban life. Unfortunately as more people become aware of this, the remote soon becomes unremote and subtopia sets in.

Low-density living has many advantages; how can it be reconciled with the need to conserve open spaces?

6 Legislation

Control

6.01 Caravan sites are controlled under the Caravan Sites and Control of Development Act 1960, which covers licensing and control of sites. Its successor, the Caravan Sites Act 1968, extends its scope and deals mainly with protection of dwellers and provision of facilities for gypsies.

6.02 Caravan operators must obtain planning permission, and a site licence from the local planning authority must be prominently displayed on the site. These are not required if caravans are used in conjunction with dwelling houses, are on the site for less than 28 days in a year and are under the auspices of an approved recreational organisation, or are used in connection with building or agricultural operations or travelling showmen. Local authorities themselves can provide caravan sites.

6.03 Camping sites for tents are controlled under the Public Health Act 1936 and the Town and Country Planning Acts.

Standards for caravan sites

6.04 *Permanent residential caravan sites* Requirements are as follows. Caravans should be at least 6 m apart and not less than 3 m from a carriageway.

Density should not exceed 50 caravans per hectare (considered by many to be much too low).

Roads should be at least 4 m wide (2·7 m for one-way traffic).

Footpaths should be at least 0·7 m wide.

No caravan or toilet block should be over 45 m from a road.

Each caravan should have a hard-standing and refuse bin.

Provision for fire-fighting equipment, water supply, drainage, sanitation and washing facilities are specified.

Lockable covered storage space, at least 2·8 m^2 per caravan, to be provided not less than 4·5 m from any other caravan, but separate from the caravan served.

Properly surfaced parking space for a minimum of one car for three caravan standings is specified. Other spaces, not necessarily surfaced, should bring the provision up to one parking space per caravan.

An area equivalent to one-tenth of the site area to be devoted to recreational purpose.

6.05 *Holiday caravan sites* (sites in regular summer use). Density should not exceed 62 caravans per hectare. Where densities are 30 to the hectare or less, no standing should be more than 5·4 m from a water stand pipe.

Standards of water supply, drainage, washing facilities, paving, footpaths, storage facilities and hardstandings are less stringent than those for residential sites.

References

1 BEAZLEY, E. Designed for recreation. London, 1969. Faber & Faber [083] *Price* £5·00

2 HOOKWAY, R. J. S. Leisure. London, 1970, Countryside Commission. [083(E2p)] *Free*

3 LYNCH, K. Site planning. Cambridge, Massachusetts, 1962, MIT Press [0] *Price* £3·75

4 WILSON, R. Mobility. *Architectural Design*, 1967, May, p217–223 [87]

5 KASPAR, K. Holiday houses. London, 1967, Thames & Hudson. [845] *Price* £5·25

6 CLOUT, H. D. Second homes in France. *Journal of the Town Planning Institute*, 1969, December, p440–443 [845]

7 Second home communities. *Architectural Record*, 1965, November p143–158 [845]

9 MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Caravan parks—location, layout, landscape. 1962, HMSO. [87]

10 NATIONAL CARAVAN COUNCIL. A manual of caravan park development and operation. London, 1970, The council [87] *Price* £2·00

11 CARAVAN CLUB OF GREAT BRITAIN AND IRELAND. Caravans and the English landscape. London, 1957, The club [87]

12 BRITISH TRAVEL ASSOCIATION. Caravan and camping sites 1970. London, 1970, The association [87]

13 Caravan sites and control of development act, 1960, and model standards. HMSO [87(Ajk)]

14 Caravan sites and control of development act, 1960: Twin unit caravans Circ. 17/65. 1965, HMSO

15 Caravan sites and control of development act, 1960: Circ. 49/68, 1968, HMSO

16 NATIONAL CARAVAN COUNCIL/BTA. Report on short-stay conference. London, 1969, The council. £0·25

17 BRITISH STANDARDS INSTITUTION. BS CP 310, 1952, HMSO

Organisations

Camping Club of Great Britain and Ireland, 11 Lower Grosvenor Place, London sw1 (01-828 9235)

Caravan Club, 65 South Molton Street, London w1 (01-629 6441)

The Motor Caravanners' Club Ltd, 22 Chiswick High Road, London w4 (01-994 3158)

The National Caravan Council Ltd, Sackville House, 40 Piccadilly, London w1 (01-734 3681)

The Forestry Commission, 25 Sackville Road, London w1 (01-734 0221)

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Section 7: **Recreation: general**

Water recreation

In this information sheet TIMOTHY COCHRANE *describes the principal sports and pastimes in, on and around water, lists their requirements and illustrates three examples of water sports centres*

1 Introduction

Water in the urban landscape scene

1.01 Though perhaps the greatest magnet in the urban scene and certainly the focal point of much recreation, water is only now beginning to be exploited properly. Use of rivers and canals as bases for linear park systems is growing, while water-based leisure complexes are being formed in the Lee and Colne valleys near London and by the Trent near Nottingham.

Multi-use

1.02 Inland water areas are subject to conflicting demands. On one hand is the day tripper's desire for at least a view of the water, if not for complete access for the increasingly popular participation in water sports. At the same time there is urgent need for more drinking water supplies, and increasing interest in wild life conservation. Multi-use is therefore inevitable and though some incompatibilities arise, they can be lessened by space zoning and time tabling (see tables I and II).

2 Water resources

Tables I and II show suitability and incompatibility of locations for water sport, and **1** shows types of inland water available.

Natural lakes

2.01 England's relatively few lakes have attracted visitors for many years, and areas such as the Lake District are now seriously overcrowded during the holiday season, whereas Scotland and Wales have many remote lakes far from population centres.

Artificial lakes

2.02 Though it is unusual for large lakes to be created for purely recreational use, existing water areas—mostly lagoons in old gravel or clay pits—are enlarged and reshaped as at the National Water Sports centre at Holme Pierrepont, Nottingham **2**.

Enlarged gravel pits

2.03 Appearing rapidly along river valleys, these have great potential, especially in helping to form large new parks such as the Cotswold water park and the Lee Valley and Colne Valley regional parks.

Canal feeder reservoirs

2.04 These reservoirs, which maintain the water level in canals, are usually owned by British Waterways Board, who may not, however, have riparian rights.

Compensation reservoirs

2.05 Most recreational uses are easily accommodated if the water is not to be drunk, eg on Snowdonia's Tryweryn compensation reservoir, which regulates the natural flow of the river.

Supply reservoirs

2.06 There is great variation in the policy of different water boards on permitting the use of reservoirs for recreation. Boards in Gloucestershire, Somerset and Derbyshire have been the most progressive. Usage depends on the water's natural purity and the consequent amount of purification required. Recreational use can obviously be allowed if the water has to be purified, but in highland areas such as

Table I *Compatibility of watersports*

	Fishing	Swimming	Subaqua	Wildfowl	Canoeing	Rowing	Sailing	Waterski-ing	Hydroplaning	Powerboats	Cruising
Fishing		X	X		PZ	PZ	PZ	X	X	X	PZ
Swimming	X			Z		Z	Z	Z	Z		Z
Subaqua	X					PZ	PZ	PZ	PZ	PZ	Z
Wildfowl		Z						X	X	X	
Canoeing	PZ					PZ	PZ	PZ	PZ	PZ	
Rowing	PZ	Z	PZ		PZ		PZ	P	P	P	PZ
Sailing	PZ	Z	PZ		PZ	PZ		PZ	PZ	PZ	Z
Waterski-ing	X	Z	PZ	X	PZ	P	PZ		PZ	PZ	N/A
Hydroplaning	X	Z	PZ	X	PZ	P	PZ	PZ			N/A
Powerboats	X		PZ	X	PZ	P	PZ	PZ	PZ		N/A
Cruising	PZ	Z	Z			PZ	Z	N/A	N/A	N/A	

Key X incompatible; P programming; Z zoning; N/A not applicable

Table II *Areas suitable for watersports*

	Lakes	Canal feeders and compensation reservoirs	Water supply reservoirs	Rivers	Canals	Sea
Fishing	X	X	X	X	X	X
Swimming	X			X		X
Surfing	X					X
Subaqua	X			X		X
Diving	X	X	X	X	X	
Wildfowl	X	X	X	X		X
Canoeing	X	X	X	X	X	X
Sailing	X	X	X	X		X
Waterskiing	X	X				X
Hydroplaning	X	X				
Powerboats	X	X				X
Cruising	X	X		X	X	X

Dartmoor, where water can be taken almost straight for drinking, purification entails considerable extra cost. In any case, additional roads and car parks, buildings, slipways etc are necessary. Water level may fluctuate.
Club membership is usually required for ease of control over fishing, sailing and canoeing. Water ski-ing, bathing and sub-aqua are rarely allowed.

Rivers

2.07 Freshwater rivers are controlled by the appropriate river authorities. Tidal rivers are often controlled by port authorities.
Uses: sailing, canoeing, rowing, cruising **6**. (Though water ski-ing does take place on rivers, it is discouraged as it causes bank erosion.)

Canals

2.08 Canals offer great potential for relieving overcrowding in popular waterways such as the Thames and Norfolk Broads. They could be made to pay by encouraging commercial as well as recreational traffic, and their use as water supply for irrigation and industry and as a permanent water 'grid'.

3 Recreations and their requirements

Sailing

Launching and mooring facilities

3.01 Dinghies need a hard beach or, preferably a slipway down which cars may reverse, allowing boats to be floated off trailers. Width must be enough to take car and trailer safely and allow room for persons helping launching. Slipways should extend to low water mark and are best set back into the bank to avoid obstructing navigation. Dinghies do not require moorings: for temporary tying up during sailing hours a slipway is adequate.
Keel boats need moorings or—particularly to facilitate winter storage and maintenance—some form of lifting device. Mooring must be to a jetty, or if there is considerable change in water level, a floating pontoon which will not foul the boat.

Building, car parks and storage

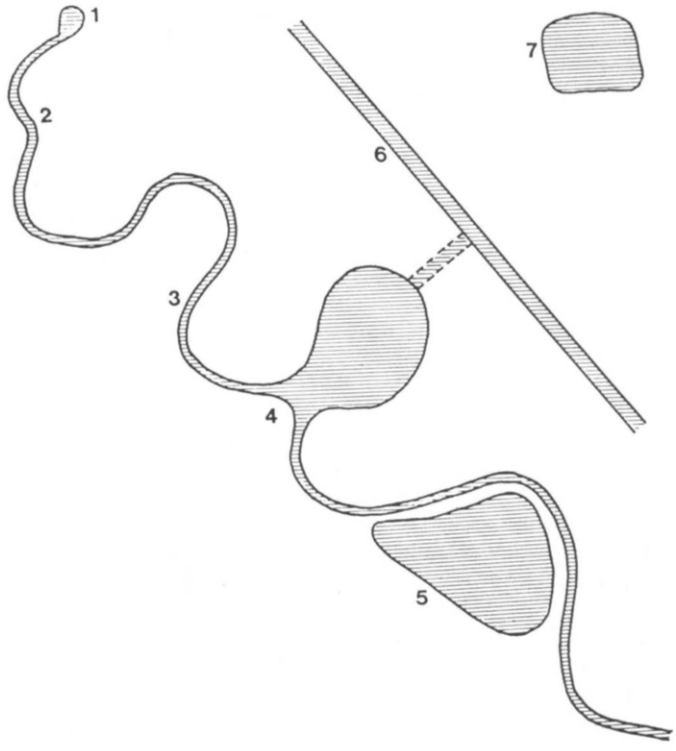
3.02 Lavatories and simple changing and washroom accommodation are essential. Sewage disposal near reservoirs must be into a public sewer or by means of a chemical process.
Parking space is needed for sailors' cars and trailers and for visitors' cars.
Boat storage sheds are advantageous but not essential. A shed and/or trestles is useful for storing spares. A covered store for other small equipment can be incorporated with other buildings.

Water requirements

3.03 *Area:* less than 4 hectares are used for competitive and recreational dinghy sailing, but the Royal Yachting Association recommends a minimum of 6 hectares. Boat density on inland waters may be in the order of one boat to 0·80 hectares, up to one boat to 0·20 hectares.

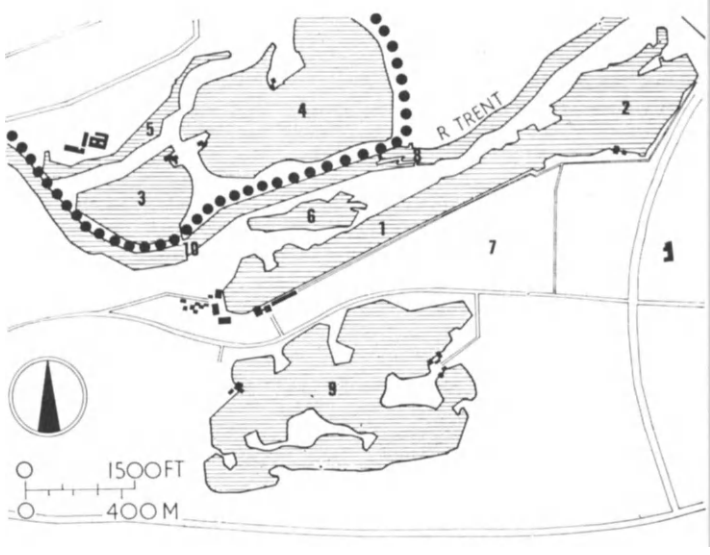
3.04 *Shape* is not very critical but the minimum area must not include small bays. A bank consisting of long smooth curves or straights is desirable. Islands are acceptable if they are at least 46 m from the bank.

3.05 *Depth* of water should be at least 1·50 m: 1·80 m is preferable. Shallows must conform to the same conditions as islands.



1 *Inland water recreation: potential sites*

Key:
1 Source of river: beauty spot, pool
2 Young river: brooks, rapids and waterfalls; footpaths, ponytrails, picnicking; basis for small country parks
3 River's middle reaches, meandering, wide, slow-flowing river; fishing and sailing; footpaths, pony trails
4 Lakes: all aspects of water sport; country parks
5 Former mineral workings, eg gravel pits: can be flooded and set aside for water recreation
6 Canals: linkage to river valley complex allows long distance tours, fishing, canoeing etc
7 Small lakes and pits: fishing, bird watching etc



Key:
1 Rowing course
2 Water ski area
3 Colwick marina
4 Sailing lagoon
5 Pleasure boating
6 Nature reserve
7 Open space
8 Canoe slalom at Holme Locke
9 Public sailing and boating
10 Waterbus terminal

2 *National water sports centre, Holme Pierrepont, Nottingham*
Colwick Marina is within Nottingham city (boundary shown by large dots)

Rowing

Launching and mooring

3.06 Launching is by ramp or steps. Landing stage: 18 m long for sideways launching of 'eights'; if necessary, with ramp and pulleys for hauling up narrow frontage.

Buildings, car parks and storage

3.07 Clubhouse should be preferably in bay or sheltered inlet away from traffic.

Training

3.08 Training can take place in a rowing tank (12·6 m × 7·6 m for one 'eight'). As shells are easily damaged by obstructions and swamping by other craft, water must be sheltered. If also used by power boats, water areas must be zoned or subject to time tables.

Water requirements

3.09 Amateur Racing Association club competition standards require a stretch of water 1500 m long, not less than 1·83 m deep and 50 m wide (four lanes).

National and regional competitions (FISA* Standard C course) require 2000 m length, at least 50 m wide (four lanes) and 1·83 m deep.

Olympic or FISA men's championship course: 2000 m long, plus 100 m beyond the finish, 75 m wide (six lanes) plus 5 m between outside lanes and bank; not less than 3 m deep.

Canoeing (general)

Launching, mooring and buildings

3.10 Canoes can be launched almost anywhere, but a landing stage is useful. In addition, canoeists need a boat store and clubhouse.

Canoe touring

3.11 Water 0·23 m deep and 0·60 m to 0·90 m wide provides a possible route. Camping sites with portage facilities will be needed along waterways.

'White water' canoeing

3.12 The correct conditions and unrestricted passage are required.

Canoe racing

3.13 The international distances for competition sprint canoeing are 500 m, 1000 m and 10 000 m. A 1000 m straight course minimum depth 2 m and 45 m wide (six abreast) is required.

Canoe slalom

3.14 This takes place on fast flowing, turbulent water, There are penalties for any divergencies from the straight course.

The course should be not more than 800 m long measured through the gates. It may extend several hundred metres down a river, or take a more serpentine route in the restricted turbulent water below a weir. In the case of a hill river course it is a great advantage, even a necessity, if the river flow can be controlled by manipulating sluices at a reservoir higher up the valley.

Sea canoeing

3.15 *Surf canoeing* takes place in surfing areas. Beaches may have to be zoned for safety reasons.

Canoe touring usually takes place in sheltered coastal areas. Ease of transport allows club hqs to be sited some distance away from water, but accommodation for changing clothes nearby is an obvious advantage.

*Federation internationale des sociétés d'aviron

Water ski-ing

Launching, mooring and buildings

3.16 Moorings and storage space for boats; clubhouse, ramp or hard beach, with jetties for dry starts.

Water requirements

3.17 As calm water is required, no designated area should be close to vertical or concrete banks which tend to build up a rebound wash. For this reason the sea does not provide the conditions necessary for competitions. Jumps and a permanent slalom course may need to be maintained. Zoning of water is important. Minimum dimensions of water for establishing a slalom course are 640 m × 182 m but 823 m × 1097 m to give greater clearance for turning and accurate speed approaches. A jump and figures course can be incorporated within a slalom course.

Powerboating and hydroplaning

3.18 Launching and mooring requirements on inland waters are as for sailing dinghies.

Larger power boats need the same facilities as keel boats. Boats can be stored outside under their own covers but engines need a lockable storage room. Fuel storage space is required. Lavatories, changing and first aid facilities are necessary and a clubhouse is desirable.

Car parking should include provision for spectators.

Water requirements

3.19 Minimum area of inland water required is 6 hectares. A large bay in a lake is desirable for 'pits'. Shape requirements of a water area are similar to those for dinghy sailing. Minimum water depth 0·92 m. Water must be weed free.

Cruising

Estuaries and inland waters

3.20 Cruisers require moorings as a basic minimum. Also needed, to a greater or lesser extent, are: boat storage, repair facilities (with lifting equipment), fuel supply, chemical wc disposal points.

Possible additional facilities: changing accommodation, lavatories, shops, restaurants, bars and car parking.

Moorings

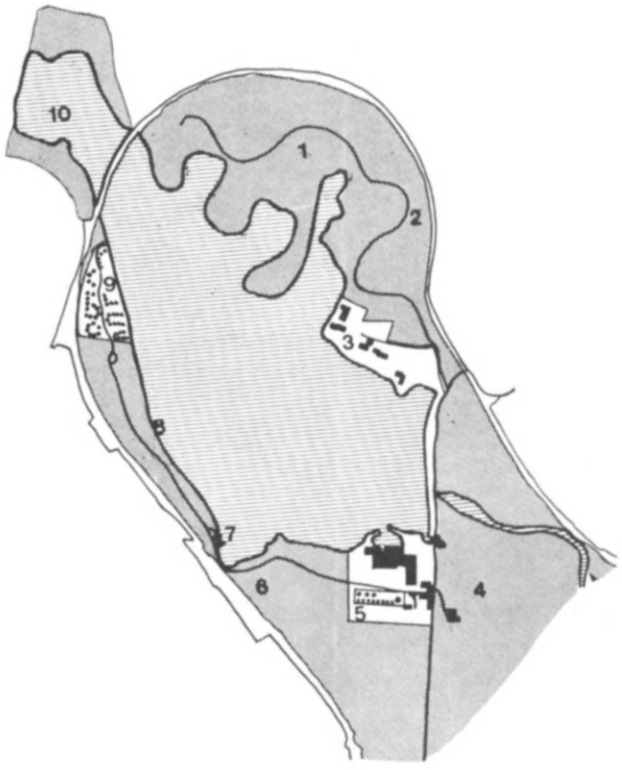
3.21 Because of great demand—particularly in south-east England—moorings are scarce and expensive.

As traditional swinging moorings take up too much space, more compact methods must be used: either mooring alongside a jetty two abreast or mooring stern-on to a jetty with bows onto piles **5**. (These are the types provided by modern marinas.)

Marinas

3.22 Originally a US term, in Britain 'marina' means an artificial yacht harbour **4, 5**. It is essentially an inward looking place facing the water activities. Though completely different in character from traditional yacht harbours, marinas provide the same facilities. Sites may be: estuaries—locked harbour basin or tidal basin (with tidal pontoons); estuaries and inland—'haul out marina' (this is cheaper, with boats stacked in boat parks on land and launched by ramp, trailer or crane); inland—non-tidal marina (on inland waters or canals).

Owing to the short season, marinas in Britain risk financial difficulties unless they provide 'pleasureland' facilities to attract vast numbers all the year. (The furore caused by the



3 *Chasewater recreation area, Cannock, Staffordshire: nucleus is former canal reservoir among reclaimed waste land*

Key:

1 Parkland area
2 Forest Park
3 Boating and sailing centre
4 Golf course
5 South shore pleasure precinct
6 Pitch and putt golf course
7 Power boat club
8 West lakeside
9 Chalet group
10 North pool
Note: dot tone indicates woods and parkland

4

5

4 *A large marina with full facilities for cruising boats and ample car parking.* **5** *shows a similar scene at eye level, with floating pontoons, locating piles, mooring bollards and overhead services. Installations on this scale need sensitive and strong handling if they are to be integrated with the landscape*

Brighton marina proposals is not over the harbour but the developments and access roads necessary.)
In addition to sport facilities the following may also be needed (see references 2, 8 and 9): water, electricity and telephones to each mooring; fire precautions; harbourmaster's office; sleeping accommodation; provision for children.

Bird clubs

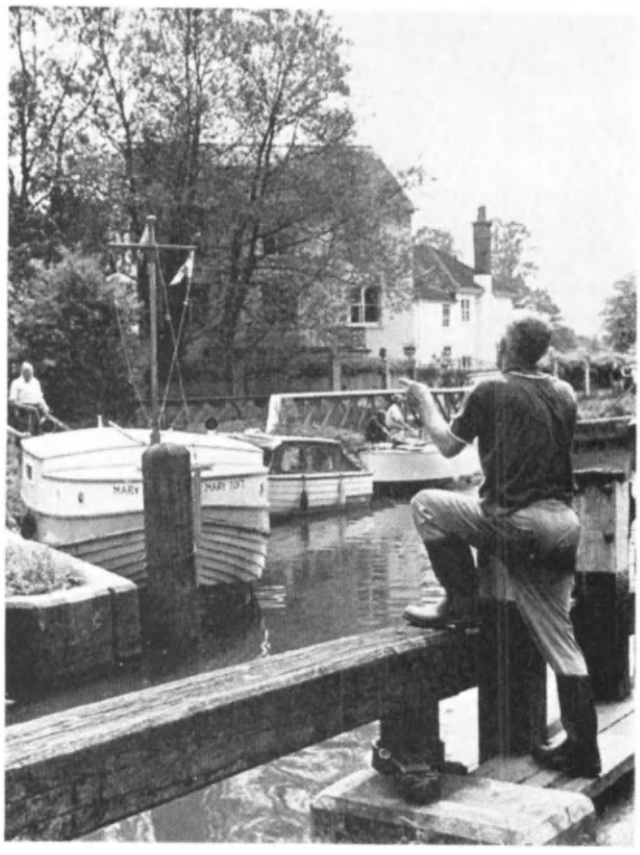
3.23 Location (dictated by bird habits) is usually by 'natural' waters but some examples are by reservoirs. Specialised requirements: 'hides', and freedom from disturbance, therefore bird clubs are compatible only with angling and possibly sailing.
Slimbridge Wildfowl Trust runs 'pop' versions, more like zoos, in Gloucestershire and Northamptonshire.

Angling

3.24 Angling is about the most popular water sport. Its varied facets allow it to be practised almost anywhere, but zoning is important. It is best restricted to banks on one side only, leaving large free areas for fish. Water disturbance by violent sports may drive fish into the free zones.

Swimming

Pools
For detailed design criteria of indoor pools, see AJ design guides.[21, 22] The following notes will cover only those basic to *outdoor* pools.



6 *The Wey at Godalming has the informal intimacy of the old river navigation system*

Outdoor pools

3.25 *Large pools:* Local authorities build few outdoor pools, though there are instances of recreational centres having both indoor and outdoor pools.

Small pools can be considered for caravan and camp sites, rural recreational areas, small recreational centres, schools, gardens.

Siting and design

3.26 Pools are best integrated with buildings or other hard elements. They can then be designed as part of the hard landscape. If freestanding, exceptional care is needed in siting and design. A would-be naturalistic pool will look alien in soft landscape, particularly for at least six months of the year, when it is not used.

Locate for maximum sunlight and privacy, screened from north and east winds and away from heavy shade trees and those with large roots (leaf-fall makes the water dirty). Check for soil bearing capacity. 'Cut and fill' should roughly balance, but use excess as banking for wind protection, or provide bleachers for spectators and sunbathers. Access is needed for bathers and cleaning equipment.

Construction and finishes

3.27 Construction and finishes may be of concrete block (maximum depth 1·14 m), brick, reinforced concrete and sprayed concrete construction, usually rendered and painted annually with cement paint or chlorinated rubber paint but marble chippings can be added to rendering to obviate painting. Other finishes: mosaic, tile or cement glaze.

Other materials: sprayed concrete, grp in one unit up to about 10·7 m × 4·25 m × 1·07 m to 2·3 m deep; flexible liner (usually vinyl) on framing—or as liner to concrete pool. (Flexible liner has a five-year life but is cheap to replace.)

Keep surrounds clear, with non-slip paving at least 1 m wide (3 m for public use), draining away from the pool. Surrounds may be stone, precast concrete slabs, bricks, mosaic, terrazzo or granolithic with carborundum finish. Asphalt, tiles and smooth cement are not recommended. A white lining to the pool gives the water a blue colour through reflection from the sky; cream is said to give a warmer and less chilly blue, while a darker colour makes the water warmer.

Planting

3.28 Planting near the pool softens glare. An adjacent pool for growing water plants can be incorporated. Planting, which must be at least 1 m back from the water, can be in raised beds, especially if it is of herbaceous or bedding types. Preferably use plants which drop no leaves during the bathing season—or evergreens which do not drop leaves so thickly.

Covers

3.29 Removable roofs are helpful in this climate. There are three types: blow-up structures, tents, and sliding transparent covers.

Filtration

3.30 Filtration is now much cheaper and more compact because of the use of diatomite filters. This is preferable to periodic emptying of pools or provision of complete water change after six hours. (Check that an outlet to sewers or ditch etc is available.)

Heating

3.31 Heating is either by conventional fuels (gas, oil or offpeak electricity) or solar heating batteries. It is usual to design for pool temperature to rise by about 4 deg °C from 10°C. Heating by poolside radiant heaters—overhead or embedded in paving—supplemented by wind screening extends the length of comfort season by the pool.

Furniture and equipment

3.32 Check for safety of equipment such as diving boards, especially in relation to pool depth. Access steps are necessary. Bridges, platforms for sitting in or over the water can make small pools more interesting. Locate seating (fixed or movable) around the pool. Sunbathing areas require shelter from prevailing winds. Though grass is obviously the best surface, in intensive situations pea shingle or hard surfaces can be covered with coir matting.

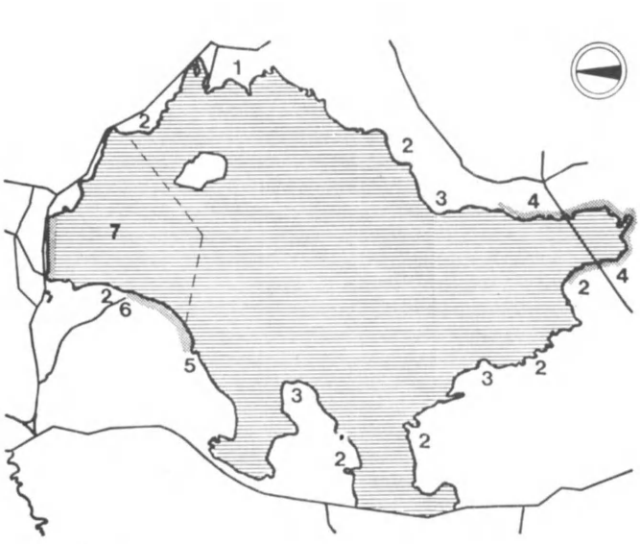
Size and cost of pools

3.33 For price guide to large public pools for general public, clubs and championship use, see AJ guides to indoor pools[21]. Private pools can be any size, depending on budget. Price for supply and construction complete with filtration plant but not surrounding buildings, range from about £150 for a 5 m × 2·7 m × 900 mm deep timber framed, vinyl lined, surface installation, through about £1500 for a pool 9·75 m × 5 m × 1 m to 2 m deep (minimum necessary to dive from 760 mm above pool).

For larger open air pools, see costs in MHLG *Design bulletin* 9 (1965) eg £8000 for a pool 25 m × 12·5 m × 1 m to 3·8 m deep.

Inland water

3.34 Suitability for swimming depends on pollution, obstructions and other uses to which the water is put. Where necessary, lakes etc can be treated to make them bacteriologically safe, eg by chlorination as at the Serpentine lido.



7 *Chew Valley lake (ten miles south of Bristol) Scale* 1:20 000

Key:
1 Picnic site
2 Entrance, parking and lavatories
3 Bird-watching hides
4 Nature reserve
5 Fishing hq entrance
6 Sailing clubhouse
7 Sailing area (summer)

Note: areas of dot tone at water edge indicate where fishing from banks is prohibited

Sea

3.35 Conflicts with other water users may arise and where conditions are dangerous it is necessary to construct safe bathing areas ie tidal pools. The popularity of seaside swimming pools show that even at the seaside, many people prefer to swim in pools. Miami's hotels provide the outstanding example of this trend.

Changing accommodation, lavatories and car parks are needed in popular areas with existing development.

Underwater swimming or sub aqua

3.36 Depth is the most important dimension; both shallow and deep water are required. Surface area is relatively unimportant.

The sea is preferred for most activities but spear fishing is now allowed in inland water. Most divers work from the shore but are increasingly using boats to reach interesting areas: they need a launching slipway or beach. Rock coasts provide good depth and good visibility.

Powerboats and water skiers are a danger to underwater swimmers. Safety is obviously important. A code of practice for underwater swimmers published by the Ministry of Agriculture, Fisheries and Food is designed to ensure that divers do not interfere with fishing interests.

Clubhouse and storage facilities for equipment are desirable.

Surf life-saving

3.37 In areas with suitable wave conditions surfing is a rapidly growing sport. The surfing clubs which have arisen provide voluntary life-saving patrols—an important development in water safety. Additional beach base accommodation will be required to house their equipment. Casual surfers predominate, but competitions to national standards take place. Water zoning is important for the safety of bathers and surfers.

4 Case studies

Holme Pierrepont water sports centre and Colwick marina,

4.01 This 240 hectare water sports centre and country par is being formed from gravel workings by the Trent **2** east of Nottingham. Banks will have a 1 : 3 slope with 2 m wide vegetational *berms** 1 m below water. Piling is required at

*Berm: a narrow shelf, path or ledge.

starts, grandstands and jetties. On this flat flood plain, tree planting is necessary as windbreak, although restricted by flood conditions. Research was made into wind and water turbulence and flood control. See references [14, 15].

Facilities (zoned)

4.02 Differing uses are segregated by area; eg water training, leisure, children's play, schools use, through to international standards. The following facilities are provided: rowing and canoeing to international standards; water ski-ing to national standards; picnicking, camping and pony trails; sailing.

Chasewater water recreation centre

4.03 This is an old canal reservoir of 90 hectares near Cannock, Staffs, among waste land reclaimed for a water park **3**. Work started in 1956.

Facilities

4.04 Area zoning:

1 'Pop' area at south end: funfair, children's play, trampolines and go-karting.

2 Power boat club to south-west.

3 Sailing centre on eastern shore: sailing is unrestricted, except during power boat events.

4 Sub-aqua to south-east.

5 Water ski-ing in northern lake.

6 Angling.

The original 1959 development plan, not fully carried out, is being recast to provide more intensive year-round facilities to serve the Midlands conurbation. Even as now planned, new development will run at a slight loss.

Chew Valley lake

4.05 The lake **7** is an impounding reservoir belonging to Bristol Waterworks Company, pioneers in multi-use of reservoirs. Construction began in 1956. Profits are not aimed at. Facilities are intended to be self-supporting.

Facilities

4.06 (All activities are zoned)

Flyfishing from bank or boat is allowed everywhere except from April to October in the areas of sailing clubs, beach and nature reserve. (As coarse fishing requires ground bait it is not suitable for water supply reservoirs.) Adjacent fish hatcheries supply 40 000 trout per year.

Sailing: Space and time zoning: 80 hectares four days a week in summer; 240 hectares four days a week in winter.

Nature conservation: Nature reserve at south end. Three birdwatching hides.

Picnicking

There are numerous car parks and ample lavatory accommodation, to minimise pollution.

5 Water areas

Outline constructional notes

Any area of water over 24 200 m^3 (5 m gall.) stored *above* ground level must be designed a qualified civil engineer (*Safety Provisions of Reservoirs Act* 1930).

5.01 Types of water

Surface water: From rivers and streams and surface drainage. Normally fertile.

Ground water: taken from below water level by boreholes etc. Geological advice from Water Resources Board.

Public supply: clean and infertile.

5.02 Types of pool or lake

Seepage reservoirs or pools

Only possible in area of high water table. Earth is dug away to expose it (eg wet gravel pit).

Impounding reservoirs

Increasingly used for flood control and therefore form an excellent excuse for providing recreational waters. May be either

Off-stream pools fed by channel from running water source, or

On-stream pools formed by dam across stream or river. Pools of this type are usually more expensive than the on-stream type but should look more natural—apart from the dam itself.

For dams and embankments earth is obviously most economic material unless engineering considerations dictate concrete. Especially suitable for recreational use where surface area, rather than volume, is important.

5.03 Types of water retention

Natural

Trial holes are needed to test holding capacity. Note that if the inlet water carries sediment it may form its own seal.

Artificial waterproofing

Sheet lining: Pvc, also called vinyl, is cheapest method, but life expectation is as yet unknown. 500 gauge (0·127 mm) is the minimum recommended for most work, but 1000 gauge (0·254 mm) and even the newer 1500 gauge (0·381 mm) are now being increasingly used. Black pvc resists sunlight better. In any case pvc should ideally always be covered with 300 mm of water or soil.

Butyl rubber. Usually about 760μ (·030in) thick. Is more expensive but does not need cover.

Reinforced bituminous 12 mm thick. Claimed to have a 20-year life and is easily repairable.

Soil treatment. The clay puddling of old times is now little used except where the right clay is available on the spot.

Cut-off method. An impermeable barrier is made round the reservoir and extends down to an impermeable layer. Clay is used in the simplest versions; bentonite is a more sophisticated material.

Edge details are vital and must be simply treated. Natural edges may be formed by using types of grass which tolerate changing water levels, or boulders, shingle or mud, while sand beaches for bathing can be graded up to 1: 10. For economy and easy maintenance strip of sand should be between 3 m and 6 m wide.

Erosion may be caused by waves, waterfowl or people. Wave height can be calculated as:

Wave height = $0{\cdot}025\sqrt{}$ max length of water surface

Stone pitching (rip-rap) is often used to protect banks from waves. It must be detailed with a concave curve levelling off at the water, and its upper edge should not stand proud of the ground at the top of the bank.

People and waterfowl (particularly ducks) are both destructive to edges. Access to water edge must be controlled and hard edges provided, with jetties or other access points. Concrete edges may be vertical or sloped to look natural. Timber edges may be formed with small piles.

Piles when larger may be of steel, concrete or timber (campshedding), which last is usually to protect other materials from boats.

References

1 ARVILL, R. Man and environment, chapters 8 and 9. Harmondsworth, 1967, Penguin Books [(E6)] £0·53

2 BEAZLEY, E. Designed for recreation, chapters 13 to 15. London, 1969, Faber & Faber [083] £5·00

3 INSTITUTE OF LANDSCAPE ARCHITECTS. Lancaster conference on land and water. London, 1969 [08]. *Available only in the institute's library*

4 Water and planning. *Town and Country Planning*, special issue June 1966 [06:13]

5 CENTRAL COUNCIL FOR PHYSICAL RECREATION. Inland waters and recreation (survey of west Midlands) London, 1964, the association [083] £0·38

6 INLAND WATERWAYS ASSOCIATION. The way ahead for the amenity waterways. London, 1967, the association [06:13] £0·13

7 GREATER LONDON COUNCIL. London's canal. London, 1969, The council [132] £0·30

8 CHANEY, C. A. Marinas, New York, 1961, National Association of Engine and Boat Manufacturers (US), second edition [566] £3·00

9 NATIONAL YACHT HARBOUR ASSOCIATION. Yacht harbour guide. London, 1963, Ship and boat builders' national federation [566] £1·05

10 INSTITUTION OF WATER ENGINEERS. Recreational use of waterworks. London, 1963, the institution [171 (E2p)] *o/p*

11 DEPARTMENT OF EDUCATION AND SCIENCE/MINISTRY OF LAND AND NATURAL RESOURCES. Joint circular: Use of reservoirs and gather grounds for recreation. 1966, HMSO [083]

12 MINISTRY OF AGRICULTURE, FISHERIES AND FOOD. Code of practice for underwater swimmers. 1967, HMSO [54 (Ajr)] *Free*

13 NOTTINGHAM CITY COUNCIL PLANNING DEPARTMENT. Colwick Park, Nottingham. Nottingham, 1967, the council [087] £0·30

14 NOTTINGHAMSHIRE COUNTY COUNCIL PLANNING DEPARTMENT. Holme Pierrepont, National Water Sports Centre. Nottingham, 1969, the council [566] £0·70

15 GLOUCESTERSHIRE COUNTY COUNCIL PLANNING DEPARTMENT. Cotswold Water Park draft report. Gloucester, 1969, the council [087] £0·83

16 BEAZLEY, E. The private pool. *Architectural Review*, 1965, May (p343–350) [54]

17 SUNSET BOOKS. Swimming pools. California, 1969, Lane Book Co [54]

18 *Swimming Pool Review* (quarterly journal). Guildford, 1959, Clarke & Hunter [54]

19 CEMENT AND CONCRETE ASSOCIATION. Building bulletin 28 Design and construction of small reinforced concrete swimming pools. London, 1966, the association [54 Yq (A3)]

20 AJ design guide, technical studies and information sheets. SWIMMING BATH BUILDINGS, AJ 14.6.67, 5.7.67 and 26.7.67 [54 (A3)]

21 AJ briefing guide, technical studies and information sheets. INDOOR SWIMMING BATH SPACES, FIXTURES AND EQUIPMENT AJ 21.10.64 to 25.11.64 [541 (A3)]

22 SLIWA, J. A. and FAIRWEATHER, L. AJ metric handbook, third edition. London, 1970, Architectural Press [F7] £2·00

23 COUNTRYSIDE COMMISSION. Coastal recreation and holidays. 1969, HMSO. £1.05

24 Water for irrigation. MAFF bulletin 202. 1967, HMSO £0·45

Information sheet Landscape 21

Section 7: **Recreation: general**

Children's play

In his final sheet in this section, TIMOTHY COCHRANE *analyses the concept of children's play and outlines the requirements of various age groups at play. See also information sheet* LANDSCAPE 27 *for additional notes on children's play in housing*

1 Introduction

1.01 In the last few years the concept of children's play has developed rapidly as more is learnt about children's real needs. Now it is realised that children cannot just be shoved into tidy little 'play areas' and told to play. A hierarchy of spaces is required, with play spaces at the nodes of the circulatory system becoming children's social centres in the way that shops and pubs are adults' meeting points **1**. New networks must be planned carefully to replace former play areas based on streets with all their attendant dangers, and architects will need to work closely with psychologists in exploring this field. Architects must look more carefully into their own motivations of design for children's play, to ensure that their designs do cater for the child's needs and are not just an excuse for indulging in 'meaningful' sculpture.

2 Why children play

2.01 Play is an essential part of a child's development and learning process. The following phases of development have been suggested by Jean Piaget of the Rousseau Institute.

Nursery school: 3 to 5 years old

2.02 *Birth to 18–24 months old: sensorimotor phase*
Learns to co-ordinate bodily reflexes. Age of 'practice play'. Repetitive actions as he discovers sensation of causing events.

18–24 months to 4 years old: preconceptual phase
'Symbolic play' or 'make-believe'; equivalent of adult day-dreaming. Still wrapped up in himself—individual play. 2½–3 years old: shift from individual to group play.

Primary school: 5 to 11 years old

2.03 *4 to 7–8 years old: intuitive phase*
No logic as yet. Relies on his intuition—constant questioning to form basis for logic. Socialises more, a transitional phase from fantasy to reality.
7–8 to 12 years old: Concrete operations phase.
Begins to understand concepts. Intense interest in games with rules—period of developing group activity and team efforts. Needs to satisfy at first hand his curiosity about things generally.

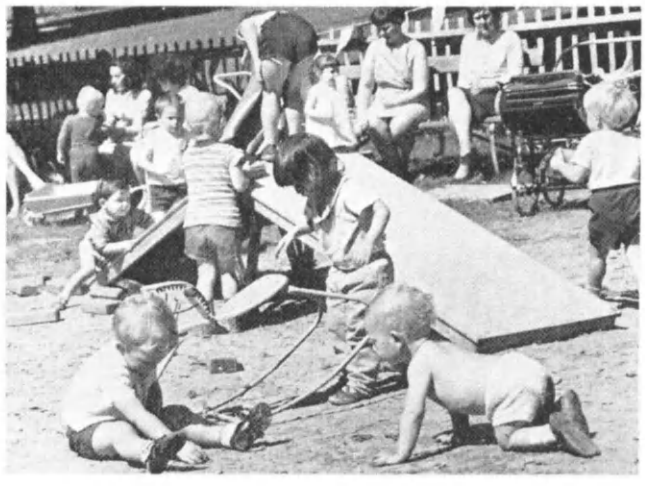
Secondary school: 11 years +

2.04 *11–12 to 15–16 years old: formal operations phase*
Adolescence—can now formulate theories to test against reality. Intense interest in regulations for their own sake.

2.05 Children's play includes:
Fantasy and flights of imagination: needs areas for exploration, with mounds and changes of level.
Imitation of adult behaviour and customs from mimicry to establishment of scaled down adult community.
Adventure: 'cowboys and indians', space exploration, battles, climbing and building.
Physical development and co-ordination: equipment is

1 *Incidental and informal play space on a pedestrian route at Winstanley Road, Battersea*

2 *Young children can play in safety watched by their mothers, at this 'one o'clock club' at Telegraph Hill, London*



needed to develop co-ordination of eye and muscle, on team, group or individual basis.

3 Requirements for 2 to 5 year olds

3.01 *Function:* meeting point for children and mothers, which should be partly enclosed with seats for mothers and space for prams **2**.

3.02 *Location:* site in sheltered locations, facing south, with some shade and enclosure where it will not attract teenagers at night. (Segregation from school age children essential.) Stimulating and imaginative landscaping required with use of levels in form of hills and mounds. Maximum walking distance about 150 m from home.

3.03 *Size:* Ball games space should be small to deter teenage children (15 m × 25 m).

3.04 Unsupervised play spaces should include:
hard surface for wheeled toys, with low walls and steps for balancing and jumping;
undulating grass areas;
rough ground or sand for digging;
shallow water for boats and toys;
semi-open shelters with seats for mothers;
climbing equipment.

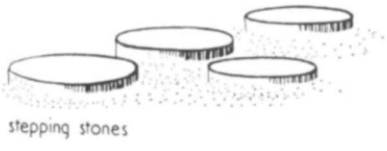
3.05 Additional equipment for supervised play spaces:
paddling pool;
blocks, constructional toys or simple materials for imaginative play;
wendy houses, wigwam tent;
paint, dough, paper and other constructive play equipment;
lock-up store and wc.

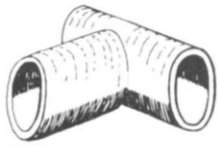
Types of toddlers' playgroup

3.06 One o'clock clubs: special schemes run by the GLC in play parks—mothers meet and talk while the children are looked after.
National Association of Pre-school Playgroups: aim to provide relaxed environments for creative and individual play. Indoor and outdoor facilities (one lavatory to 10 children and ideally a staff/child ratio of 1 : 8).
Save the Children Fund playgroups run in areas of particularly poor housing or high flats. Indoor and outdoor spaces.

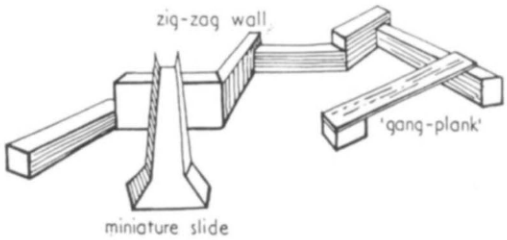
4 Requirements for 5 to 11 year olds—primary school groups

4.01 Types include supervised play parks, adventure-playgrounds, and equipped playgrounds (usually unsupervised). Imaginative layout and landscaping is essential. They should be sheltered from wind and facing south, with some

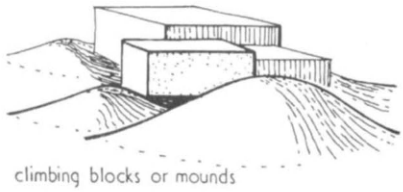

stepping stones


simple crawl-tunnels


climbing logs



miniature slide


climbing blocks or mounds

simple, imaginative items are desirable for toddlers

no climbing piece should be more than 2' high - most should be less


scramble rocks


twisty, hard-surfaced paths make good kiddy-car or tricycle tracks

3 *Facilities for 2-5 year olds (toddlers). No mechanical equipment is needed for toddlers, but what is desirable is simple imaginative ideas like those shown above. Small sandpits could also be provided, but only where they can be overseen by adults and be adequately maintained.*

shade. Noise should be diverted away from residents. Wc to be nearby. Site should be subdivided for different activities.

Play park or comprehensive playground

4.02 A relatively new type of park, developed in Scandinavia, in Canada and the US and in this country by the GLC.

4.03 *Function:* to cater for children of all age groups up to 18 in an informal and permissive atmosphere. In London they are often sited next to old fashioned 'equipped' playgrounds giving access to their lavatories and shelters. *Subdivisions:* adventure play (see para 4.06); quiet areas (play acting, artistic activities, quiet games); formal games (tennis and other ball games, sometimes separated for boys and girls); equipped playground, where not attached to one; 'tot-lots' (separate provision, often with shelter, which serves as shelter for play park); old people's rest areas (also important in play parks). Leadership and supervision are essential to this type of park **4**.

4.04 *Location:* as a local amenity, it should act as the centre of a neighbourhood. Popularity and usage depends on walking distances with an optimum of 300 m (400 m maximum). Nearby schools and shops give vitality.

4.04 *Size:* 15 000 m² is adequate. If larger it can be more 'park like' with increased grass areas; if less, it is necessary to separate outdoor 'rooms' for rich variety of activities.

Adventure playgrounds

4.06 The first adventure playground by C. Th. Sorenson opened in Denmark in 1943. It is noisy, unsightly but successful in inculcating development of character in children **5**.

4.07 *Functions:* to cater for children's natural preference for play on building sites to that in a 'proper' playground. Activities—building huts, forts, caves etc; firemaking and cooking; tree climbing and swinging; digging; camping etc; team and group games and also voluntary services to the community. Supervision and leadership essential.

4.08 *Location:* can be independent, or part of play park.

4.09 *Size:* 10 000 m² if a separate entity or 15 000 m² if part of a properly set out play park, as play is spread among the other sections.

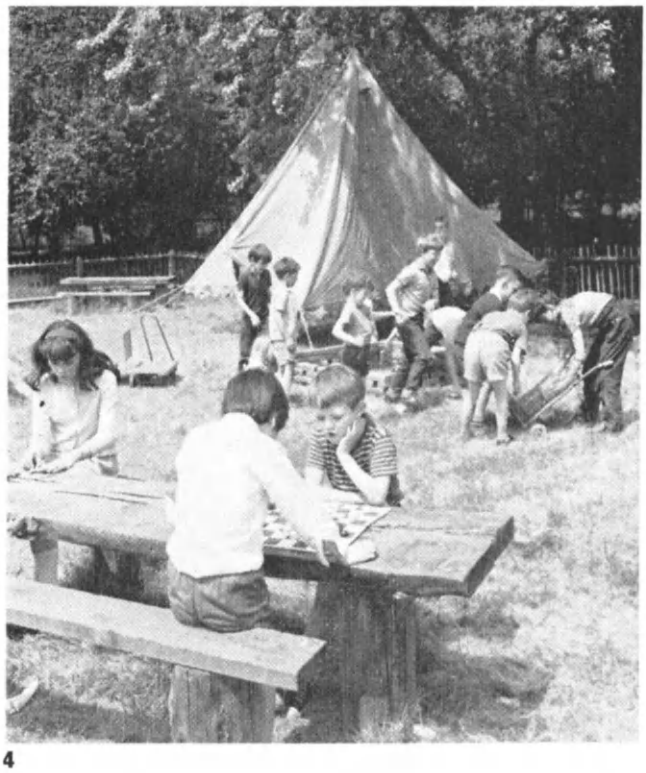
4.10 Layout area should be split into smaller units for wind protection and sense of identity or scale. External framework, either by mounding or by walls and fences, is essential to enclose children from the outside world.

4.11 *Equipment:* Play hut or building with lavatories etc and playleader's office with lock-up storage. Building materials and tools; materials for dressing-up, acting, painting etc; games equipment ie table tennis, record player.

Equipped playgrounds without leadership

4.12 Most existing playspaces of this type are unimaginative flat tarmacadamed areas. This has led to a reaction away from them to fully fledged adventure playgrounds. Even so, equipped playgrounds with their swings, roundabouts, and slides are still an essential concomitant of the children's play scene **7**.

4.13 *Equipment: Swings, roundabouts and slides;* these provide for movement, exhilaration and a feeling of danger. Slides should be placed on a slope or mound.



4

5

4 *Space to sit quietly and play chess, or build with bricks, at Peckham Rye playpark, London*
5 *Adventure play in full swing; Notting Hill adventure playground, London*
6 *Natural play area, Holland Park*

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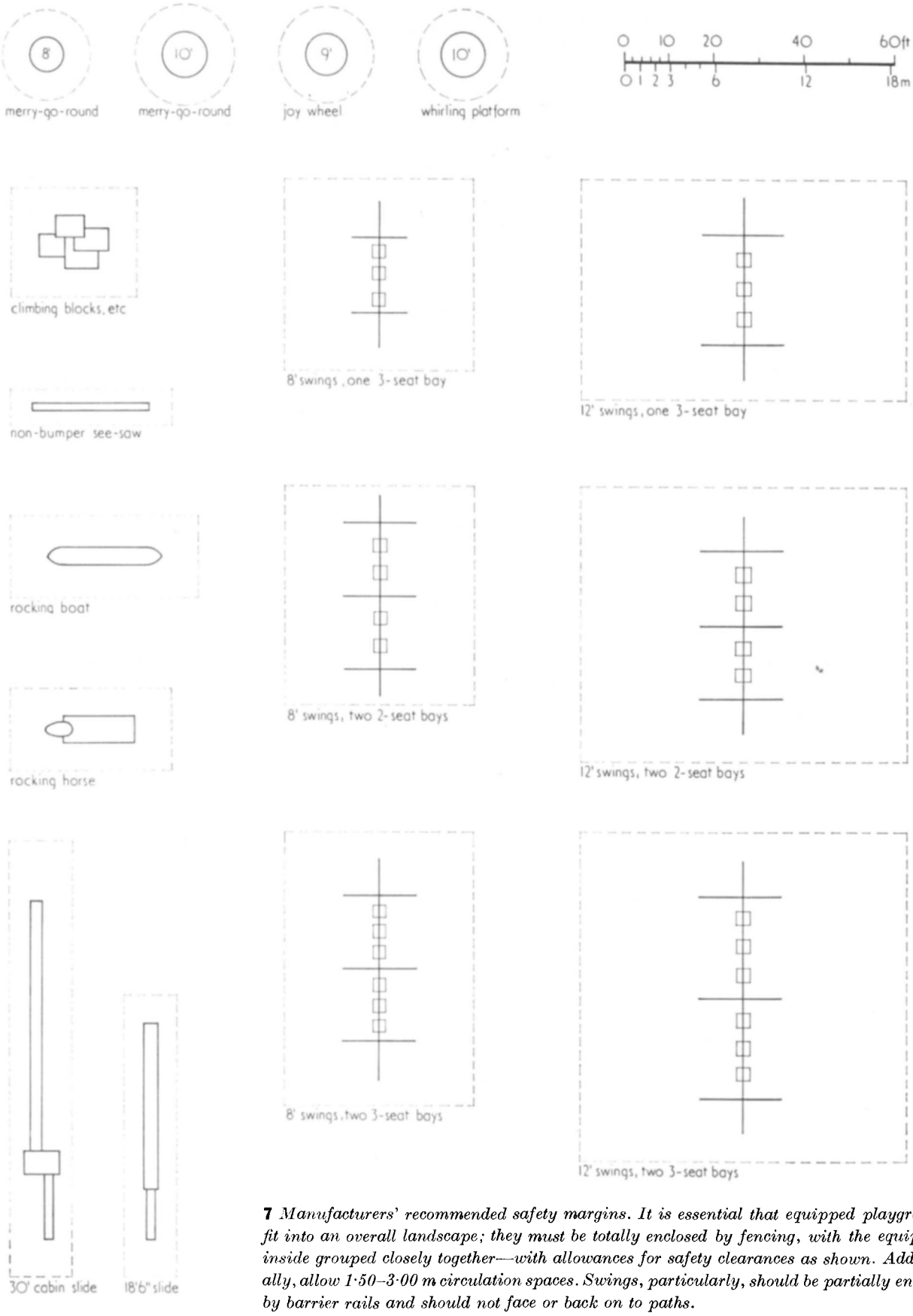


7 *Manufacturers' recommended safety margins. It is essential that equipped playgrounds fit into an overall landscape; they must be totally enclosed by fencing, with the equipment inside grouped closely together—with allowances for safety clearances as shown. Additionally, allow 1·50–3·00 m circulation spaces. Swings, particularly, should be partially enclosed by barrier rails and should not face or back on to paths.*

Single swing bars: these can be useful especially if dispersed round site.

Large hill or mound: uneven contours are best, with rugged and deeply indented outline. Turf should be used unless exceptionally intensive use. South-facing indentations will accommodate many small scale separated activities. Commando bridges useful between mounds.

Shelter and benches

Static equipment: limited use of play sculptures and pipe frame constructions can contribute to children's play. Play sculpture is best integrated with street furniture.

4.14 *Free play area:* Walls, hard surfaces or grass can be incorporated in a separate 'free play' area which could include a 10 m × 18 m pitch.

Walls: A wall of height 2·25 m can be used as a knock-up wall area for ball games and also as an irregular area for climbing.
Hard surface area: For wet weather play and sheltered games these can be associated with a shelter. Incorporate draughtboards etc in surface.

4.15 *Natural play areas:* A natural area with interesting changes of level, trees and logs is an essential adjunct to the equipped play area. It is different from adventure playground proper with its supply of building materials. It will look messy and requires screening.

5 Teenage play areas

5.01 Unorganised ball play needs 3 m high fence or wall, grass up to 0·6 hectare football pitch if possible, and an all-weather surface 30 m × 15 m minimum (see information sheets LANDSCAPE 14 to 17).

6 Detailed requirements for play spaces

6.01 Seats, litter bins, drinking fountains and barrier rails at vulnerable exits are all essential. Covered play spaces can be either open or in rooms. Floodlighting and local lighting will maximise use of facilities.
Drainage is required near equipment and walls. Use locking safety grids on all gullies. Pools need drainage at outlets and overflows, with anti-flood measures for rapid emptying.

6.02 Planting must be robust. Good sized trees (large nursery standards) well staked and guarded are more costly but will stand up to wear more readily. Multi-stemmed trees are more resistant to damage. Shrubs for mass planting can include thorny species such as *Berberis, Cydonia, Crataegus, Pyracantha, Genista,* with *Polyantha* and *Floribunda* roses. All shrubs should be contained in fencing or raised beds.

7 Checklist of activities possible under play leadership

7.01 Three categories of activity are given below. For a fuller list see NPFA publication[13].
Team games (see information sheet LANDSCAPE 14): basketball and netball; bicycle polo; cricket; football; rounders; rugby; table tennis; tennis; tug-of-war.
Group activities: balloon races; dodge ball; hopscotch; potato race; soapbox derby; treasure hunts; wheelbarrow race; pillow fights.
Individual sports and pastimes: athletics; cycling; physical training; skipping; roller-skating; chess; walking on stilts.

Cultural and creative activities or hobbies

7.02 Dancing—all kinds; discussions and quizzes; drama and fancy dress; music making; painting; playwriting and story-telling; book binding; cookery; dress making and knitting; making mosaics and brass rubbing; basket making and woodwork; pottery; bulb and flower growing; visits to places of interest, eg: museums, British Rail loco depots, water works, power stations.

Adventurous activities (some away from urban areas)

7.03 Camping; fishing; rambling, hiking and tracking; tree and rope climbing; digging; hut and den building; fire lighting and cooking; water play.

Voluntary service

7.04 Work for old age pensioners, such as: decorating and painting, housework and shopping, hospital visiting, reading, concert entertaining.

8 Play space standards

8.01 There are no statutory minima as yet in this country, but various authorities or groups have made recommendations **8, 9.** MHLG in *Homes for today and tomorrow* (1961)[10] noted the difficulties in relating play space requirements to numbers of child users, because of changes in age groups and location, such as main roads to cross. They recommend as follows: children's play: 2 to 2·4 m² per person on estate, not counting one and two person dwellings; 0·4 hectares for an average 5 hectare scheme with 350 habitable rooms per hectare.
They also suggested the increased use of play leaders, with part time nursery schools and supervised play spaces for young children.

8.02 At the 1967 conference on recreation and play, Peter Daniel put forward the following recommendations now being adopted for new and expanded towns (see table 1).

Table 1 Recommendations for new and expanded towns

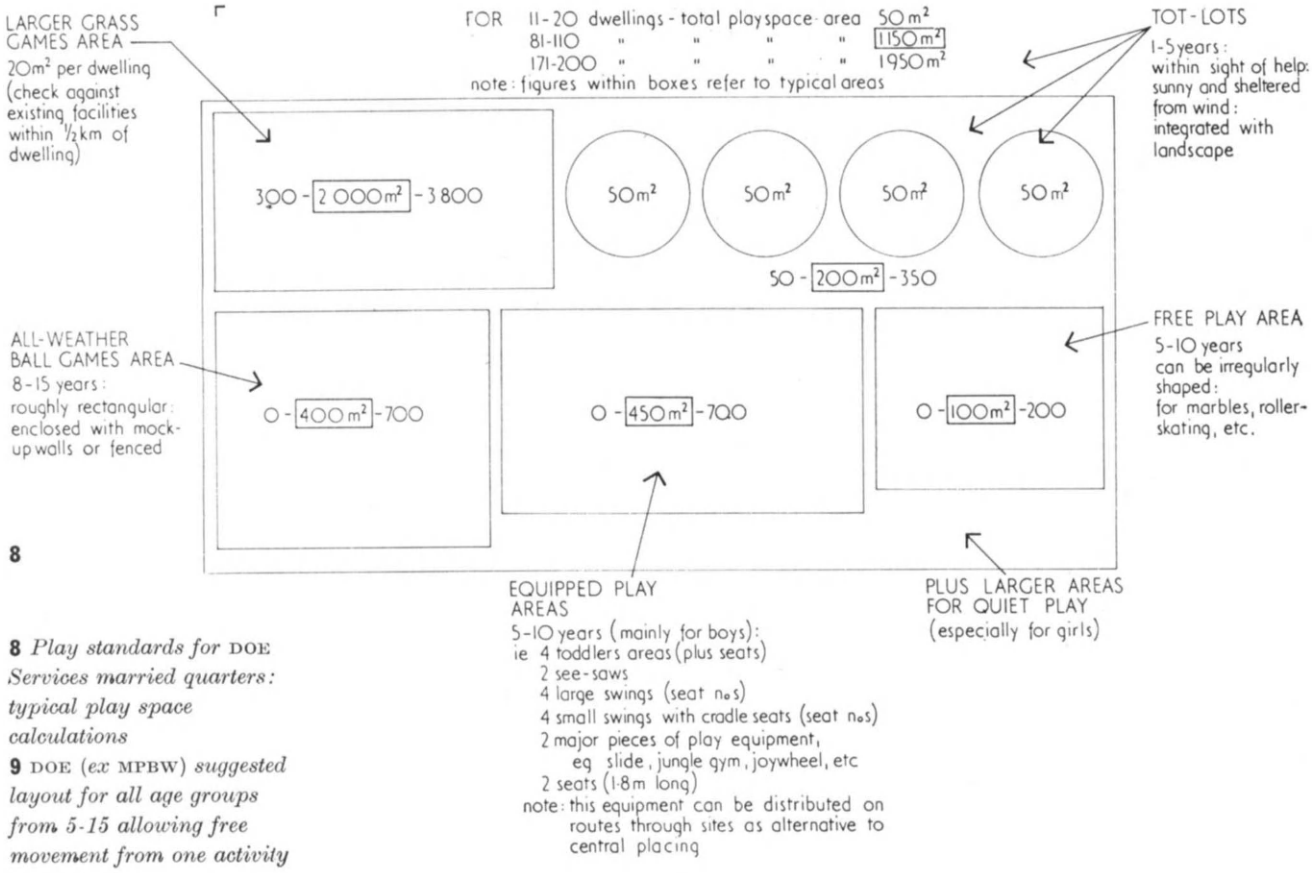
Age group	Land type	Hectares/ 1000 population
0–5	play areas	0·08
6–12	playgrounds and cricket areas	0·36
adult	tennis/bowls	0·2
all ages	playing fields	1·4
children	public/school playing fields	0·6
all ages	golf course	0·56
all ages	parks and gardens	0·81

8.03 MHLG circular 36/67[23]—the notorious cost yardstick—states: 'Play space must be provided in schemes of 200 persons per hectare and above on the basis of 1·4 to 2 m² per bedspace, with a minimum of 1 m² in exceptionally favourable circumstances, such as where an estate has existing playgrounds readily accessible in the immediate vicinity.' But no date was given for this to become mandatory.

8.04 NPFA recommended in 1925 and revalidated in 1955: 2·43 hectares of play space including 0·2 hectares of children's playgrounds per 1000 of population; children's playgrounds at not more than 1 km intervals in built-up residential areas, with in between spaces for pre-school age groups; tennis, kickabout areas etc—not more than 1 km from centres of residential areas.

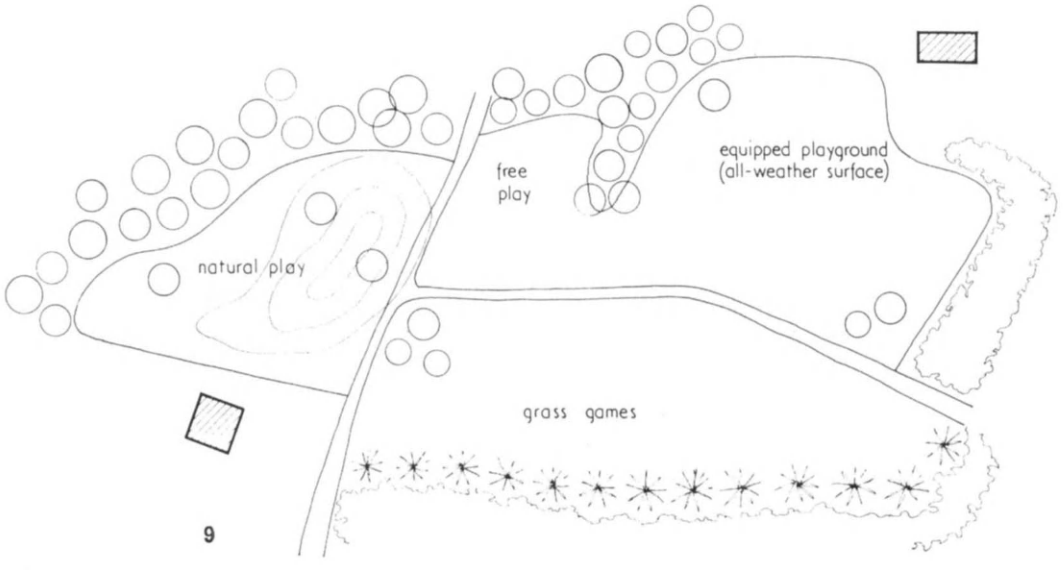
Organisations

National Playing Fields Association, 57b Catherine Place, London SW1 (01-834 9274)
The best source of information on children's play. Has information centre and comprehensive list of publications on all aspects of children's play.
International Playground Association, 57b Catherine Place, London SW1 (01-834 9274)
Holds conferences and brings together experts concerned with creative playgrounds.
Nursery School Association of Great Britain and N. Ireland, 89 Stamford Street, London SE1 (01-928 7454)
Pre-School Playgroups Association, 87a Borough High Street, London SE1 (01-407 7815)
Gives help to amateur organisers (mothers) or play groups and one o'clock clubs.
Handicapped Adventure Playground Association, 56 Oldchurch Street, London SW3 (01-352 2062)
Save the Children Fund, 29 Queen Anne's Gate, London SW1 (01-930 2461)
Establishes and operates playgroups with buildings for 2 to



8 *Play standards for* DOE *Services married quarters: typical play space calculations*

9 DOE (*ex* MPBW) *suggested layout for all age groups from 5-15 allowing free movement from one activity to another*



5 year olds, particularly in areas of acute overcrowding.
GLC Parks Department, Cavell House, 2a Charing Cross Road, London WC2 (01-836 5464)
The largest parks department in the country, it runs play parks, one o'clock clubs and adventure playgrounds.

References

1 HOLME, A. and MASSIE, P. Children's play. London, 1970, Michael Joseph [528]. *Price* £3·25
2 HOLE, V. and MILLER, A. Children's play on housing estates: a summary of two BRS studies. AJ, 1960, June 22, p1529–1536 [SfB Ac6; CI/SfB 528:8]
3 HOLE, V. Children's play on housing estates. NBS research paper 39. 1967, HMSO [528:8]
4 ASH, J. and SHEPHERD, N. Children's playground: a usual commentary. AJ, 1967, June 14, p1409–1412 [SfB/Ac6; CI/SfB 528]
5 Climbing frames. *Which?*, 1970, August [90.78]
6 DATTNER, R. Design for play. London, 1970 Van Nostrand-Reinhold [528] *Price* £5·35
7 BENGTSSON, A. Environmental planning for children's play. London, 1970, Crosby Lockwood [528] *Price* £4·50
8 BRITISH STANDARDS INSTITUTION BS 3178: Parts 1 to 4 Playground equipment for parks, 1959–65 [528 (90.78)]
9 BRITISH STANDARDS INSTITUTION BS 3191: Parts 1 to 3 Fixed playground equipment for schools, 1959–65 [71(90.78)]
10 MINISTRY OF HOUSING AND LOCAL GOVERNMENT Homes

for today and tomorrow (Parker Morris). 1961, HMSO (especially p39–43 and 77–80) [81(E2)]

11 MINISTRY OF HOUSING AND LOCAL GOVERNMENT R & D GROUP Housing—the home in its setting. AJ, 1968, September 11, p493–554 [81]

12 ALLEN, LADY OF HURTWOOD. New playgrounds. London, 1964, Housing Centre Trust [528]

13 NATIONAL PLAYING FIELDS ASSOCIATION Pamphlets dealing with children's recreation—insurance aspects: 1 Insurance 1967; 2 Statutes and constitutions 1967; 3 Play leadership by W. D. Abernethy 1968; 4 Playgrounds by W. D. Abernethy 1968 [528(A9S)]

14 ALLEN, LADY OF HURTWOOD Planning for play. London, 1968, Thames & Hudson [528(A3)] *Price* £2·10

15 LEDERMANN, A. and TRACHSEL, A. Playgrounds and recreational spaces. London, 1968, Architectural Press, 2nd edition [528] *Price* £5·50

16 NATIONAL PLAYING FIELDS ASSOCIATION Playgrounds for blocks of flats. London, 1953, The Association [528:816]

17 INTERNATIONAL PLAYGROUND ASSOCIATION Playgrounds —with or without leadership? London, 1969, The Association [528]

18 GLC PARKS DEPARTMENT Playparks. London, 1969, The Council [528] *Free*

19 GLC PARKS DEPARTMENT With children in mind. London, 1969, The Council [528] *Free*

20 INTERNATIONAL PLAYGROUND ASSOCIATION Recreation and play. London, 1967, The Association [528]

21 NATIONAL PLAYING FIELDS ASSOCIATION Sandpits, construction and maintenance. London, 1953, The Association [90.71]

22 NATIONAL PLAYING FIELDS ASSOCIATION Specification for hard surface area. London, 1963, The Association [528(90.41)]

23 MINISTRY OF HOUSING AND LOCAL GOVERNMENT Circular 36/67: Housing standards, costs and subsidies. 1967, HMSO [81]

Section 8 **Gardens**

Information sheet Landscape 22

Gardens: user requirements and site analysis

In this sheet, the first of three on gardens, TIMOTHY COCHRANE *describes user requirements and presents a check list for site analysis of gardens*

1 User requirements: general

1.01 As people become more mobile and move house more often, they require gardens with simple flexible layouts and fast growing plants for instant effect. The increase of other attractions—cars, sport, tv—has led to smaller, low-maintenance private gardens with communal recreation areas.

Type of user

1.02 The user's interest in his garden depends on personal factors such as age and occupation, but it will also be greatly affected by whether he is a tenant or owner of his property. Generally, where the occupier has less control over or interest in his immediate environment, small patio-type gardens with larger communal spaces are desirable (see table I).

2 Requirements

Families

2.01 Young families with children need tough gardens with paved areas, grass, robust shrubs and trees, and possibly some play equipment. As children grow more decorative planting can be used, but there is still need for ball-games spaces.

Older people on their own tend to become more interested in ornamental gardening. At retirement stage the garden should be simplified with raised beds to reduce work at ground level.

Personal needs

2.02 See table II.

2.03 Checklist of activities

Passive: sunbathing, picnicking and barbecues, clothes drying, loose and caged pets, hobbies (eg do-it-yourself, car, boat).

Active: parties, growing flowers and vegetables, children's play (see information sheet LANDSCAPE 27), ball games (see information sheet LANDSCAPE 14), swimming, cycling, riding.

3 Site analysis: general

3.01 This refers to analysis on a garden scale only; for more detail refer to AJ design guide LANDSCAPE.

Basic factors to be considered are:
Climate—aspect, sun, wind
Access and circulation
Topography—changes of level

1 *Maintenance-free surfaces and raised beds help elderly gardeners*

Table I *Type of occupancy*

Type of occupier	Remarks
House owner	Interest in maintaining value—improvements
Co-owner—housing association or co-ownership scheme	As above, also communal interest
Co-owner—long lease with communal responsibilities	As above (eg Span)
Private tenant—long term	Landlord often lays down covenants
Private tenant—short term	May be maintained by landlord or covenant in agreement
Local authority tenant—usually long term	No interest by tenant, except for control enforcement by local authority. Low maintenance, tough scheme needed
Ministry of Defence—usually short term (1 to 3 years)	No interest in improvements. As above

Table II *Personal needs*

Client type	Needs
Keen gardener—flowers and vegetables for use or for shows	Strong framework for activities so that seasonal changes do not disrupt environment
Elderly or disabled gardener	Raised beds, use of pots for plants, extra attention needed to maintenance-free trim at ground level **1**
Children—specialised needs	Sandpits or swings. Ball game spaces and paved areas for other and wheeled games, screening for sound insulation and for protection of adult sections of the garden. (See information sheet LANDSCAPE 21)
Recreational types—active/passive	Lawns or paved spaces for activities (see checklist)

Services—connections and easements
Regulations—building lines, covenants on heights etc
Contiguous neighbours
Outlook—views out, introverted, enclosing elements
Soil—acid/alkaline (including drainage) plus existing vegetation
Garden and house character

3.02 Climate

Sun

Sunlight is important, not only to people, but also in the way it highlights garden elements such as screens, plants, water and trees. South or south-west aspect would suit most people's free times. Note local elements such as urban haze and topography causing mists and frost pockets **2**.

South walls reflect the sun, and should be covered in summer with deciduous climbers or wall shrubs. Paved areas absorb and re-radiate heat, increasing surface temperature.

Wind

Wind inhibits outdoor living in this country. If wind is controlled, the microclimate of any location will improve to the equivalent of 7° latitude southwards. Examine effects on existing site, eg leaning trees, absence of plant material. Wind cools people and desiccates and stunts plants. (Katabatic winds in early spring are very dangerous to newly opening leaves.) Permeable screens, eg bamboo, open timber or even netting are best against strong wind to avoid wind eddies **3**. High (3 m) screens should be used on north faces, and low screens on south faces. Houses themselves provide the biggest screens.

Temperature

Experiments have shown that highly enclosed patio gardens, with solid walls on all sides to retain heat and provide wind shelter, maintain a consistently higher temperature than that of surrounding areas. It should be possible to grow more exotic types of plant in these gardens (compare old kitchen gardens with high walls which often provide enough shelter to cultivate peaches on them).

3.03 Access and circulation

Check pedestrian and vehicular access points. Analyse circulation and 'desire lines' to give logical route network.

3.04 Topography

It is essential to conserve and intensify any changes of level in the garden, as they add interest and scope for children's play. But all new contours and changes of level should be broad and sweeping, rather than 'pimples' on the surface **4**.

3.05 Services—overhead and underground

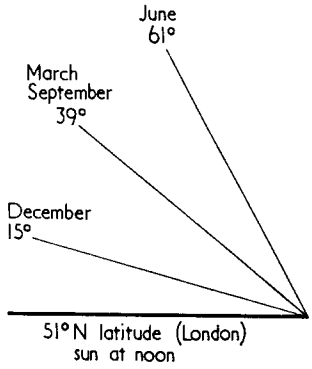
Check points for connections and easements. Check levels to ensure that earthmoving operations will not expose them.

3.06 Regulations

Check for building lines, covenants or other regulations on heights, types of walls, and other external elements. Check also for road sight lines; also check building regulations for position and construction of outdoor elements.

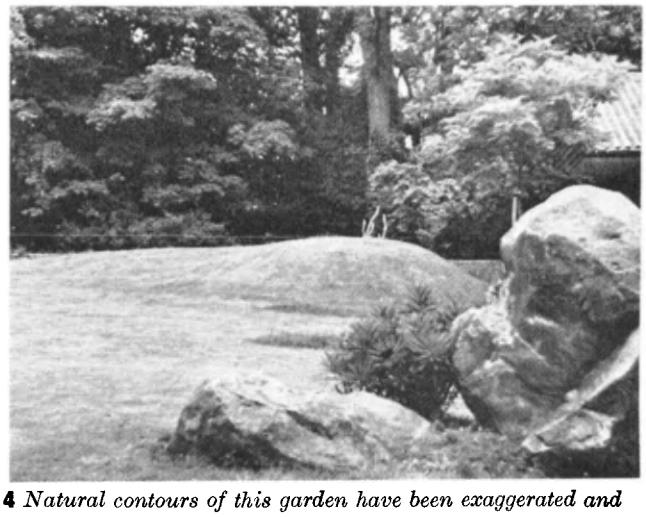
3.07 Neighbours

Consider neighbouring artefacts especially in terms of noise, smells and pollution, and plant material such as overhanging trees or voracious roots. Check whether views are liable to be blocked by new artefacts or growing plants.

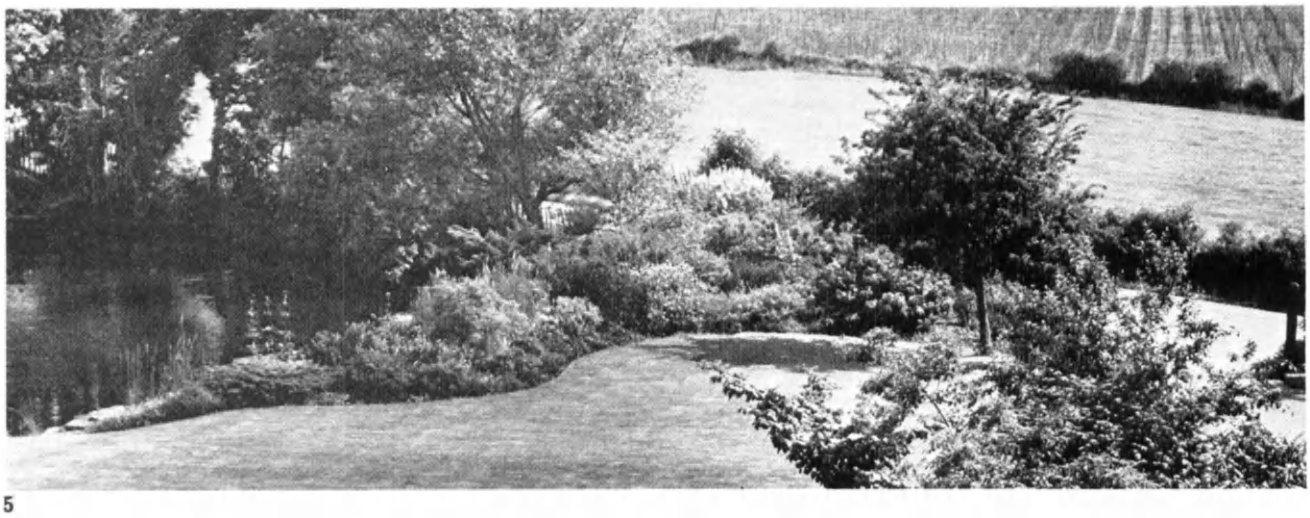


2 *Diagram showing angle of the sun at noon*

3 *Screens for wind shelter can also support climbing plants*



4 *Natural contours of this garden have been exaggerated and enhanced*



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5, 6 *Two gardens of totally differing character, one in undulating countryside, the other in a town.*

3.08 Outlook

Outward views can be borrowed and brought into the garden, as in the Japanese art of shakkei. Conversely, it can be shut out and the scheme introverted.

3.09 Soil

Check for depth, pH value and consistency. Check also for good drainage or otherwise. This will determine planting types and their location (ie uncorrected bad drainage would lead to raised planting beds). With some topsoil costing £3/m^3 it is essential to conserve what there is on the site and to stop builders removing or burying it.

3.10 Vegetation

Existing natural vegetation can be an excellent soil indicator (see information sheet LANDSCAPE 10) while larger units (trees, shrubs) should be carefully surveyed for their potential. Trees, especially if they are to be the main features of the site, should be checked carefully regarding their potential health. Far too many developments have been ruined by these centrepieces failing due to lowering of water tables, root truncation or soil level changes (see Arboricultural Association advisory leaflet no 3). As trees take so long to grow it is essential to take all steps to protect and preserve them during and after construction.

3.11 Garden character

This is somewhat nebulous, that which used to be called *genius loci*—or the extension and cultivation of potential. It is related to the ecology of the area either in terms of the natural soil base, or in the degree of urbanisation and pollution present **5, 6**. For detailed discussion of gardens and their relationships see information sheet LANDSCAPE 23.

3.12 Planting notes

For fuller information see information sheets LANDSCAPE 5 to 10 and 41.

Trees: check medium and small trees for most garden situations. Deciduous give summer shade but let in light in winter. Specials, such as the Victorian monkey-puzzle, can give character (see information sheet LANDSCAPE 6).

Shrubs: help to form basic background. They can be either fast-growing (eg broom, buddleia), or slow-growing (eg *laurustinus*).

Hedges: will need artificial screening to begin with. Hardiness is all important as some (eg *macrocarpa* cypress and *lonicera nitida*) can be patchy. There is a choice of slow-growing, easily manageable plants (eg yew), or fast-growing rampant plants (eg privet), which will need cutting frequently and which may be greedy and thus inhibit nearby plants from growing.

Climbers: These are invaluable in small spaces. There are two types: self-clinging (eg ivy, virginia creeper, climbing hydrangea) and non-clinging ramblers and twiners which require support (eg the clematises, honeysuckles). These require support from wires, trellises, or pergolas. Some shrubs can be used as 'wall shrubs' (eg *ceanothus*, roses, firethorn). Check catalogues for aspects.

Ground covers: are expensive but are most attractive low maintenance cover.

Herbaceous, alpine, herbs, annuals, bulbs: The client can exercise individuality with these against the basic background of other material.

Grass: needs careful control in tight plans but excellent for large sweeps.

Vegetables: some excellent foliage plants in this group, (eg asparagus).

Information sheet Landscape 23

Section 8: **Gardens**

House/garden relationships

In this information sheet TIMOTHY COCHRANE *describes how the concept of integrating house and garden has developed, and suggests ways in which it might be achieved*

1 Introduction

1.01 Historically, integration of house and garden was achieved by the Moors in Spain in the ninth to 13th centuries. In Arabic, the word 'carmen' describes the fusion of house and garden as one, it has no equivalent in English. This ideal is exemplified in their superb masterpiece at Granada **1**.

1.02 In America, similar attempts to relate gardens to houses have been made, notably by Frank Lloyd Wright in his earlier houses, and also by landscape architects L. Halprin and R. Royston in the California Bay region. They related one-off house designs directly to the site, using external spaces as real outdoor rooms, or full extensions of internal living spaces **2**.

1.03 The idea of the garden as subordinate to or integrated with the house is quite distinct from the English idea of the garden as a vehicle for 'plant worship'. But with growing pressure on space, this unification of gardens with houses becomes necessary. For example patio gardens in low-rise high-density housing, as in the recent 'kasbah' developments, are literally outdoor rooms. Planting must be relegated to its proper role of simply enclosing and decorating the elements of the scheme.

2 Space analysis

2.01 It is clear in this context that garden design cannot be separated from house design. New thinking in house design has questioned stereotyped concepts of 'front' and 'back' of houses, and the same must apply to 'front' and 'back' gardens. It would be more logical to divide the garden into public open space and private open space.

Private open space

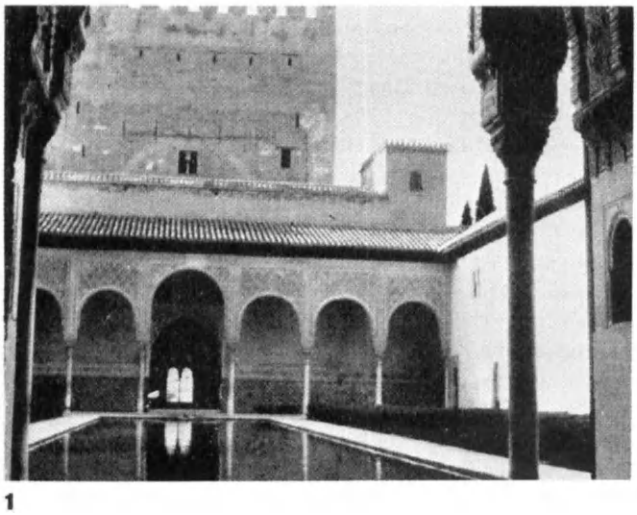
2.02 Private open space must be a minimal requirement of any house, whether in the form of 'back' or 'front' garden, patio or balcony. The area must be screened for privacy, and should ideally be related in function to adjacent indoor living spaces. For instance, living rooms should relate to outdoor 'show space' and eating or sitting out areas. Kitchens should be in sight of young children's play area, and adjacent to outdoor work space, sheds, refuse disposal, storage and herb garden. Studies and bedrooms should relate to tranquil, restful outside areas. All rooms should project outwards naturally, with external heating and lighting facilities. Changes of level, so often an obstacle in relating inside to outside, can be eliminated by 'gapping' at the dpc.

The most important basic requirement is privacy within immediate environs of outdoor space, with necessary screening in high-density areas taking top priority. Stores, plant shelters, greenhouses or conservatories can help but they must be sensitively designed as a transition between indoor/outdoor scale.

Larger private open spaces

2.03 As most inorganic materials are expensive, spatial dividers and surfacing will normally be soft, with trees, hedges and shrubs providing screening and shelter both in the long and short term (though some temporary light screening would be necessary at first). Fast growing plants can be used for quick effect while the slower growing plants come up (see information sheet LANDSCAPE 24).

1 *Integration of house and garden is no new idea; it was realised in the 12th century in the Alhambra at Granada*
2 *In California, a natural extension of living space to outdoor sitting space*



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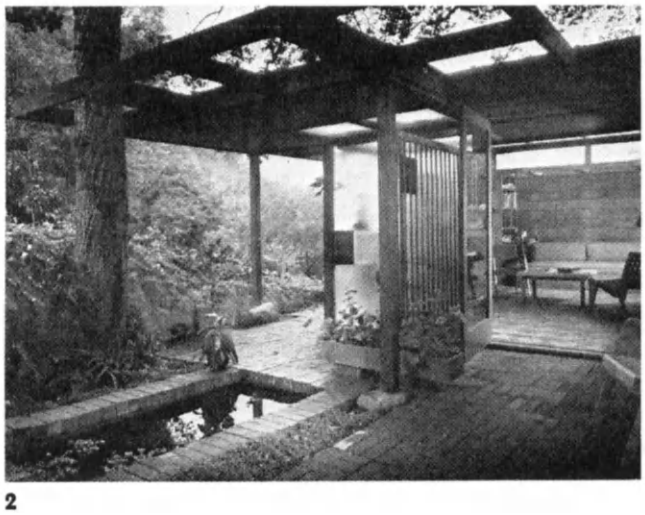

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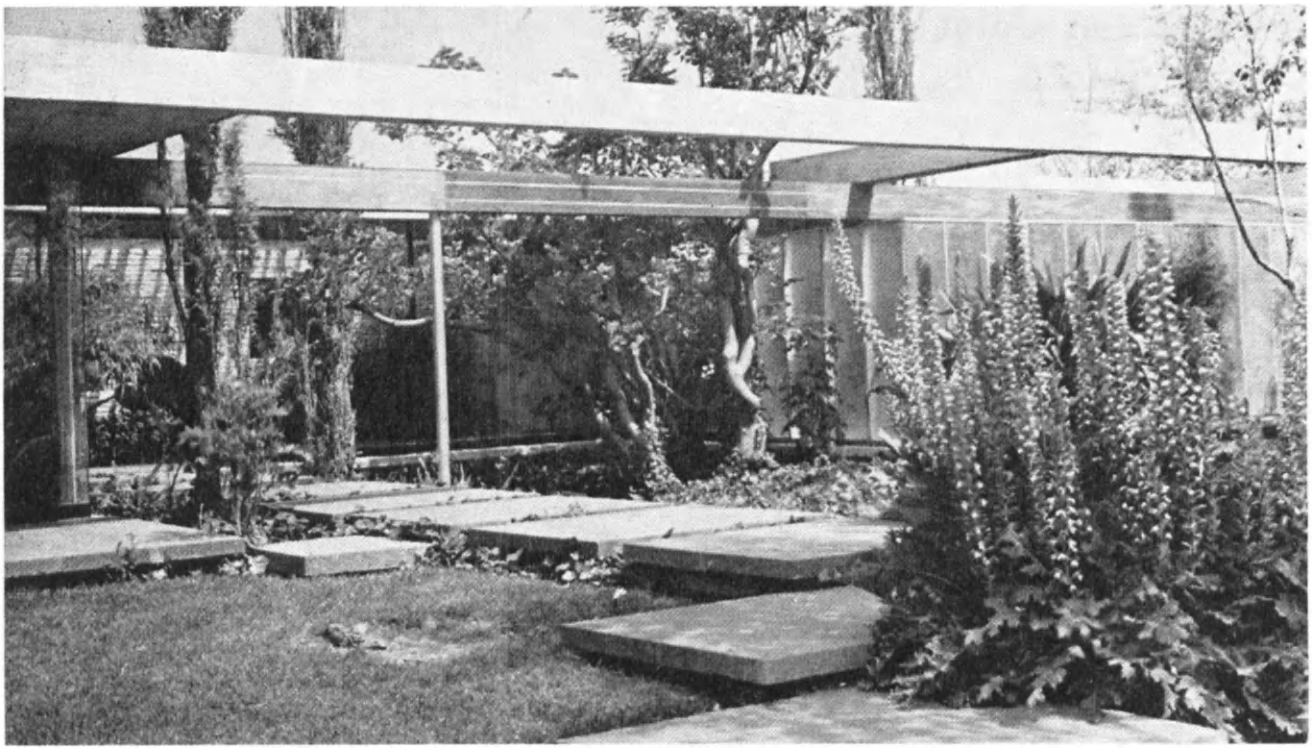


3 *The entrance to a Mexican house—in strong contrast to the dull mixture of flat lawn, tarmacadamed drive and clipped hedge which seem part of the English way of life*

Public open space

2.04 The public open space has been the subject of much muddled thinking, resulting in a sterile 'no man's land' of front gardens without fences or hedges, decorated with manhole covers. Public space serves two functions; entry and recreation (although it is clear that children regard the whole urban scene as a play area. See information sheet LANDSCAPE 21.)

Entry areas

2.05 Small planting pockets for trees, shrubs and climbers will soften hard walls and tarmac surfaces necessary for car access and hardstandings. Large open spaces by entry areas should only be used when they perform a definite function, eg a quiet communal garden or recreational space.

Recreation areas

2.06 Recreation areas can be either on the entry side of the house or on the garden side. But communal recreational facilities shared by near neighbours gives a more positive unit than merely sharing a patch of open space.

Functions can include: sitting areas, children's play, swimming pools, recreation for adults (see checklist in information sheet LANDSCAPE 22).

3 Leisure gardens

A change of attitude in use of gardens or private plots is shown in the departmental committee of inquiry into allotments,[14] which has recommended that allotments be replaced by 'leisure gardens' in high density areas near buildings and low density gardens at a maximum 20 miles away for day trips. These are envisaged as attractive gardens rather than functional allotments. Previous rigid administration would give way to a more flexible and imaginative control. But gardens will still need grouping of huts or chalets with strong visual screening which will look good in winter, and with banking and proper fencing which would give individual tenants full freedom to exert their individuality within a strong framework. Placed adjacent to public parks or children's recreational areas, with 30 per cent available for communal recreation, it is considered that they would be cared for by tenants and respected by the general public.

References

Note: This list applies to information sheets LANDSCAPE 22, 23 and 24.

1 SHEPHEARD, P. Gardens. London, 1969, Macdonald & Co (Design Centre Publications) [084]

2 MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Homes for today and tomorrow (Parker Morris report) (p39 and 53–54). 1961, HMSO [81(E2)]

3 SUNSET BOOKS. Landscaping for modern living, California, 1963, Lane Book Co [08]

4 JELLICOE, S., and JELLICOE, G. Modern private gardens. London, 1968, Abelard-Schuman [084]

5 BROOKES, J. Room outside. London, 1969, Thames & Hudson. [084] *Price* £2·10

6 ROPER, L. Successful town gardening. Country Life. London, 1957 [084] *Price* £2·10

7 MINISTRY OF HOUSING AND LOCAL GOVERNMENT. The home in its setting. AJ, 1968, September 11, p 494–514 [81]

8 GREATER LONDON COUNCIL (Town Development Division). The landscape and your garden and you. 1969 *Not for sale*

9 HURTWOOD, LADY ALLEN OF, and JELLICOE, S. The new small garden. London, 1956, Architectural Press [084]

10 BROOKES, J. Living in the garden. London, 1970, Queen Anne Press Ltd (Gardening Centre Library) [084]

11 SUNSET BOOKS. Garden and patio building book, California, 1962, Lane Book Co [084] *Price* $6·95

12 ARBORICULTURAL ASSOCIATION. Advisory leaflet no 3, The care of trees on development sites, London, 1969, The Association [(90)Yx1]

13 CHEMAYEFF, S., and ALEXANDER, C. Community and privacy. Harmondsworth, 1966, Penguin Books [(E2s)]

14 MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Departmental committee of inquiry into allotments. 1969, HMSO [168] *Price* £2·10

Information sheet Landscape 24

Section 8: **Gardens**

Gardens: detail design and maintenance

In this information sheet TIMOTHY COCHRANE *sets out a check-list for design of garden elements and design for maintenance of private gardens*

1 Design elements

Hard surface

1 Very small gardens are often best completely paved
2 Paving should be laid open jointed or, where there is little or no soft surfacing nearby, be pervious to let in moisture to plant roots
3 Small scale paving units are most suited to small gardens
4 Planting between joints is acceptable when surfaces are subject to casual use only
5 Moss growth can be encouraged by preparing paving sub-base with bone meal
6 Where vehicle access is required, surface has to be strong enough to support vehicles
7 Is surface capable of 'do it yourself' repair?
8 Does external surface texture relate to internal surfaces?
9 Is area large enough to warrant use of specialist surfacing equipment—eg asphalting?
10 Is surface easy to clean, with drainage outlets etc?
11 Types of surface materials: Hoggin, gravel, shingle, concrete, stone, bricks, cobbles, setts, tarmac, tiles, timber
12 Mowing trims: brick, concrete, shingles, aluminium
13 Kerbs: precast concrete, timber, brick etc
14 See information sheets LANDSCAPE Section 10

Enclosing elements

Generally
1 Provide shelter from wind
2 Provide privacy
3 Should be integrated with buildings, roofs, structures etc
4 Walls can be open, solid or permeable
5 Will a bank serve better than a retaining wall?
6 Screens could be built on castors and movable to suit prevailing winds
7 See information sheets LANDSCAPE Section 10

Masonry
1 Bricks, stone and concrete block are expensive
2 Pierced concrete block is useful as permeable screens
3 Brick is strong and relatively frost proof
4 Copings can be used to delineate surfaces
5 112 mm brick work close to buildings can appear insubstantial, usually better to use 225 mm thick walls

Timber
1 Bamboo screens and chestnut paling, useful in small gardens, require firm support
2 Boarding can be open or closed, random sized, horizontal or vertical
3 Woven fences can be wattle or hurdles
4 Palisade
5 Post and rail
6 Timber posts with wire strung between them
7 External grade, waterproof ply screens

Metal, plastic, glass, wire etc
1 When used for security, fencing element can be concealed with planting
2 Metal posts with wire strung between them
3 Canvas screens and awnings
4 Glassfibre translucent sheeting as screens
5 Steel usually requires galvanising
6 Asbestos cement sheeting as screens
7 Glass screens should be of wired glass

Water

1 Ornamental pools in a natural setting are best treated as incidents in the landscape layout
2 Ornamental pools and fountains requiring formal treatment are most effective when raised above paving areas
3 Pools can be 'natural' with balanced conditions of plant and pond life
4 'Artificial' pools require frequent maintenance
5 Swimming pools are best linked with the house and sheltered with screens to extend in-use season
6 Water flush with surrounding surface has maximum effect
7 As water reflects sky it usually appears grey
8 Surface reflection gives crisp definition to surrounding surfaces and structures
9 See information sheet LANDSCAPE 9 for water plants

Play areas

1 It must be remembered that all of the garden will be used as a play area; elements endangered by trespass should be used with care
2 Play areas require paved areas as well as grass
3 Changes in level, contoured mounds etc can be developed as natural features while serving as play zones
4 Climbing frames etc can serve as attractive design features
5 Sand pits are best in a paved space with a 150 mm ash base to assist drainage
6 For listed age groups, check following points:
Baby—pram standing, constant supervision
Toddler—hard and soft surfaces, sand, water, constant supervision, noise
Pre-teen—hard and soft surfaces, a place for pets, climbing apparatus ie trees or frames, room for ball games
Teenager—room for ball games, sunbathing, making a mess
7 In play areas check design for:
Noise, mess, clear definition between children's area and parent's garden areas—ie to prevent trespass on planting beds etc
8 See information sheets LANDSCAPE 21 and 27

Buildings/structures

Outdoor storage

1 Storage for whatever cannot be kept indoors is vital, but often neglected
2 Should be integrated into building design as well as garden layout
3 Can be used to form part of enclosing or dividing systems in garden layout
4 Most 'do it yourself' systems very untidy. Possibly modular systems will look best
5 Potting sheds are often required
6 Check building regulations
7 Keep timber off ground—possibly with frame raised above ground on metal dowels set in footings or impregnated or creosoted timber posts set in concrete

Greenhouses

1 Now available in circular or dome shapes and can be sited in clusters quite successfully with internal access between units
2 Available in glass, plastic, wood and fibre glass
3 As for outdoor storage, items 6 and 7

Pergolas and climber supports

1 Plants need to be removed for repainting or staining structure
2 As for outdoor storage items 6 and 7
3 Allows for heavy hanging plant containers and large climbers when designing structure
4 Roof members should slope so as not to drip water on users
5 Glassfibre translucent sheeting for roofing
6 2·75 m optimum height for access to hanging plant containers etc
7 Timber trellises can appear clumsy—plastic coated wire mesh is available instead, but must be fixed firmly

Ornamental elements

1 Elements need not be considered as free-standing objects only
2 Elements are usually best when incorporated with background planting
3 Scale of objects, number and relationship to landscape layout—are they intended as focal points or not?—should be considered

Plant containers

1 Available in many different materials: terracotta (earthenware), concrete, stone, asbestos, glassfibre, metal and wood
2 Useful in low or so called 'no-maintenance' gardens with planting requiring only spring and autumn replacement
3 Containers allow easy re-arrangement of planting layout
4 Containers are used extensively in Moorish gardens—an idiom easily translated to suit present requirements
5 When using ornamental styled containers, care should be taken that they do not detract or clash with the contents
6 See information sheet LANDSCAPE 10

Heating

1 Heating, incorporated with wind and rain shelter, will extend usable time of garden considerably
2 Heating can be by:
overhead radiant units
subsurface heating—by imbedded hot water pipes or electric coils
portable garden heaters
open fires in barbecue units
3 Heating for domestic greenhouses and conservatories

Furniture and fittings

1 Chairs are available in metal, glassfibre, wood and canvas
2 Seating built round trees, raised planting beds or pools can be used visually to relate other artefacts or to unify garden layout
3 Barbecues should be placed in a sheltered paved area
4 Brick barbecues can be easily integrated into garden layouts and will also serve as incinerators or planting shelves
5 Basketware seating is very comfortable, but deteriorates quickly if left out in all weathers
6 Select materials that will dry out quickly—ie permeable
7 Timber, canvas, metal etc should be weatherproofed

Lighting

1 Should be used to integrate house with garden at night
2 Light source is best kept below eye level
3 Several low intensity units usually can be used to better effect than a single high intensity unit
4 There are three basic methods for lighting: direct, indirect and sparkling
5 Floodlights and fluorescent fittings can be used for colour effects
6 Low set 'mushroom' fittings are best used in shrub, grass and ground cover planted areas
7 Weather-proofed fittings and pvc or pyrotenax sheathed cables are essential for outdoor electrical work
8 Night flares fed by portable cylinder gas
9 See information sheet LANDSCAPE 40 for lighting

2 Maintenance

1 Design should be for low maintenance as most jobbing gardeners and maintenance firms will only do relatively straightforward work
2 For low maintenance use simple layouts and shapes eg large sweeps of grass with clearly defined edge trims or mowing strips
3 Use shrubs etc for a permanent background to groundcover which can be replaced periodically with other planting or with a heavy mulch
4 Use paving to reduce area to be maintained
5 Wall climbers, planting in raised beds or potted plants which have a far greater visual effect than other planting techniques requiring a similar degree of maintenance
6 Use a garden layout that allows for the presence of weeds in lawns, shrubs to grow rampant and for flowering weeds
7 Simplified maintenance schedule could be drawn up to accompany design for garden layout. It should cover:
Removal of short-lived planting as permanent material develops
Thinning of some plants
Replacement of sun-loving plants by shade-loving plants as tree canopy develops
Trimming and training of hedges and climbers
Notes on future changes to garden as children's play requirements change
8 Hard surfaces and surfaces adjacent to container planting may require hosing down, and should be laid to falls with drainage outlets
9 Timber elements require painting every two to three years or creosoting or wood preservative annually
10 Check stability of pergolas as climbers develop
11 Grass can be close or long cut and newer machines allow for easier cutting of grass banks
12 Convenient watering points should be provided
13 To keep hard surfaces weed free, use weed killer every two to three years sprayed over surface
14 See information sheets LANDSCAPE section 4 and information sheet LANDSCAPE 44

Section 9 **Housing estates**

Information sheet Landscape 25

Housing: External space types

The basic premise of this information sheet is that the design of external spaces needs a disciplining of functions as taut as that relating to the internal planning of the dwelling. The objective of the external space type classification system given in this sheet is to create a tool that can be used at every stage in the design process from briefing, layout design, and resource planning, to detailed design, costing and management. Above all, it is intended as a method of comparing the performance and standards of the many different modern solutions, as well as traditional ones and those applicable to rehabilitation work.
The aim at this stage is to create a methodology that can grow, adapt and be added to—a sort of 'do-it-yourself' kit for architects. To exemplify the method, some model situations are illustrated and evaluated on the basis of this system.
NOTE: *This sheet should read with information sheets* 26, 28, 29, 30, 31, *which employ the same space analysis.*
The author, MICHAEL BROWN, *wishes to thank A. E. J. Morris and Richard Evans, Judith Allan (who has also assisted in extensive revisions) and Terry Nunns for their help, and particularly to acknowledge the valuable constructive enthusiasm, comment and help from very many other architects and landscape architects.*

Contents

General objectives
To identify the distinctive functions of the external spaces of which housing layouts consist in order to develop a critical method that may be used at any stage in the design process, from briefing, resource planning, layout design to costing, detail design and management.

Specific objectives
The system sets out to achieve the following specific objectives:
1 A method of assessing and subsequently comparing specific solutions with a view to identifying the factors that are relevant to performance and environmental quality. These could be carried out in respect of many different solutions whether contemporary or traditional and including those applicable to rehabilitation (see information sheet 31).
2 Cost guide lines which can be applied to external space types as readily as those already used for cost feasibility studies in building.
3 A simple, speedy method of quickly testing the feasibility of a design without developing it to a stage of refinement involving more effort and work than is justified at the initial stage of design. This would involve the application of knowledge from a vocabulary of comparative solutions or models with sufficient factors in common with the situations being examined.

1 Scope

1.01 The complexity of housing is such that the principal factors (eg density, access etc) cannot be considered in isolation from each other. A method of analysing and evaluating the landscape of housing is needed, which can inter-relate these problems in an integrated way, and at the same time enable the designer to examine the question 'what are the spaces for?' Unless every square metre of outside space is put to use as effectively as the space within the dwelling, land and resources may be wasted or misapplied.

1.02 This sheet is closely linked with information sheets LANDSCAPE 26, 29, 30 and 31 which deal respectively with car and service spaces and access, with detailed design, and with resource planning and costs and rehabilitation. The contents of the latter information sheets have been structured to fit into this space classification system so that these sheets can be used together.

1.03 The analysis is based on four main functional characteristics of external spaces. Definitions of these in the legend on pages 159-160.
They are:

DOMAIN	private space
	communal space
	private + communal space
CIRCULATION *for*	pedestrians
	vehicles
	pedestrians + vehicles
distinguishing	route space
	local access space
	non-route *not symbolised
EDGE CONDITIONS	non aspect
	controlled aspect
	open aspect, no privacy strip
	open aspect, with enclosed garden
	space under block
	garage/service space
	+ adjacent space *not symbolised
ACCESS *to dwelling*	linear
	single
	multiple
	end/linked
	deck

2 Application

2.01 The application of this system is illustrated by examples **1** to **12**.

2.02 The first diagram is a key to external space type classification, showing the four facets of domain, circulation edge condition and access to dwelling, and indicating the symbols which will be used to represent them in all the following figures.
The second diagram is an assemblage of space types, a plan which identifies, by the use of pictographs embodying the symbols referred to, the element spaces which are grouped to form part of an actual housing layout.

2.03 Various situations (indicated on the key page) reflecting particular combinations of circulation function, access type, and edge condition, are then illustrated in **1** to **12**. Most of these schemes are models—some drawn from one or more existing situations—and each represents a fairly typical, common situation in existing housing.
Since most housing layouts embody a number of edge conditions, grouped in a multitude of ways, it has been thought most valuable to study first the smaller element spaces where only one or two edge conditions are significant. Comments on the general characteristics of each of these model situations are shown by means of annotation; and the space types identified by pictographs as in the example assemblage, page 162.
The small key diagram in the upper right-hand corner of each sheet symbolises the circulation and ownership characteristics of the situation illustrated. It identifies the domain, ie whether private or communal and the type of access provided, ie whether for pedestrians, vehicles, route, non-route, etc.

3 Design determinants

3.01 These functional characteristics are accompanied by a check list of the principal determinants that vitally affect the treatment and character of the landscape of housing.
The check list and determinants of these appear on page 160.

General

3.02 There is a need to clarify priorities in order best to resolve inevitable conflicts; these are most marked for high densities. Particular objectives will influence these eg required housing mix, privacy, access type, car provision and parking arrangements, management policies etc. Low densities pose particular problems also: more space may leave residual little used or neglected areas with problems of care, thus worsening the capital versus maintenance costs relationship. Although lower cost investment per unit area is possible, this may be offset by increased area of common land, or at least by attenuated and therefore less useful spaces along road and boundary edges. If it is not, private gardens may be bigger than necessary and loss of privacy may result from cheap boundary treatment due to excessive perimeter lengths. Fiddling densities by adjusting garden sizes is a common habit. What size is needed should be the question with first priority here.

Density

3.03 Density has an important although not exclusive effect on building form and grouping, which may themselves vary considerably within any one range of densities. High and low densities both produce their characteristic problems. It does not however follow that only high density schemes have to provide for areas of intense use: these will occur on many lower density schemes also.
Greatest conflicts with other determinants in high density schemes make it necessary to establish clear priorities and relate them to specific objectives ie housing mix, maintenance arrangements.
High densities pose particular problems of proximity, car provision, privacy.
Fuller provision of adjacent facilities can offer opportunities denied to lower density schemes.
Low density: ensure effective use of residual spaces, arrangements for maintenance which may need to provide for larger or at least more attenuated spaces.
Though lower cost investment may be possible per unit area, this may often be offset by increased area of common land and maintenance costs. Capital versus maintenance costs need this to be taken into account.

Ground coverage

3.04 This is a more relevant form of analysis for landscape external use, for it is a more appropriate measure of the effect of density on layout, and can be expressed in simple terms.
Careful interpretation of functional analysis can be vital, and usefully identifies disposition of resources. See information sheet 30.

Adjacent facilities

3.04 Greatest resources for common facilities are often more readily available at high densities. Lack of these may aggravate and attenuate vehicle access roads arrangements or cause social deprivation (new town blues) if facilities are not provided or are beyond walking distance.
Where these facilities do exist close to housing areas, reduced provision within the scheme may be possible: leading to economies in cost and land—eg adjacent public

open space or school fields that can be used for kickabout out of school hours.

Local intensity of use

3.05 Heavy use is a product of movement and routes and may occur at low densities as well as high ones. It will require appropriate materials and detailing.

Play spaces

3.06 Designation of specific areas for play is always somewhat arbitrary since short of establishing child or adult ghettoes the whole housing area must be regarded as common adult + child territory.

Site arrangement, size and density in relation to adjacent facilities can help significantly in resolving incompatibility between them, though children's play areas inevitably are intensively used.

Most play will occur informally. According to age group, children will make particular use of paths and paved areas for wheeled play at greater or lesser distances from the dwelling. The possibility of such areas being related so as to provide play circuits will make them especially attractive. These should be arranged to provide a safe counter-magnet to vehicle spaces. Steps, walls, changes of level, railings, are inevitably attractive to children for informal play. Adequate grass areas are desirable also but problems of erosion must be considered where heavy use is likely.

Sitting spaces

3.07 Distinguish between those spaces best related to routes—preferably in eddies adjacent to them—and those set a little away, eg on the edge of or within suitable spaces. Consider orientation and other conditions relevant to comfort, such as sense of enclosure, outlook. Take conflicts of privacy into account.

Access is important, especially where siting may risk undue erosion at corner of grass, planted areas. Walls, railings, changes of level, should be used to eliminate short cutting. Some sitting space should be sited close to areas suitable for younger children's play.

Access system and links

3.08 Check interrelationships and hierarchy of spaces and links to general movement pattern for vehicles and pedestrians. Consider convenience of access routes: are they on desired lines?

Check vehicle/pedestrian conflicts. Design principles and details should reinforce objective selected eg whether mixed or segregated layout and place in hierarchy of privacy and community.

Where mixed vehicle/pedestrian system is adopted, establish character intended: is pedestrian or vehicle to be dominant? Establish general principles for methods to be used for reinforcing routes to avoid short cutting. Consistent symbolism of limited range of details assists comprehension—see also identity.

Relate road widths, sight lines, turning radii, loading and other criteria to design objectives—see services, utilities and information sheet 26.

Relate important links to schools, play areas, shops, open space, vehicle stopping and storage points and other magnets. Check that spaces related to routes are well situated to provide dwelling access without privacy conflicts and that situation will reinforce intended use.

Car storage

3.09 There is a close relation between building form, density and the desirable degree of vehicle penetration. Decisions involved are fundamental to layout and have a vital effect on the use of resources (see information sheet 30). Method of use, convenience, flexibility should be considered, with the need to avoid the customary sterile atmosphere of car courtyards. The advantages of segregated versus mixed access should be balanced. The advantages of segregated access (convenience, safety, economy) should be balanced against those of mixed access (economy, complete car accessibility to dwelling).

Provision of open, covered or enclosed storage, and long or short term use should be related to varying requirements.

Services and utilities

3.10 Requirements of various types of service or emergency access should be distinguished. Cases where special requirements (loading, space limitations) exist should be identified and it should be ascertained whether they are compatible with other uses such as pedestrian routes, paved amenity spaces, grassed areas.

Compare implications (running costs etc) of customary space consuming techniques with alternative methods utilising more flexible technologies (eg paper/plastic sack methods are less demanding in their requirements than 12T refuse collection lorries, refuse containers on clumsy paladins). Existing access requirements for fire vehicles can often be modified after discussion with fire officer. Possible adjustments in internal planning (doors, window positions) can be usefully considered with these. See access and links, and information sheet 26.

4 Site

4.01 Careful use of site and relation to building can reinforce sense of place. Consider orientation, views etc. Identify site constraints: eg avoid areas of poor drainage unless necessary steps can be taken and money is available to deal with consequences.

Regard existing assets as resources the replacement cost of which would diminish budget available. Take careful account of site assets. Survey condition, position and levels at base of trees; identify trees requiring remedial work or removal.

Fixing levels of buildings, roads etc should be fully integrated with existing contours. Utilise natural falls where possible. Take advantage of natural variation in slope and general topography where possible. Where major grading is required, soil conditions and type will affect settlement characteristics; it is frequently more economic to site buildings in cut than on filled material.

Use of careful grading plans with existing and new contours showing finished levels and falls can avoid risk of drainage problems and contractual misunderstandings, and enable accurate estimate of cut and fill prior to abortive contract work.

Conserve and protect existing topsoil for re-use, scrape aside BEFORE start of all other work. Consider soil improvement where necessary—this can be started whilst still in spoil heaps (eg legume planting, liming to improve organic content and soil structure).

Microclimate

4.02 Consider thermal properties, sun/shade, light/shadow, rain, noise, wind pollution and select appropriate landscape elements such as covered ways.

Arrange buildings to provide enclosure and shelter, but ensure provision for cold air drainage where, as in valleys, cold air flows are likely to cause fog or frost pockets which may therefore trap cold and moist air.

On flat exposed or windswept sites juxtaposed building heights and alignments, and a serrated skyline help to

reduce wind flows without excessive turbulence. Complex broken plan layouts are better adapted to alleviate this problem than long or large blocks which canalise and speed up wind and cause turbulence, especially where vertical or horizontal slots occur in unfavourable wind situations.
Meteorological Office information is seldom of relevance and may be very misleading. Their observations are frequently taken at a level suitable for observing general climate conditions rather than local microclimate, which may be greatly altered by buildings not yet erected.
Specialist advice may be needed to interpret information or to apply observations from comparative situations elsewhere.
Where screen and shelter belts are required, provide adequate space at planning stage.
Consider internal planning in relation to exposure and orientation, also waterproofing of windows, eaves, and other details, where high winds and turbulence may tend to cause lateral or upward rain movement. Consider advantages of providing generous covered ways, eg from car parking areas to front door. Where possible exploit the possibility of putting covered spaces (garage areas under raised decks) to double up use for covered play. Site sitting play spaces, to take best advantage of orientation and shelter.

Privacy

4.03 Building arrangement or grouping of dwellings needs to accord with intended balance between degree of privacy and community to be achieved.
The treatment and position of the edge of the privacy zone to dwelling establishes mode and degree of privacy to be achieved. The possibility of choice by the resident is important. The edge condition should be regarded as the interface at which the privacy/community relationship starts: the relationship is inherent in internal planning and house type, and needs to relate well to layout in order to avoid incompatibility and conflicts. Where these occur, methods of dealing with them should be fully integrated with the layout of the dwelling and adjacent external spaces. Position of front door is critical.
Alternative degrees of privacy can be achieved for any one house type by juxtaposition of adjacent dwellings, garage/store blocks, stepped terraces, blind patios with or without upper storeys, balconies, roof terraces. Consider extent of choice and action to be left to resident by wall, fence, single aspect, raising building, lowering path—or just net curtains!
How much should be provided for them?
Where territorial boundary is to be visually indicated rather than created by a barrier near or above eye level, a range of alternatives exist, knee rails, may be used or plant beds, hedges, trees; there is a choice of surface treatment. Insert strip or studs let into ground surface may delineate extent of ownership and maintenance responsibility. Consider boundary of territory indicated in relation to arrangements for management, desire for outlook, and identify conflicts.

Identity

4.04 There are three major aspects:
1 Social identification/individual personalisation.
2 Awareness of visual physical grouping—this can help to make form comprehensible.
3 Sense of place—an intangible amalgam of 1 and 2 on a particular size with its characteristic existing or created landscape.
Planning may reinforce social contact and give or deny opportunities for personal involvement. Size of spaces and groups is important. Consider desirable degree to which building and/or external spaces should be left partially incomplete within or even beyond realm of private domain. Balance is required between opportunities for personal change and effort and visual chaos. The strong framework of a unified design may best be able to accommodate this without creating disorder.
Proximity of particular dwelling types important, and therefore the housing mix.

Outlook

4.05 Pleasant interesting views should be provided. Where natural advantages cannot be exploited, variety and interest must be provided by changes of level, planting, additional spaces and so on.
Conflict may occur in relation to privacy requirements. Consider exploiting changes of level ie raised living room as traditional Georgian house, lowered path etc, or use of upper storey in patio type dwelling, or slots in terraces or enclosing walls or fences to courtyards.

Management and ownership

4.06 Who owns what? Who is responsible for what? What are the boundaries of responsibility? Clear answers are required. Problems can arise where edges of differing responsibility meet, or where overlaps occur: eg privately owned spaces may be visually public. Who pays for maintenance—there are advantages in residents being financially involved. Consider an annual contribution or declared allocation of rent for care of landscape. Arrangements must be made for security protection. Where residents are involved and contribute to upkeep, they can help in policy. Experience has shown that lively play leadership schemes with skilled play leaders help reduce occurrence and extent of vandalism.
Group ownership schemes or housing associations are now posing new possibilities, through leasehold agreements local authorities may be able to consider delegating responsibility to residents' groups.

Maintenance

4.07 Consider capital and maintenace costs. In relation to likely viable life span some materials, eg grass, are much more expensive than high quality hard landscape.
Likely standard of maintenance will have a vital effect on design decisions and should be reflected in the investment necessary for appropriate materials.
The vulnerability of all soft landscape is such that annual budget provision *must* be made for replacements by housing management. Failure to match design with maintenance can lead to neglect, vandalism and waste of money.
Balance and a sound value judgement are required in recognising where higher maintenance costs are justified and necessary: compare with normally accepted cost of street sweeping, floor carpet cleaning, building painting costs.
Plant beds frequently need symbolic protection—knee rails, raising or lowering level of beds. Choice of plants—thorny plants are seldom effective until fully established—it is preferable to overplant for speedy establishment at initial stages.
Consider access for window cleaning eg stepping stones in plant beds. Provide for water supply and drainage for extreme rain or drought. Artificial irrigation may be needed where planting is justified under cover or on decks: much of SE England lies in area of annual drought.
Particular problems of maintenance occur immediately on completion of new housing schemes, especially where premature handovers and partially incomplete landscape may cause division of responsibility for damage: adequate replacement guarantees must be provided for. Maintenance

during these periods may cause difficulty if responsibility is divided.

5 Environmental quality and cost effectiveness

5.01 Establish desirable standard (this is a value judgement) which must be a factor of environmental quality, but needs to be related to a clear image of what type of environment is to be achieved. Comparison with a known example can be helpful (see cost graphs information sheet 30) and can avert failure by identifying at cost planning stage where investment is justified, necessary or indispensable. Test out design against its purpose.

Check priorities to ensure that objectives can be achieved and revise design concepts if necessary.

Cost effectiveness. Taken over viable lifespan, considering maintenance against capital costs.

Density/local intensity of use. Vital effect on cost.

Access arrangements. Are these under or over provided?

Privacy/identity. Adequate enclosure, variety to avoid sterility.

Shelter. Eg covered ways, covered play. Relation to microclimate.

Road sight lines and service access. Daylight standards: are these so expensive that they reduce resources or benefits: eg excessive distances between blocks which reduce enclosure. Re-examine assumptions where necessary.

Car access and storage. Is it more important to shelter people than cars? Is the investment in balance?

Use of materials and detail design: relate to local use intensities need for protection on routes.

Social and morale benefits. There are significant intangible benefits to be gained from an investment sufficiently increased to enable the landscape to be complete, and to appear to be semi-mature upon occupation.

Flexibility

5.02 *Need for flexibility during tree or plant growth or other natural changes.* Right from the outset of a new scheme the landscape is developing and changing. In these respects, therefore, dynamic change is and has to be built into the design which must be able to adapt to it. Whereas some changes (altered water tables due to extensive development) cannot be anticipated, they can be planned for to some extent, and ideally the design should be capable of absorbing normal characteristics of growth.

How well this happens may depend on a maintenance programme which the designer cannot necessarily control, though ideally he may be able to influence it, if possible by being consulted from time to time as the scheme develops.

Changing requirements. Check assumptions for design and its ability to cope with changing needs. Assumptions which were valid at the inception of design may become obsolete during the lifetime of the scheme.

Car parking provision, vehicle access, turning circles, methods of servicing, waste disposal, are likely to change radically, perhaps within a decade or so.

Certainly within the life of most schemes it seems wise to anticipate the effect of such changes, however uncertain, as possible alternative uses for surplus land, or need for additional land, and to consider how this may become available. Where spaces can be designed to accommodate more than one specific use, they less readily become obsolete.

Changing responsibilities. The formal responsibilities existing at inception may change: tenants become owner-occupiers; leasehold arrangements or agreements may change; community organisations may assume partial or whole responsibility for maintenance. Any, or all, of these can have a vital effect on maintenance. If possible the basic design should enable a strong unifying thread of permanence to permit local adaptation and change.

6 Definitions

6.01 Domain

Private space. Enclosed spaces which are entirely private and are the clear responsibility of the family for management. For the purposes of this system these are private spaces which are enclosed by a wall or fence at eye level, and achieve total privacy at ground level. This is denoted by the edge condition '. . . with enclosed gardens'.

Communal space. This is available for use by all residents, and may also be available to though not meant for the public (eg where a public right of way, as 'route space', penetrates a housing scheme). Communal or local access and 'non-route' spaces would normally be used only by residents who live close by, and may indeed be maintained and managed by resident groups. Local access spaces would generally be most closely related to quite a small group of dwellings and might sometimes be of a semi-private character. Traditionally these may be spaces with a gated entrance to a restricted number of dwellings, achieving a particularly strong sense of identity.

Communal + private · open communal spaces with private spaces adjacent to the dwelling which are only partly screened or are totally visible from the open spaces. Such spaces may be privately owned, maintained and managed. Traditional front gardens with low hedges or walls or Georgian terraces with a sunken area would fall into this category, as would terrace housing where publicly maintained strips adjoin the footpath: this is symbolised by the edge condition '. . . with privacy strip'.

6.02 Circulation

Route spaces: may be for vehicle, pedestrian, or vehicle + pedestrian use.

Local access spaces may be for vehicle or pedestrian use. Local access vehicle spaces will often be associated with pedestrian routes, as where a route adjoins a vehicle cul-de-sac.

Non-route spaces. These are pedestrian spaces only and are not designed to be used for access—eg grassed courtyards or perhaps a totally enclosed paved space with no access to dwellings or gardens. Such spaces can thus be expected to have much less intensive use, and are normally especially suited for grass or planting areas.

Notes. Some service routes, eg fire and refuse, may pass through spaces which are predominantly pedestrian; these are defined as pedestrian, or pedestrian-dominant spaces.

6.03 Edge conditions

Are related to the form of the spaces enclosed. They will be influenced by dwelling type and arrangement of its outdoor privacy zone. With small or narrow spaces, the dimensions of which are frequently dictated by housing by-laws, daylight distances and vehicle and service requirements, the character of these spaces will be dominated by their edge conditions. With larger spaces the overall form is likely to be dominant characteristic.

Non-aspect. Any enclosure reaching to above eye level, eg enclosed garden, wall or fence, patio or garage wall, gable wall end of blocks, set backs etc.

Controlled aspect. These occasionally occur with a privacy strip but since such strips are not usually necessary thev are not shown on the edge condition. Where such an area is privately maintained this is, however, symbolised on the plan as 'private'.

Open aspect, no privacy strip. Traditional by-law housing type—ie front door opens directly on to street; which also occurs with Georgian type terraces.

Open aspect, with privacy strip. Edge where unscreened or partly screened space is required to reinforce privacy for an open aspect dwelling—this may be a narrow 'privacy' strip or open front garden designed to keep persons a little distance from the window.

Open aspect with enclosed garden. Enclosure of sufficient height to provide privacy: eg hedge, fence, wall forming courtyard type garden.

Under block. Ground level space continued under overhang of block roof or canopy, the edge of which implies boundary of the adjacent space. This would also occur on covered decks.

Garage/service space. Areas of garages, stores, servicing ie where garage doors, or entrances may be predominant features; these may occur under blocks eg on deck schemes.

+Adjacent space. This describes the situation where a large space is bounded only by one edge.

Access to dwellings

Positions of entrance points to individual dwellings, groups of dwellings or blocks. Single access to detached dwellings, blocks of flats.

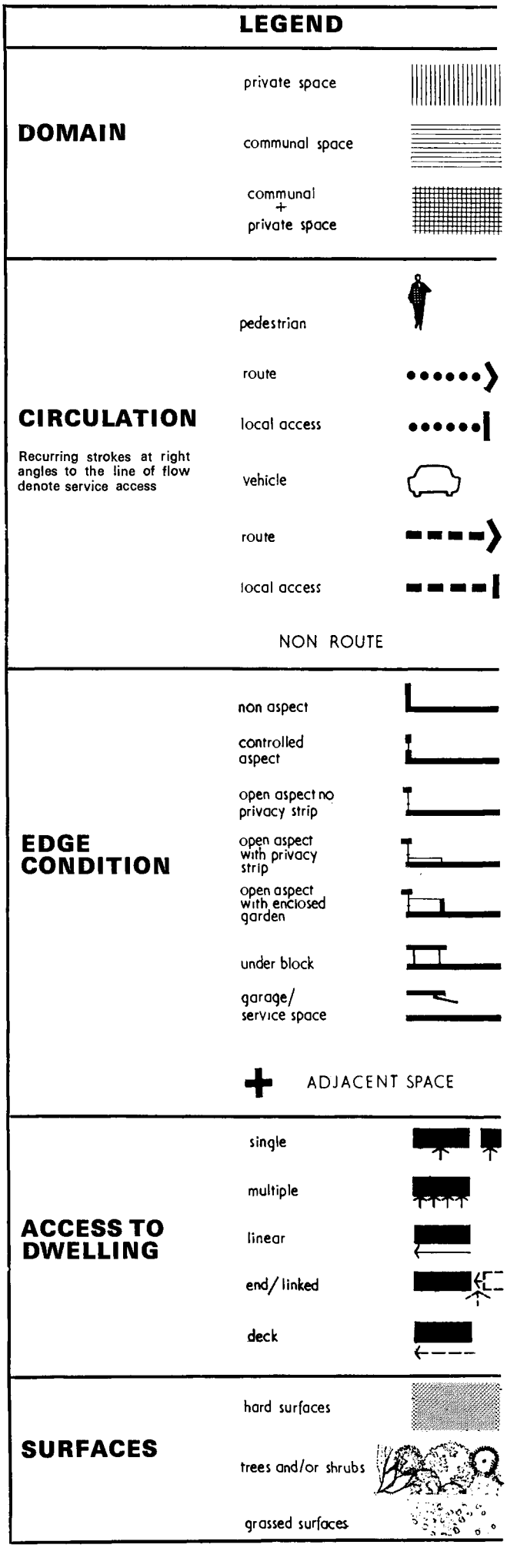
Multiple access to terrace houses etc. Linear access to maisonette entrances at ground level.

End/linked access at end positions of single or linked blocks.

Deck access deck access on edge of blocks or centrally within structure of paired blocks.

Design determinants—check list

1 **Density**
2 **Ground coverage**
3 **Adjacent facilities**
4 **Local intensity of use**
5 **Play spaces**
6 **Sitting spaces**
7 **Access systems and links**
8 **Car storage**
9 **Services, utilities**
10 **Site**
11 **Microclimate**
12 **Privacy**
13 **Community**
14 **Identity**
15 **Outlook**
16 **Management, ownership**
17 **Maintenance**
18 **Environmental quality cost effectiveness**
19 **Flexibility**



KEY DIAGRAM

EDGE CONDITION	····›	····|	NON ROUTE	- - -›	- - -|	-·-›	-·-|	····› - - -|
non aspect	K*	F M	J		E D		B	
controlled aspect	9 9 10	8				3	3	
open aspect no privacy strip	9		9			2	1	5
open aspect with privacy strip	5 10	10 L				2	10	
open aspect with enclosed garden	10 A D	10					12	
under block							3	
garage/ service space	A				9 C E	3 4	12 4 B	9
+ ADJACENT SPACE	9 9 10 D H 9		9			2	1	5
COMBINATIONS OF EDGE CONDITIONS								
	7 D K*	7 11	J				11	
	9 7	7					6	
								H
	7	7 11					12	
	8	11 8					6 11	
	6 7 8	6 7 11 8					6	
	1	M				G		A
						2		
						4	4	
		F L				4	4 12	5
	M					3	3	
	6 O 8	6 8						

TYPE OF ACCESS

linear single multiple end/linked deck | linear single multiple end/linked deck | non access | linear single multiple end/linked deck | linear single multiple end/linked deck | linear single multiple end/linked deck | linear single multiple end/linked deck | linear single multiple end/linked deck

KEY

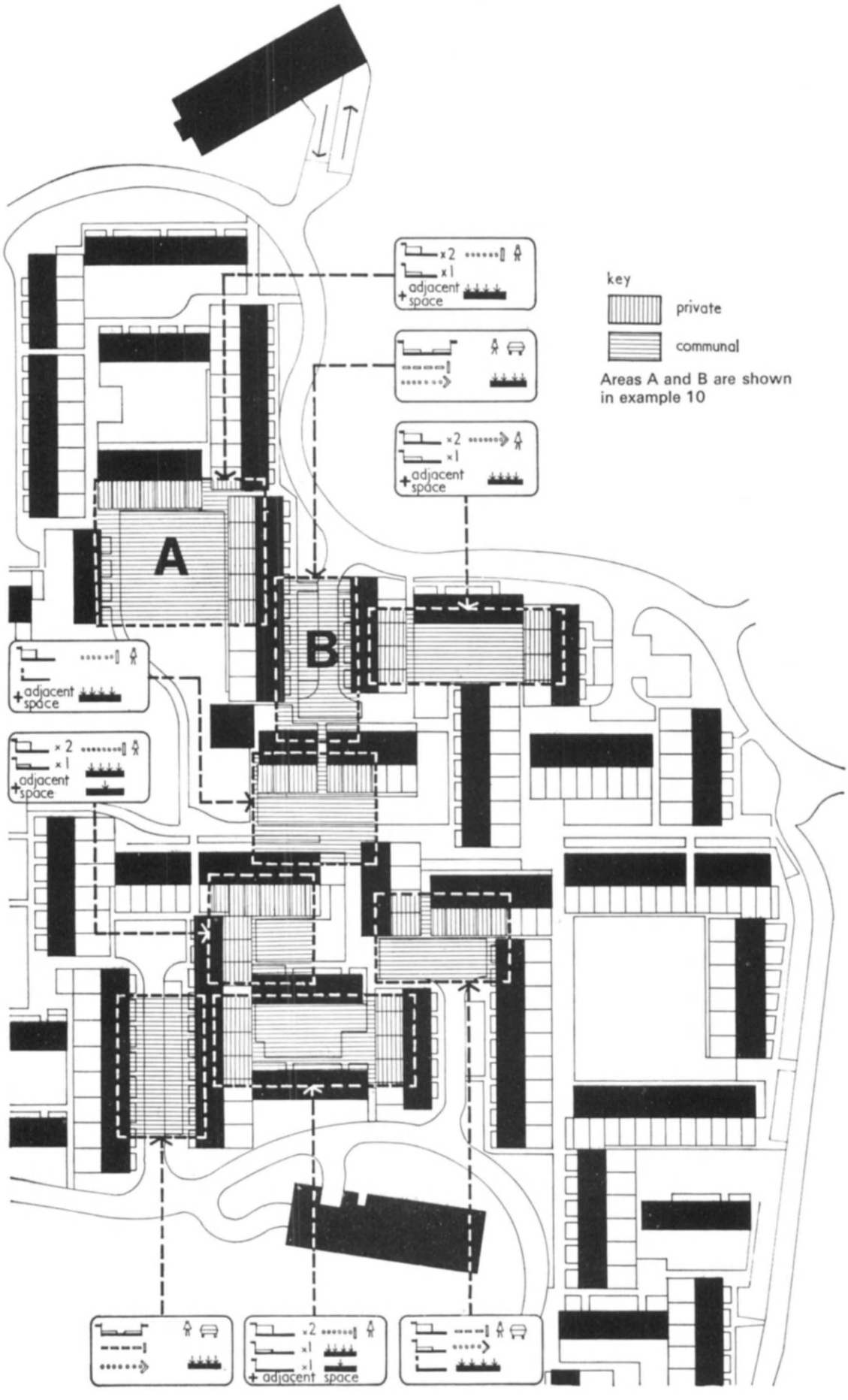
* NON-ROUTE

8 Each number refers to the relevant diagram (see following pages illustrating an example of that particular condition)

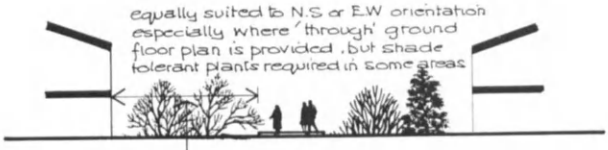
H Letters refer to situations appearing on INF Sheet 31 Rehabilitation see plan page 199

Assemblage of space types

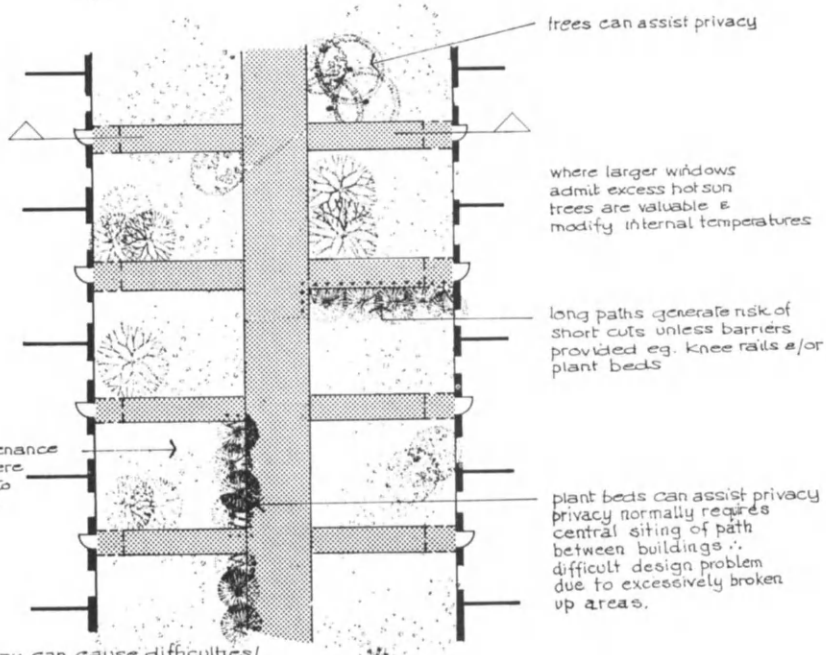
Beavers Farm, Hounslow



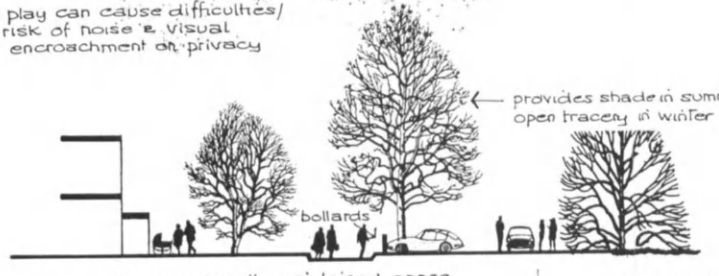
1 Terrace house types

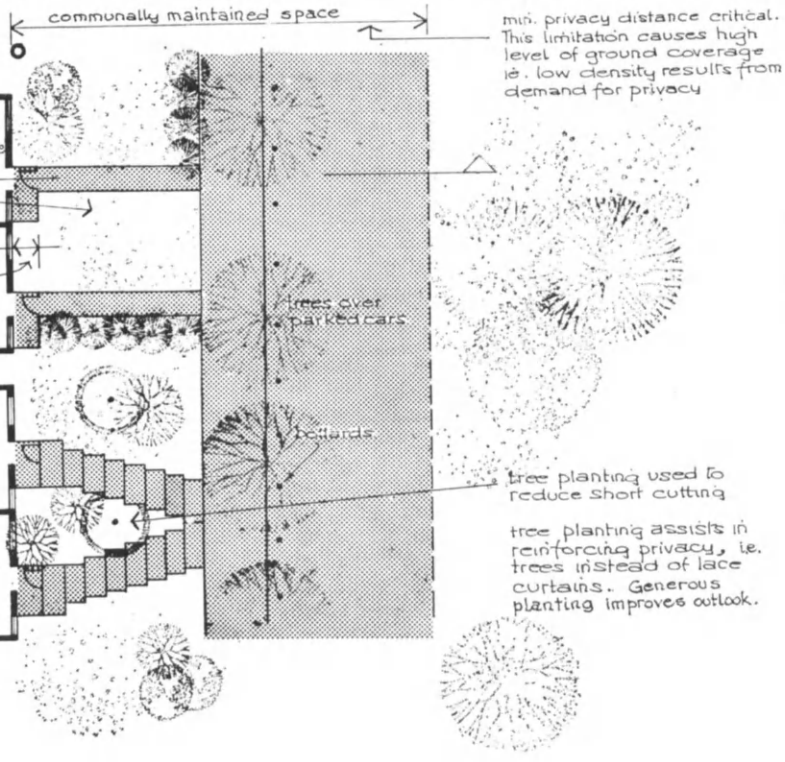


if maintenance of this area is private, responsibility of appearance of gardens is visually critical to whole space



childrens play can cause difficulties/ friction – risk of noise & visual nuisance encroachment on privacy





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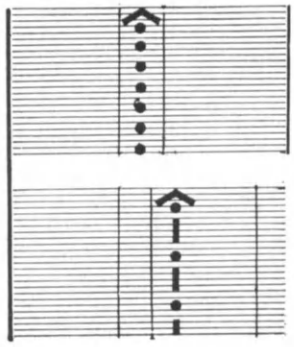
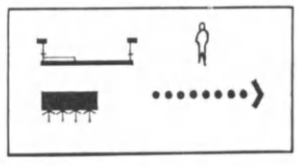
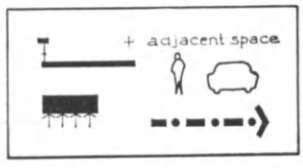


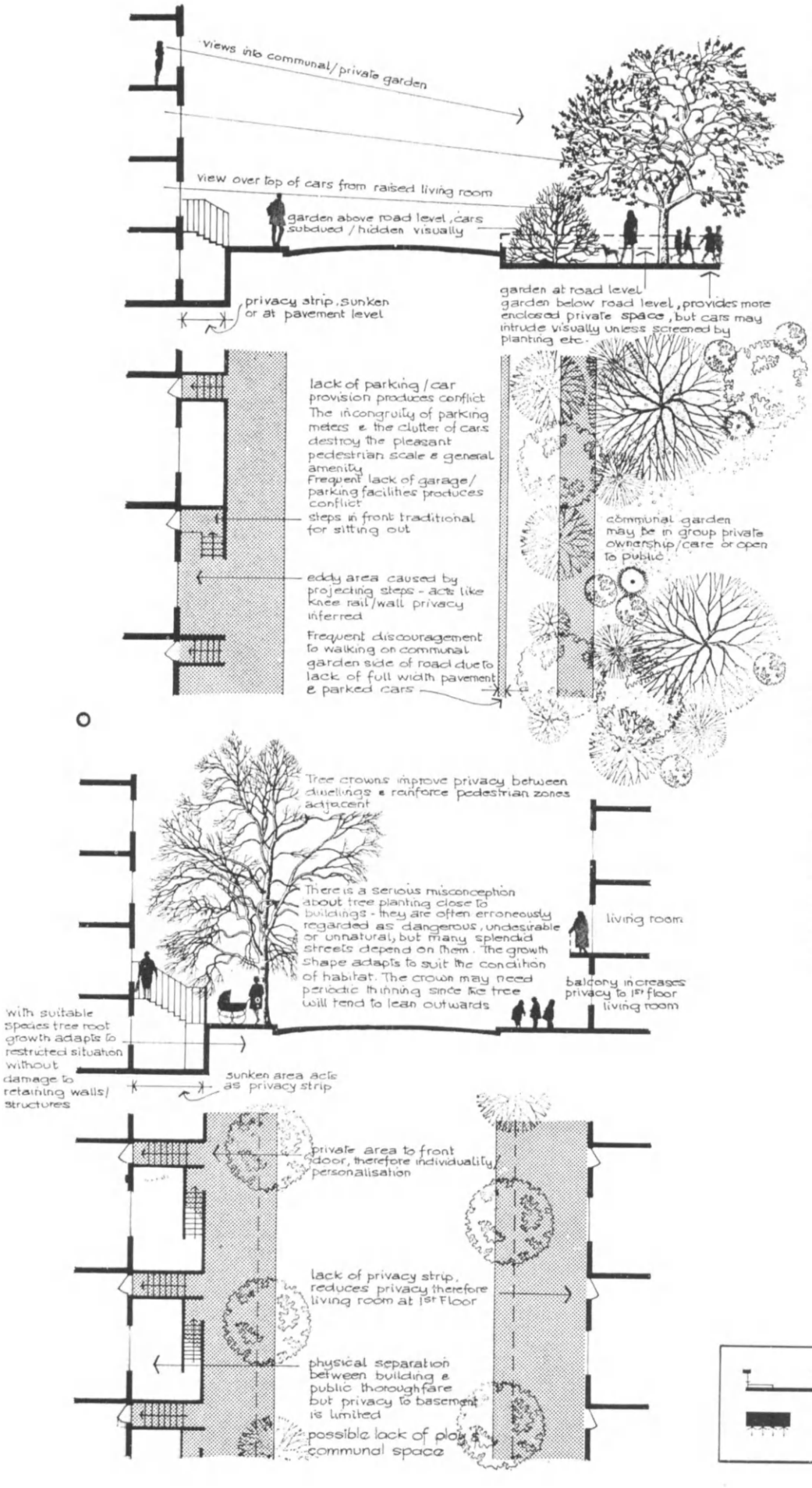
CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space





2 Georgian streets and squares



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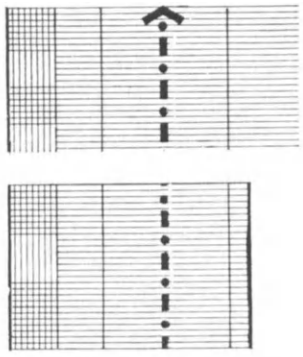
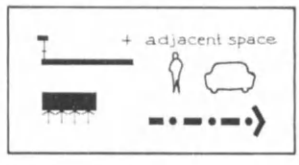


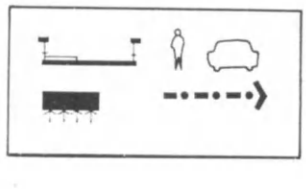
CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

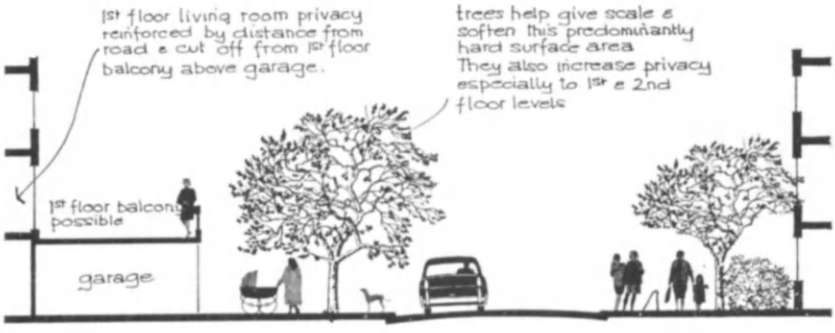


GENERAL

Sunken area acts as privacy strip but infringement of privacy to basement rooms may be reduced by internal planning; back of house is then private. Basement areas may be unsightly, but use of small trees, and shrub plant climbers can be used to make these more attractive.



3 Town house types



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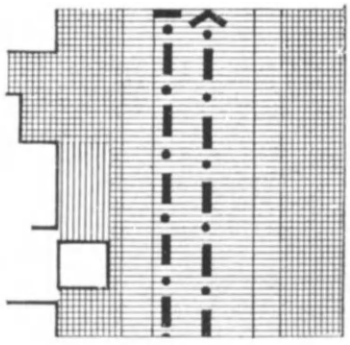
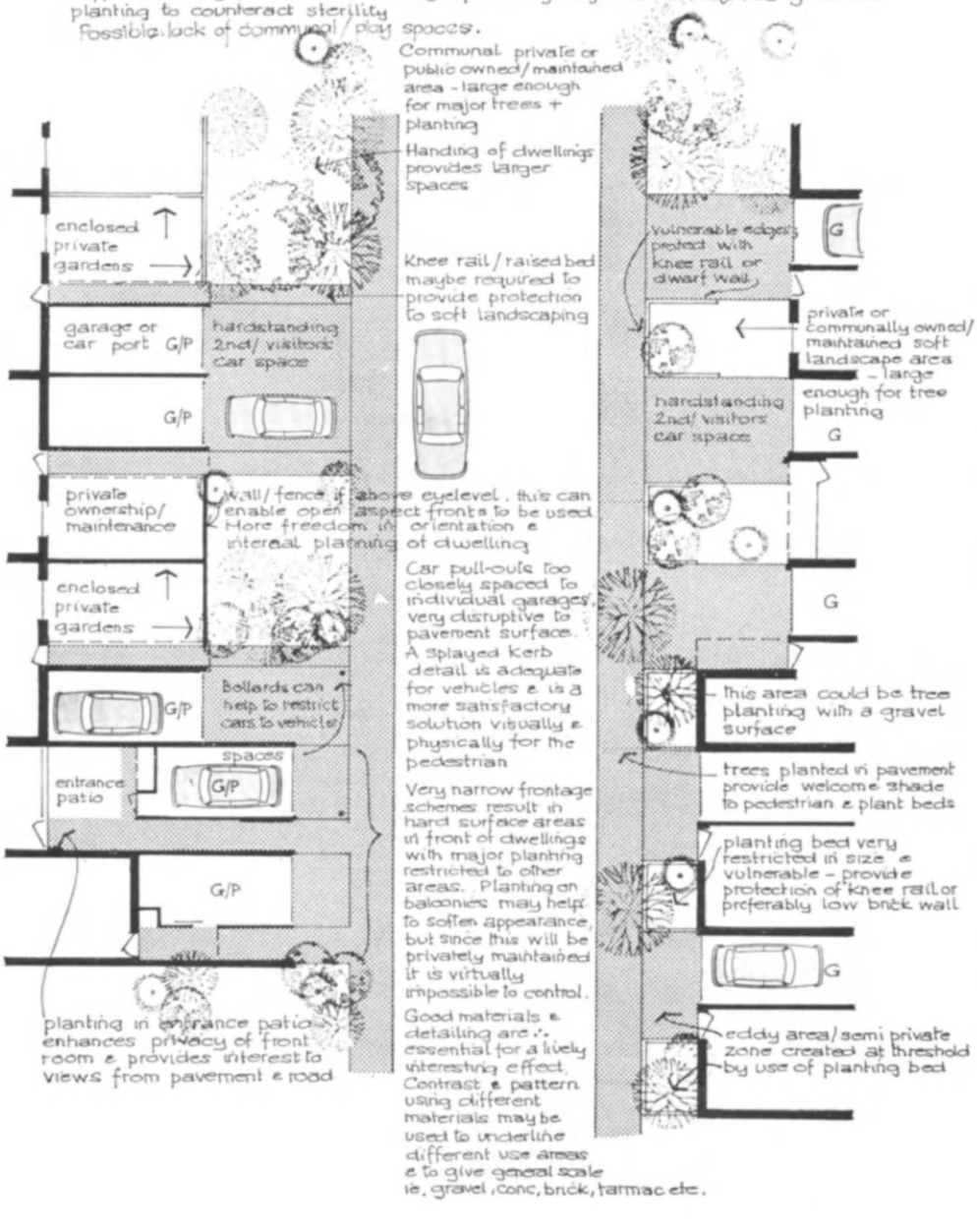
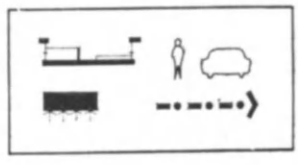


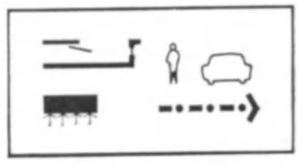
CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

Generally:
The high intensity of use in this type of development and the very high proportion of ground level area devoted to car provision necessitates the use of hard materials & leads to very restricted areas for and dependent on tree planting & soft landscaping. In such areas, soft landscaping is particularly vulnerable to damage & must be very carefully protected & maintained. It is vital to use carefully selected, high quality materials, well designed in places where intense use is to be expected - this results in a high capital cost.
Effect of large numbers of closely spaced garage doors requires generous planting to counteract sterility
Possible lack of communal / play spaces.

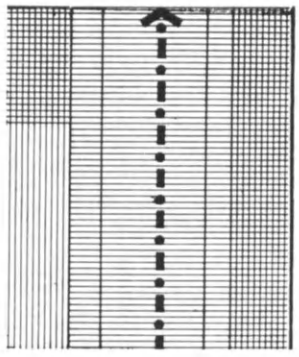


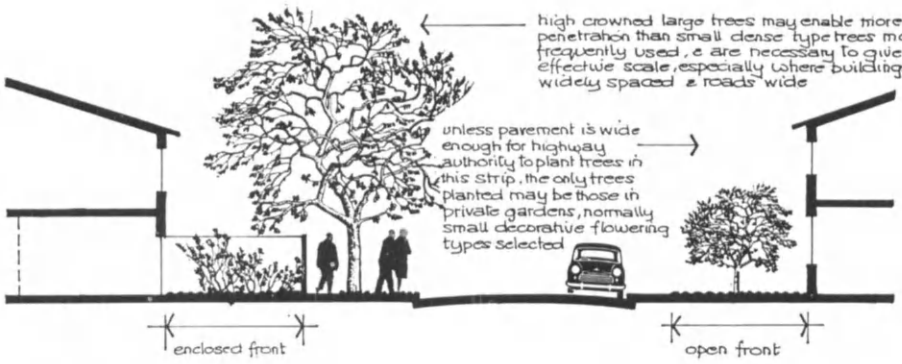




4 Suburban street types

KEY DIAGRAM





General

Except where typical suburban semi detached dwellings occur in 'local access' rather than 'route' spaces there is a safety conflict due to temptation for children to use road for ball games, wheeled play etc. Down grading road by introducing bollards, gates or narrowing roads etc can help resolve this or by roughening road surfaces

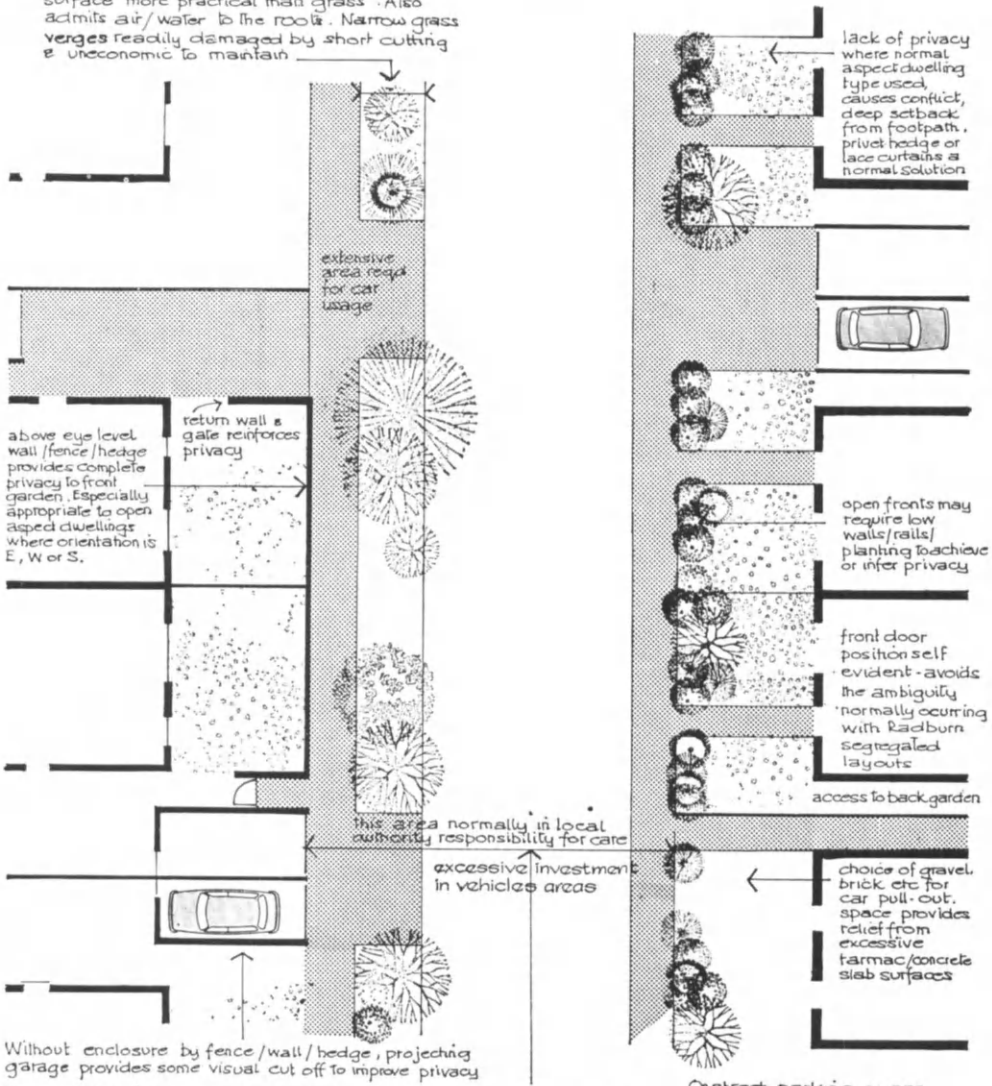
Absence of safe traffic free areas for childrens play
No communal space for general amenity
Avoids need for residents /group/ communal responsibility for maintenance
Private gardens occupy all residual space resulting from byelaw. spacing & density restrictions

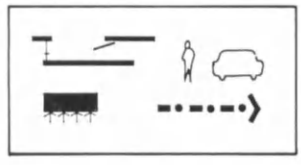
CIRCULATION & OWNERSHIP

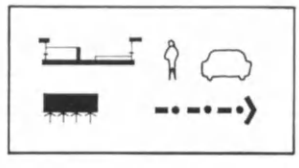
A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

provision of strip between footpath & road enables large trees to be planted. Assists in separation of vehicle & pedestrians. This can be reinforced by planting &/or grass banks where sufficient extra available space &/or adequate maintenance can be carried out. Where flat gravel surface more practical than grass. Also admits air/water to the roots. Narrow grass verges readily damaged by short cutting & uneconomic to maintain

with widely spaced housing there is opportunity for personalisation of private domain, but visual chaos results without strongly unifying feature eg. trees, garden walls + consistent use of unified design details + materials etc.

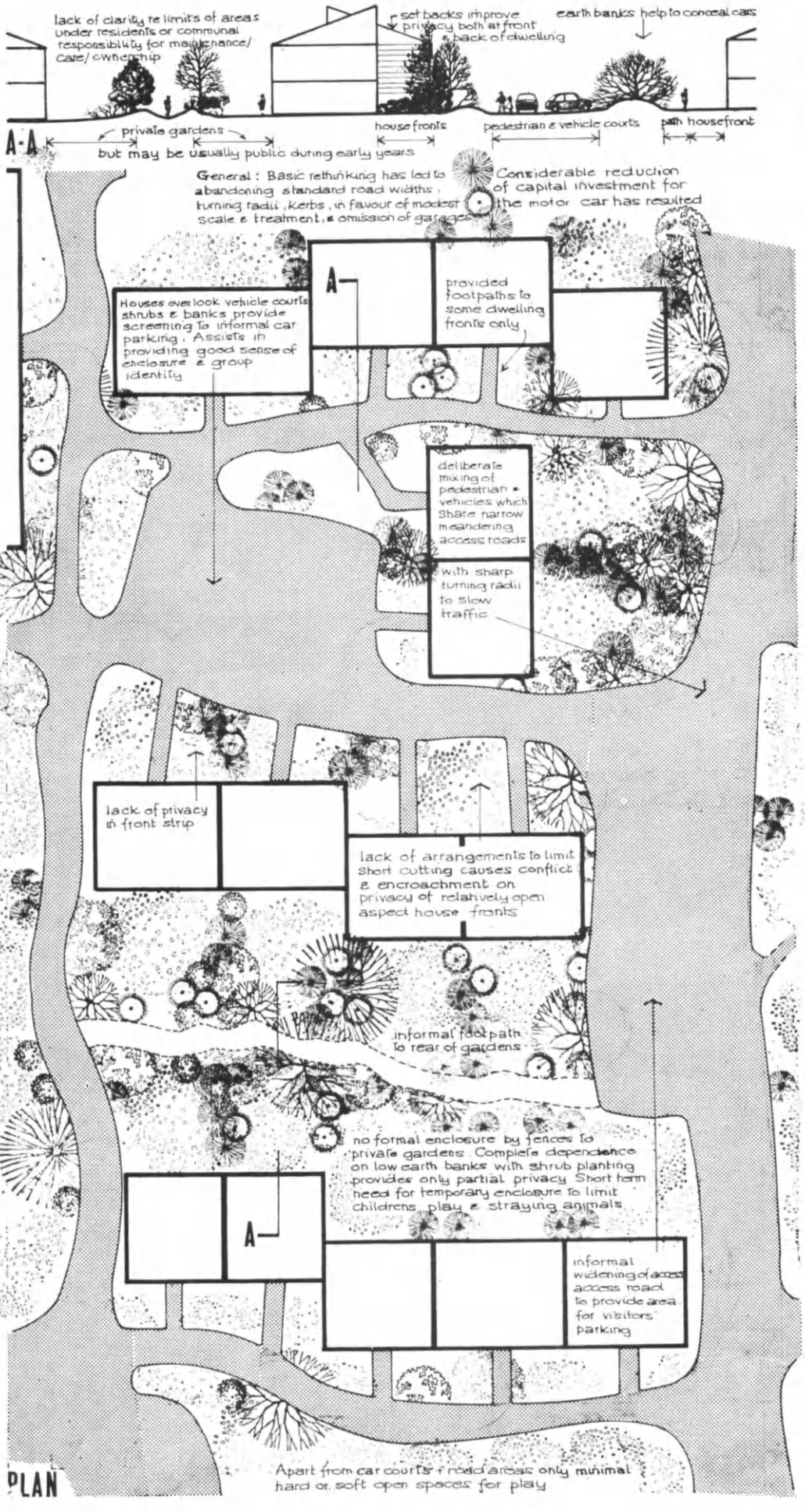






5 Dwelling types grouped around vehicle spaces

based on The Brow, Runcorn, Cheshire
Runcorn Development Corporation Architect's Department



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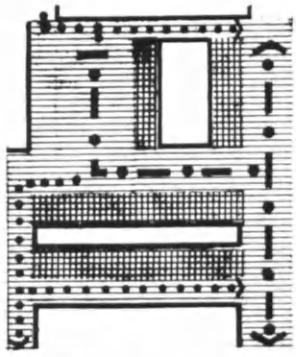
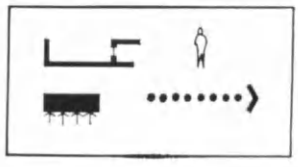
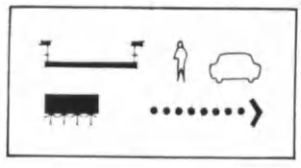
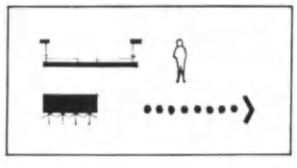


CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

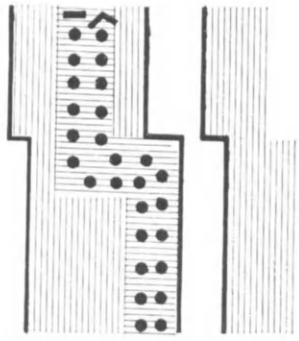


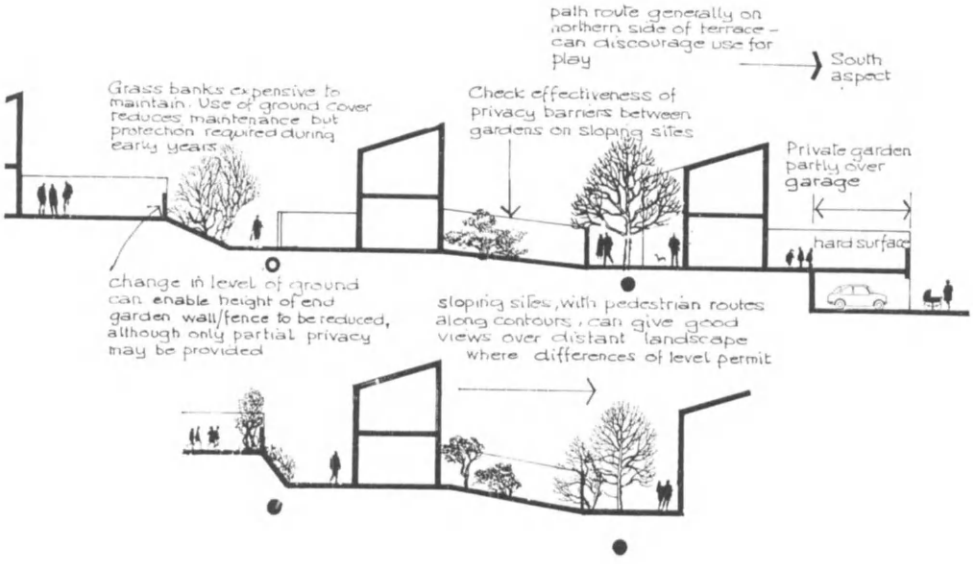


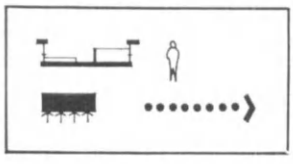


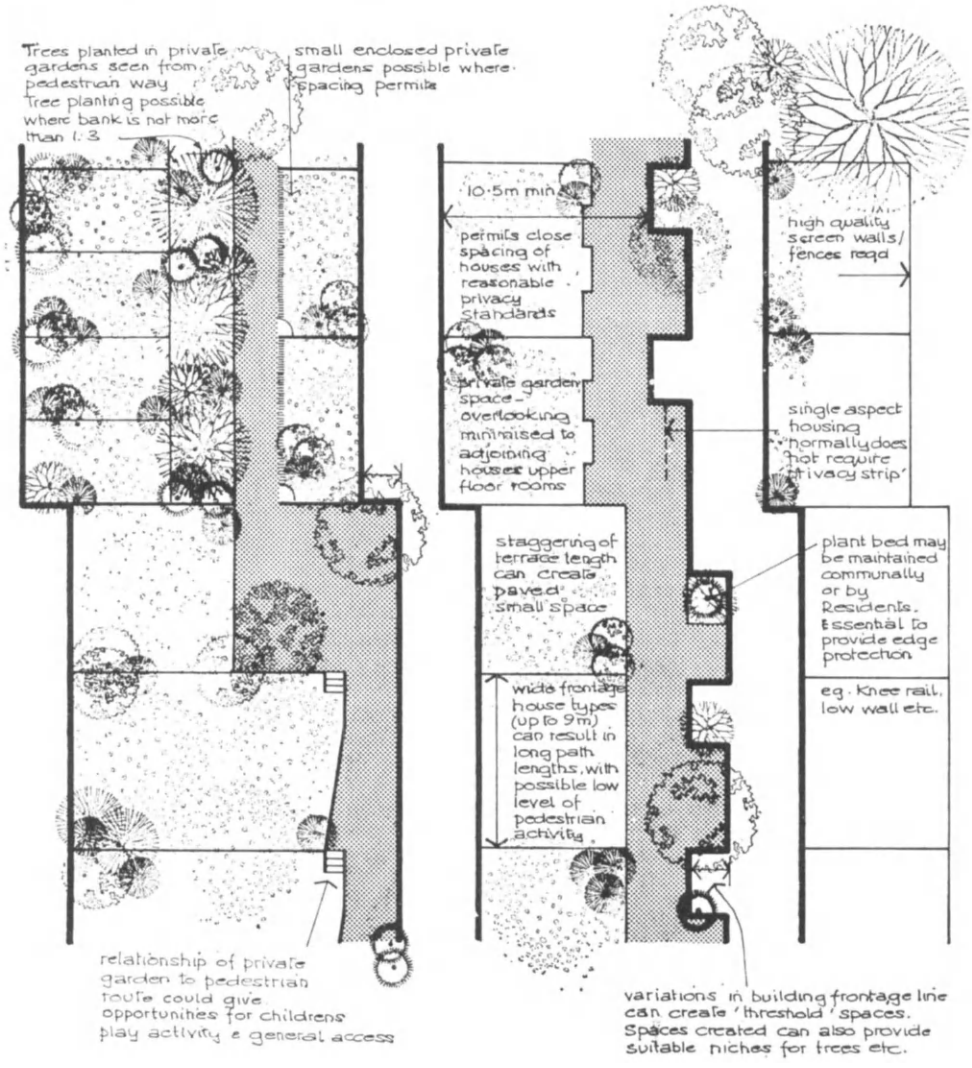
6 Controlled aspect type

KEY DIAGRAM







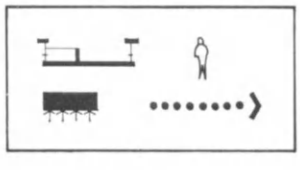


CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

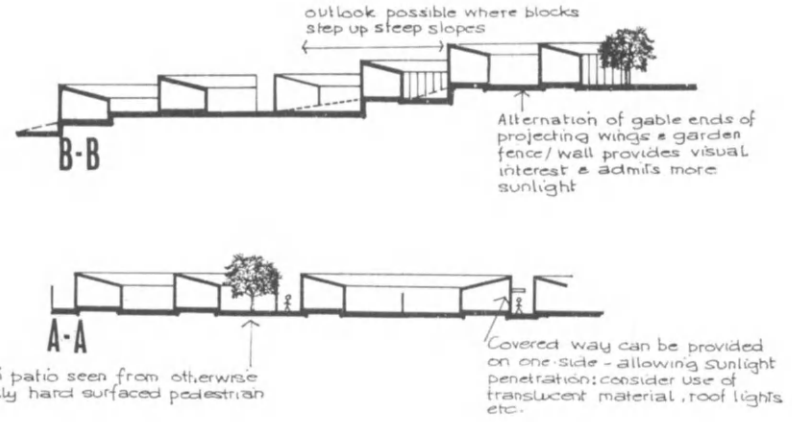
GENERAL

If the pedestrian way is a main route increased use makes it livelier.
On non-route pedestrian ways, with dwelling entrances on one side, only especially wide frontage types are used, privacy improved by less frequent use but isolation could be a problem.
Breaking continuity of terraces can help avoid monotony.
Since entrances are normally on north side, pedestrian spaces are seldom sunny.



7 Patio type

based on Clarkhill, Harlow
Bickerdike, Allen, Rich & Partners



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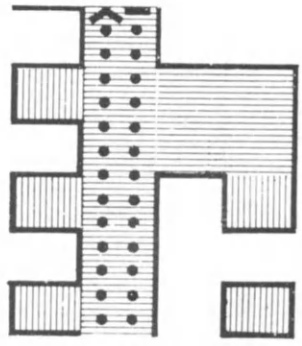
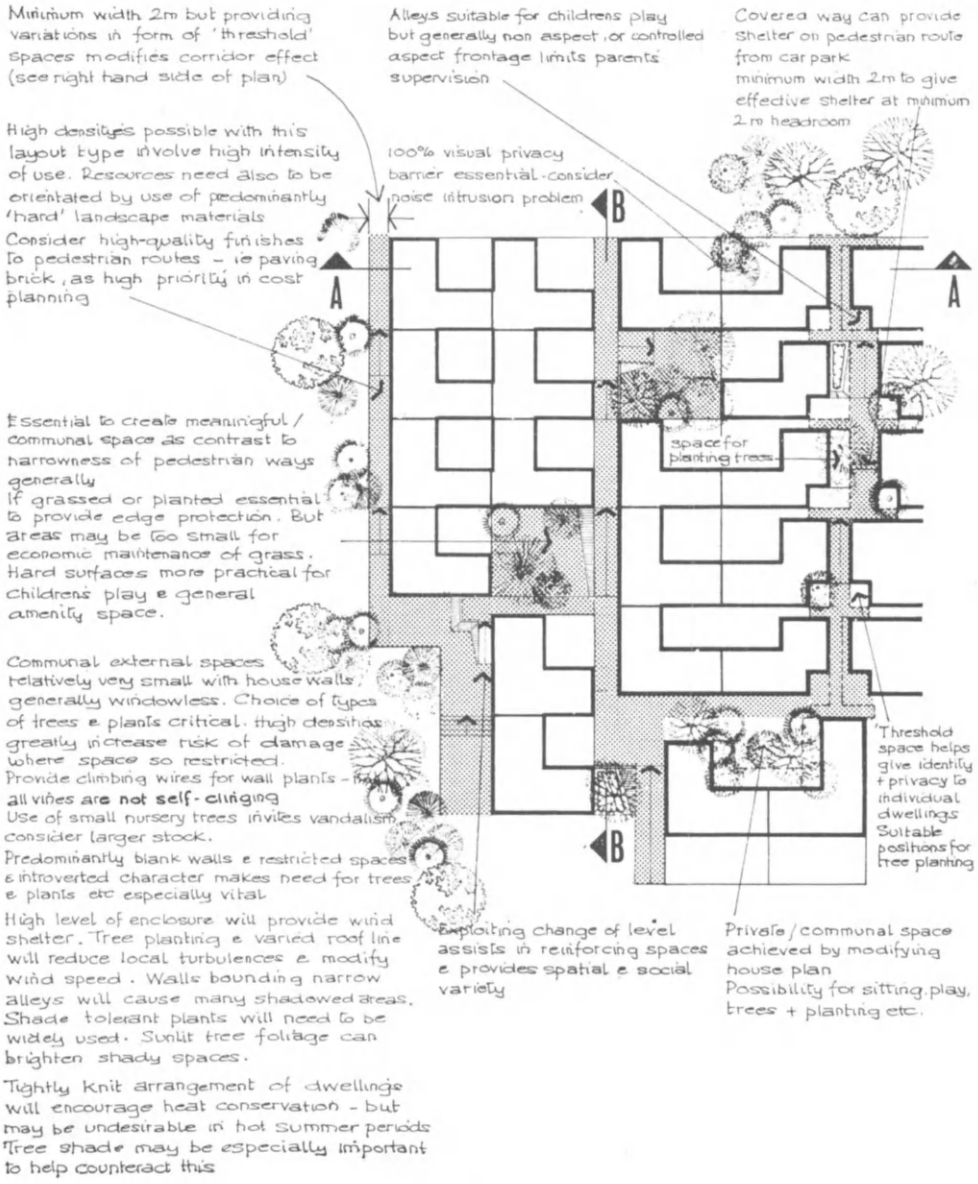


CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

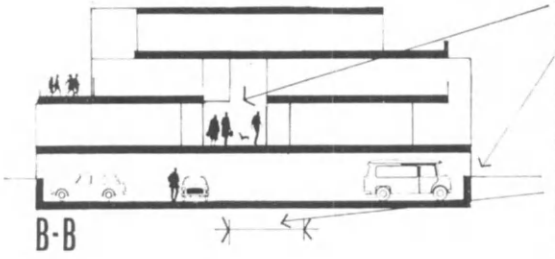
GENERAL: *Courtyard housing, especially on flat sites, can suffer from lack of outlook. Larger spaces along routes are therefore needed. An upper storey in part of the plot can give some outlook and make this otherwise attractive house type less claustrophobic*

Dense layout greatly restricts tree space. Congested underground services inhibit choice of tree species, position and plant beds. Climbers become especially useful. Avoid inconvenient access through dwelling to courtyard: involves gaps between blocks, but this has compensations: simpler, cheaper junctions at changes of level; modulation of spaces by gaps increases perimeter wall cost but improves sound insulation and increases interest by freeing layout



8 Deck access types

based on Alexandra Road, Camden London Borough of Camden Architect's Department; Lillington Street, London SW1 and Marquess Road, London N1 Darbourne and Darke; Lancaster Road, London W11 Clifford Wearden and Associates



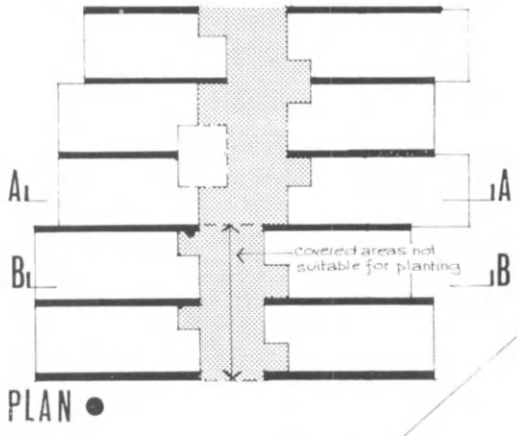
where portions of deck are covered an already limited outlook may be further restricted

Garage vents at GL free planning of deck but limit finished ground levels round building perimeter. Lowering ground adjacent to dwellings assists privacy

Dimensions for garage/parking/underground spine road predetermine dwelling sizes & structural economy limits possible for sizes of spaces between dwellings

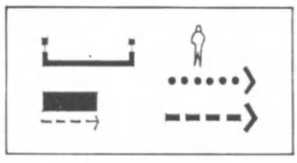
High density & structural limitations of deck at high level frequency imposes rigid limitations on distance between dwellings

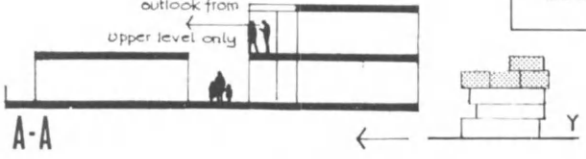
Decks safe for childrens play but noise problem especially difficult to ameliorate without variation of deck form to provide niches, setbacks etc. Check orientation of these. Decks can be isolated if they do not occur on ROUTES. But if the route is too busy there may be noise & privacy problems

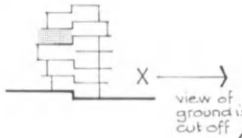


Restricted outlook in central deck spaces can be aggravated by long lengths of narrow unvaried areas. There is particular dependence on very high quality finishes, paving materials etc. to provide extra colour & texture & to avoid aridity

Generous plant bed provision can help here but adequate maintenance/management arrangements are vital







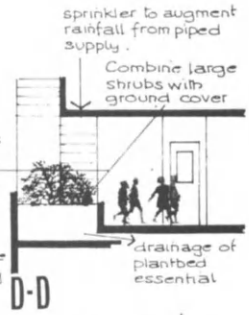
sprinkler to augment rainfall from piped supply.

Combine large shrubs with ground cover

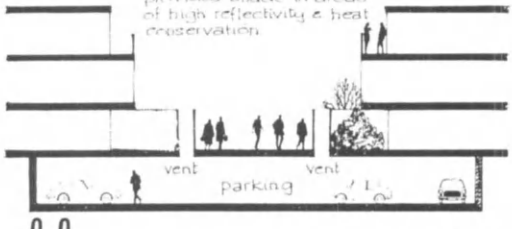
view of ground is cut off

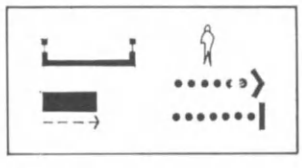
but plant beds on deck enrich views & give sense of security

drainage of plantbed essential

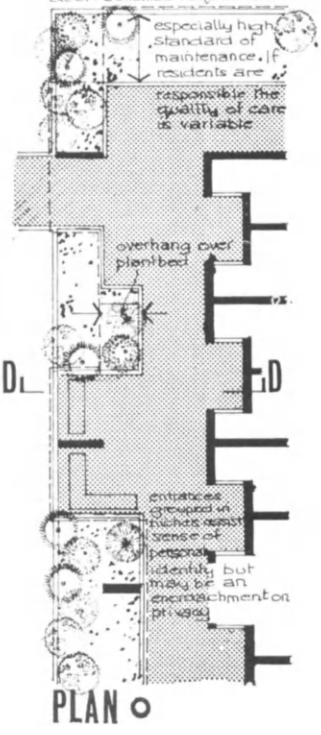


High structures flanking deck may encourage wind funnelling. Omitting groups of car bays at intervals enables tree planting to help reduce effect of this & also provides shade in areas of high reflectivity & heat conservation





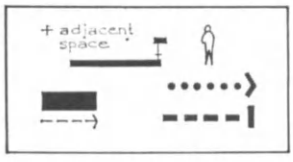
Generously wide plantbed but there are important problems. The high densities usual for deck schemes require an especially high standard of maintenance. If residents are responsible the quality of care is variable

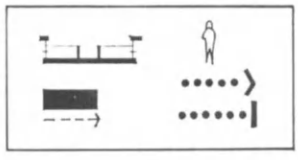


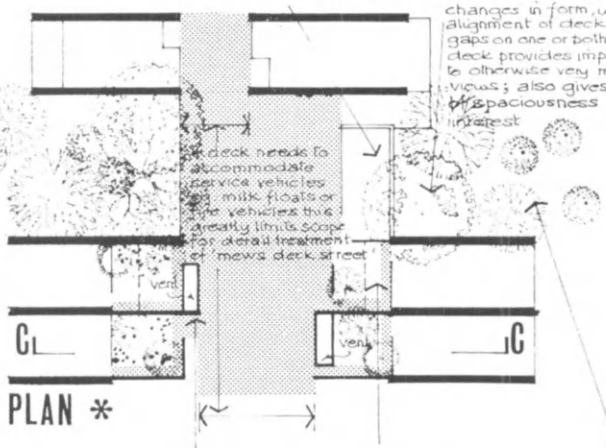
deck construction limits extensive topsoil areas; predominantly hard treatment normally unavoidable.

changes in form, width & alignment of deck & leaving gaps on one or both sides of deck provides improved outlook to otherwise very restricted views; also gives sense of spaciousness + interest

deck needs to accommodate service vehicles eg milk floats or fire vehicles this greatly limits scope for detail treatment of 'mews' deck street







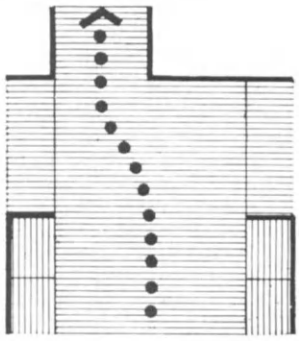
need for generous vents to underground garage limits planning arrangements at deck level. Integrate these with structure walls or other features where possible.

Provision of wall round private deck gardens can enable open aspect dwelling type to be used

tree planting round perimeter of building can penetrate deck space & be visible within it.

Planting safer than in enclosed raised boxes - less risk of drying out, more stability & less expensive structure.

KEY DIAGRAM



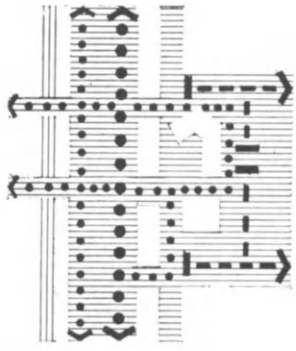
CIRCULATION & OWNERSHIP

A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space

9 Grahame Park, Hendon

GLC Architect's Department

KEY DIAGRAM



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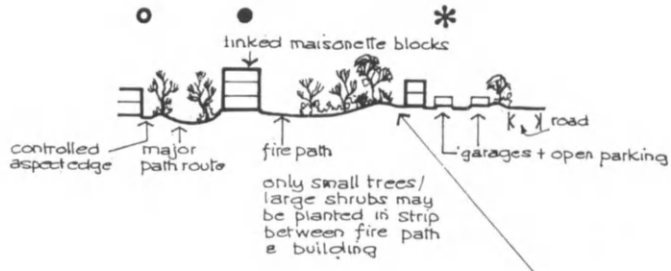


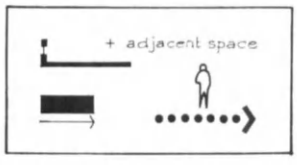
Grass banks & tree planting 1) reinforce routes by limiting temptation to take short cuts across vulnerable grass surface. 2) Strengthen spatial enclosure to green spaces. 3) assists privacy of open aspect dwelling types at ground floor level

General.

A Where buildings lie parallel to contours & cul de sac roads cross them, conflict of relative levels may mitigate against economic solution to achieving privacy.

B Careful appraisal of apparently 'flat' sites seldom fails to reveal difficult junctions at points where levels differ
Without stepping long or linked blocks to follow contours uneconomic cut/fill, retaining walls of foundations result. Due to problem of consolidation/settlement normally more economic to cut than to have to import expensive hardcore fill etc.

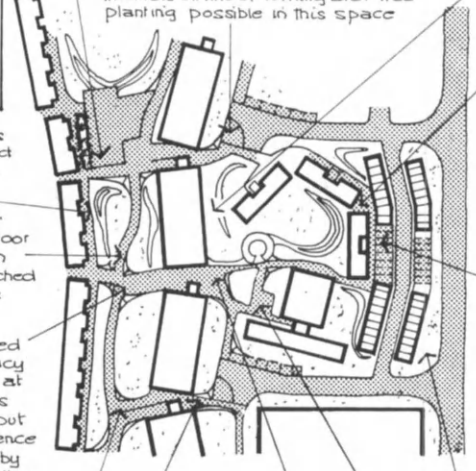
C Requires high standard of maintenance to communal areas. Scope of this is minimised by extensive use of hard materials on intensive use areas



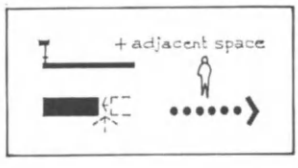
Play areas sited at junctions of pedestrian routes. Closest to single aspect side of space. Possible source of privacy conflict, but minimised by wall & planting on edge & change of level. Additional space with seats etc for adults nearby

Requirements for Fire Path along edge of 4 storey maisonette conflicts with design intention to provide non-route space. Take care in selection of surface treatment for Fire Path & symbols used to indicate position & extent eg. grass planted over perforated slabs, use of fire bollards/gates etc

Need for quadrant line of hammerhead eliminated by providing brick inserts at intervals on line of turning arc. Tree planting possible in this space



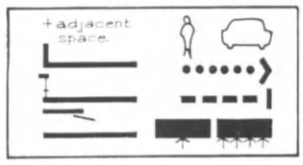
Detaching blocks which are irregularly arranged enables changes of level readily to be accommodated, ie. in relation to topography/road levels etc, but may create awkward left over spaces. If well orientated these can be put to useful purpose for sitting spaces etc.



Secondary linear access route to controlled aspect dwellings doubles up on on main route

Due to need for privacy to open aspect ground floor rooms major pedestrian route is generally detached from linked maisonette blocks

Group garage/parking space adjacent to open aspect dwelling edges. Garage wall can reinforce pleasant enclosure on path route. Alternating garages/open parking bays enable trees to be planted in otherwise sterile area. Requirement for Fire/Refuse access an important restraint on detail design may prevent enclosure where this is desirable.



All maisonettes on raised plinth to minimise privacy conflict, most critical at junction of link access points & cross routes, but normal minimum difference of level is increased by further lowering of paths & activity areas on these nodes where possible

Wear on vulnerable edges of raised grass areas next to paths minimised by brick on slope or low walls. Careful placing of trees & grading assists this

Pedestrian forecourt between head of cul de sac & linked entrance hall provides amenity/play area close to vehicle space where activity is attractive to children but with reduced safety hazards

Complex detail design problem with many conflicting requirements in close proximity.

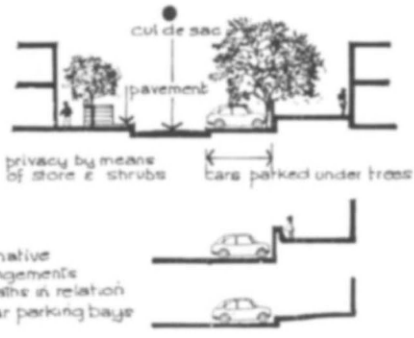
1. paladin refuse access ramp down to lower level
2. main paved surfaces need to be kept low to avoid privacy conflict.
3. entrance ramp required to raised ground floor slab level

Adequate space between road + garage edge to enable tree planting

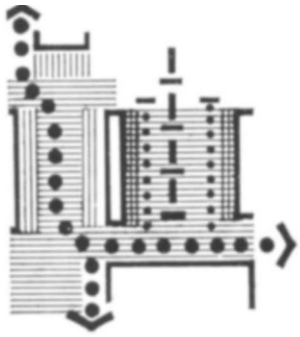
Providing terrace at intermediate level can help to avoid critical gradients for old persons & for paladin refuse access

10 Beavers Farm, Hounslow

GLC Architect's Department

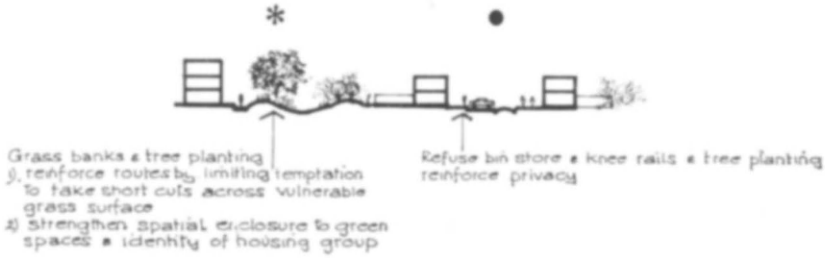


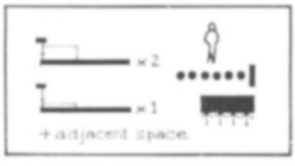
KEY DIAGRAM



CIRCULATION & OWNERSHIP

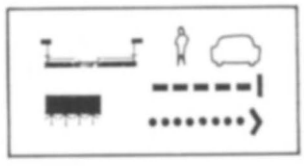
A symbolic identification of the situation illustrated: shows circulation, access and relationship of private to communal space





Surface & edge treatment should accentuate the pedestrian dominant realm. Highway standards of kerb construction are out of scale with the detail treatment of such areas & restrictive local authority requirements should not be permitted to frustrate this objective

Visual impact of cars limited by: tree planting between bays; limited parking to small groups; lowering road / parking areas below path / building levels. garages grouped separately in multi-level buildings



Planting read to reinforce privacy from adjacent main footpath route - but should preserve view to adjacent open space: low ground cover / shrubs & stemmy trees appropriate

Sloping grass surface accentuates spaciousness by creating illusion of distance. Minor path for rear garden access only

Residual quadrant area suitable space for tree planting to assist in modifying effect of large area of road surface

Detailing of spaces which must accommodate Fire routes etc. needs to leave adequate free space for turning circles etc.

Contoured grass banks & changing path alignment minimise otherwise dominant importance of main footpath route.
Illusion of sunken path assists visually in unifying adjacent space
Consistent quality of care for privacy strips dependant on individual residents

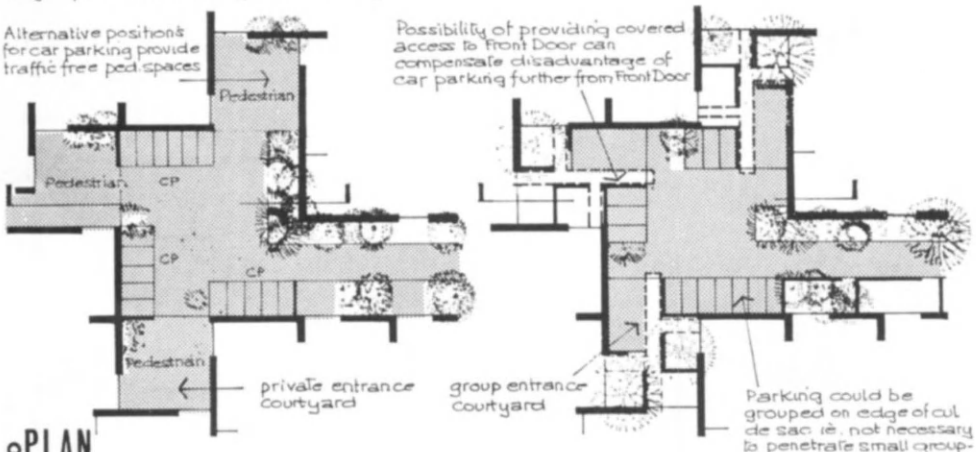
Some form of screening eg. trees / hedge / planting/grass bank / wall required at head of cul de sac.
Also helps to screen car head lamps.

Generous provision of communal space requires high standard of maintenance; latter may be minimised by adequate capital expenditure & careful detailing.

11 Dwelling group courtyards

based on Stokesley RDC by Manning and Clamp

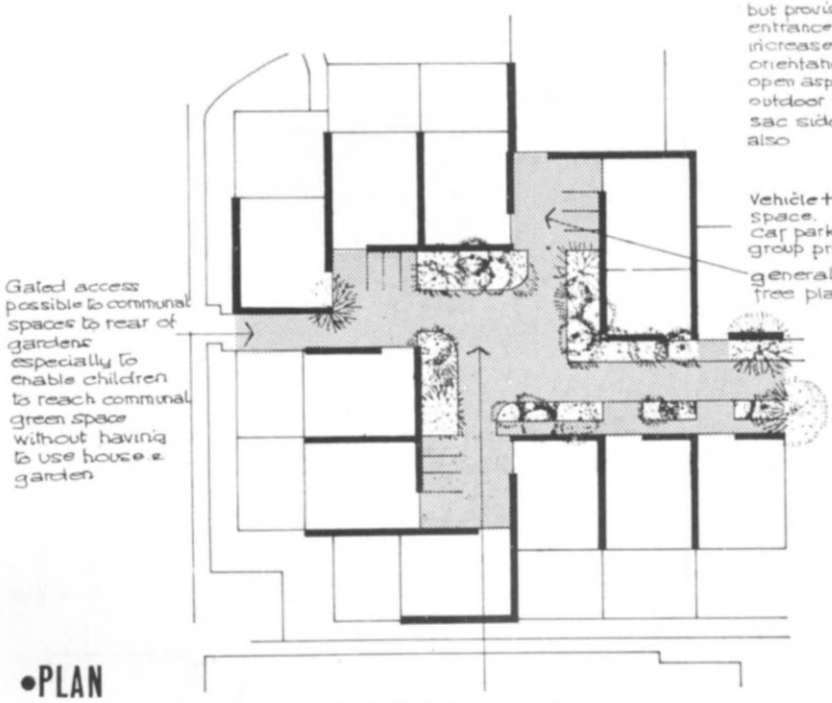
General
Car parking within smallest group space requires excessive enlargement for turning circles etc. Reduces opportunity for varying character. Exclusion of cars could permit smaller sized courtyards
Small compact groups of parked cars minimise their visual impact
Hierachy of spaces well recognised. Strong sense of identity & dwellings, privacy achieved by small groups of dwellings round semi private local access courtyard. Juxtaposition of dwellings reinforces this. Residents management/maintenance arrangements essential.
Dependence on high quality of materials + generous tree planting to give enclosure to relatively large space enclosed by low buildings.



•PLAN

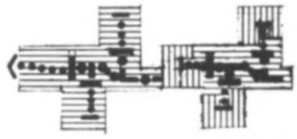
General
Low density, but general planning arrangements would enable higher densities to be achieved by closer spacing of both blocks of clusters

Best suited to non aspect/controlled aspect dwellings but provision of private entrance courtyards can increase freedom of orientation by providing open aspect spaces for outdoor living on cul de sac side of dwelling also



•PLAN

KEY DIAGRAM



CIRCULATION & OWNERSHIP

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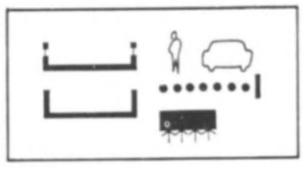
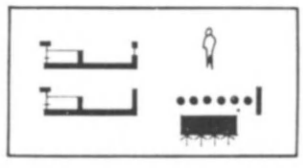
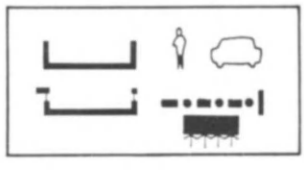
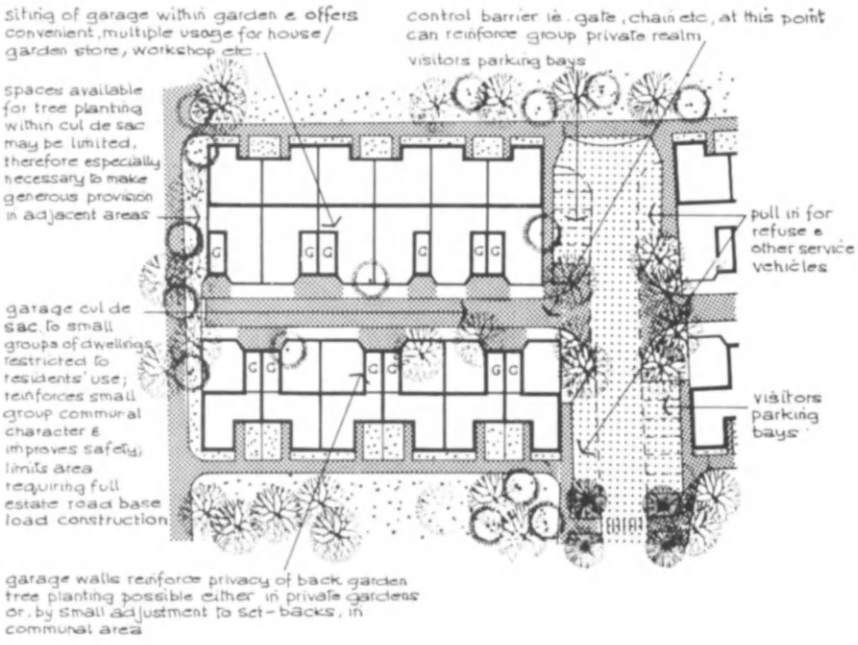
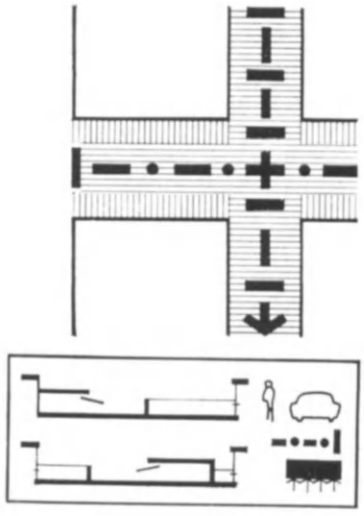




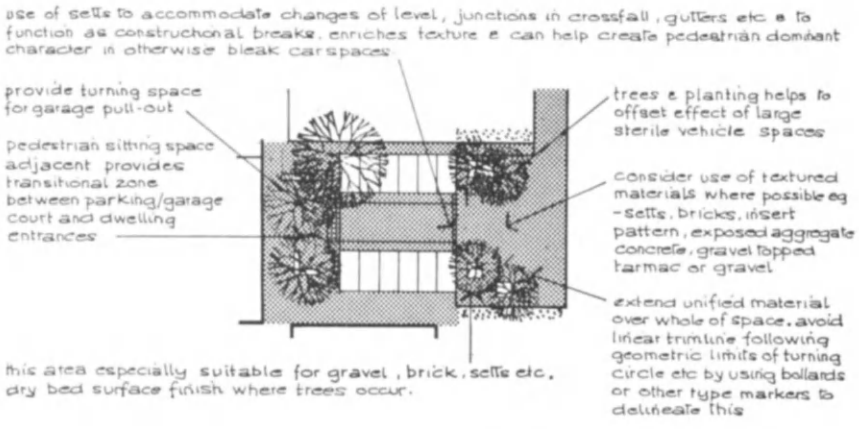


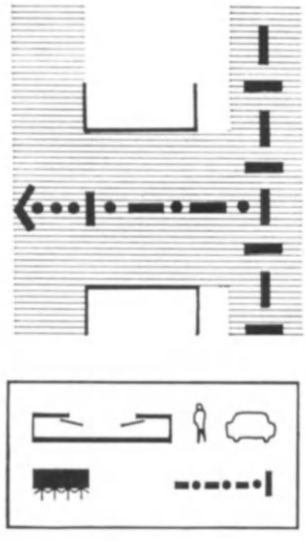
12 Car parking & garage spaces based on Popley 2, Basingstoke; Wilson and Womersley



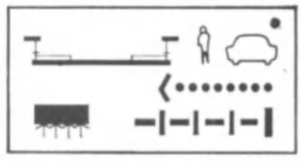


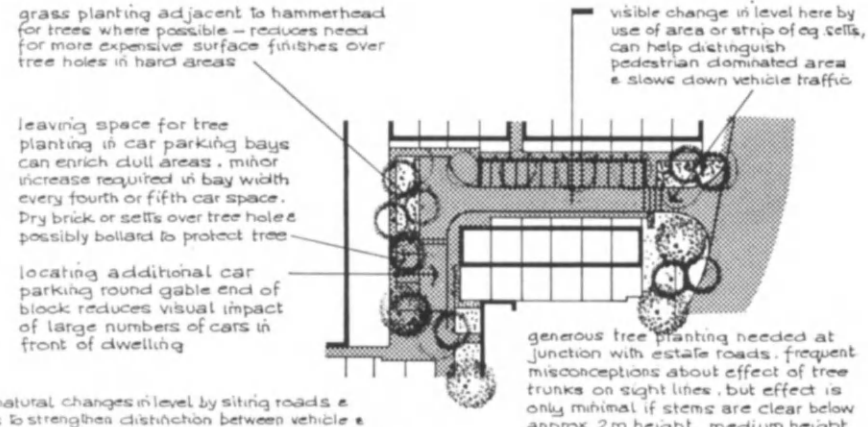
Garage court adjacent to axehead

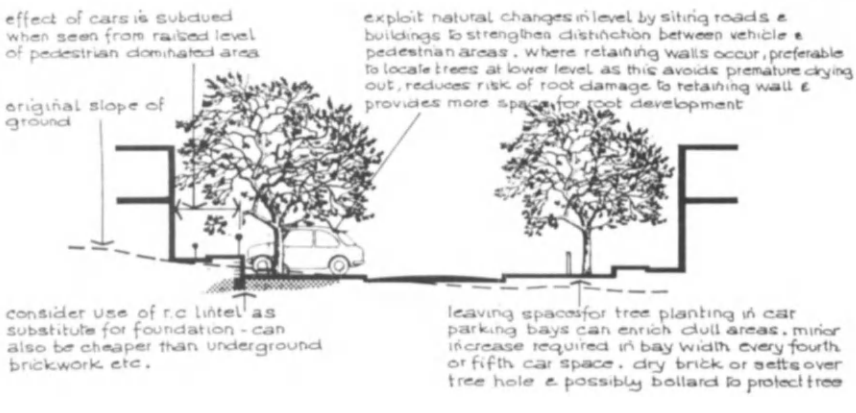


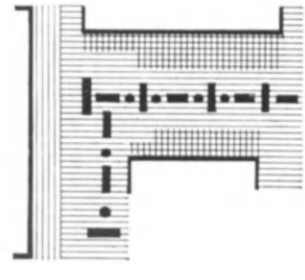


Open car parking bays









Information sheet Landscape 26

Section 9: **Housing estates**

Housing: Vehicle access and servicing

In this information sheet, MICHAEL BROWN *and* RICHARD EVANS *describe the conflicts which arise when providing for pedestrians and vehicles in housing, list requirements to be considered, and illustrate access and circulation requirements of vehicles on housing estates. See information sheets* LANDSCAPE 38 *and* 43 *for further aspects of car parking*

1 Introduction

Conflict: motorist or pedestrian?

1.01 Motor vehicle circulation, both personal and service access, is often a major design factor in housing layouts. Only at high densities are there adequate grounds for reducing the problem by vertical separation.

The substantial provision for motor cars on housing estates usually results in conflict when providing both for the needs of people, in and around their homes, and for requirements of vehicles. Aspects of this conflict can be considered:

Necessity for complete accessibility

Complete accessibility, with cars garaged or parked within house domains, is not always justified or necessary.

Covered pedestrian access

Covered pedestrian access ways could link grouped garages to houses, with possible economies from shorter, more compact vehicles access routes.

Complete elimination of vehicle penetration into housing areas could derive from the use of small pramlike trolleys (possibly self-propelled) as part of the household equipment.

Is the sort of parking adopted for flats a solution for housing?

The type of relationship between car parking and dwelling used in flats may also be acceptable in housing layouts but with the access link by corridor systems at ground level instead of by vertical circulation systems.

Space around entrances

Especially where vehicles and pedestrians are mixed garages, integral or adjacent to housing, monopolise much of the space around house entrances, making it difficult to plant trees. Space left over from car standings and footpaths is apt to be too small to be readily maintained, and children's play on these hard surfaces also tends to mitigate against the survival of any adjacent planting.

Pedestrian access decks

Pedestrian access decks, integral with, adjacent to, or separate from house blocks are often rational arrangements, but when situated above garages or parking decks, there may be problems with tree or shrub planting, especially with regard to providing for light and adequate watering.

Accessibility and car provision

The assumption that the right level of car provision solves the accessibility problem implies a sad disrespect for human values and ignorance of the facts of life—for it ignores the fact that almost half of a housing population will include children and old people or other persons not able or competent to drive. When these people do travel by private car they are dependent largely on parents or relatives.

Car courtyards

Separation of pedestrians and vehicles is desirable—it is safer for children, and generally more pleasant to have pedestrian spaces around buildings. However, cars when not in use often promote contact with neighbours, provide joint activities for parents and children, and especially, make a play situation almost irresistible to children. Car courtyards, where pedestrians could mix safely with a small number of cars, would be an acceptable pedestrian/vehicle mix—see p167 and p173.

2 Vehicle access requirements

Considerations

2.01 To determine effects of vehicle requirements on housing planning layouts, consider the following:

Purpose of access

There are six categories of vehicle access to housing:

1 Residents' long-term parking.
2 Residents' and visitors' short-term parking.
3 Visitors' long-term parking.
4 Regular deliveries and collections.
5 Irregular and infrequent servicing and deliveries.
6 Emergency servicing.

Degree of penetration

Para 1 proposes that full vehicle penetration is generally not justified, and offers possible alternatives. Usually, requirements for fire brigade appliances at high densities and for refuse collection at low densities constitute the greatest degree of unavoidable penetration into housing layouts.

Frequency of use

Vehicle access requirements for infrequent servicing activities should be allowed to influence landscaping as little as possible. Very infrequent services such as fire brigade appliances and moving vans could be allowed to operate in otherwise pedestrian areas if the surface is suitable.

Intensity of use

As said earlier, car parking provision does not necessarily improve accessibility for everyone on a housing estate. Further, 100 per cent provision is rarely warranted, and before such a decision is made, there should be research to establish the proposed population's actual requirements.

Manoeuvring requirements

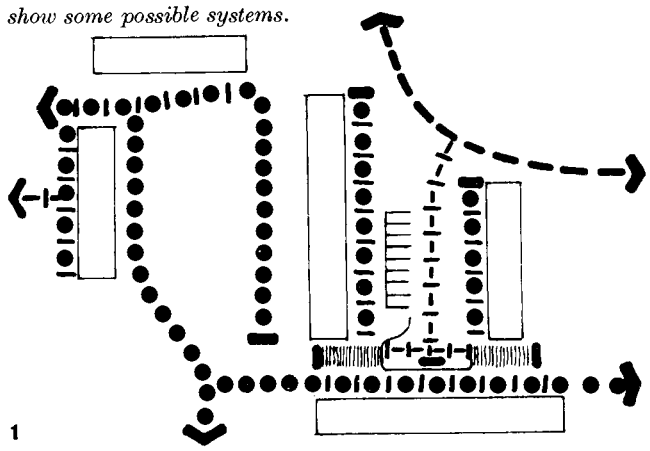
Requirements should be identified with respect to widths, headrooms, gradients, turning circles, loading of vehicles involved (pp177-80). Future development of small runabout vehicles is almost inevitable, and may render current road layout standards obsolete. This condition already exists with current refuse collection techniques—time may show that it is ridiculous that turning circles of refuse lorries should be the arbiters for planning housing layouts.

GENERAL NOTE

Turning requirement criteria shown in the diagrams on the following pages indicate geometric minimum shapes and should not necessarily be the designed shape of the surface edge. For more comprehensive data see AJ *Metric Handbook.*

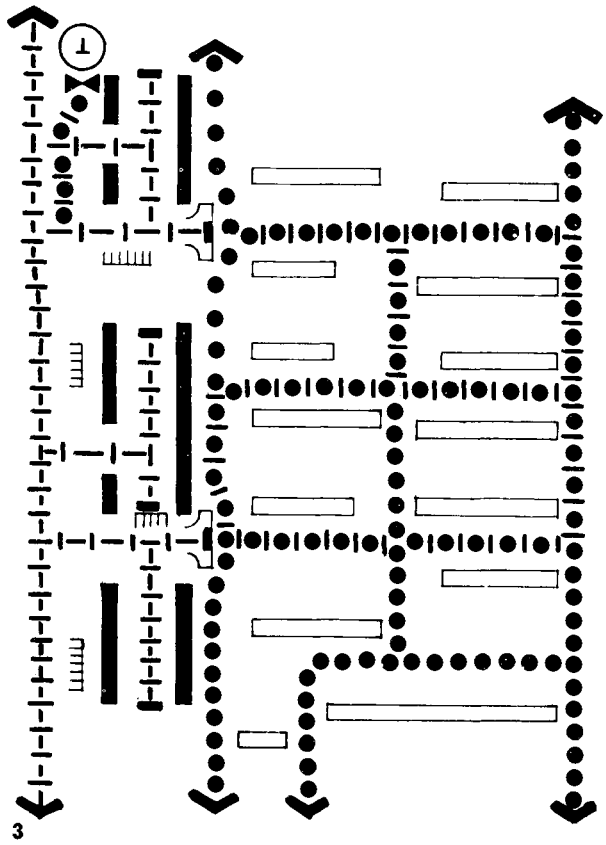
Service access systems

Different types of layout require simple or complex arrangement for vehicle and service access. These diagrams show some possible systems.



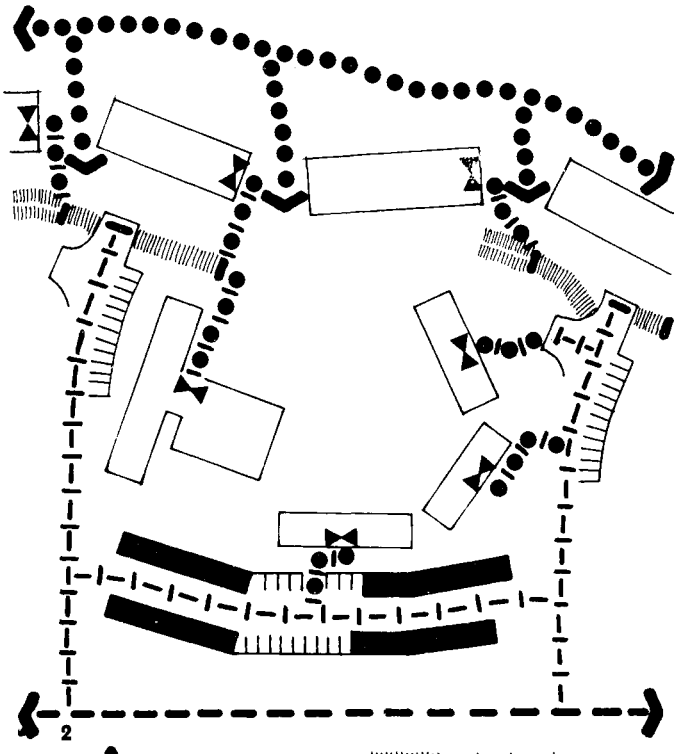
1

1 *Shared service and private vehicle access segregated from pedestrian routes and open space enclosed by buildings. Two dwelling blocks to the left are serviced from adjacent cul de sac (see also information sheet* LANDSCAPE 25 *diagram* 10)



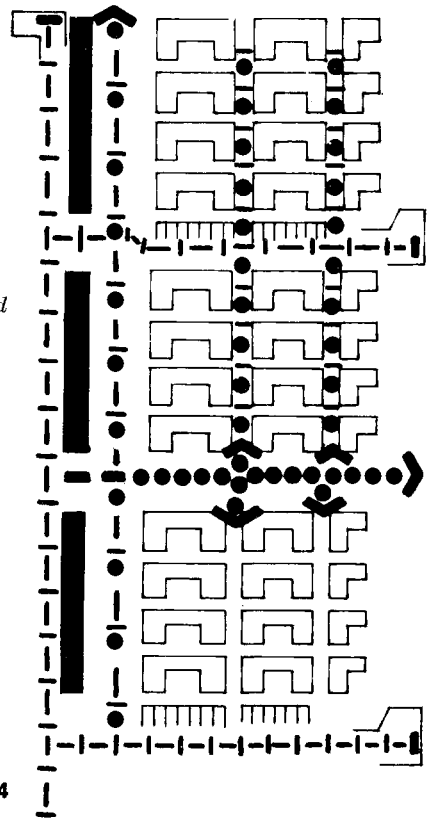
3

3 *Shared service and private vehicle access segregated from pedestrian routes and open space between buildings. Estate management delivers refuse by trolley to transfer station*



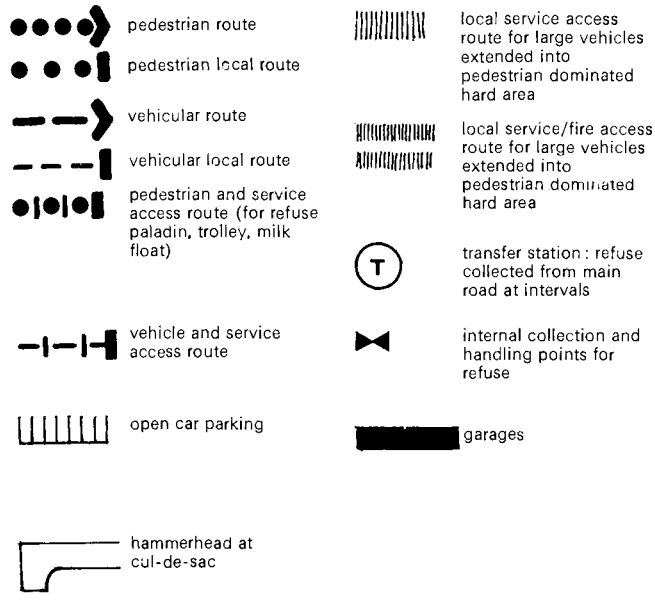
2

2 *Shared service and private vehicle access segrated from pedestrian routes and open space enclosed by buildings. Estate management delivers refuse to service collection points by trolley (see also information sheet* LANDSCAPE 25 *diagram* 9)

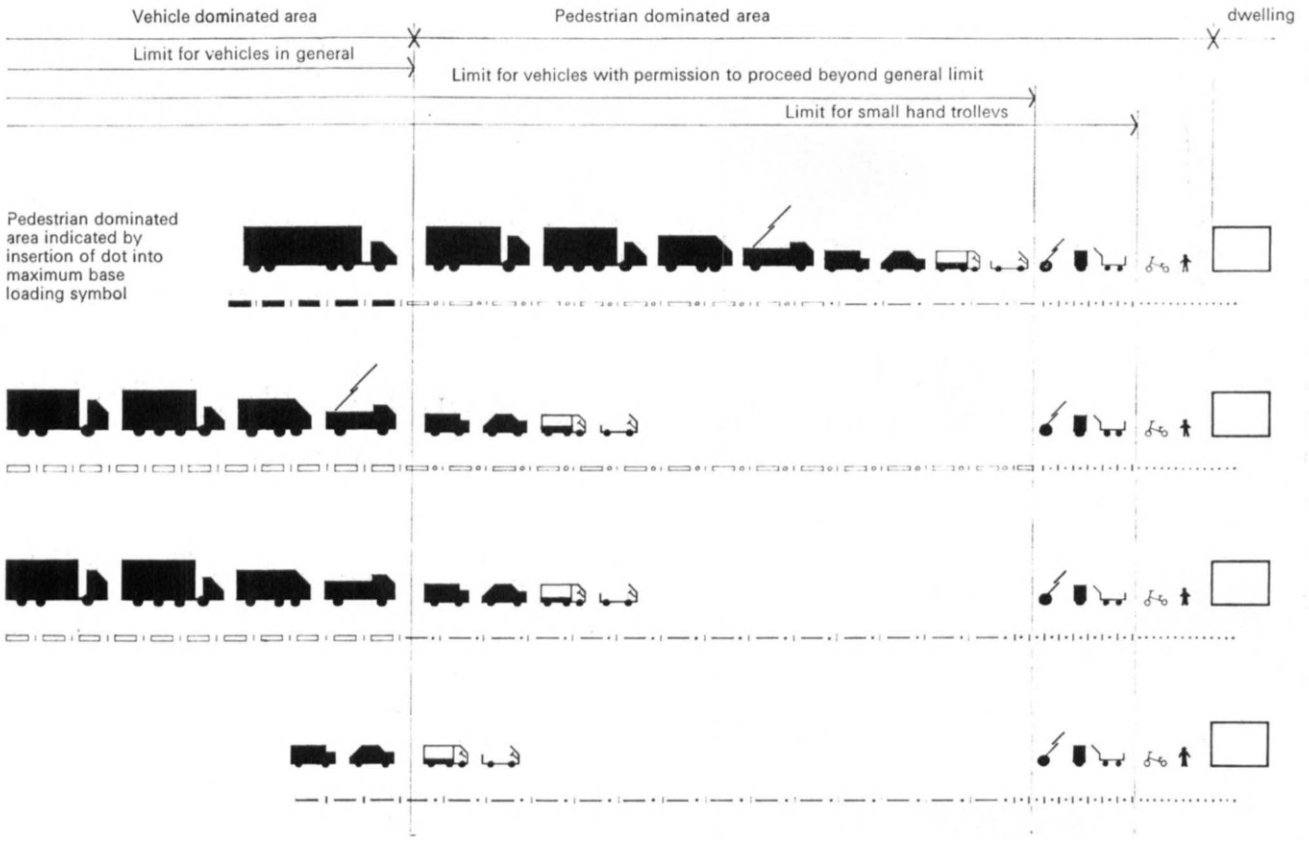


4

4 *Shared service and private vehicle access segregated from housing (patio type see information sheet* LANDSCAPE 25 *diagram* 7). *Pedestrian access to dwellings is by covered alleys between units which are also routes by which estate management delivers refuse to collection points. Open car parking within housing is an example of car courtyards*



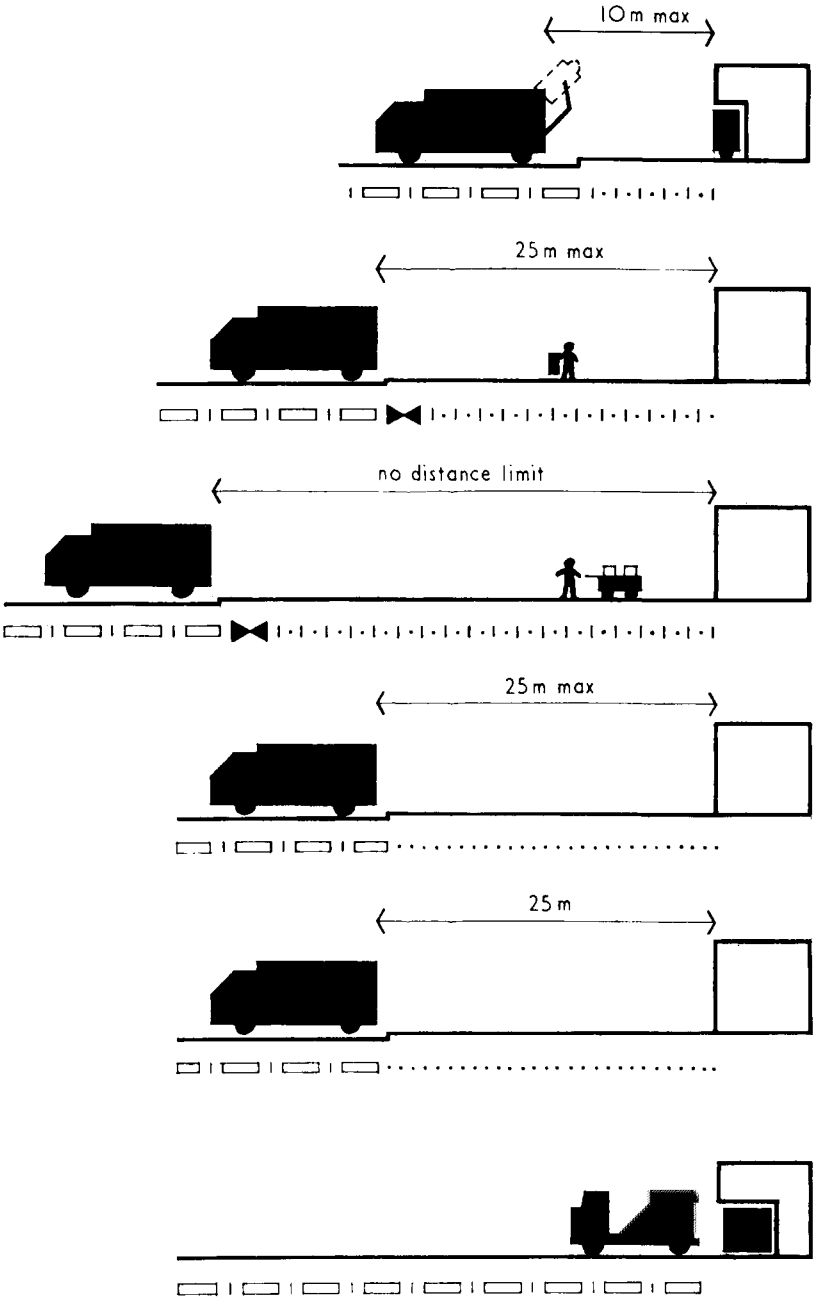
Service access to housing



Max base loading	Vehicle	type	Max gradients where critical	Track of rear wheels (approx)
41 tonnes		oil truck		2·5 m
		refuse lorry		2·5 m
12·2 tonnes		large delivery truck		2·5 m
		pump escape	1:10	1·83 m
		turntable escape	1:10	2·0 m
		light delivery vehicle		1·83 m
2·5 tonnes		private car		1·83 m
		milk float		1·27 m
		large refuse trolley		1·83 m
		wheeled escape	1:10	2·3 m
0·76 tonnes		paladin	1:14 down to collection vehicle (or 1:30 up to collection vehicle)	1·07 m
		hand operated trolley		1·27 m
		bicycle		
light		pedestrian	1:7 max 1:10 normal max 1:15 desirable max 1:35 max for wheelchairs	

5 *Diagrammatically shows four possible options for service access to housing. For each service, maximum degree of penetration must be decided—ie one of the options is selected for that service, and maximum distance allowable from limit of that option to dwelling is determined. When all services have been assessed, compatible access layout can be arrived at. Local authorities should be contacted for specific requirements*

Access for refuse collection



Refuse collector pushes paladin 4 journeys Gradient level of 1 : 14 down to vehicle

Resident carries paper sacks to collection point or station 2 journeys

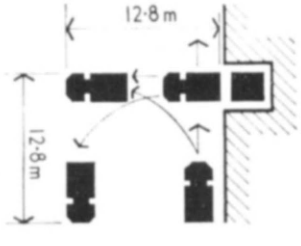
Refuse collector pushes trolley to collection station 4 journeys

Refuse collector carries dustbin 4 journeys

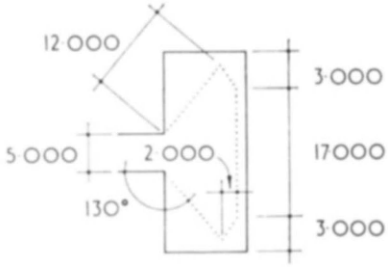
Refuse collector carries paper sack to vehicle 2 journeys

Container collection by direct vehicular access to building

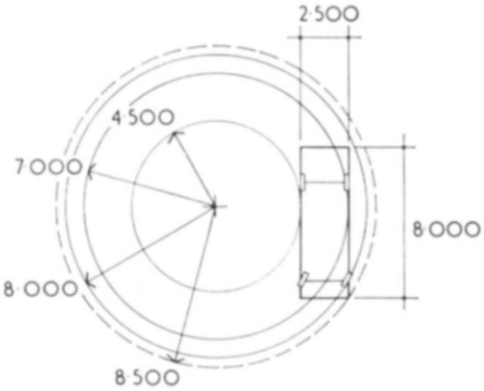
6 *Possible options for refuse collection, with generally accepted distances and gradients where these are critical. Local authorities should be contacted for specific requirements*



7 *Movement requirements of container vehicle (Humpster Dumpster)*

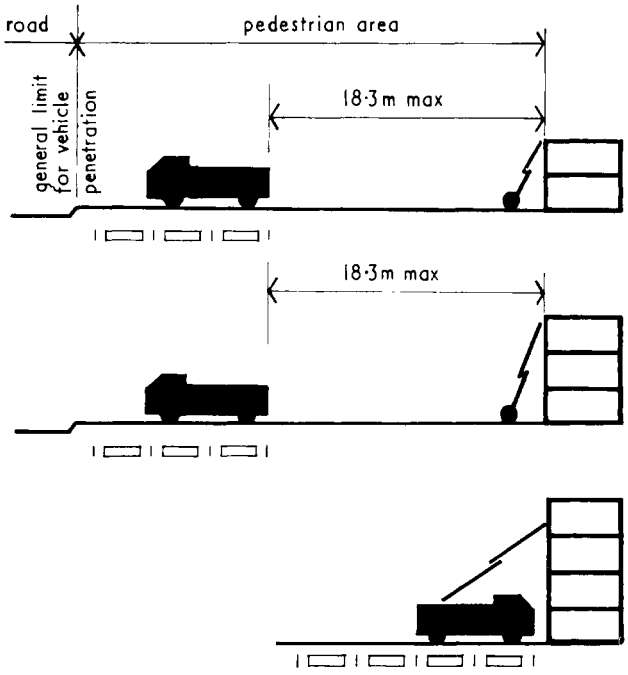


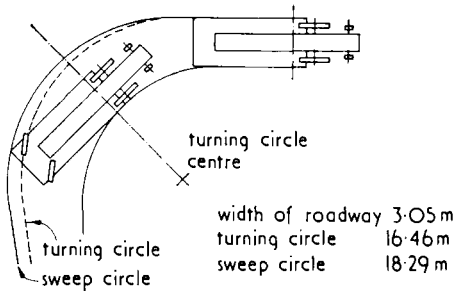
8 *Dotted line indicates minimum area for refuse vehicle to turn*

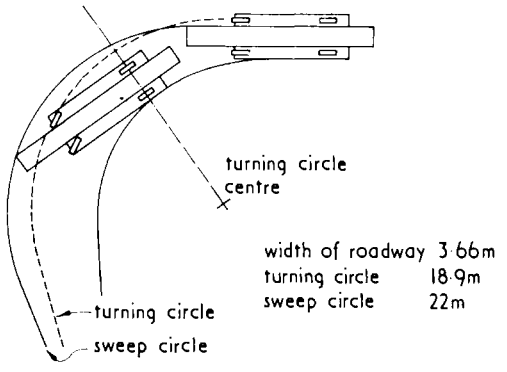


9 *Turning criteria for common refuse collection vehicle*

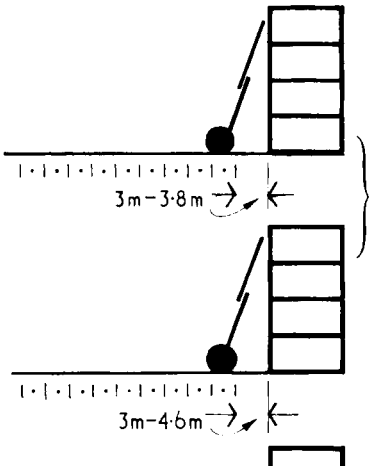
Access for fire vehicles



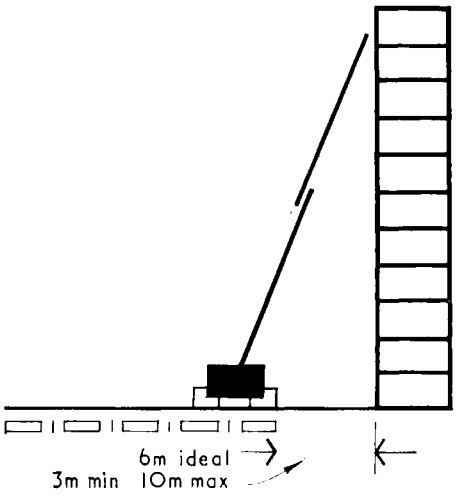




11a *Shows path of fire brigade pump escape appliance*
11b *Shows path of fire brigade turntable loader appliance. Drawings are not intended to indicate kerb lines*

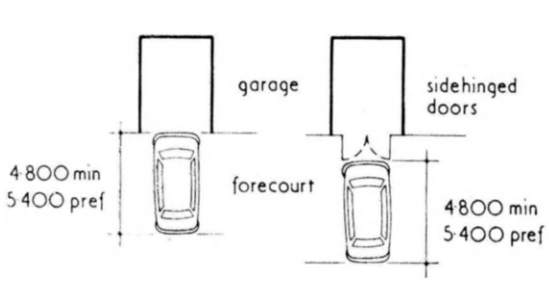


Wheeled escape 0·77T
Escape must be capable of being wheeled the entire length of one face of the building or both faces where dwelling units are back to back.

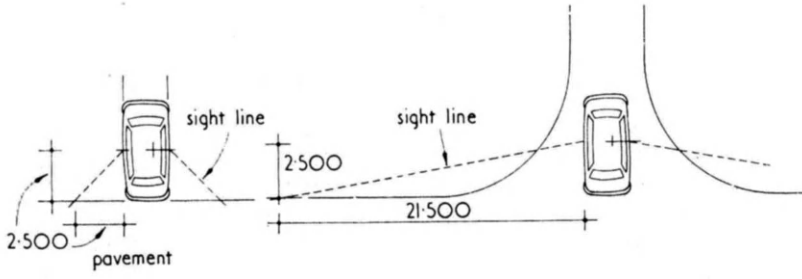


Turntable ladder 12T
Diagram shows access requirements. Strips for wheeled escape may also be required to serve lower floors.

10 *Shows acceptable degree of vehicle penetration for fire-brigade appliances. Data shown is based on requirements of* LFB *and may vary slightly in other parts of the country*

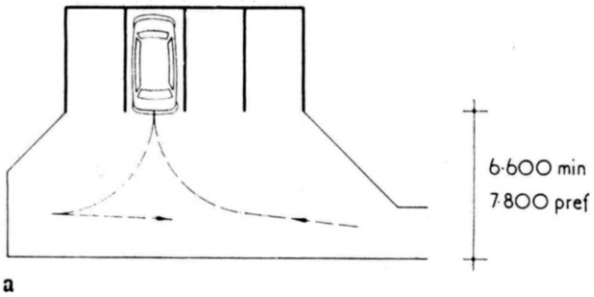


12a b



c d

12a *Shows minimum and preferred depth recommended between garage and pavement. This forecourt permits a car to be parked outside garage for cleaning and unloading*
12b *Where garage doors are hinged and do not open back fully, they should be treated as obstructions and the forecourt distance should allow for them*
12c *Layout of sight lines necessary for drivers to see traffic or pedestrians from either direction*
12d *Recommended sight lines for junction of roads carrying low speed traffic* (24 *km/h*—15*mph*)



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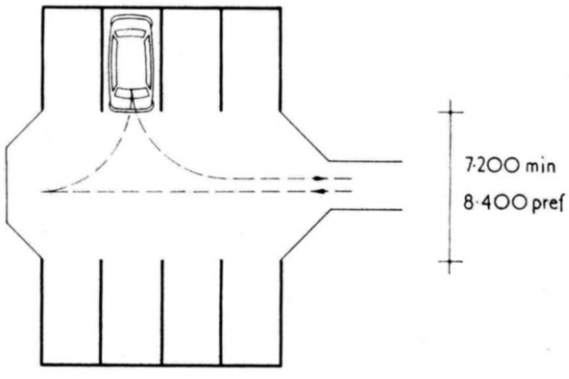
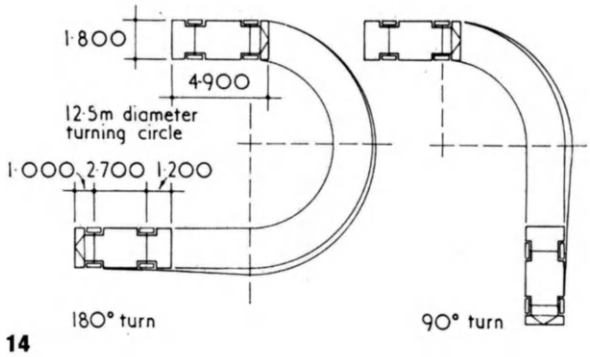


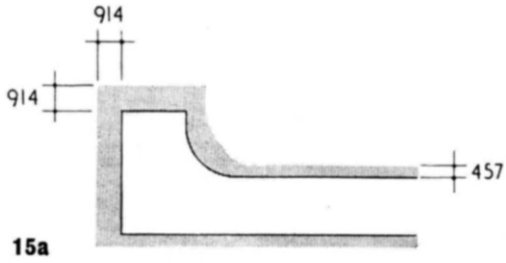
13b

13a *Shows minimum and preferred widths of forecourts for manoeuvring car from garage with a kerb opposite, low enough for car to overhang*
13b *Shows minimum and preferred widths of forecourts for manoeuvring car from garage with other garages or a wall opposite*

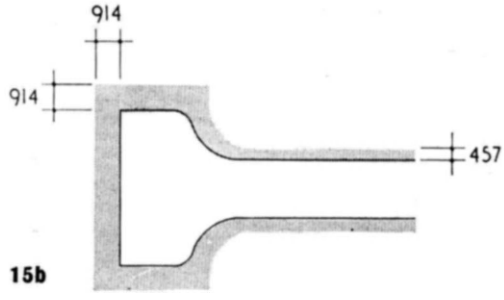


14

14 *Illustrates inside splay and 'swept-area' covered by private car during* 90° *and* 180° *turns. Diagram shows geometric shape and dimensions of a* 4·9 *m standard design car. Diameter of turning circle is to outside wheel*



15a



15b

15a *Hammerhead*
15b *Axehead*

Information sheet Landscape 27

Section 9: **Housing estates**

Housing : Children's play

Information sheet LANDSCAPE 21 *considered why children play, and outlined the requirements for recreational play. In this information sheet* MICHAEL BROWN *suggests that the design of the whole area round housing layouts should be such that children's play can occur naturally*

1 Introduction

1.01 Designed play areas do of course have value but are much less important than achieving the right general character of the total housing environment. Even if children were consulted before housing managers put up their notices or architects put the appropriate titles on their plans to denote where children's play is supposed to occur, the extent to which formal play provision meets their real needs is often very limited.

Play being, for children, a part of living, it is pointless to design for it as if it were a commodity that can be procured only at designated places—a sort of supermarket at which their needs can uniquely be provided. The fact is that the instinct for play is within the child. Our job is to nurture the development of the instinct that is an essential part of the child's total development.

1.02 Though equipped playgrounds play an important role in children's play, studies by DOE suggest that only about 15 per cent of children's play actually takes place there. To a child, the whole urban scene is a play area, and while special playgrounds should be provided, housing layouts should rather provide the right setting so that children's play can occur naturally. The whole estate must be regarded as a potential play space with networks of routes for play, and for wheeled toys and bicycles. The sense of challenge can just as readily be met by walls and benches, steps, ramps, contoured grass areas, as by specially designed equipment in designated spaces imposed upon children by adults. Not only do children ignore rules and boundaries, but they delight in using 'forbidden' areas such as car parks. Indeed it is important for them that there should be some rules they can break.

2 Children/house relationships

2.01 The relationship between the child and the private domain, the small group private domain, and the communal domain will vary with the child's development. There must be freedom to choose in which of these the child wishes to play and freedom for the parents to choose to which the child should be encouraged to go.

2.02 For Piaget's detailed phases of development see information sheet (para 2.02 to 2.04).

2.03 Very young children (up to five years) need close contact with their family, and will tend to play in the private domain—the back garden—or close to the house entrance **1**. The boundary between outdoors and indoors must be such that the child moves freely from one to the other enlarging the radius of his activities as his feelings of safety and self-reliance grow. This aspect of development is of course denied to young children living in tall blocks. In their first most formative years ground level remains a foreign world and they feel lonely and isolated as a result.

2.04 Older children of primary school age (five to 11 years) socialise more with their peers, and are more mobile. Generally they range beyond home to the communal domain.

2.05 Secondary school children (11 years plus) with developing independence and mobility, need neutral ground, depersonalised from the family. 'Kick-about areas' for energetic and noisy ball games can be further from housing, but should still be related to it, for incidental supervision.

3 Children/vehicle relationships

3.01 Only a counter attraction to these extensive flat hard surfaces can enable the segregation principle to be reinforced by children's actual choice of place and activity. The arrangement of pedestrian routes to provide vehicle areas, particularly parking and garage courts on vehicle segregated layouts, seems to have an irresistible attraction to children. Current thinking (ie Halton Brow, Runcorn and Stokesley information sheet 25, diagrams 5 and 11) is tending towards a compromise, but Bengtsson and others believe that only total segregation can achieve a proper safe provision for children.

This can be achieved, firstly, by locating a dominant 'play circuit' on pedestrian routes (see para 4) and secondly by routes. Children are attracted by flat hard surfaces and establishing hierarchies of vehicle segregation on vehicular proximity to house of garage courts, but soft surfaces would deter them. This has been done at Popley II Housing Estate, Basingstoke (see information sheet LANDSCAPE 25, diagram 12). Visitors' parking and service, fire and refuse vehicles are restricted to the service cul-de-sac only. House owners' cars use the group garage court.

3.02 The treatment of garage court areas should by choice of materials/detailing emphasise a pedestrian dominance rather then vehicle dominant character. The use of traditonal 10″ × 5″ BS kerbs and the usual estate road paraphernalia is not consistent with this objective, nor are the road widths and sight lines which would be required for fast roads.

Bumps, and soft surfaces such as hoggin, ash or gravel, provide a dual function in slowing down cars and deterring children on bicycles and pushcars. A gate between a garage court and cul-de-sac would also define pedestrian space.

1 *Children's play in communal area overlooked by private dwellings enabling easy contact between parent and child, freeing the child to enlarge his radius of activity as he grows more self-reliant*

3.03 As children cannot be physically prevented from using garage courts, the total pedestrian environment must be made a more positive, more attractive alternative to play in than vehicle spaces.

4 The external play environment

4.01 The play needs of children at different age levels (para 2) can be met by different kinds of spaces.
4.02 *Private domain:* small scale intimate spaces at house threshold for young children's play, a little off main pedestrian routes. Sandpits, simple play equipment and varieties of hard surfaces **2**.
4.03 *Small group private domain:* spaces shared by a small housing group. Opportunities for larger spaces and special surfaces and informal play equipment. Railings, benches, steps and ramps are all as attractive to children as formal equipment **3**.
4.04 *Communal domain:* includes pedestrian routes which link houses to shops, schools and playgrounds. These must be more direct than vehicular routes. Surface treatment should be of hard materials suitable for very intensive use and low maintenance **4**. Small variations in materials and levels can add interest **5**. A more formal, small scale playground, with swings and roundabouts is very useful within car-free shopping precincts, as it enables mothers to shop in comfort while children play.

Supervised play in housing layouts

4.05 Play leadership is valuable and necessary, but there is need too for skilled persons capable of supervising small play areas within housing schemes. As responsibility for housing and welfare functions is divided in most local authorities it is difficult for staff and resources of parks departments to be used within housing areas. In existing housing areas, the play facilities of a nearby school can provide valuable ball-game areas for use by local children outside school hours: see diagram.
The periods at which supervision is needed within housing areas would permit the resources of available people to be spread over the day—the greatest need for the youngest children being when the facilities for the older children are less used.

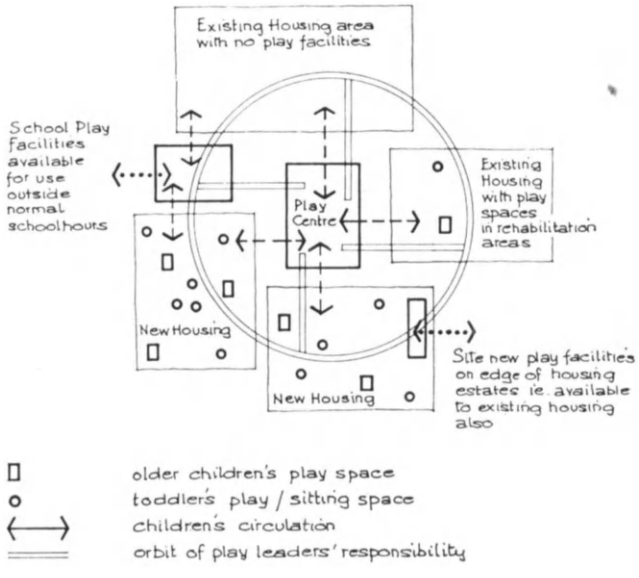


Diagram shows how a separate play centre could act as a base for skilled play leaders. With co-ordination between housing, parks, and welfare departments the leaders could extend their supervision into the small play spaces in adjacent housing estates for a few hours per space per day.

5 Rehabilitation

5.01 By-law streets in older towns will continue to be the play environment for many children. With imagination these areas can still be reasonably adapted for play in safety (see information sheet LANDSCAPE 31).
5.02 The old 'play street' from which traffic is banned during the day still serves a useful purpose, and can be made permanent if car parking can be located elsewhere.
5.03 Waste land and temporarily vacant lots can be converted into play areas by using portable re-usable equipment, as developed by the department of parks in New York.

2

3

4

2 *Hard surfaces attractive for wheeled play. Incidental street furniture such as knee rails can be as effective as formal equipment*
3 *Small group private domain: natural slopes and ramps are sometimes more exciting to play on than formal equipment. Greenlands, Redditch new town*
4 *Difficult topography, with a 1:5 slope turned to advantage, providing a children's play area where the main ramped footpath routes wrap around a hollow in the slope*

Information sheet Landscape 28

Section 9: **Housing Estate**

Housing: Industrial building

In this information sheet MICHAEL BROWN *and* TERRY NUNN *discuss landscaping in connection with industrialised building. Heavy concrete systems pose particular problems, and these are illustrated with examples. Lightweight small component industrialised systems are covered in information sheets* LANDSCAPE *25 to 27*

1 General

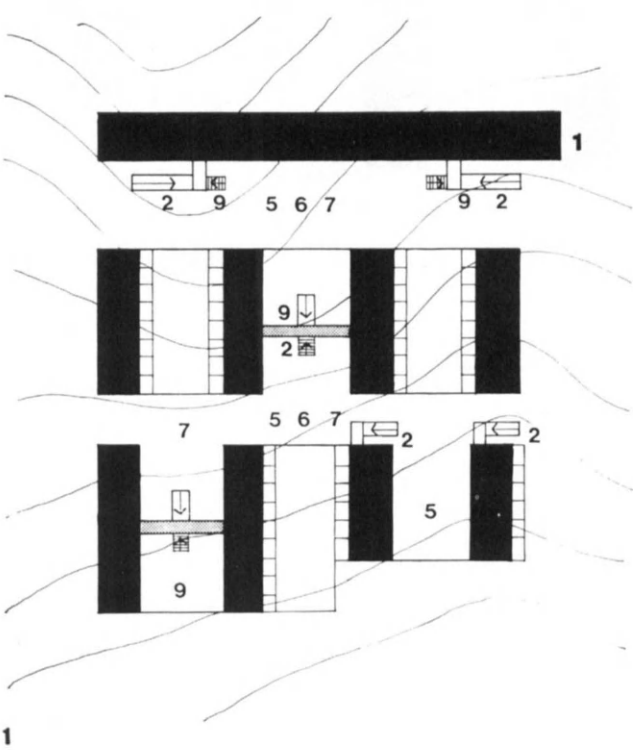
1.01 The use of heavy industrialised systems for housing poses certain design problems which are difficult to reconcile with good landscaping. Most problems arise because industrialised systems can justify themselves economically only by maximum standardisation of house type, layout, finish and elevation. This leads to excessive rigidity of plan and lack of identity of spaces between blocks. Also, systems with large slab components requiring cranes have innate inflexibility in coping with small-scale changes at ground level **1**. 'Cellular' systems, such as that of Yorkshire Development Group, **2**, **3**, **4**, have shorter component elements which can be joined in a variety of ways resulting in less conflict at ground level. Ideally, industrialisation should be on this component scale. Low-rise patio-type housing, such as Clarkhill, Harlow, and Albertslund, Denmark, is far more readily adaptable to industrialised systems. These problems are discussed in detail, with reference to examples, in para 2.

2 Appraisal of four industrialised schemes

2.01 The following list summarises certain problems of industrialised construction and their consequent effect on the landscape with reference to examples. Numbers preceding the text refer to those on relevant parts of all four plans **1** to **4.**

1 *Slab block housing layout based on the Laing-Jesperson system. Blocks are four storeys high, and longest block is approximately* 0·4 *km in length. Spaces between are dictated by minimum working transit distance of cranes. Contours on all plans at* 250 *mm vertical intervals*

2 *Enclosed linked five to seven-storey housing layout based on Yorkshire Development Group system (Leeds). This has more flexible crane system than* **1**, *leading to more interesting layout*



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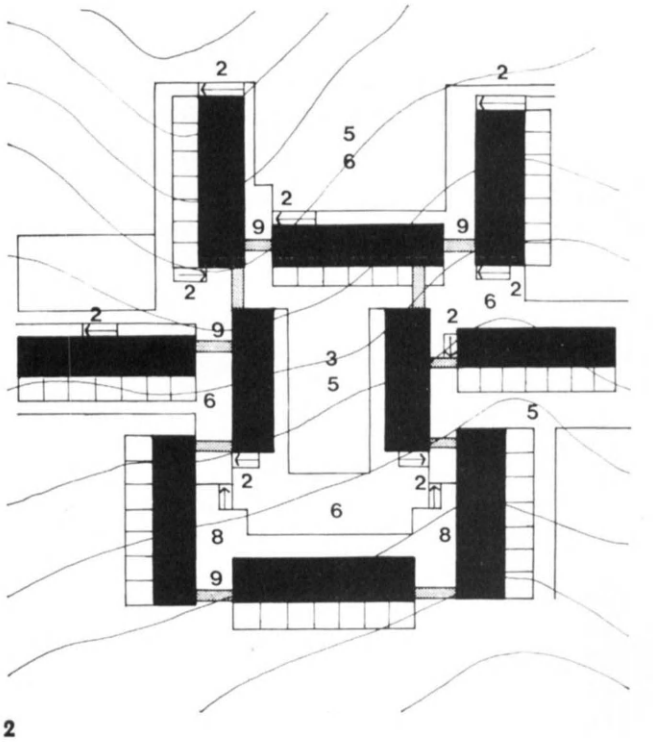

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Key to plans

Para numbers refer to numbers on plans.

1 Long, simple blocks on plan; any variations in ground level must be taken up by stepping within the building, usually at the base. Lack of economy in long blocks running at right angles to contours, due to excess 'cut and fill'.

2 Ramps, steps and foundations have to be designed and built as 'one-off' jobs. This can be expensive and time consuming on contracts which are specifically geared to not using the traditional methods that can readily cope with them.

3 Crane runs make it difficult to leave existing topography. Phasing of craning to co-ordinate planting needs to be very carefully worked out.

4 Where blocks are stepped down the contours, retaining walls at garden junctions are needed, and there may also be damp-proofing problems at gable ends.

5 Cranes can be economically justified only by maximum use; this encourages high-rise blocks, excessively long blocks, four- or five-storey deck access blocks, all of which make microclimate problems, such as wind turbulence at ground level.

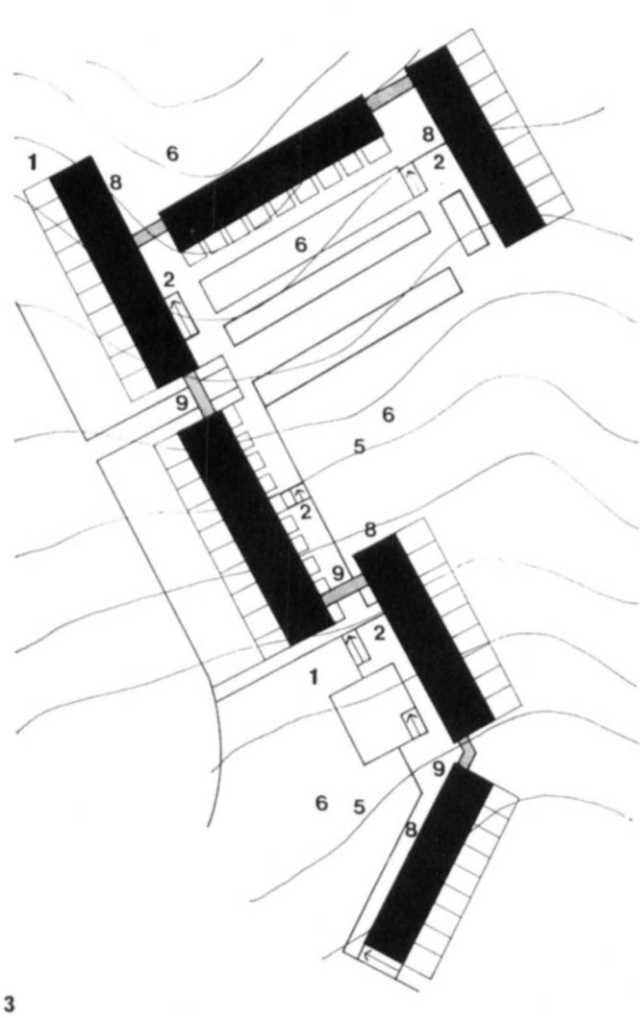
6 Long crane runs make it difficult to create small intimate spaces. Repetition of regimented blocks leads to lack of identification between spaces. There is thus especial need for the landscaping to provide identification and individuality.

7 Economies of erection, design and crane runs can lead to excessive rigidity of plan.

8 Heavy industrialised systems tend to use concrete cladding units, often with minimal variety. As in 6, this creates lack of identification between spaces and the plain surfaces invite vandalism. The potentialities of adapting traditional materials for industrialised use (eg brick veneer set into concrete slab) could be considered.

9 In the case of linked blocks, the link itself could be adapted to accommodate small differences in level, thus saving expensive substructure work. Links are often erected quickly to provide access for trades, before landscape work commences. This can lead to problems of access for cranes, large trees and machinery for landscaping.

10 Where roads run up or down rather than across the slope, serious anomalies can occur where rate of slope of road does not tie in with rate of stepping of block. An interlocked system of courtyards as in plan **2**, with little vehicle penetration of the centre, reduces this conflict.



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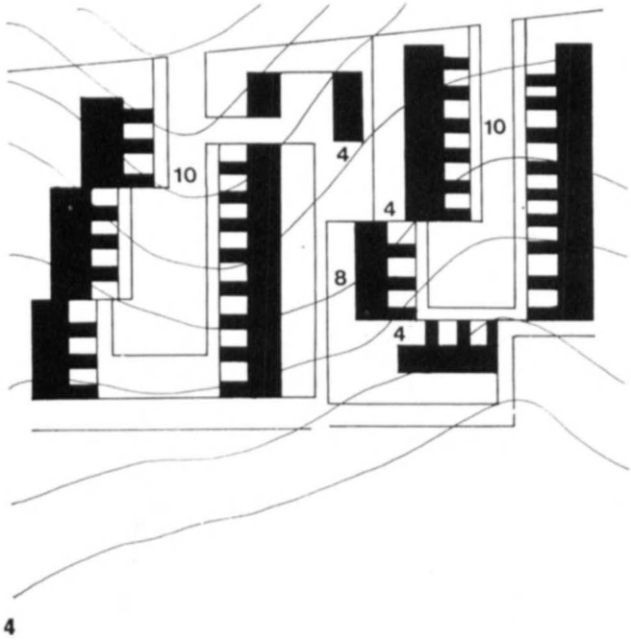

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3 *Linear linked six-storey housing layout based on Yorkshire Development Group system (Hull). Greater vehicle penetration than* **2** *may cause problems in heights of links over roads*

4 *Low rise two-storey housing layout based on Midland Consortium system. Blocks which can be staggered have more inbuilt flexibility than long slab blocks*

Information sheet Landscape 29

Section 9: **Housing estates**

Housing: Detailed design

In this information sheet MICHAEL BROWN *comments on a miscellany of examples of external housing spaces, drawing attention to the advantages and disadvantages of particular types, and evaluating the specific examples shown. This sheet should be read in conjunction with information sheet* LANDSCAPE 25, *which explains terms such as 'open aspect', 'controlled aspect', and so on*

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1 *Open aspect situation. Tree planting close to dwellings (in spite of narrow pavements) contributes to character, and reinforces privacy. Simple traditional doorstep detail; attractive contrast in textures*

2 *Where grass edges are vulnerable, protection is essential*

3 *Open car parking area. Shows value of providing pedestrian forecourts for sitting/playing adjacent to car park. Bold tree planting reduces visual effect of parked cars*

4 *Town house type with controlled aspect front. Planting in left-over spaces difficult, and made feasible only by using protecting rails. These spaces would have been more useful if big enough for tree planting*

5 *Grass banked open space provides enclosure for sunken sitting area. Generous young tree planting for quick effect; simple steel knee rail provides essential protection. Brick paving used for sitting area provides rich texture*

6 *Open aspect, pedestrian local-access space. Minimal separation in spacing of Victorian houses produces privacy conflict but achieves a sense of intimacy and identification. Grouping round tiny space on exposed sloping site is effective microclimate solution. This example would not be allowed today*

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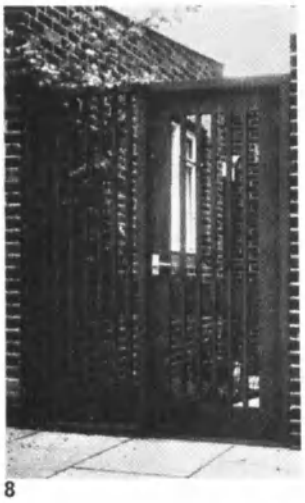

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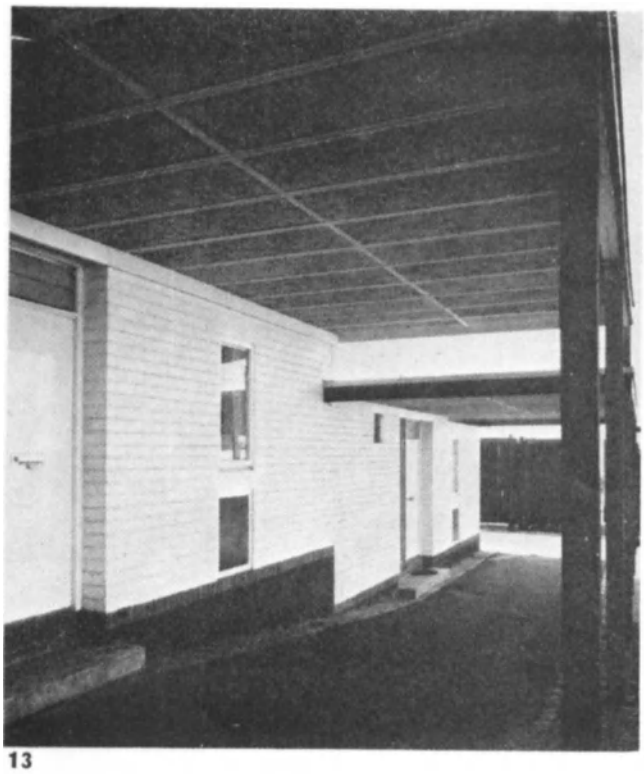
7 *Siting of back gardens above route reinforces privacy—very important as only low open fence is provided. Ground cover may be difficult to establish in early years*
8 *Front patio garden for pedestrian route. Sense of enclosure and privacy, combined with good outlook*
9 *Vehicle/pedestrian local access route. Provision of minimum-width, common drive contradicts myth that turning radii and sight lines are correlative with safety. Contrasting paving materials establish hierarchy of traffic use*
10 *Open aspect front of vehicle/pedestrian route space where foot-path passes dwelling. Tree planting reinforces privacy*
11 *Single aspect types forming intimate pedestrian housing group. Illustrates pedestrian route space which frequently occurs with this type*
12 *Varied character of alleyways, made possible by bridging over sections, helps modulate space*



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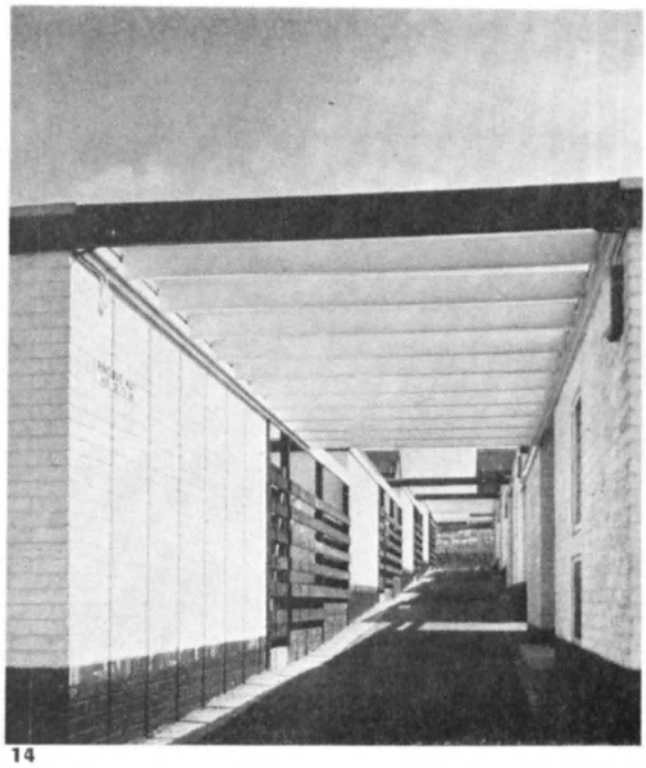

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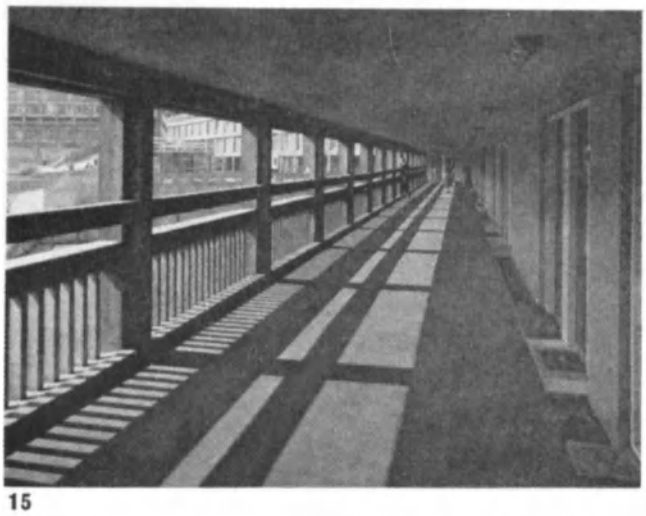
13 *Use of covered way to give sheltered access*
14 *Narrow covered alleyway; note crisp detailing of screens, and use of setts to edges of alley for drainage*
15 *Linear access deck can produce sterile monotonous character. Varied width of setbacks could help solve problem*
16 *Formidable character of concrete balustrade and elevational treatment, unrelieved by tree planting, is a missed opportunity. Bridges provide space modulation.*

17 *Deck schemes provide excellent opportunity for high density and complete segregation. But below-deck garages can be bleak, cavernous and vandalised. Many people are reluctant to use them due to isolation and fear of molestation*
18 *Above deck. Important to create interest, variety, intimate spaces. Limited scope for planting produces problems; provision of set-backs to accommodate tall trees, planted in ground below, is one possible solution*



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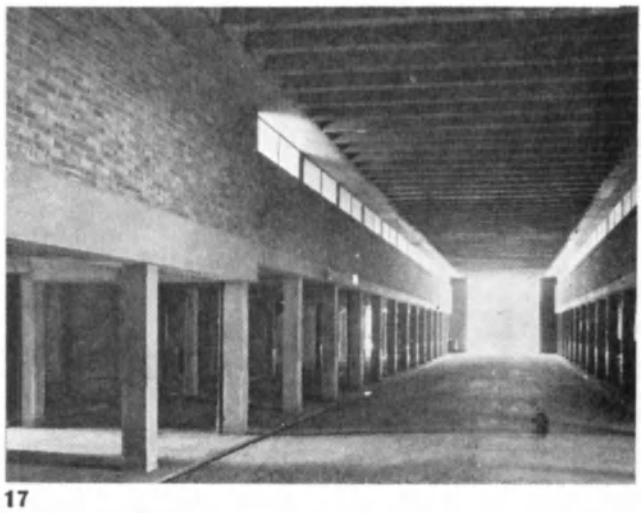

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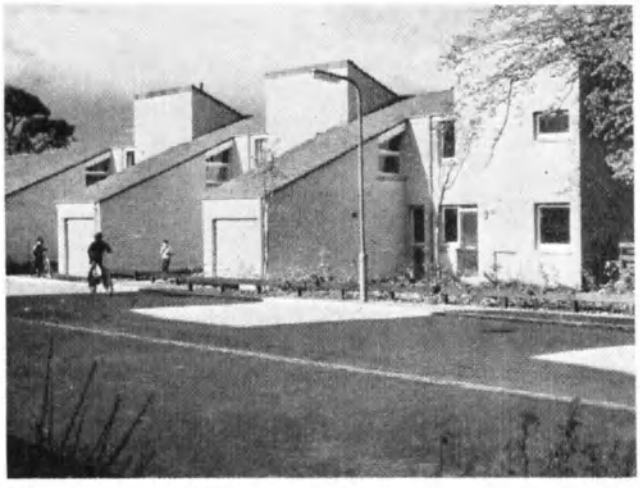

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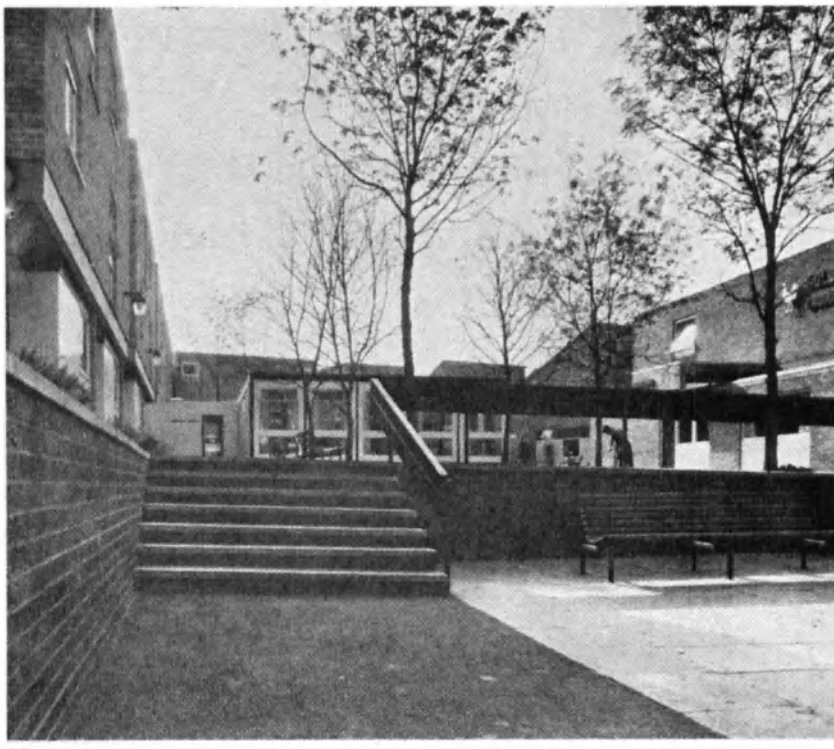

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19 *Covered carports give cheaper shelter than garages; can be widened to act as covered ways for pedestrians*
20 *Attached projecting garages reinforce privacy and provide mixed pedestrian/vehicle area. Simple yet adequate knee rail*
21 *Illustrates symbolic use of different surface treatments to identify and reinforce hierarchy of paths; use of ground cover (heather) to provide unified sweep of soft carpeting without clutter; use of setts to take up irregular edges*
22 *Exploiting change of level to provide amenity/playspace*
23 *Varied arrangements of garages; contrasting textures avoid stretches of sterile asphalt*
24 *Single aspect dwellings on sloping site allow pedestrian and vehicle routes to be arranged at different levels. Good detailing of low rail and stepped ramp. Use of setts enables junctions to be well handled*

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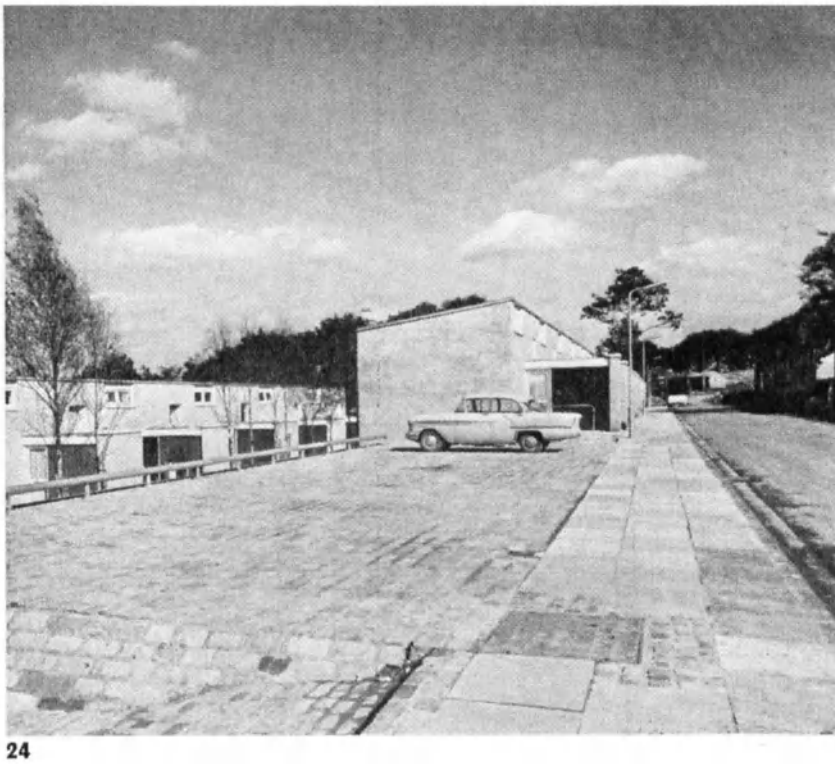

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25 *Mixed pedestrian/vehicle courts where narrow roads are used also by pedestrians. Low investment cost creates maintenance difficulties—note erosion at corners. Use of soft landscape to form enclosure can create problems of establishment in early years*

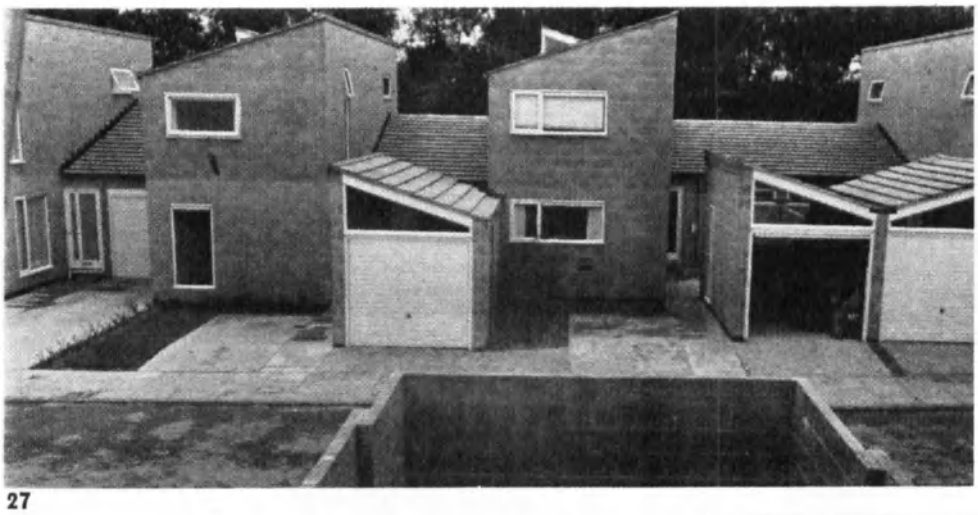
26 *Stepped alleyways between single aspect blocks on sloping ground frequently provide opportunity for creating interesting and exciting townscapes.*

27 *Good space enclosure making use of garages to exploit situation. Concrete block walls need to be humanised by trees*

28 *Informal paths; generous planting; use of rough banks to screen car parking*

29 *Domestic entrance courtyard given over to storing car and bicycles. Plenty of climbers can make such multiple-use spaces attractive in spite of the vehicles.*

30 *Use of small groups of attached garages to create garden spaces. Unusual door shape, and alternating pattern of garage and garden walls, is welcome improvement on usual bleak garage situation*



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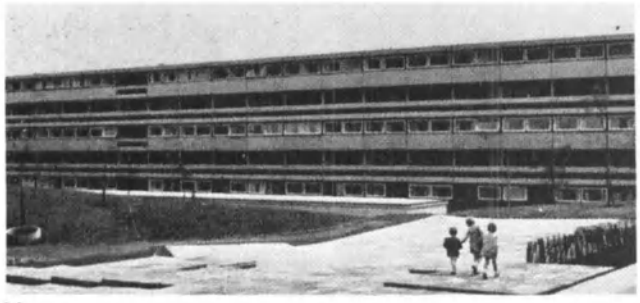

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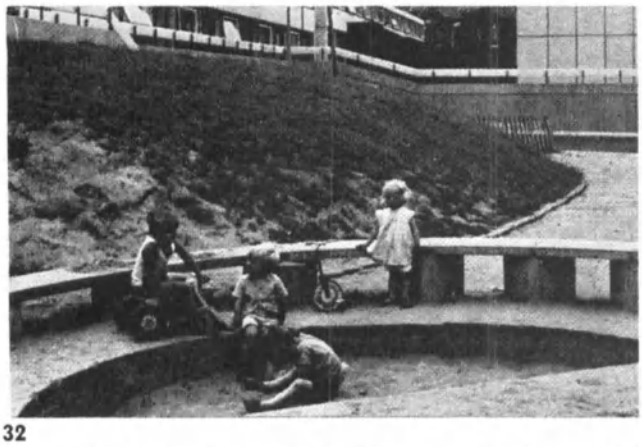

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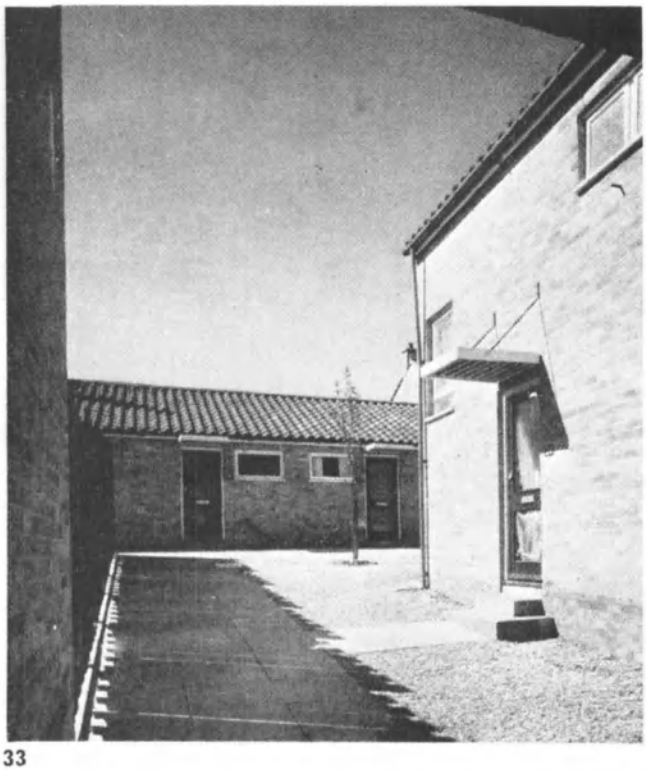

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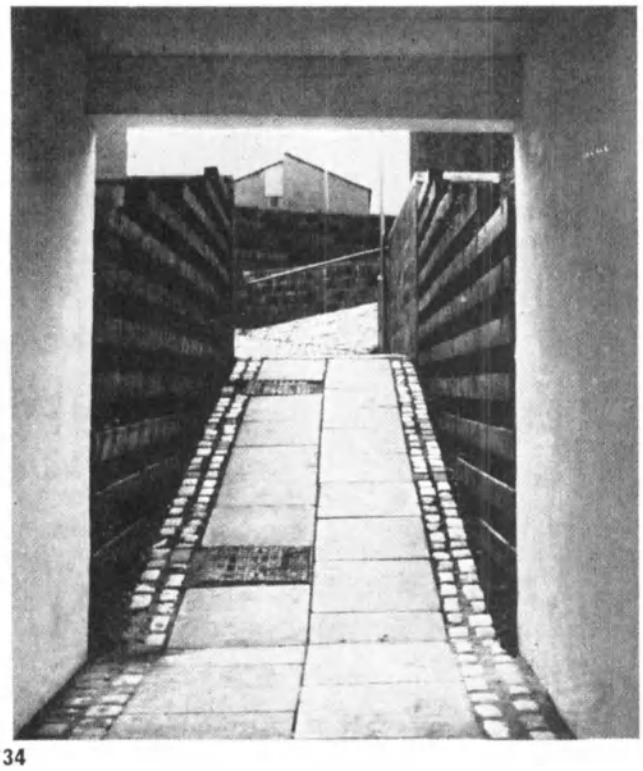

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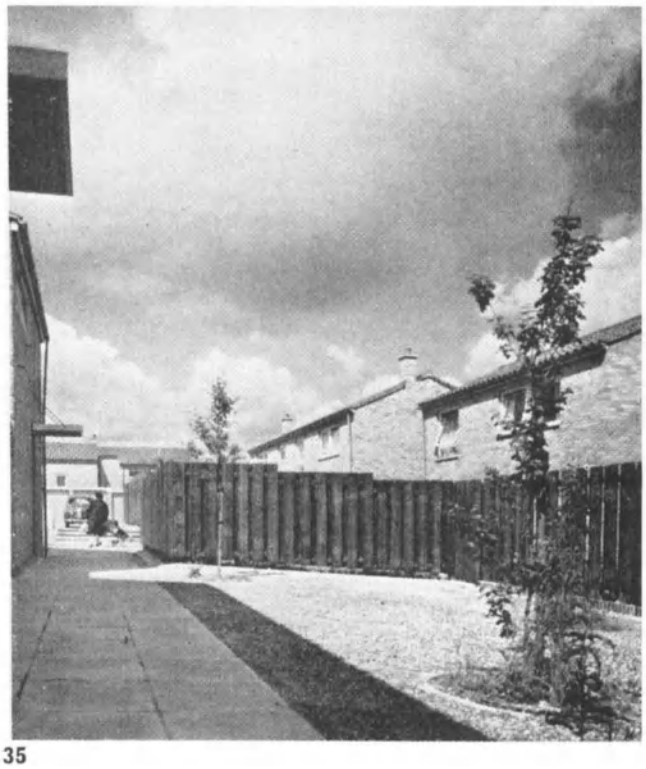

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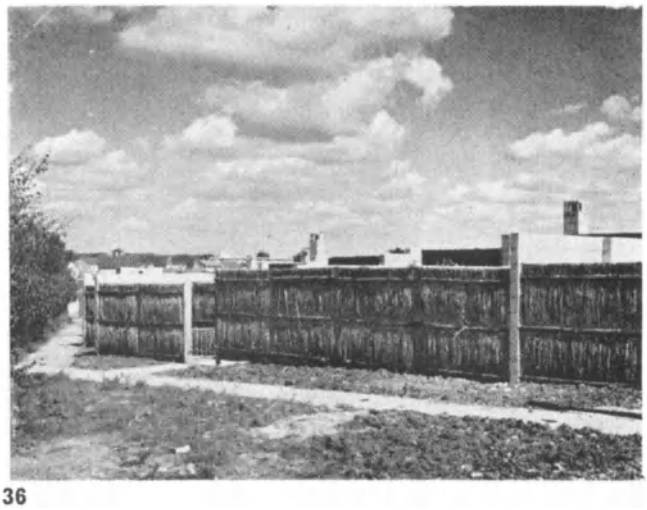
31 *Adequate tree planting is particularly important with industrialised building*
32 *Exposed vulnerable areas of grass or planting require protection, especially during early years*
33 *Gravel is an economic, practical surface material, but requires great care in siting and detailing. Should preferably not be used on routes and should be at lower level than pedestrian paving*
34, 35 *Contrasting use of horizontal and vertical timber fencing. In each case fencing must accommodate changes of ground level. This is easier with vertical types*
36 *Reed or rush fencing—an unusual solution*



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37 Open aspect with pricacy strip + adjacent space. *Garden side should provide a reasonably private area; short glass screen seems hardly adequate nor practical. Private initiative strives against heavy odds to put this right. Generous tree planting in communal green space would have helped privacy and added to interest and enclosure.*

38 Group communal local access space. *Intimacy without loss of outlook: controlled aspect blocks presenting gable ends to communal space. Vertical boarded fences make gardens reasonably private.*

39 Non-aspect pedestrian route. *Topography exploited to afford dramatic outlook without jeopardising privacy to dwellings or gardens.*

40 Non-aspect garden entrance to dwelling. *Provides full privacy and covered access, but can be forbidding. Outlook needed, but see* **41**.

41 Open aspect with garden and non-aspect gables end + adjacent space. *Revival of traditional first floor living room compensates for restricted outlook along covered access alley on opposite side of dwelling.*

42 Non-aspect route space. *Change of level in covered slot between blocks reinforces intimacy and sense of place to route space beyond. This is accentuated by planting at change of direction in alley.*

43 *Railings for safety where needed: and dispensed with at discretion where unnecessary. Functional need for shade has encouraged residents to plant climbers at entrance.*

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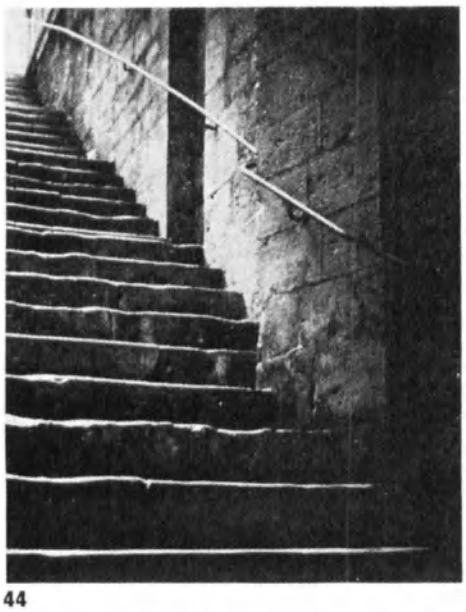

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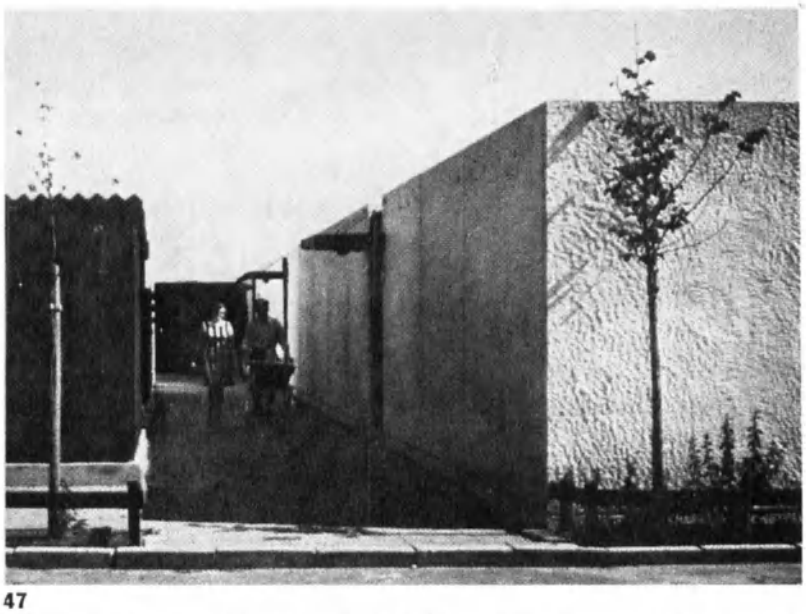

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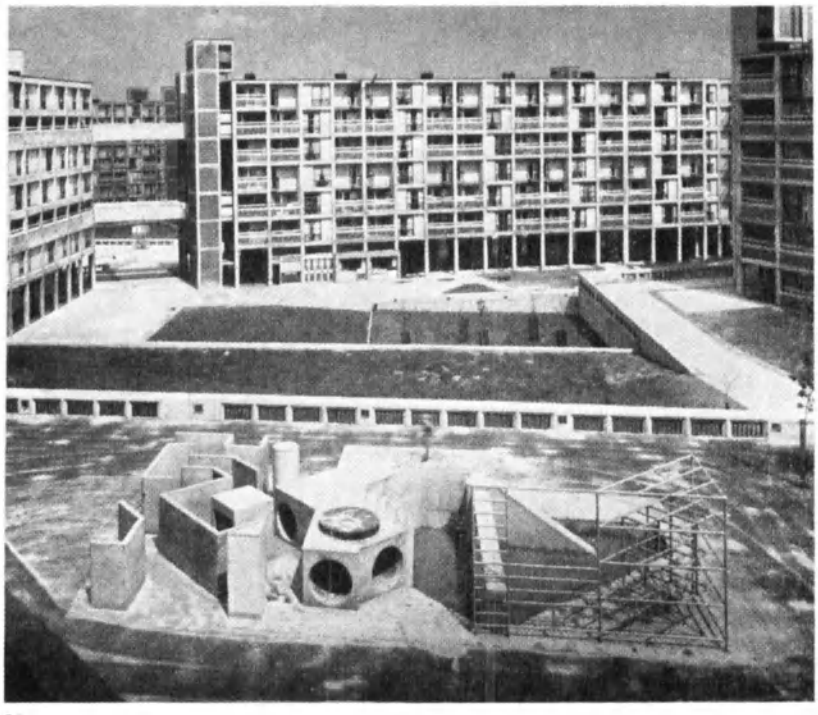

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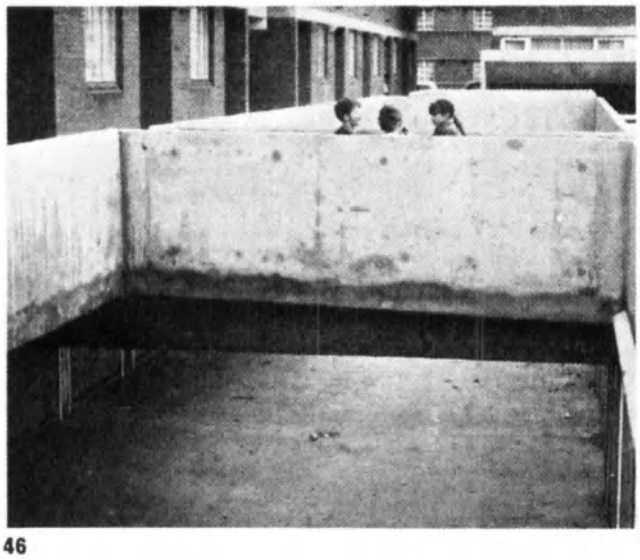
44 *Rail is functional and economy of material and line provide simple, elegant solution*



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45 *Play equipment should offer challenge for multiple uses. Adults' sculptural solutions are of questionable relevance to children's real needs*

46 *Separating vehicle access and storage in deck schemes often produces problems. Lack of trees and planting, use of raw finishes and poor weathering material all look sterile. Outlook is restricted and closed parapet walls may be risky: some open railings would enable small children to see without climbing where it is dangerous*

47 Non-aspect route space. *Single-storey industrialised courtyard housing can be monotonous, with long horizontal routes alongside low buildings. There is a special need for generous planting of trees which need to be large enough to have an immediate effect*

48 Open aspect route space. *Trees can be astonishingly close to buildings without ill effect if care is taken to suit species to situation and soil. Periodic skilled thinning may be needed, but is no less justifiable than accepted maintenance of roads and sewers*

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49 Open aspect dwelling. *Large trees valuably enhance the scale of domestic buildings—it is a mistake to think only small trees are suitable here. From street level in summer these trees almost totally screen a formidable 20-storey slab.*

50 Non-aspect route. *Semi-mature trees closely grouped by new buildings are particularly valuable when industrialised concrete systems are used. Textured concrete and plenty of brick paving or garden walls help to enrich external spaces. Low walls and raised plant beds separate path from road. Fire barrier indicates where fire path crosses this space.*

51 *Wrapping new building around existing trees can create magic in outside spaces. Disturbance to root system must be minimised by avoiding changes of level, cutting roots and impeding water supply or soil drainage. Minor modifications to structure or garden walls, by spanning openings at or just below ground level to preserve root systems intact, can enable trees to survive.*

52 *Quite a low wall can effectively cut off traffic by enclosing pedestrian space. Pavings are used for routes: gravel for less intensively used areas provides contrast in texture, is economical and allows water to reach tree roots.*

53 Open aspect route space. *Living space is raised above route as with traditional Georgian terrace house. Steps up to a series of private terraces could also be relevant to problems on current deck schemes. The single tree has great significance in identifying place and marking change of level.*

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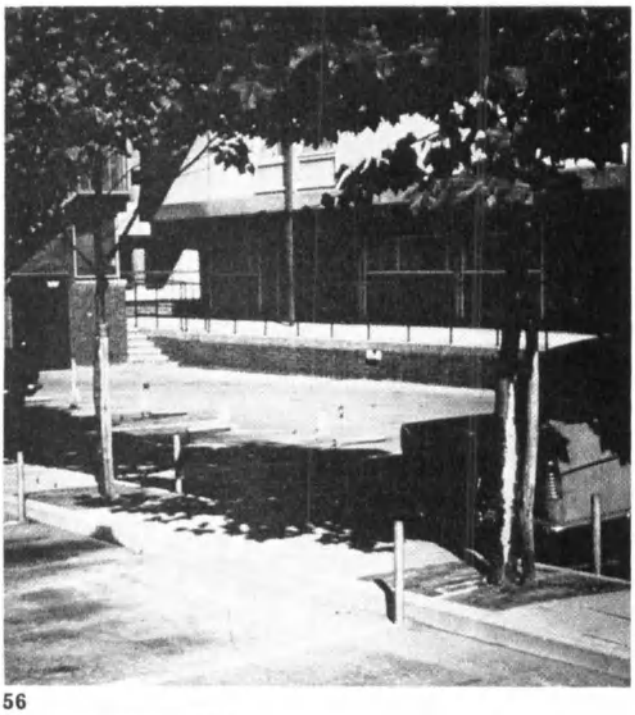

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54 *Large sweeps of car parking and hard surfaces can be uncompromising and exceptionally dull. On complex projects where decks produce structural problems there is special need to mitigate sterility with generous tree planting.*

55 Controlled and non-aspect garage mews. *Trees could be planted between garage openings in mews where space is restricted for tree planting. Where this is not possible there can be the benefits of 'borrowed landscape' from trees within adjacent gardens.*

56 *Bollards prevent car overhangs from damaging trees set in very narrow strips between opposite car bays.*

57 *Providing small car parking spaces where tree planting and garden walls can effectively screen cars helps to avoid problems of scale.*

58 Non-aspect vehicle route space. *Offsets in building and garden walls provide niches for tree planting where road alignment allows this. Siting trees in such situations is less risky than having to depend on private care for trees which have communal value but are within the gardens.*

59 *Insistence on normal sight lines with road and building splays can be irrelevant to safety if adequate alternatives exist. Very narrow road with bollards restricts speed, achieves same objective with less space and preserves scale of townscape. See also para* 4.13, *page* 36.

60 Vehicle and pedestrian route space. *Where resources are limited or the existing fabric of towns is sufficiently valued, transport may be adapted to an intermediate technology. See para* 3.01, *page* 31. *Perhaps we too should design vehicles to match the scale of existing routes instead of destroying our cities to accommodate fast cars and juggernaut lorries.*

Information sheet Landscape 30

Section 9: **Housing estates**

Housing: Resource planning and costs

This information sheet by MICHAEL BROWN *and* BRIAN PUGH *is an attempt to point the way towards a methodology which will enable architects to allocate available resources more strictly in accordance with need, when planning housing schemes*

1 Need for analysis and comparison

Current approach

1.01 The cost of spaces between buildings has not hitherto been the subject of as much analysis and consideration as the buildings themselves. In most cost analyses, the element 'external works' covers a multiplicity of situations and solutions, and gives little information on function, cost and quality.

In the public housing sector, in particular, cost planning has often concentrated on constraining the design of externals within the 'external works' portion of the yardstick.

Future approach

1.02 If the spaces between buildings are to be used to their best advantage it is essential that methods of analysis and comparison be evolved which will enable the designer to analyse the functions and uses of external spaces very rigorously, and then allocate available money in relation to *need*. The major objective should always be to solve conflicts of usage, ensure privacy, and concentrate expenditure on areas of highest intensity of use.

Methodology

1.03 Such a methodology does not exist yet; but the following cost analyses of a selection of housing estates, and the accompanying notes, will give an indication of the kind of thought which needs to be devoted to the costs of external spaces. Even if it is too early to provide a method, designers can begin to develop the correct approach.

Intention of notes

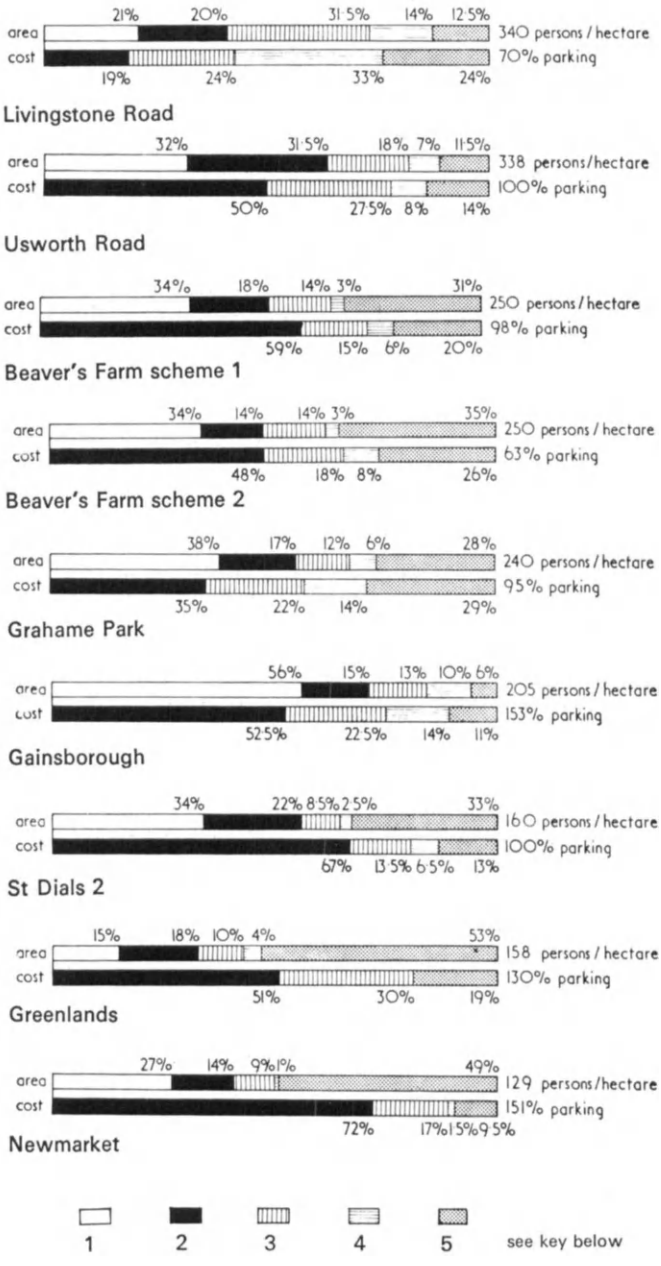
1.04 The notes on the various examples are intended to be read only as an illustration of this analytical approach, and should not be taken as hard and fast judgements on the schemes under discussion; for the latter purpose more detailed information would be required than that contained in these bar charts. One would need to know more about the detailed circumstances which underlie the particular cost distribution of each; about the exact definitions used for calculating the costs; and above all the percentages given for each scheme would have to be related to the *total* cost in each instance, if comparisons between various schemes are to be reliable. Nevertheless, the percentage breakdowns shown do give an indication of the priorities of investment within each scheme; and will serve as examples of different patterns of resource allocation **1**. To avoid misunderstanding, it should be noted that the element 'buildings and private gardens' is included in the upper part of the bar chart (area) in each case, but excluded from the lower part (cost).

2 Examples

2.01 *Beaver's Farm, Hounslow* The two schemes analysed give an indication of the consequences of different levels of car parking provision. The most interesting point is that a large increase in car provision has resulted in a relatively small increase in investment. The most likely explanation for this apparent anomaly is that the bulk of the money is spent on an infrastructure which has to be provided regardless of whether car parking provision is 63 per cent or 98 per cent; once this has been provided, additional car parking is comparatively inexpensive.

2.02 *Grahame Park, Hendon* Has similar density, but slightly lower car parking provision than the 98 per cent car parking Beaver's Farm scheme, and therefore makes an interesting comparison. The relatively low cost of the Grahame Park car areas is partly explained by the fact that some of the roads in this case also serve adjacent areas, as part of a comprehensive development, and the cost is shared; whereas in the case of Beaver's Farm the total cost is borne by that estate. A larger proportion of total investment has therefore been devoted to hard and soft landscaping, and pedestrian routes, in Grahame Park.

2.03 *Livingstone Road, Battersea* A high-density medium-rise scheme; the intensity of ground usage associated with this type of estate requires comparatively large areas of hard landscaping which can stand up to hard use, and smaller areas of soft areas, adequately protected by knee-rails, banking etc. Cost of both hard and soft landscaping is therefore abnormally high for this scheme, and have been shown to be justified. Investment in motor car provision could be kept low because the estate is in a fairly low-income, low car-ownership area. Again, this has been shown to be justified; even though the estate is several years old, car parking provision still seems adequate.



1 *Analysis of land use and cost on a selection of housing estates. Percentages are approximate and do not always add up to* 100 *per cent:*
1 '*Building and private gardens*' *includes area of all buildings except car storage, and entirely private gardens only*
2 '*Car access and storage*' *includes internal roads (not peripheral roads); car parking areas (open or covered); garages and service access areas*
3 '*Major pedestrian routes*' *include all major footpaths*
4 '*Other hard areas*' *include playgrounds; incidental (ie non-essential) walkways; sitting and other paved areas*
5 '*Soft landscape areas*' *includes all non-constructed landscaping (eg banking, planting and grassing); and all public or semi-public garden areas*

2.04 *Usworth Road, Washington* Comparing this scheme with Livingstone Road, several interesting points emerge: densities are much the same, but because this is a comparatively low-rise scheme, a larger proportion of site area has been devoted to buildings and private gardens. Car parking provision is 100 per cent as compared with 70 per cent for Livingstone Road, consequently there is a much higher investment in car access and storage, both in terms of area and cost. This leaves only a small area for hard and soft landscaping.

2.05 *Gainsborough, Corby* One is struck by the large area devoted to dwellings and private gardens, and the low area of soft landscaping. The explanation is that private gardens are both larger and more numerous than in the foregoing schemes; and that there is usable open space adjacent to the estate, so that there was less need for soft areas to be provided. The high ratio of private to public areas is therefore justified in this particular case. The surprisingly low area of car parking space (only 15 per cent for 153 per cent car parking provision) is explained by the fact that garages are situated underneath dwellings.

2.06 *St Dials* 2, *Cwmbran* What stands out is the abnormally high investment in car parking. Area devoted to car parking is, however, fairly average; it would be instructive to discover the reason for the discrepancy. Ratio of private to public spaces is more representative than in the case of Gainsborough.

2.07 *Greenlands, Redditch* Scheme is situated on a hilly site, and had to incorporate a lot of open space, which explains the high proportion of soft landscaped areas. But, even though area is large, investment is fairly average. In comparison with St Dials which is of equivalent density, a much higher provision for car parking has been achieved for a lower proportion of total cost outlay. The comparatively high cost of hard areas and pedestrian routes in the case of Greenlands can probably be explained by the hilly site (steps, retaining walls and so on).

2.08 *Newmarket* This scheme incorporates attributes such as low-density cluster layout, combined with high car-parking provision, which are currently very fashionable. The apparently enormous expenditure on car parking therefore requires careful investigation; if this were typical of such schemes, it would point to a very distorted investment of money. The comparatively low investment in the very large proportion of soft landscaped area adds to this impression of distorted investment.

References

1 BROWN, M. Landscape and housing *Official Architecture and Planning*, 1967, June, p791–799 [06:8]
2 BROWN, M. Landscape and housing *Housing Review*, 1968, May–June, p95–103 [06:8]

Information sheet Landscape 31

Section 9: **Housing estates**

Housing: Rehabilitation

This information sheet by MICHAEL BROWN *and* JUDITH ALLAN *considers the opportunities for improving spaces commonly found in rehabilitation areas and gives some examples of the variety of ways in which they can be improved. Housing in rehabilitation areas was discussed in detail in* AJ 10.6.70 *and* 1.7.70

1 General notes

Character

1.01 Areas needing rehabilitation are usually closely-built, two-storey terraces with a small rear yard and back alley. Front gardens are rare and entrance to dwelling is direct on to pavement or road. Roads are long, monotonous, and usually treeless. (Where complex patterns of streets exist there is opportunity for a more enriched pattern of rehabilitation, illustrations **7** to **18**.)

Public open space

1.02 These areas lack communal open space and density and proximity of dwellings often restricts size of new communal spaces. But many small areas are useful especially if sited on pedestrian routes.

Noise from children's play may disturb residents where size of communal spaces is restricted. Lack of ball game areas leads to bouncing balls on house walls etc.

Infill development

1.03 Social and physical character of rehabilitation areas can be enriched by introducing infill building **1, 2.** Infill at street ends may close it off to form a cul-de-sac. Through traffic is stopped, and the number of dangerous minor crossroads can be reduced. Visually infill across a road becomes a barrier, giving each street identity, and it could be a useful amenity such as social centre, nursery school, or housing for old people. (As no vehicular access is necessary, space in front of infill could be soft surface such as grass with trees and benches.)

Variety in building, space and landscape (often lacking due to repetitive form), can also be introduced by replacing some older terrace properties by blocks of garages and play areas. New infill should be set back to vary the skyline and townscape, allow tree planting, benches etc.

Different levels can be exploited to assist enclosure and privacy, and to add interest and variation.

Vehicle problems

1.04 Improvement of external space must take place within whole areas, so that vehicle and pedestrian flow can be considered as a whole. By-law streets are characterised by lack of provision for car, whether parked or in transit (except in areas such as Islington where small as well as large houses frequently front on to wide streets). On-street parking is usually inevitable but setbacks and closing of streets can provide open or closed car storage.

Planting

1.05 Generous tree planting should be provided either in communal areas (eg pedestrian sections of streets, bays, paved areas, between parking bays etc) or in residents' gardens (incentives should be provided to residents to plant trees). The latter can add variety to streets where open spaces are too restricted for tree planting or where they adjoin communal areas.

1

1, 2 *Infill development in a rehabilitation area at Lambeth includes a health centre and day nursery*

2

Existing trees should be surveyed, and arrangements made for tree care and surgery. Trees should be graded as to quality and tree preservation orders imposed where appropriate.

Edge protection is usually necessary for plant beds, and arrangements for responsibility and maintenance should be made. Highly used areas pose particular problems, and residents' society or equivalent should assume responsibility for maintenance.

Lack of rear access to gardens causes problems of refuse collection. Privacy strips at dwelling fronts can sometimes include a small refuse store.

References

1 Housing Act 1969 Chapter 33. 1969, HMSO [81 (Ajk)]

2 MINISTRY OF HOUSING AND LOCAL GOVERNMENT Circular 64/69 (Welsh Office Circular 63/69) House improvement and repair. 1969, HMSO [81 (Ajk)]

3 MINISTRY OF HOUSING AND LOCAL GOVERNMENT Circular 65/69 (Welsh Office Circular 64/69) Area improvement. 1969, HMSO [81 (Ajk)]

2 Examples of rehabilitation

2.01 The following points are located on plan 5. This is not a comprehensive rehabilitation scheme, but an assemblage of different situations indicating the ways in which external spaces can be improved.

1 Alley with pleasant intimate urban scale where vehicle access has been eliminated. Distances between dwellings are less than for present daylighting requirements. Only very restricted space for planting or trees but opportunities for residents initiative (eg window boxes and tubs of flowers) to confer privacy and identity to windows.

2 Width of street is sufficient for parking and use is restricted to residents. Several small parking bays may be planned on one side only, interspersed with areas for trees and planting. Where necessary, maintenance arrangements can be made.

3 Wide carriageway with use restricted to local access provides many opportunities for redesigning the space between the buildings and for providing alternating car parking, tree planting and bays.

4 Mews town houses inserted at rear end of long gardens. Requirements for car movement restrict space for trees so there is particular dependence on choice of materials, texture and colour and on residents initiative (eg window boxes).

5 Restricted outlook can be improved by climbers on non-aspect walls.

6 Flats with linear deck access gallery over garage block inserted at end of long gardens. Requirements for car movement restricts space for trees so particular dependence on choice of materials, textures and colour.

7 Paved and planted area with stair up to access gallery contrasts with sterility of garage court.

8 Long linear pedestrian route space can vary by widening in places with planting, trees, and climbers to improve communal outlook. Small areas for sitting and play may be achieved by shortening gardens but these will then need a high fence for privacy. Where these spaces are overlooked by open aspect dwellings they are ideal protected areas for younger children's play.

9 Very small main garden adjoining main pedestrian thoroughfare requires high fence for privacy.

10 Where open garden occurs on pedestrian through route there is particular need to indicate the private/public boundary by use of short wall or knee rail. Renewal of fences is frequently required to improve character of space.

11 By restricting parking and service access to end of cul-de-sac a communal pedestrian open space may be formed with greatly improved outlook to the dwellings.

12 Where open aspect dwellings overlook new communal pedestrian spaces a privacy strip may be necessary. This can be achieved by use of knee rail or fence, by projecting line of party wall, by new building extension (eg ground floor bathroom). Where there is no rear access to gardens there is frequently refuse storage and collection problem. A new refuse store in front of dwelling could also act as a privacy strip.

13 Where road width permits, parking may suitably be provided adjacent to non-aspect gable ends.

14 Where road width (ie dimensions between houses) permits, a new block of garages (with a flat over) would close off the road and provide an enclosed courtyard.

15 Setting back infill block to provide main garden in front gives more privacy and varies street and pedestrian way character.

16 Consider possibility of donating trees or providing them at cost to residents for planting in back gardens. Of particular value where these back onto pedestrian ways and where they will add variety to streets with spaces too restricted for tree planting. These trees may require the protection of a tree preservation order.

17 By closing off street to vehicles a pedestrian area is achieved between gable ends of existing blocks. A wall would reinforce enclosure and value for play. The positions of the wall should take orientation into account. Problem with noise from bouncing balls.

18 Gardens facing onto a play space should have high walls (2 m) to provide enclosure and privacy. This also provides a hard vertical surface for ball games.

19 Closed off sections of road and junctions and removal of end houses of terrace blocks, provide linked communal spaces within existing alleyways. Construction of small garage blocks enables pedestrian space to be set back from road but related to pedestrian route. Gable ends and garage walls provide enclosure for play space.

20 Gate at junction of communal area and pedestrian route space could reinforce residents group maintained realm.

21 Infill housing or garages, set back (in alignment with existing terraces) gives variety of space suitable for tree planting and sitting.

22 At road junctions gardens are often stopped off by gable end of adjacent terrace blocks, if the garden is long enough, this is an ideal space for off-street parking.

23 Where road width is excessive and use is restricted (ie in cul-de-sac) widen pavement, plant trees and provide benches.

24 Low wall at end of parking bay to screen windows from car head lamps.

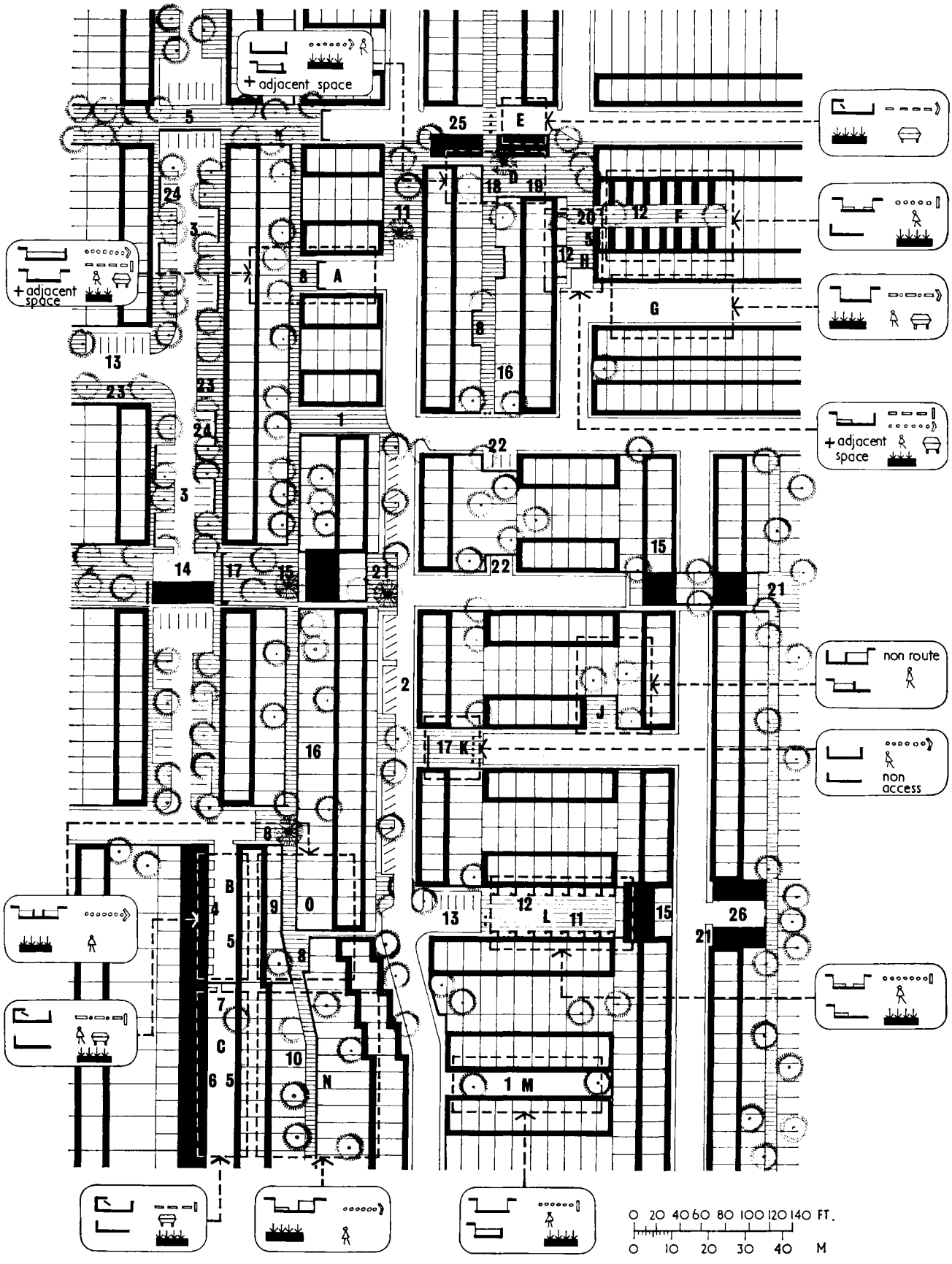
25 Garage roofs could be used as raised play deck but enclosure important for safety and privacy (eg overlooking of gardens and open aspect dwelling). More intensive use of land may be achieved by exploiting opportunities for multi-level use (ie play space or balcony over garage which may also assist privacy and reinforce pedestrian/vehicular separation).

26 Garage blocks inconspicuously sited in closed-off road junctions or spaces formed by demolition of some housing.

3

3, 4 *Portland Grove, Lambeth, before and after rehabilitation. New communal space is paved, but surface treatment changes near houses to provide privacy*

4



5

5 *Although this is not a comprehensive rehabilitation scheme, it does illustrate many different situations where external spaces have been improved. Letters refer to overall classification—see pages 160-1. Numbers refer to key on facing page. Solid blocks indicate new infill development.*

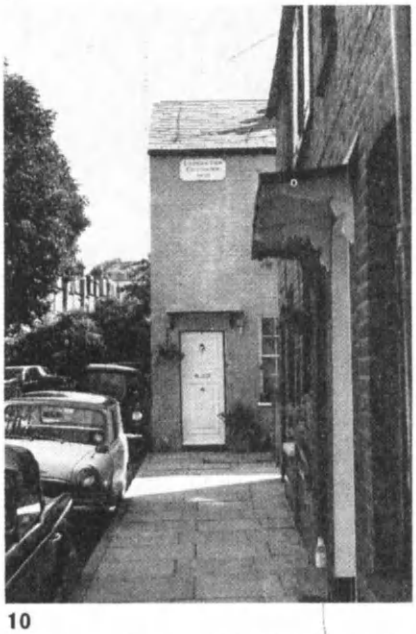
Problems of rehabilitation 7 to 11

7

8

9

7 *Lack of facilities for play, for sitting, clothes drying and general amenity*
8 *Sterile tenements—the only communal space a drab featureless storage area for refuse*
9 *Even potentially pleasant areas have their problems where lack of facilities for refuse storage and collection remain unsolved*
10 *Parked cars encroach on pedestrian scale*
11 *Neglect leads to dereliction*



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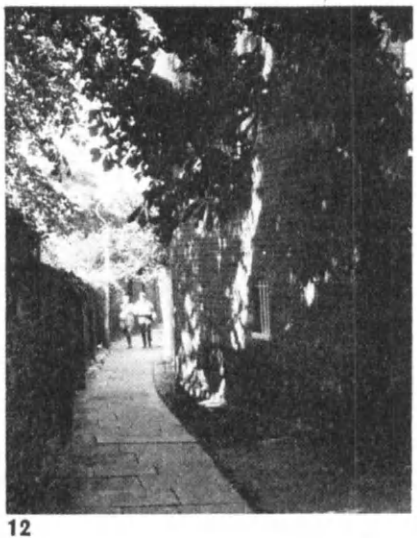
Space types 12 to 18



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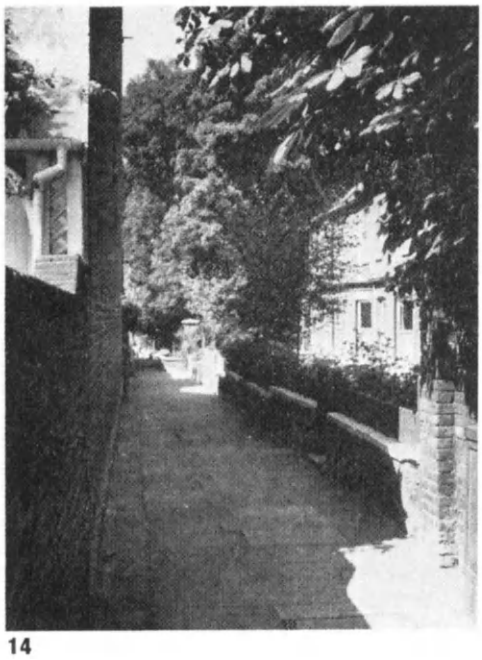
13

12 Non aspect—route space. *Overhanging branches from adjacent private gardens enliven narrow alley and compensate for lack of space for tree planting in communal areas*

13 Non aspect—plus adjacent space—route? *Incorporation of small incidental spaces for sitting, or play on pedestrian alley provides for interest and amenity*



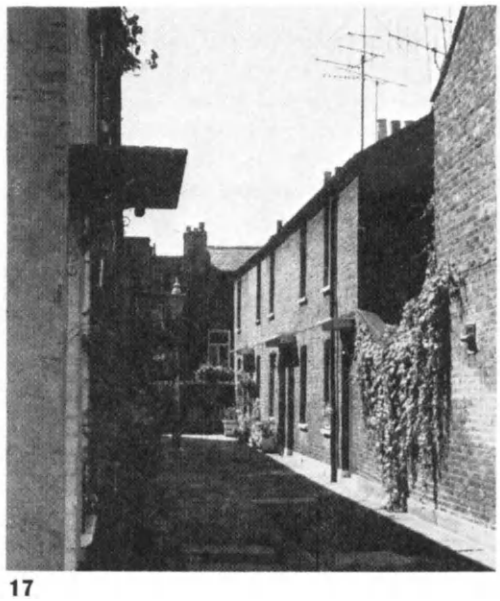
14

14 Non aspect and open aspect + privacy strip—route space. *Open fronted gardens along pedestrian alley. Low brick walls indicate private/communal boundaries*

15

15 Open aspect for private strips—route space. *Small front gardens increase privacy and allow individuals some initiative in making the space attractively varied. See note* 10, *space N, pages* 198-9

16



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18

16 Communal local access, non-route space. *Communal gardens visible through railings give a pleasant view from public thoroughfare and an outlook for residents to see passers-by*

17 Open aspect + non aspect, local access space. *Pedestrian alley with pleasant urban scale. Interest and texture added by paving patterns and private initiative in providing plant boxes and climbers, especially on non-aspect wall. See note* 1, *space M*

18 Open aspect space—local access. *Access to house fronts through communal garden enclosed by high wall and gates encourages social cohesion of small groups of residents. See note* 11, *space L*

Section 10
Elements of landscape construction

Information sheet
Landscape 32

Ground modelling

This information sheet, prepared from information supplied by LANDSCAPE DESIGN PERSONNEL, UNIVERSITY OF NEWCASTLE UPON TYNE, *deals with procedures for preparing ground modelling, discusses various problems likely to arise during excavations, and concludes with a description of machinery available and methods for calculating volumes of earth works*

1 Site information

General survey

1.01 From a general survey, information should be accumulated on surrounding land forms, land use, function, and access to and through the site, both existing and desired. See information sheet LANDSCAPE 1.

Survey information

1.02 A survey should be carried out to determine accurate levels. Aerial surveys can be used, but ground surveys are usually more economic on urban sites. On small sites spot levels may be sufficient, but contoured plans at 1 : 100 or 1 : 200 scale are easier to work from, provided spot levels are included for critical points not covered by contours; eg tops of mounds and site fixtures such as manhole covers.

Surrounding landforms and features

1.03 Survey information should be continued outside the site, if possible to limits of views, or at least for 15 m. Any proposed or existing levels or features around sites should be considered as design limitations.

Soils and geology

Solid geology

1.04 Geological survey maps of the region surrounding sites can be consulted to ascertain likelihood of problems affecting sites such as subsidence, underground springs, water table levels and drainage impedance. Borings to intended depths of excavations will indicate if solid geology encroaches on any work to be done.

Subsoil and drift geology

1.05 Examination of ordinance survey drift maps and sampling on site will show nature of drift material and subsoil and any drainage problems. If layers are substantially different, they may have to be stripped and stored separately.

Topsoil

1.06 When planting is proposed, physical and chemical analysis of topsoil should be made, especially characteristics such as pH and nutrient status. To control stripping and storage of topsoil, profiles should be drawn with notes on depths and physical character.

Water problems

1.07 Drainage systems must be capable of coping with any precipitation to avoid standing water and flooding. Study of the preceding information will expose drainage problems likely to be encountered as well as natural drainage patterns across sites and into and out of surrounding areas. Natural outlets, ditches, ponds, reservoirs and streams should be noted, and sites for soakways should be considered if solid geology is permeable. Relevant authorities should be consulted with reference to use of drainage outfall possibilities.

Public utilities

1.08 Minimum depths of cover over services are specified by public utility authorities and are intended to prevent damage while allowing access for maintenance. Existing services form fixed levels in proposed designs and should be mapped. Table I is only a guide to depths of cover normally required for various services, and in all cases relevant public authorities should be consulted.

Table I Guide to depths of cover normally required

Service	Normal depth of cover (m)
Water: mains	0·900 to 1·100 (depends on diameter)
branches	0·750 (depends on diameter)
Gas: mains	0·450 to 0·758 (depends on diameter)
branches	Less than 0·450 (falling to main)
Electricity: mains	0·450 (falling to main)
branches	Just below surface
GPO telephone cables	0·225, 0·350 or 0·450 (depends on material)
Drainage: sewers	Variable, consult the local authority
land drains	0·700 to 1·200 (depends on soil type)

Vegetation

1.09 Existing vegetation on the site should be surveyed. Tree preservation orders should be noted, as ground round protected trees should not be raised or lowered by more than 250 mm for a distance equal to the canopy span of the trees. Trees not under preservation orders, but considered for retention should have the same criterion. Design should avoid leaving trees in drainage basins which would result in waterlogging of soil round roots.

Bulk material

1.10 Characteristics of bulk materials should be studied with reference to working, storage and transportation. Surrounding areas can be examined for sources of bulk material, and opportunities noted for disposal of excess material; eg playing fields, local quarries etc.

Climatic limitations

1.11 Local and regional climate should be studied for prevailing wind, length and direction of sunlight and rain precipitation levels. Microclimatic effects should be considered with reference to aspect, wind funnelling and turbulence, and shadow and shelter zones so they may be accounted for in the design.

2 Characteristics of bulk materials

Generally

2.01 To create stable conditions for establishing and maintaining vegetation cover of slopes, the nature of existing geology and desirability of bringing in new material; eg topsoil, should be studied.

Behaviour of slopes

2.02 Resistance of fragmented material to movement is due, in part, to its cohesion, and in part to friction. Friction is reduced by the weight of overlying material and is therefore related to angle of slope. Cohesion is reduced by increase in water content. In some clays this movement can be induced by a moisture content as low as 10 per cent.

Non-cohesive soils

Sands and gravel: shear strength arises entirely from friction. Failure of these slopes is a surface phenomenon producing saltation, with dry particles rolling down slopes. Flow slide is a condition of this failure occurring when saturated fine sand is disturbed; eg by vibration.

Cohesive soils

Clays: friction and the cohesive qualities of colloids serve to stabilize the slope of such soils. Slope failure occurs at angles greater than 20°, and as in all materials, slope angle decreases with height. Table II approximates general limits for angle of repose for various soils.

Table II Approximate limits for angle of response in soils

Soil type	
Non cohesive soils and chalk	35°–40°
Rock waste	45°
Very wet clay and silt	15°
Wet clay and silt	25°
Dry sand and gravel	50°
Dry clay	35°
Moist sand	40°

Table III Safe angles of repose in rock

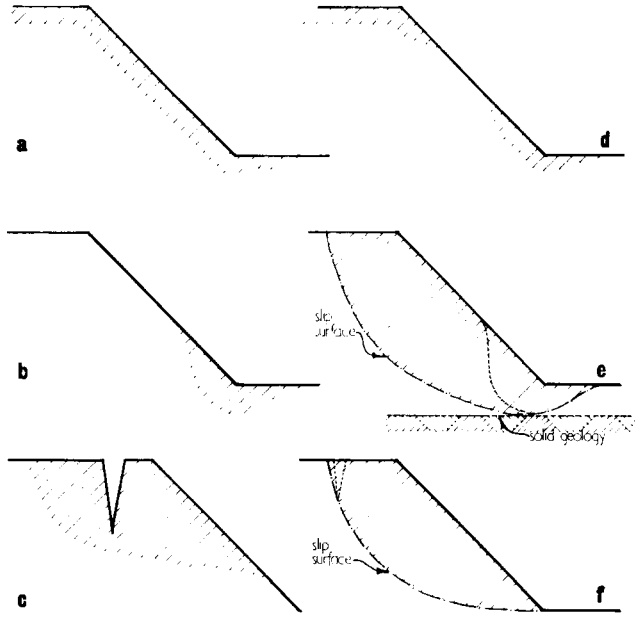
Rock type	tonnes/ cu m of solid material	Safe slopes cuttings angles refer to horizontal	Angles of repose embankments
Hard massive sandstone	2·40–2·72	70°–90°	38°–42°
Soft sandstone	2·08–2·40	50°–70°	33°–37°
Shale	2·40–2·56	45°–60°	34°–38°
Marl	1·92–2·24	55°–77°	33°–36°
Limestone (hard eg carboniferous)	2·64–2·80	70°–90°	38°–42°
Limestone (soft eg Portland beds)	2·24–2·48	70°–90°	38°–42°
Chalk	1·92–2·80	45°–80°	33°–36°
Igneous rocks	2·56–2·96	80°–90°	37°–42°
Metamorphic rocks	2·56–2·88	60°–90°	34°–48°

Table VI Slope distances from situations or activities

Situation or activity		Min level area required
Rural roads		0·6 m to 1·2 m
Main roads		3 m
Buildings for:	construction operations	1 m to 3 m depending on activity
	foundation inspections	
	service, fire and private access	
	building maintenance	
	landscape maintenance	
Boundaries for:	maintenance of fences walls and hedges	1 m

Failures

Watch points for failures: examination of material at bottoms of cuttings can reveal possibility of failure. Thin rock beds weather rapidly and to a greater extent than thick rock beds. Water along bedding planes causes rock slips by chemical disintegration and leaching of cementing properties. Weight increase due to the presence of water is taken up by the soil causing stress and pressure in face of slope, which is relieved in the form of vertical cracks which will lead to failure **1**. There is considerable settlement in peat as it shrinks after drainage. Table III shows safe angles of repose in rock.



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1 *Illustrates critical zones in slopes. Resistance of fragmented material to movement is due in part to its cohesion and in part to its friction. Friction is reduced according to the weight of over-lying material. Cohesion is reduced by an increase in water content. The interaction of these two conditions can result in slope failures:*

a *Surface softening due to loss of cohesion after increase of water content*

b *Softening at toe of slope due to loss of cohesion after increase in water content caused by bad drainage.*

c *Shrinkage due to loss of cohesion and deep seated softening due to water penetration at cracks*

d *Shaded areas indicate danger zones to be protected by suitable drainage facilities*

e *Deep seated slip resulting in cohesive soils over solid geology following surface and two softening*

f *Deep seated slip resulting in cohesive soils following shrinkage cracking and deep seated softening*

Rainwater run-off volume

2.03 Factors affecting run-off volume:

1 Rainfall duration.

2 Type of precipitations: snow will give a much more sudden release of water than rainfall.

3 Precipitation intensity.

4 Topography—ie catchment shape: an elongated catchment is less likely to flood than a broader shape. Slope angle and orientation, both to solar radiation and prevailing winds.

5 Type of vegetation.

6 Percolation and infiltration: rate of percolation and infiltration is affected by:

a Physical characteristics of soil.

b Soil moisture content.

c Surface cover: vegetation and snow increases infiltration.
d Gradient of slope.
e Rainfall characteristics.
f Organic content: high organic content promotes drainage.
g Inorganic content: gravel (particle size 20 mm to 60 mm) freely draining; sand (particle size 0·06 mm to 2·00 mm) freely drained with very little shrinkage or swelling; silt (particle size 0·002 mm to 0·060 mm) particles have similar characteristics to those of sand, but are less well drained; clay (particle size less than 0·002 mm) has very restricted drainage and holds more water than other soil types, thus restricting the amount available for plant growth.

Types of movement

2.04 Following are various types of soil movement:
1 Soil creep: slow process not exceeding 2 m per year and occurring particularly in stiff fissured clays. Usually only upper layers are affected, but occurs on slopes to 1 in 5½.
2 Fragmental slides: these occur in non-cohesive materials; eg sands and gravels, and exhibit slip if near their angle of repose. Embankments of these materials are not desirable.
3 Detritus slides: these occur where there are shallow layers of cohesive materials, or in fine grained materials, which take up water and slide under the influence of gravity.
4 Rock slides.
5 Rotational shear slips: where earthwork slopes are being constructed through clay formations it is desirable to create only moderately high embankments and cuttings as rotational sheer slips are deep seated and common in clays, though they do not occur in non-cohesive soils.

3 Design limits

Maintenance

3.01 The following factors should be considered as design limitations imposed by maintenance machinery:
1 Minimum turning circles of machinery.
2 Manoeuvrability of machines: slopes curved on plan fit more easily into the sequence of operation of machines than straight slopes. When straight slopes meet at an angle the problem is acute.
3 Operability of machines on steep slopes: steep slopes should be avoided; angulation usually upsets lubrication and fuel feed before the angle defined by the machine's centre of gravity is reached. Though gang mowers can accommodate any reasonable slope on undulating ground, cross slopes of more than 1 in 30 are liable to be 'skimmed-off' by the cutter bar leaving bare patches in the grass.
4 Slopes should be rounded at their tops and bottoms.
5 See table v for recommended gradients for mowing.

Affecting variation to slope limits

3.02 Soil materials are not stable if constructed with steeper slopes than their natural angle of repose unless reinforced.

Topsoiling
On inclines steeper than 1 : 1½ it is necessary to hold top soil in place with wooden frames, longitudinal boards or wire mesh staked in place.

Ground preparation
Organic matter is spread over the surface and worked in to improve top soil structure and water retention. To do this at low cost, any immediately available type of organic matter can be used; eg grass cuttings, leaf litter, sawdust, threshed soya bean plants.

Inert resins and emulsions
These have been used successfully on many areas as they can be sprayed cheaply, ready mixed with seed and fertilisers, from machines. They have the same retention properties as mulches.

Matting
Mats of brushwood can be pegged or embedded on slopes to retain water and prevent erosion, and through which the plants are established. Cheap jute matting is used for extensive areas, but for long lasting continuous support of steep slopes, polypropylene netting should be used.

Seeding
Compounds, paving, bricks, tiles, setts, cobbles and timber. These hard surfaces will also increase slope limits above natural angles of repose.

Costs; effects of construction equipment and techniques

3.03 Following factors should be considered as design limitations imposed by costs, construction equipment and techniques:
1 Balance of cut and fill is economically desirable, but an average of 25 per cent more cut than fill should be allowed for because of compaction
2 Minimum turning circles of equipment often establishes minimum curvatures of ground modelling in design or are a deciding factor in selection of machinery for use on sites with limited movement
3 Haul distances between points of cut and fill become important as scale of design increases
4 Availability of machinery
5 Desire to use only one machine
6 Nature of material to be excavated
7 Time for completion
8 Season and weather conditions
9 Water table and other site conditions
10 Whether topsoil and subsoil operations are separated
11 High mounds and deep depressions become costly on sites over a hectare

Cost reducing factors

3.04 No precise statement for cost design differences is possible, but in general:
1 Circumferential deposition of earth is usually the most economical technique
2 Cut and fill operations within a single site is advisable
3 Profits and overheads on contracts for small sites are relatively greater than for larger sites
4 Hill and valley designs are less expensive than terracing designs and are relatively more visually effective for amount of earth moved
5 Variations in designs do not result in large cost variations, for sites less than 2 hectares.
6 High rises and deep depressions become very expensive on sites greater than 1 hectare

4 Three dimensional design

Surrounding topography

4.01 Landform of sites are enriched by designs which take into account the surrounding topography. In an urban setting, topography surrounding sites will also include buildings which must also be considered in the design solution. Surrounding topography can be ignored to an extent when sites are enclosed by mounds or embankments to reduce noise levels or improve microclimates.

Abstract and geometric forms

4.02 Choice of abstract or geometric landforms is a matter

for the designer to decide, but following points could be considered:
1 Continuity between one form and another
2 Interlocking and overlapping forms
3 Spiral, wave and cellular forms in nature
4 Symmetry, assymmetry and rhythm
5 Expression of mathematical formulae as with sand dunes which express relationship between frictional resistance of sand grains and wind.

Building forms and land forms

4.03 Land adjacent to buildings can be developed to relate the buildings to surrounding landscape. Some designers often design buildings to grow out of sites **2**, or emphasised buildings as artefacts in landscapes by placing them on landform platforms **3**. Another approach is to use the landform to emphasise the form of the building. Attention should also be paid to approaches to buildings, considering them as part of the landform design **4**.

Microclimate and landform

4.04 Effects of wind funnelling and frost pockets occur in large and small landform situations. But, although knowledge now available on these effects in building complexes is relevant, much research has still to be carried out as regards to landforms.
Warm places within a site can be achieved with landform design when orientation and shelter are considered along with time of day and year when area will be used.

Land uses and landform

4.05 Many activities and buildings require level surfaces. The inherent lack of interest in flat surfaces can be countered by arranging spaces at different levels to each other. As the several processes of an industrial plant need not be at the same level, by varying them, not only can sites be more economically prepared in terms of cut and fill, but the landform design can make the industry more visually acceptable.
Existing undulating landform need not always be greatly altered as some activities such as parks and play areas benefit from variety in landforms and sites capable of subdivision into small units, as in housing, can also be located without substantial change to topography.

5 Drainage

Slope erosion

5.01 Stabilisation of slopes is an essential part of ground modelling, especially on slopes which have no vegetation, or on slopes where vegetation has not fully established itself. There are two types of slopes: cut and fill. Erosion on either is unsightly and potentially dangerous, and, on the latter type, liable to be unnoticed for some time, requiring extensive repairs when discovered. Though erosion can be by

2 *Wright's Herbert Jacobs house, an extreme example of a building designed to grow out of a site*
3 *Mias' Farnsworth house is emphasised as an artefact in the landscape by placing it on a landform platform*
4 *Approach to house integrates landform and building*

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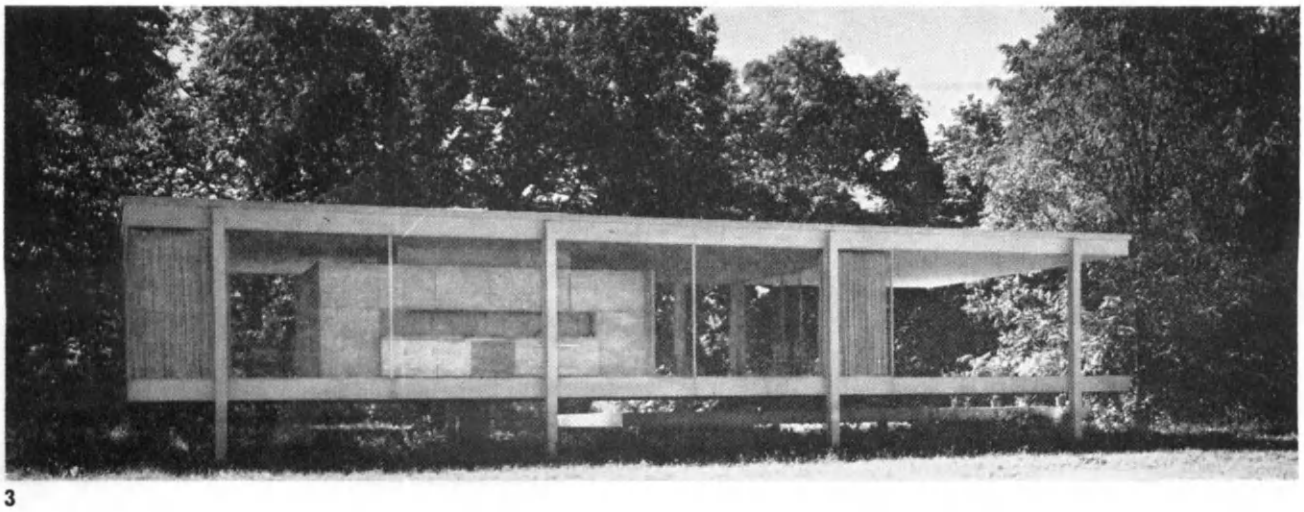

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several agents, water is the most common one in an urban setting.

Cut slopes

5.02 The usual method for reducing amount of run-off on cut slopes is by positioning an intercepting ditch at tops of slopes. Soil loss is then only caused by water falling directly on the face. Such ditches lose their value if not kept clean.

High cuttings

5.03 Low cuttings are not subject to rapid soil loss, and it is an advantage to be able to terrace a high cutting into a series of low ones. Terraces should be designed to intercept run-off water and to lead it to one side for dispersal to the bottom of the cutting via a paved ditch or pipe.

Vegetation

5.04 Vegetation naturally and attractively controls erosion. Roots mechanically reinforce soil, decaying organic matter improves soil structure and foliage, alive or dead, protects surface against rain or wind.

Slope failure

5.05 Most failures occur during the first winter after installation of the slope, before vegetation has been completely established. Immediate attention to failed areas can forestall serious repairs until vegetation matures.
Most frequent failures are caused by surface slippage. Failure in top third of slope indicates possibility of water seeping or percolating from above into a porous layer of subsoil. Failure by slippage in bottom two-thirds of slope is usually caused by saturation of soil caused by inadequate compaction before rains start.

Repairing erosion to cuttings

5.06 In most cases only gulleys will need attention. They should be backfilled, fertilised, seeded and mulched. Old slopes which have never received a stabilisation treatment and are eroded badly require a light cultivation of the compacted soil to smooth out gulleys and rills, break up channels and make a more favourable seed bed.

Repairing erosion to fill slopes

5.07 Repair work to deeply eroded fill slopes is a long term proposition. Large gulleys or slip-outs require careful and quick attention to protect the surface adequately. There are ways to quickly control fill erosion:
1 A logs and coarse brush crib is constructed at the toe of the fill failure. Loose brush is then placed in the gulleys and covered with a thick layer of backfill material. Additional brush is spread over the surface and covered with soil. In this way further layers are provided until the fill contour is restored.
2 A logs and coarse brush crib is constructed at the toe of the fill failure. Backfill material is furnished from the top of the slope and a bulldozer is used to spread, compact and shape the material to the original fill contour. Brush layers are installed at suitable intervals as the fill is built up.
3 A further method is to use metal cribbing into which the backfilling can be dumped. This, possibly, is the most efficient and long lasting method.

Provision for flash floods

5.08 Usually drains are only sufficient to cope with the normal rainfalls for an area. Provision should be made for flash floods where there is a history of their occurrence, by increasing drain sizes and numbers.

Cuts below water table

5.09 When landscape designs are likely to disturb the local or regional water table, the various characteristics of subsoil water should be ascertained at the earliest possible stage—ie during site survey. Where possible designers should avoid unnecessary cutting below the water table. If it is unavoidable, as in the case of pipe laying etc, the depth, extent and direction of flow of ground water should be accurately determined. This can be done in three ways:
1 By extensive test boring
2 From geology and hydrology maps
3 From previous excavations and local knowledge. Characteristics of the material above the water table should also be considered to determine the effects of, say, heavy rainfall on the excavated site

Dewatering

5.11 One way to overcome this problem is to eliminate it. This can be done with a system of wells and pumps, but it is costly and mainly applicable to sands and gravels. However, most excavations allow for the removal of ground water from the site floor as the cutting proceeds with ditches and sumps. Ditches are positioned normal to the direction of flow and sumps are placed as near as possible to the main source of flow. Sumps can then be pumped or gravity fed through the ditches for disposal.
Ignorance of the existence of ground water can lead to gross miscalculations of excavation costs.

6 Calculations

Level of accuracy

6.01 Size of sites will control, to an extent, the degree of detailing. Designs for small sites usually drawn to large scales will often be prepared with considerable detailing, but as they are likely to require only one earth moving machine, they do not need sophisticated calculations. Large sites, however, may have many machines involved and large volumes of earth work. In such cases the degree of accuracy in the design will depend greatly on the accuracies possible with the machinery and the scale at which the drawings can be produced. An inaccuracy of 1 mm on a drawing at 1 : 200 represents an inaccuracy of 200 mm on site. Table VI lists acceptable deviations from planned contours.

Calculation of volumes

6.02 There are several methods depending on the degree of

5 *Sites for a 'ranch house' development in Los Angeles. Combination of effects due to cohesive soils, flash flooding and local seismic problems has resulted in several slope failures on developments such as this*

5

accuracy required and how involved the topography may be.

Contour lines
A method used for simple sites, but not suitable for computers. The total area between adjacent contours is measured with a planimeter. The result is halved and multiplied by the height between the two contours. This is repeated for the whole site. By comparing the results for the existing topography and the proposed topography, the balance of cut or fill is expected **6c**.

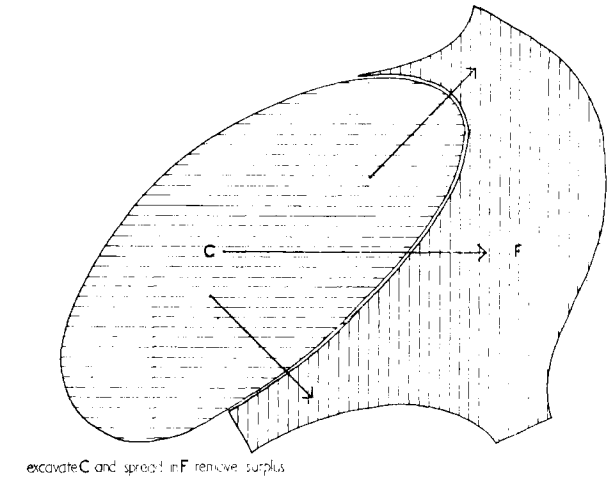
Cross-sections
Quantities of cut and fill are calculated from profile sections with a planimeter. The system is subject to error which is likely to be increased if the profiles are taken equidistant across the site. However, it is simple to operate and adequate for most small contracts **6c**.

Grid of levels
This is a technique for larger sites using a computer. Regular grids may be transferred direct from the original aerial survey to the computer—the degree of accuracy obtained on exceptionally broken ground may not favour this approach, but the square grid has great advantages in case of recording, storing and recalling data **6b**. Accuracy is a function of the grid spacings adopted and variable spacing to suit topographical requirements is recommended. It should be noted that when material is moved there is likely to be a change in density and this should be allowed for.

7 Grading

Major and minor grading

7.01 Grading is the reshaping of existing ground forms. Aims of grading are:
1 To achieve efficient surface drainage
2 To fit design elements to the site
3 To create a pleasing appearance
Minor and major grading forms the major part of ground modelling works. Their links with other landscape work on a site is shown in the network analysis diagram **7**.



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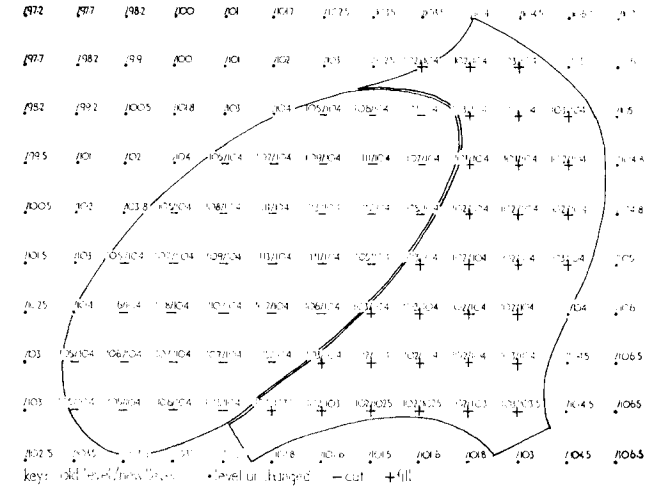

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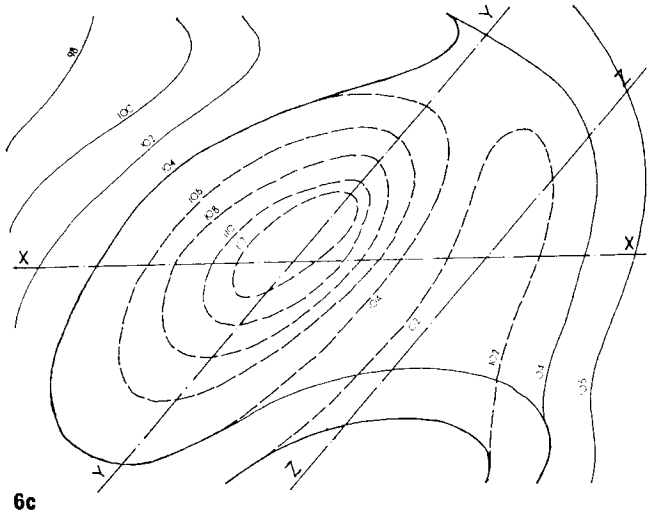


6c

6 *Three drafting techniques for showing earthworks:*
a *Movement of materials from areas of excavation* 'C' *to areas of fill* 'F'. *Such drawings would be supplemented by site directions*
b *Areas of excavation shown by old spot levels reduced to new; areas of fill shown by old spot levels raised to new*
c *Areas of excavation and fill shown by contours indicating existing and proposed grades. Axes* XX, YY *and* ZZ *represent section lines for calculating quantities of cut and fill see para* 6.02

Table VI *Accuracy of contours*

Description	**Maximum permitted deviation from planned gradient** (or given levels)	**Maximum permitted deviation when tested by placing boring rods at the distance apart indicated**	
		Distance apart	**Deviation**
General grassed landscape areas	±100 mm	30 m	±50 mm
Sports field: organised games	±75 mm	30 m	±25 mm
Sports field: special standards	Tolerances should be specified to a higher standard in accordance with the requirements of the appropriate sporting organisation		

Minor grading or regulating
Minor grading or regulating is the process for forming true running contours by blade grading within the depth of the topsoil. Topsoil should be at least 150 mm deep and hollows should be filled by tipping if regulating is to be practical.
After scrub and unwanted trees are removed, the surface of the site is cultivated by plough or disc-harrow and a root rake if trees have been removed; hollows are filled and the fill consolidated—surface soil particles should then be small and dry enough to move freely with blade graders. Grading can be by a grader trailed or hydraulically controlled from wheeled or crawler tractors, a motor road grader or an earth travelling blade to a wheeled tractor, rear mounted.
With boring rods high and low spots are plotted and an estimate of volumes is made; areas to be adjusted are stripped of topsoil which is set aside to be returned after the levels have been reduced and raised as required.

Major grading
Major grading is the method for adjusting contours when final levels can only be obtained by excavating the subsoil.

Topsoil

7.02 For the purpose of most landscape work topsoil is a defined in BS 38826. The need to conserve topsoil should be understood as fundamental and imperative. It should be stripped and stored for re-use or it can be sold if not needed.

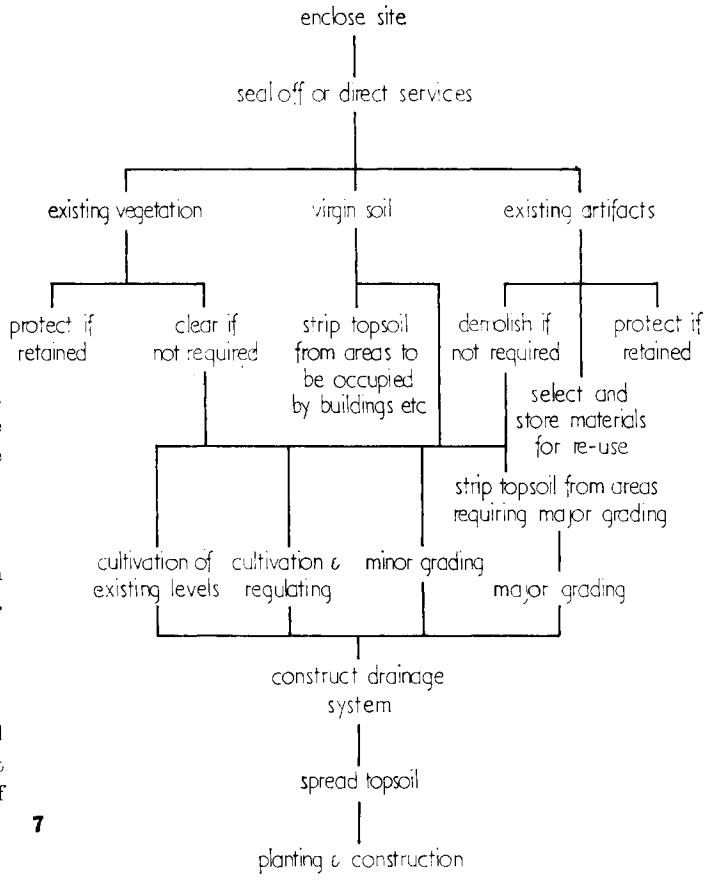
Stripping topsoil
Stripping topsoil usually requires the removal of the top 150 mm–500 mm of surface soil. Soil should be removed without the need to run over the material to avoid compaction, it is a specialist job and best carried out by landscape contractors.

Storing topsoil
Temporary topsoil heaps should be positioned on undisturbed ground, clear of all building and grading operations. Resiting soil heaps damages material as it is 'double worked'. Siting should take into account building location, access and movement of equipment and maintenance of site drainage during building opperations. When soil is returned to the site after grading operations have been completed, the soil should be neither layered or compacted. See information sheet LANDSCAPE 10 para 3.05 for minimum depths of topsoil for planting.

Compaction and layering

7.03 As loadbearing foundations are rarely required in landscape work, little layering or compaction of fill is necessary except where slopes steeper than the angle of repose of the material are desired. Surfaces likely to require mechanical maintenance such as grass, need some compaction to reduce the possibility of minor distortions to these surfaces.

Compaction
There are four basic ways of compacting soils:
1 By applying weight to press particles together
2 By working the material while applying pressure—ie kneading it
3 By vibrating particles into compact formations
4 By striking the soil surface—ie pounding particles together
See para 8.04 for suitable equipment for compacting various materials.



7 *Network analysis diagram for landscape work (from* BS 4428:1969)

Layering
Layering is used to achieve highly compressed fill material capable of bearing loads. For all but large areas this is most satisfactorily achieved by compacting successive 150 mm deep layers. For large areas good results can be achieved by mass compaction of the lower parts of the fill then using the layering technique with land drains for the surface.

8 Ground modelling plant

Generally

8.01 There is a variety of earth moving and shaping machines available for ground modelling on urban sites. Their selection depends on several factors: size and topography of site, accuracies required, number of machines needed to complete operations or the versatility of a particular machine etc. The larger machines are of two types: those fixed in position while operating and those which are mobile while operating.

Fixed position while operating

8.02 Three machines are suited to urban sites:

Dragline
Only the smaller machines are suited to the scale of most urban sites. They function best with fairly unconsolidated material, particularly, excavating wet or marshy sites. Their earth moulding capabilities are limited.

Power shovel
This machine is most efficient for embankment digging and is not at all satisfactory working in non-cohesive soils as they will not stand in banks well. They are effective for

moving rock broken by blasting and a variety of buckets enables the power shovel to perform a variety of tasks such as deep excavations—trenching, and surface stripping—skimming. Their earth moulding capabilities are limited.

Hydraulic excavator
A flexible and general purpose machine for small sites and precise excavations. They have loading buckets, can operate as back acting diggers and can be used for most general shaping and grading.

Mobile while operating

8.03 Machines in this category are more suited to bulk, wide area excavations and their application to earth modelling is generally more specific.

Bulldozer
Bulldozers can perform a variety of tasks with all types of materials, though they work best on firm and level ground. They are particularly suited to remodelling plateaux and embankments, though their capacity for shifting earth over large distances is limited.

Scraper
Their large turning circle may preclude all but the smallest machines from narrow sites. They are most suited to shallow cuts, and can carry large loads over considerable on-site distances. Scrapers cannot operate on very loose, dry materials or on very wet sites.

Grader
Generally for fine grading for finished levels, taking over from where the bulldozer or scraper leaves off. Size of contract area usually limits the use of this machine.

Compacting machinery

8.04 In certain cases subsoil has to be compacted to achieve stability and cohesive strength. Maximum compaction is achieved when a specific soil moisture state exists. Following are machines suited to compaction work:

Smooth wheeled roller
Ranges in sizes from 1·5 tonnes to 18 tonnes and will compact up to 250 mm deep layers of hard core, crushed stone, and earths with gravel, sand and clay mixtures.

Pneumatic type roller
Ranges in sizes from 10 tonnes to 50 tonnes and will compact up to 450 mm deep layers of any type of soil, though sands and granular materials are most responsive.

Sheepsfoot roller
Used on cohesive clays or silts where its spikes prevent crust formation on the surface of the material.

Vibrator roller
Acts best on granular soils and sands, vibrating particles into place.

Hand and pneumatic tampers
Only suited to small or narrow areas.

Explosives

8.05 The use of explosives is often a solution for the removal of rock, tree roots and old foundations, even for sites as small as 40 m × 40 m in urban situations. This work should always be carried out by specialists.

References

1 OGLESBY, C. H. and L. I. HEWES, Highway Engineering. Chichester, 1963. J. Wiley [12] *Price £6·10*
2 WEDDLE, A. E. Techniques of Landscape Architecture. London, 1967. Heinemann [08] *Price £4·50*
3 CARSON, A. B. General Excavation Methods. Maidenhead, 1961. McGraw-Hill [(02)] *Price £6·95*
4 NICHOLS, H. L. Modern Techniques of Excavation. London 1951. Odhams [(02)] *Price £3·50*
5 BRITISH STANDARDS INSTITUTION
BS CP 303:1952 Surface Water and Subsoil Drainage [(52·5)]
6 BS 3882: 1965 Recommendations and classifications for top soil [(L4)]
7 BS 4428: 1969 Recommendations for general landscape operations (excluding hard surfaces) [(083)]

Table v *Slope limits for various land uses*

Situation	Gradient min*	max
To facilitate mowing:		
Hand maintenance (eg scythe)		1 : 1
Special bank machines (eg air-cushioned mowers)		1 : 1½
Small machines		1 : 2
Tractor drawn machines	1 : 70	1 : 3
Roads (longitudinal slope)	1 : 200 (unless frequent drainage gulleys provided)	
Trunk roads (longitudinal slope)		1 : 25
Public roads (longitudinal slope)		1 : 10
Private roads (longitudinal slope)		1 : 6
Concrete roads (cross slope to crown)		1 : 48
Bituminous roads (cross slope to crown)		1 : 32
Gravel roads (cross slope to crown)		1 : 24
Parking areas	1 : 100	1 : 20
Walks and pathways		
Adjacent to buildings (within 6 m-long. slope)	1 : 100	1 : 25
Approach and access paths (longitudinal slope)	1 : 100	1 : 10
Cross slope	1 : 100	1 : 25
Playing fields		
For reasonable standard of play without undue fatigue (grass pitches should be sited so steepest gradient is transverse to direction of play, regardless demands of good orientation)		1 : 40
Winter games and cricket outfields		1 : 50
Tennis, netball, baseball etc		1 : 80
Running tracks (longitudinal slope)		1 : 1000
(cross slope)		1 : 100
Play areas	1 : 200	1 : 1
Gutters and swales		
Seeded swales (longitudinal slope)	1 : 100	1 : 10
Paved gutters (longitudinal slope)	1 : 200	1 : 25
Planted banks		1 : 2
(Absolute maximum with no maintenance)		1 : 1
Absolute minimum slope for any surface	1 : 200	
Absolute minimum slope for any soft surface	1 : 100	

*Minimum ensuring adequate drainage

Information sheet Landscape 33

Section 10: **Elements of landscape construction**

Surface treatments

This information sheet by SHIRLEY ANDREW *deals with selection of surface treatments for pedestrian areas. It is intended as a basic guide to choice. Information sheets* LANDSCAPE 34 *and* 35 *describe in detail paving and trim types*

1 Selection of surface

Choice

1.01 Choice of surface treatment will generally depend on some or all of the following considerations. Table 1 compares various surface materials.

Use

1.02 There are several aspects of use:

Visual: It may be required to demarcate access, to relate building to site, or merely to look exciting or restful.

Pedestrian: It may be required for walking over, pushing prams or children's cycles over or sitting on.

Vehicular: Even in predominantly pedestrian areas access may be required for service vehicles, milk floats, post office vans, GPO service vans, ambulances, refuse disposal lorries and fire fighting appliances.
It is possible to cater for this occasional vehicular traffic while still retaining a predominantly pedestrian character. This can be done for example by strips of more durable surfacing in a paved area which can also serve to give direction and to make the area safer by alerting pedestrians to the possibility of traffic.
In an area surfaced with grass the continuity of the grass can be maintained but vehicles allowed for by, for example, spaced paving slabs which allow the grass to grow between. There are proprietary precast concrete slabs such as *firepath pots* which are specially made for the purpose of allowing grass to grow while providing a stable surface for vehicles. See information sheet LANDSCAPE 34 para 1.08. Another method is by stabilising the grass in convenient parts by covering with sand and spraying with bituminous emulsion. Areas of gravel may be treated in a similar way to grass so that greater stability can be achieved where it is required without the expense of treating the entire surface.

Durability and maintenance

1.03 The most durable materials are not necessarily the most trouble free, and surfacing chosen should withstand conditions imposed without the necessity of replacement. See table 1 and information sheet LANDSCAPE 34 para 4.03 for durability of paved areas.

Table 1 Comparison of surfacing materials

Surface	Use			Durability	Initial cost	Maintenance	Remarks
	visual	pedestrian	vehicular				
Producing visually smooth surface:							
Unit paving	√	√	√	high	high	low	
Continuous paving	√1	√	√	high	med-high	low	1 best when care is taken in choice of aggregate to give pleasing colour
Sand	√	×	×	med 1	low	low-high 2	1 subject to displacement by traffic or winds 2 depends on appearance eg Japanese sand gardens
Fine gravel	√	√	√	med	low	med-high	subject to displacement by traffic
Stabilised gravel	√	√	√	med-high	med	low	bituminous emulsion with fine gravel rolled in produces a more stable surface, more impervious to weeds
Coarse gravel	√	√	√	high 1	low	med	1 but subject to displacement
Hoggin, rammed earth	√	√	√	med	low	low 1	1 assuming a casual appearance is being aimed at
Fine grass	√	√1	×2	med	low	med-low 3	1 provided intensity of use not concentrated 2 unless stabilised only suitable for occasional use 3 depending on desired appearance
Water	√	×	×	med-high 1	high	med	1 if well maintained
Producing visually rough surface:							
Cobbles	√	×	×	high	high	low	
Loose stones	√	×	×	high	med	low	
Rough surfaced, precast concrete	√	×	×	high	high	low	
Low ground cover plants	√	×	×	low-med	low	med	weeding, pruning, replacement of plants occasionally
Low spreading plants in regular rows	√	×	×	low	low	med	see information sheet LANDSCAPE 7. Replacement will be necessary from time to time
Precast paving with grass	√	√	√	med-high	med	med	paving slabs are set low enough that grass can be mown over the top

Cost

1.04 The true cost of surfacing is the initial cost plus maintenance cost. More expensive surfacings tend to be cheaper to maintain. Of the cheaper surfaces maintenance costs can be very variable.

Grass varies enormously in maintenance cost from the lawn composed of fine grasses requiring maintenance every four or five days in spring and summer, to coarse grasses where some roughness and weeds are acceptable.

Gravel and hoggin are almost the cheapest surfaces to provide, but are often the most costly to maintain. Weeds can easily become established and the surface readily displaced by traffic.

Availability

1.05 Obviously availability is also related to cost. Imported materials are usually expensive, while indigenous material is often cheaper and more likely to fit into its surroundings.

Appearance

1.06 It is important to consider colour, scale and texture of materials, especially where surfacing extends over a large area, as a very small difference in shade can be quite telling. Very near shades rather than contrasts are usually more pleasing in large schemes. Even a slight difference in surface texture of the same paving material produces enough colour variation for pleasing patterns to be made, but any great difference would tend to spoil the unity of the whole.

1.07 Small units are quite satisfactory in large external areas, because they tend to read as a textured homogeneous surface. It is also possible to use small units to achieve large scale pattern if required **1**.

2 Range of choice

Selection

2.01 The material chosen will provide a surface which is visually, either smooth or rough—ie ranging from water or fine grass to large cobbles or low ground cover plants.

Smooth

2.02 Smooth surfacings include:

1 Smooth or fine textured unit paving
2 Continuous paving (flexible surfaces and rigid pavements)
3 Sand
4 Coarse gravel
5 Fine grass
6 Coarse grass
7 Stabilised grass
8 Rammed earth
9 Water

Rough

2.03 Rough surfacings include:

1 Cobbles
2 Loose stones
3 Rough textured precast concrete paving
4 Low ground cover plants
5 Coarse grass eg, as when planted in regular rows
6 Precast paving with grass growing through

3 Construction details

Paving

3.01 See information sheet LANDSCAPE 34 for paving and information sheet LANDSCAPE 35 for trim and changes of level.

Grass and ground cover

3.02 See information sheet LANDSCAPE 7.

Water

3.03 This information applies to water areas which are related to buildings, formed pools either natural or formal. Large areas of water are dealt with in information sheet LANDSCAPE 20.

Siting: Formal areas of water may be required near to buildings as part of their setting, or as reflecting pools. If pools are required for planting aquatics, they are best sited away from buildings to ensure good light for the plants. Most aquatics require light for good growth and the few shade lovers can be planted in the protection of other plants. See information sheet LANDSCAPE 9 for water plants.

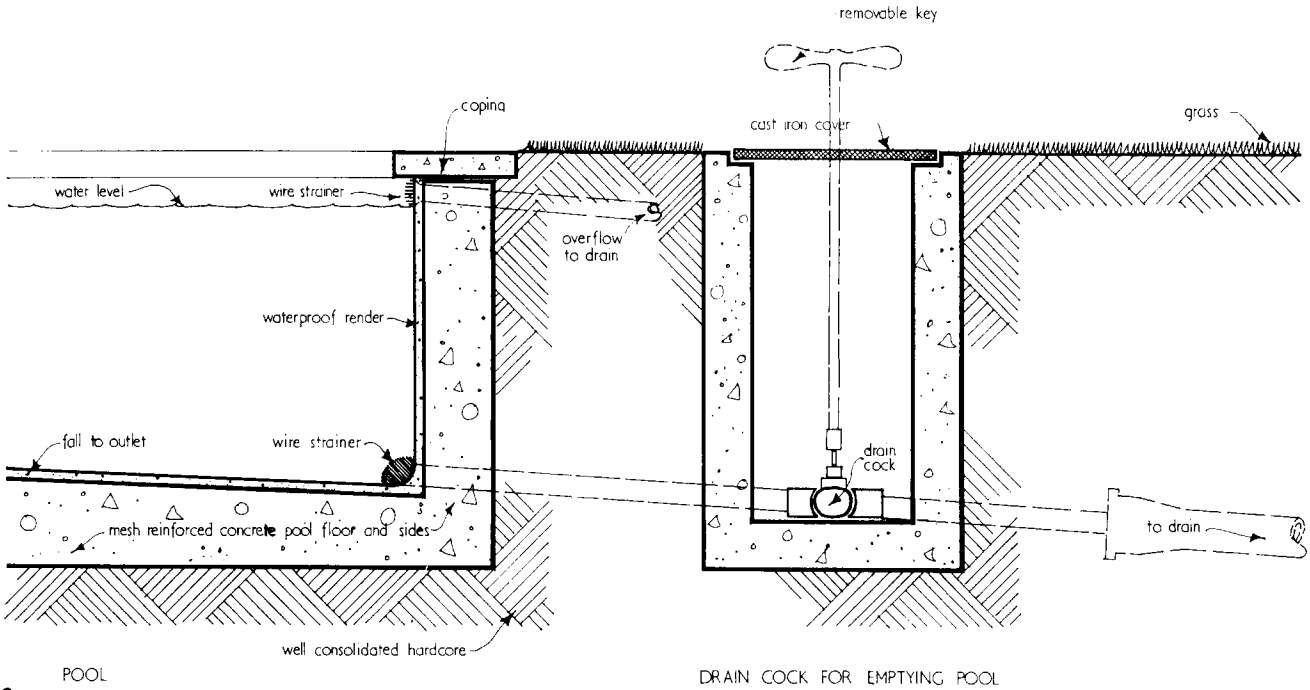
Pools near buildings: These must be constructed in water-proof materials, lined with water-proof rendering or rendered and tiled. They need a means of filling and emptying for periodic cleaning and maintenance. Algicides may be used to keep the water sweet.

Small pools: These may be emptied by syphoning with a length of hose if there is a suitable run-off place for the water at a lower level, but otherwise a drain cock will be necessary in a position accessible with a loose key so that the water can be run off to the regular drainage system **2**.

1 *It is possible to use small paving units to achieve large scale patterns. These illustrations show the effect of paving patterns from above* **a** *and at eye level* **b**

1a

1b



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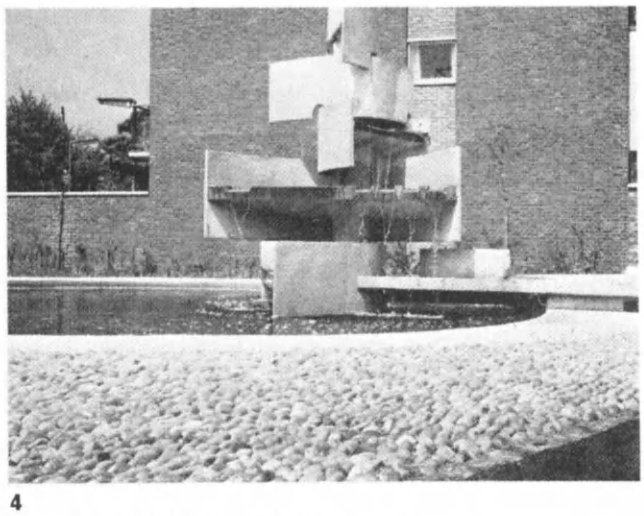
3 *Reflecting pool with stepping stone bridge linking areas of housing estate. Unfortunately the pool proved to be too much of a hazard for children, and has been filled in*
4 *Rough texture of cobbled surface used to demarcate car parking from pedestrian/pool zone*
5 *Grass/concrete paving for continuity between hard surfaced car parking area and surrounding soft/grass surfaces (special preparation seed/soil mix required)*
6 *Contrasting paving units used to demarcate parking*

3



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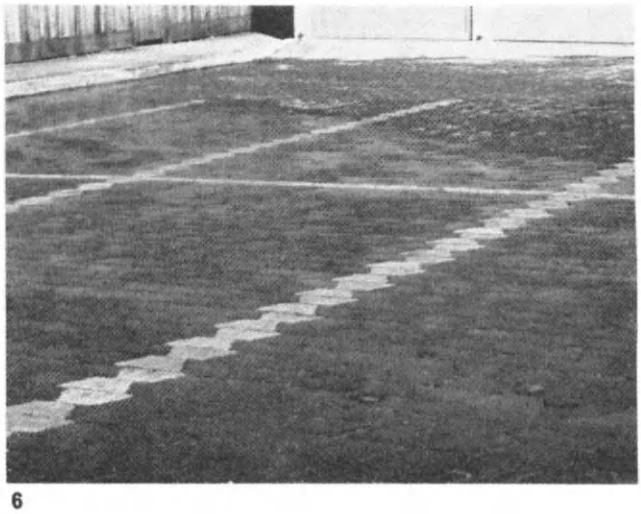

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Information sheet Landscape 34

Section 10: **Elements of landscape construction**

Pavings

This information sheet by SHIRLEY ANDREW *is a guide to the choice and design of pavings and hard surfaces for areas intended primarily for pedestrian use. Hard surfaces for vehicular traffic are beyond the scope of this sheet*

1 Unit pavings

Precast concrete slabs

1.01 Precast concrete slabs are manufactured by hydraulic pressing or by casting in open moulds. For pedestrian traffic, slabs are 50 mm thick; and for occasional vehicular traffic, 63 mm thick[1]. Table 1 lists commonly available sizes. Other sizes and shapes are obtainable from certain manufacturers.

Table 1 Standard sizes for precast concrete flags

Type A 600 × 450 mm	Type C 600 × 900 mm
Type B 600 × 600 mm	Type D 900 × 900 mm

Finishes

Precast concrete slabs are available in a variety of surface finishes and textures. Careful consideration should be given to choice of aggregate when specifying.

Exposed aggregate slabs are obtainable by scattering crushed stones or gravel on wet concrete and tamping down; or by casting slabs on top of aggregate to be exposed and brushing away the fines before slabs set hard. The latter technique allows for larger aggregates and gives a more durable finish **1**.

1 *Precast concrete flags with exposed aggregate surface*

Mechanical textures can be produced by moulding slabs on rubber or glass fibre mats.

Non-slip surfaces can be created by inserting rubber strips, by a mechanical texture or by casting carborundum into the surface.

Precast reconstructed stone

1.02 Natural stone slabs can be simulated in cast form by the use of crushed stone aggregate and pigments[2]. Shapes, patterns and uses are as for precast concrete slabs but costs are generally higher.

Natural stone

1.03 Natural stone is relatively expensive but its slight irregularities and natural weathering properties may justify the extra cost. Secondhand stone may be cheaper to buy but more expensive to lay. Secondhand materials, most commonly York stone from broken or replaced pavements, are often available from local authorities. When using new material, quarries should be consulted for sizes available from seams currently being cut before deciding layout patterns.

York stone was commonly used for pavements before the advent of the mass-produced precast concrete slab. It is available with a riven, sawn or rubbed surface. The riven face is cheapest. Colour range from light buff to brown; blue is also obtainable. Similar stones come from Lancashire and the Forest of Dean. Usual thicknesses are 50 mm and 65 mm in sizes up to 900 mm × 600 mm.

Granite is hardwearing, slow to weather, but expensive and rarely found in large slabs. Colours obtainable include greys, pinks and dark greens. Single axed surface is best for pavements.

Slate is hardwearing, slow to weather, but expensive. colours obtainable from Westmorland, Lancashire and Cornwall generally range through blue-greys and green, some with brown flashes; from Wales, purple, blue and grey. A wider range of colours is available from a few quarries. Smaller slates are usually riven but larger sizes can be sawn, planed or fine-rubbed, though at extra cost.

Slate slabs 25 mm to 30 mm thick are usual, though slabs 12 mm thick can be used, but must be very well bedded, and for all but light domestic traffic, a concrete base is advisable. Sizes range from 450 mm × 230 mm at 12 mm thickness (riven) to 900 mm × 600 mm at 25 mm (sawn or rubbed). Larger sizes may be obtained up to 50 mm thick.

Finely rubbed finishes tend to become slippery when wet, and riven or sawn textures are better in these conditions.

Portland stone is generally grey or white in colour. It is rather soft and should not be used where heavy traffic is anticipated. Available in sawn or rubbed finish (latter is more expensive), in slabs 50 mm to 65 mm thick.

Purbeck portland stone is harder and more expensive than ordinary Portland. Usual thickness about 65 mm.

Bath stone is not hard wearing and should be used externally only for lightly trafficked surfaces.

Quartzite is a hardwearing, but expensive stone imported from Norway. Colours range from silver-grey to green-grey and surface is usually riven. Thicknesses are from 12 mm for slabs up to 600 mm × 600 mm to 50 mm and over for slabs up to 1·5 m × 1·2 m. Thin slabs must be bedded solid on a cement screed.

Tiles and mosaics

1.04 Tiles and mosaics are suitable for small areas requiring special emphasis, but they must be frostproof. A wide variety of sizes, shapes and colours is available.

Clay quarry tiles are covered by a BS [3] which separates them into two sets of conditions. Type A tiles range from 230 mm × 230 mm to 100 mm × 100 mm and thicknesses from 20 mm to 30 mm. Type B are smaller, thinner, have a fine smooth texture and are not as suitable for external paving. Pattern-making tiles (as quarry tiles, but in interlocking shapes) are available in great variety in the UK and from the Continent. Only a few clay tiles are frostproof.

Mosaics are usually about 3 mm to 5 mm thick. There are various proprietary methods of laying, generally using latex cements.

Bricks

1.05 Hard, well-burnt bricks resistant to frost and sulphate attack can be used for external paving. These, rough in texture and laid on edge are most suited to non-slip surfaces. Colours available include dark blues, plums and reds.

Wire-cut bricks are ideal as pavers as the 115 mm face is without a frog. This face usually has a slightly textured surface resulting from the manufacture process that will reduce slipperiness.

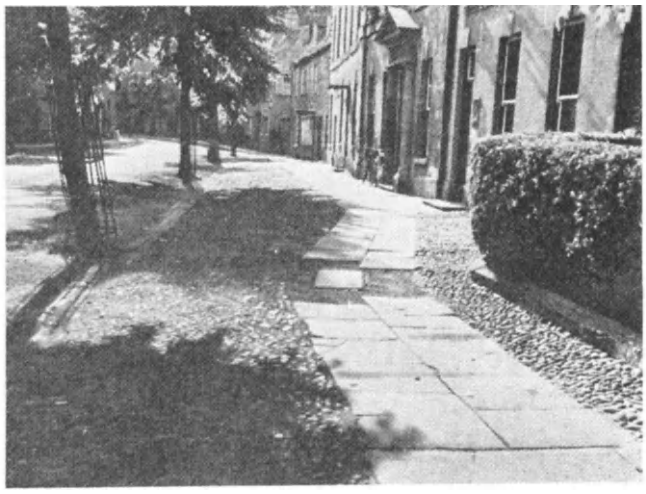
Pressed bricks can be used as pavers when available with a single (or no) frog and without shunt marks.

Stock bricks: Bed faces of a well-fired rough stocks are good for paving.

Engineering bricks manufactured as pavers are available plain or patterned, and manufactured by wire-cut and pressed processes. Blue and red are most common colours though buffs are available. Sizes are as for ordinary bricks, thicknesses vary from 40 mm to 70 mm.

Setts

1.06 Setts can be obtained new, or more cheaply, second-hand, though paving contractors may charge for cleaning them. They are suitable borders to smooth or flexible surfaces as they withstand rolling. Sizes range from 50 mm and 100 mm cubes to larger, and rectangular, blocks. Granite is the hardest wearing surface of all paving materials



2 *Small free path of stone flags set in a buffer zone of cobbles bordered by a small paved gutter*

and the most common for setts, but whinstone, limestone and concrete setts are also made. Suitable hardwoods or treated softwoods laid in setts with the end grain as the wearing surface provide a resilient, durable and pleasing paving material.

Cobbles

1.07 Cobbles, obtained from beaches, river beds and gravel pits, can be laid random, roughly coursed or in patterns; and either flush with or proud of adjoining surfaces depending on whether they are to be walked over or not. Large oval cobbles laid closely on edge and raised are suitable for discouraging pedestrian traffic **2.** Sizes are up to 100 mm and usually round or oval.

Sources of supply

Fawn and grey cobbles are from beaches and river beds; dark blue cobbles, which are flint gravel rejects, from gravel pits. Wash mill flints, grey in colour, are from potteries and also imported from Normandy.

Firepath pots

1.08 Firepath pots are precast concrete units, usually hexagonal or circular in shape, 100 mm thick and with a hole in the middle. The surface is suitable for occasional vehicular traffic such as fire appliances. The hole in the middle of each pot can be filled with soil and grass grown in it.

2 Flexible surfaces

Description

2.01 Flexible surfaces are those materials with no tensile strength. Flexible pavings usually comprise of at least two layers, the base-course (not to be confused with the base, see para 5.01) and the wearing course. Flexible surfaces may be laid loose or incorporate a binder.

Cold asphalt

2.02 Cold asphalt is a mixture of bitumen and crushed igneous rock, limestone or slag, passing a 6 mm sieve. The surface is usually sanded or roughened. It is a surfacing material mainly intended for use with a tarmacadam base-course. Unlike hot asphalt, cold asphalt can be laid in comparatively small areas provided a roller can be used[4]. Thorough compaction is essential. It is rather more costly than a bitumen macadam wearing-course, but is unlikely to need resurfacing for up to 10 years. Usual thickness for cold asphalt surfacing for mainly pedestrian traffic is 10 mm to 20 mm.

Gravel

2.03 Gravel is usually laid loose on a suitable base such as 100 mm clinker or hardcore. Self-binding gravels may be obtained which, when watered and compacted, lightly bind together. Colours vary according to locality of pit.

Loose cobbles

2.04 Loose cobbles laid directly on soil or hardcore form a deterrent to traffic, and are useful in discouraging or preventing traffic over parts of a paved area. Sizes are usually from 30 mm to 130 mm diameter. Real cobbles are oval and water worn or regularly pitted.

3 Rigid pavements

Concrete

3.01 In situ concrete, 75 mm thick unreinforced, is a cheap paving material for pedestrian areas. Normal mix is 1:2:4.

Finishes

Untextured surfaces must rely on coloured cements and jointing for visual interest. The simplest finish, where a texture is not required, is obtained by drawing a medium to stiff broom transversely across the paving shortly after compaction. Textured finishes are obtained either by using exposed aggregates or mechanical methods.

Exposed aggregate

Various methods of exposing the aggregate are available such as by brushing, jetting with a hose, and grit blasting. However, it is a skilled job and it is advisable to seek guidance from the Cement and Concrete Association. A wide range of white and coloured aggregates is available including pinks, greys, blues, greens, browns and blacks, and the colour of the cement should be carefully chosen to harmonise or contrast with the aggregate. Road Note 25[11] gives an indication of colours of aggregates available in different parts of the country.

Mechanically textured surfaces

Crimping roller with projecting steel cones gives an indented texture.

Linear board Patterns up to 20 mm deep are made with shaped edge boards. This technique is being developed, especially for ramps, as it not only provides a non-slip surface but the lines also help drainage if laid in vs to the sides.

Joints

Quite apart from structural considerations, joints can create interesting paving patterns. Effective results are obtained with in situ concrete—used in conjunction with some form of trim, such as setts or bricks, to form bold patterns.

Coated macadam

3.02 The term 'macadam' commonly means stones which are usually bound together by a binder. The binder may be tar, bitumen, or a proprietary tar which may contain a little bitumen. BS 1242[5] specifies materials and manufacture and gives recommendations on laying and guidance on covering capacities. A usual specification for mainly pedestrian areas is a 12 mm wearing course of bitumen or tarmacadam on a 40 mm to 50 mm base-course of nominal aggregate tarmacadam.

4 Choice of paving and hard surface

Choice

4.01 Choice of paving or hard surface is generally governed by the function of the paved area, the type of traffic anticipated, local site conditions, availability of materials and cost.

Function of paved area

4.02 The primary function of paving is to provide a hard surface suitable for anticipated traffic. Other functions the designer must take account of may include providing a sense of direction, eg a strip of paving flags across a cobbled courtyard; indicating a hazard eg with setts in a flag pavement where crossed by a drive way; or indicating change in ownership.

Traffic

4.03 Three aspects of anticipated traffic should be considered: loading imposed; ease of traffic movement over the paving; and durability.

Loading

The loading imposed by pedestrians, prams and children's bicycles is relatively light and unless soil conditions are particularly unstable should not pose design problems. The load of traffic on paving acts on the soil immediately below the topsoil (or stripped) level. The paving function is to distribute loads evenly over this soil, known as the sub-grade. The design of the base on which paving is laid is the important factor in terms of the future of the loading and intensity of traffic.

Ease of movement

In considering paving's intended function, the extent to which various forms of traffic are to be encouraged or discouraged should be decided; eg whether to encourage pedestrian traffic but discourage cycling, or to discourage walking over a particular area of paving. Short of erecting fences, the most effective way of encouraging traffic over a particular area, or in a particular direction, is to pave with a material conducive to comfortable movement, and the surrounding area with a material which is decidely less comfortable to walk, ride or drive over **2**.

Durability

Depending on circumstances it may be desirable to choose a highly durable paving such as granite setts even though this surface is less comfortable for traffic than a less durable surface. A broad grading of pavings into categories of durability is given in information sheet LANDSCAPE **33** table 1.

Safety

4.04 Hazards are intended to discourage traffic, but they should not be a danger to it; drainage falls, slopes and ramps should not be too steep or unexpected, and surface texture of paving should be suitable for the type and speed of traffic using it. It is a relatively simple matter to specify non-slip surfaces at the design stage. Pressed concrete paving slabs and brick paving with sunken joints (which encourage the growth of moss) can result in slippery surfaces. For secluded areas this may not matter, but they are not acceptable finishes where regular traffic can be expected.

Local site conditions

4.05 The information contained in this sheet relates to normal conditions, which may be defined as reasonably

stable soil conditions and the absence of exceptional weather conditions. Where conditions are not normal, it is advisable to seek expert advice. Depending on the area of paving concerned and the seriousness of the conditions this information can be obtained from a trade association, such as the Cement and Concrete Association, from the local borough engineer or from a consultant engineer. Small unit pavings (eg bricks and setts) and flexible surfaces (eg gravel) generally perform more satisfactorily in subsidence conditions than slab pavings or rigid pavements.

Availability and cost

4.06 Availability of paving and base materials and their cost are obviously related considerations. Materials quarried or manufactured locally are usually cheaper than the equivalent imported from another part of the country. Before choosing a material it is advisable to make inquiries concerning local availability. Local borough engineers will often help in this respect.

Table II *Comparison of cover*

Material	Approximate area covered (m^2)
1 tonne of york stone, in slabs 50 mm thick	9·2
1 tonne of york stone, in slabs 60 mm thick	7·5
1 tonne of concrete paving slabs 40 mm thick	12·5
1 tonne of concrete paving slabs 50 mm thick	10·0
1 tonne of concrete paving slabs 60 mm thick	8·3
1 tonne of slate, in slabs 25 mm thick	12·7
1 tonne of gravel, well rolled 50 mm thick	12·5
1 tonne of gravel, well rolled 75 mm thick	8·3
1 tonne of setts 150 mm × 100 mm × 100 mm	3·7
1000 bricks, in simple rows, on edge	16·5
1000 bricks, in simple rows, flat	25·0
1000 bricks, in pattern, with cutting, on edge	15·0
1000 bricks, in pattern, with cutting, flat	22·5

This table allows for normal jointing, but not for cutting to boundaries, breakage, or waste

Costs are much affected by size of contract and local conditions such as soil conditions, labour and transport costs and availability of material. A guide to the comparative costs of laying various pavings is given in information sheet LANDSCAPE 33 table I. Table II gives approximate coverage with various materials.

5 Construction of paved and hard surface areas

Bases

5.01 The foundation or *base* on which paving is laid will depend on local site conditions, but for normal conditions the following should be adequate:

Pedestrian traffic

A thickness of 50 mm to 70 mm of well rammed hardcore such as crushed stone or slag, gravel, hoggin (a gravel/sand/clay composition), or hard well-burnt colliery shale and spent oil shale free from ash and rubbish. Hardcore should be well broken down so as to be properly compacted and there should be enough fine material to fill the interstices. Alternatively well-burnt clinker blinded with sand may be used.

The base should be laid and rolled to the falls of the finished paving unless the surface of the ground (known as the formation) has already been graded to falls. Minimum fall should be 1 m 60 to ensure good run-off of rainwater.

Occasional vehicular traffic

Where service vehicles or other occasional vehicular traffic are anticipated, it is advisable to lay paving on a 70 mm to 100 mm thickness of concrete, mix 1:9; either directly on the subsoil on 70 mm of hardcore as described above.

Laying paving

5.02 Methods of laying slab pavings, bricks, tiles, setts and cobbles are described in table III.

Jointing

5.03 There are several joint conditions to be considered:

Butt joints

These are maintenance free and if tight will withstand heavy traffic. However, butt jointing is only suitable with paving materials having reasonably regular edges such as precast concrete slabs or engineering bricks.

Soil joints

Plant growth can be encouraged between paving units by leaving joints 12 mm to 20 mm wide filled with sieved soil, and topped up until settlement is complete. Where pedestrian traffic is heavy, the lower half of the joint should be mortar.

Mortar joints

For moderate and heavy traffic, joints should be grouted, but to a strength and durability that is not greater than that of the paving. A grout mix of 1:3 brushed into joints should be adequate to discourage plant growth.

Stepping stones

5.04 Stepping stones should be at 700 mm centres and laid below grass level. To form stepping stones with in situ concrete involves cutting out sods of turf and removing topsoil and roots. Concrete to a mix of 1:2:4 can then be laid 70 mm thick directly on the undisturbed subsoil. Where subsoil is at a greater depth, a base of sand-blinded cinders can be used. Spacing between in situ stepping stones should be at least 300 mm to protect the edges of the grass during cutting.

Trees

5.05 Precast concrete, metal surround or small paving units such as bricks or setts (on 25 mm fine grit on 50 mm coarse gravel) can be used around trees in paved areas. An area 2·5 m to 3 m diameter around a tree should be laid with joints close butted to take traffic or filled with gravel to allow water to reach the roots.

6 Construction of rigid pavements

Bases

6.01 In rigid pavements the concrete slab is the main structural component and the base is primarily to form a working surface when laying concrete on clays and silts, to control slab thickness, and to allow work to proceed during wet weather without damage to the sub-grade. Consequently base materials need not be such high standard as for flexible surfaces. See Specifications 'Landscape Work' for specifications for sub-grades and bases suitable for pavements.

Concrete slab design

6.02 Details of the design of concrete slabs including surface finishes suitable for pedestrian paved areas are given in AJ information sheet 1424[12].

7 Surface water drainage

Generally

7.01 Generally with impermeable pavings adequate falls must be provided to direct surface water to collecting points, to be removed via a gulley and pipework to a sewer, soakaway trench or natural water course.

Table III *Methods of laying paving*

Paving material	Methods of laying	Remarks
Precast concrete and natural stone slabs	25 mm bed of sand	Traditional method suitable for slabs thicker than 25 mm in lightly trafficked areas. Edging strips prevent sand washing out at edges.
	Mortar bed of lime/sand or cement/sand, 1 :5 mix	Suitable for heavier traffic, but slabs bedded solid on mortar are difficult to lift and access to services is difficult
	Mortar bed of cement/lime/sand, 1 :1 :6 mix	As above. Cobbles may also be laid in cement mortar, usually by burying them for half or two-thirds of their depth
	Mortar dots, 1 :5 mix of cement/sand, one at each corner and one in the centre of each slab	Mortar dots facilitate levelling. Slabs are easy to lift for getting at services. Not recommended for small or thin paving slabs
	25 mm cement/sand screed, 1 :3 mix	Essential for thin materials, especially slate and quartzite. Any paving material will withstand heavier loads if laid on a screed
Tiles and mosaics	20 mm cement/sand screed, 1 :3 mix	Tiles should be soaked in clean water before laying. They should be laid while the screed is still green on a 5 mm thick cement/sand bed
Bricks and brick pavers	Sand or sand/lime bed, 1 :4 mix	Bricks may be butt-jointed, particularly if engineering bricks are used. Bricks with less regular edges should have joints 5 to 10 mm wide. Recessed joints should be avoided, as they could cause break down of edges of bricks due to frost attack after freezing of water in joints
Setts	25 mm bed of sand	Should be laid in breaking bond. After laying, surface should be well rammed and joints (about 10 mm wide) filled with chippings and run with a cement/sand grout
Cobbles	50 mm layer of compacted sand on which 50 mm of concrete (1 :2 :4 mix with small aggregate) is laid. The cobbles are then pressed in by hand until they protrude the required amount	Where vehicular traffic is anticipated cobbles should be laid as described but on a concrete slab base
Firepath pots	Laid loose on a suitable base such as 150 mm of compacted hardcore with ash blinding	The hole in the middle of the pot can be filled with soil for grass or with a loose filling material
Cold asphalt	*Single-course* construction: 20 mm thickness on a suitable base (100 mm to 150 mm hardcore, depending on site conditions) rolled with a 350 kg to 2500 kg roller *Two-course* construction: 20 mm thickness on a base course of 40 to 50 mm tarmacadam	Suitable construction for footpath or playground Design of flexible pavements using cold asphalt or coated tar macadam is a specialised subject and expert advice should be sought
Coated tar macadam	*Single-course* construction: 20 mm thickness of 6 to 10 mm tarmacadam, *or* 20 mm thickness of 10 mm tarmacadam on a wearing-course of 12 mm thickness of 6 to 10 mm bitumen or tarmacadam, *or* 40 to 50 mm thickness of 25 mm nominal aggregate tarmacadam	As above
Gravel (unsealed)	A finish of 20 mm fine gravel, or fine grit or shell, or stone chippings to pass 20 mm mesh, spread and rolled on 25 mm finished thickness of fine gravel with sufficient hoggin to act as a binder on gravel to pass a 50 mm screen rolled to 50 mm finished thickness on a base of hardcore or clinker rolled to 100 mm finished thickness on a sub-base if required	There are many specifications for gravelled surfaces, few of which agree. This specification should be adequate for pedestrian areas. On driveways a sub-base should be provided or the base thickened to 150 to 200 mm. It is essential for good results that heavy rolling is employed. For driveways an 8000 to 10 000 kg roller should be used. For pedestrian path a 500 to 750 kg hand-roller should be adequate
Gravel (sealed)	*For driveways:* Cold bituminous emulsion is spread over a well-consolidated layer of 200 mm thickness of 150 to 75 mm clean angular stone on a well-consolidated base and immediately covered with 12 to 10 mm clean limestone, granite or other hard chippings. Surface should be rolled immediately then rolled again the next day. After 10 to 14 days, during which it can be open to traffic, the surface should be swept and a sealing coat of emulsion applied and covered with 6 to 10 mm chippings or clean washed shingle	This specification is based on the use of a proprietary cold bituminous emulsion. Consult manufacturers for specific applications
	For paths: Provide base as above. On this spread a layer of 20 mm clean chippings or sharp gravel well watered and consolidated. Apply emulsion and evenly cover with 6 mm stone chippings or clean sharp shingle. Two days (minimum) later when the emulsion has set a second dressing should be applied and covered with 6 mm stone chippings and well rolled	As above
Loose cobbles	Hand-packed oval cobbles 30 to 125 mm diameter laid on hardcore or directly on the subsoil	
In situ concrete (rigid pavement)	*Pedestrian traffic only:* 75 mm thick unreinforced concrete on 75 mm base of compacted hardcore with 25 mm wide joints at 3 m spacing (max) for contraction and 27·5 m spacing (max) for expansion	These are basic specifications suited to conditions where the traffic is not heavy and the subsoil is stable. Unreinforced slabs should *not* be used in the following situations: (i) On Subgrades susceptible to non-uniform movement, such as highly plastic clays or peat (ii) On embankments over 1·2 m high (iii) On subgrades where the water table may rise to within 610 mm of the formation
	Light vehicular traffic (not exceeding 45 commercial vehicles a day): 180 mm thick unreinforced or 130 mm thick reinforced concrete slab laid on 75 mm base of compacted hardcore with 25 mm wide joints at 5 m spacing (maximum) for contraction and 27·5 m spacing (maximum) for expansion	

Table IV *Recommended minimum falls*

Item	Minimum crossfalls
Roads	1 :40 to 1 :50
Cycle tracks	1 :40
Footways	1 :30 to 1 :40
Item	**Minimum gradients**
Gutters and drainage channels	1 in 250

Table V *Recommended crossfalls for various surface treatments*

Surface	Crossfalls
Concrete	1 :60
Bituminous or tar surfacing	1 :40 to 1 :50
Gravel	1 :30
Paving slabs	1 :70

Design Data

7.02 Before designing a surface water drainage system the following information should be obtained:

1 Site ground levels and gradients; levels of all rainwater outlets; all levels related to the ordnance datum

2 Nature of subsoil in the area

3 Water table level and any possible fluctuations, eg seasonal

4 Proximity of natural drainage channels such as ditches or streams and their capacity

5 Availability of sewers—combined, partially separate, totally separate (see AJ Services Handbook Section 4 information sheet DRAINAGE 11)

6 Proposed local development; probable extent of paved or built-over areas

7 Rainfall intensity generally 40 mm/h for paved areas

8 Porosity of surfacing material

Calculation of pipe sizes

7.03 Calculations for drainpipe size and determining fall is given in AJ Services Handbook Section 4 information sheet DRAINAGE 2.

Drain laying

7.04 Drain laying is described in AJ Services Handbook Section 4 information sheet DRAINAGE 6.

Surface water disposal

7.05 Disposal of surface water is described in AJ Services Handbook Section 4 information sheet DRAINAGE 1.

Falls

7.06 Minimum cross-falls and gradients shown in table IV. Table V gives recommended falls for various surfaces. Generally steeper falls are required on rougher surfaces. Paved areas should fall away from buildings (at least 1 in 50 for a distance of 3 m) to avoid 'kickback', In narrow alleys this would mean central channels.

Channels

7.07 Channels can be used at junctions of hard surfaces and kerbs or two paved areas falling towards each other. Channels should be made part of the paving pattern.

Dished channel

Dished channels are usually made of precast concrete or stone, the latter is more expensive.

Flat channels

Flat channels can be made of precast concrete (BS 340)[6] granite setts (see information sheet LANDSCAPE 35); cobbles; granite and whinstone (BS 435)[7].

Gulleys

7.08 Placing of gulleys is usually determined by the total amount of fall, and depends on area to be drained, its slope, expected rainfall and the capacity of gulleys. See BS 539[8] and BS 556[9]. Maximum spacing of gulleys for roads is usually 45·7 m.

Gratings

7.09 Gratings are usually of cast iron, but steel is used where greater strength for size is required, though it is liable to corrosion. Each 0·2 m^2 of grating will take about 1 m^3/min of water if the bars are across the flow. Calculations should be generous to allow for clogging by leaves. Another method of disposal is the monsoon drain, a continuous slit in the paving over channels.

Manhole covers

7.10 Covers should be parallel to the overall pattern and to sloping surfaces, and set well within the paving surface to avoid projecting manhole walls which are unsightly and dangerous. Concealed manhole covers are sometimes used for services manholes. The Post Office uses a small triangular marker plate, to indicate them. BS 497[10] deals with quality and dimensions of cast manhole covers, road gulley gratings and frames for drainage purposes.

Local authority approval

7.11 Before work commences, plans of proposed surface water drainage schemes must be deposited with the local authority for approval. There is a legally prescribed notice of intention to connect to a public sewer which must be served on the local authority. If discharge into a watercourse is contemplated approval may be required from other controlling authorities concerned with rivers, navigation or fisheries. The local authority will advise.

8 References

BRITISH STANDARDS INSTITUTION

1 BS 368:1956 Precast concrete flags [(90.4) Sf2]

2 BS 1217:1945 Cast stone [Yf3]

3 BS 1286:1945 Clay tile for flooring [(43) Sg]

4 BS 1690:1962 Cold asphalt [(90.4) Ps5]

5 BS 1242:1960 Tarmacadam tarpacing for footpaths, playgrounds and similar works [(90.4) Ps5]

6 BS 340:1963 Specification for precast concrete kerbs, channels, edgings and quadrants [(90.22) Ff]

7 BS 435:1931 Granite and whinstone kerbs, channels, quadrants and setts [(90.22) Fe1]

8 BS 539:1968 Dimensions of fittings for use with clay drain and sewerpipes [(52) Ig3]

9 BS 556:1966 Concrete cylindrical pipes and fittings including manholes, inspection chambers and street gulleys [(52.1) Yf]

10 BS 497:1967 Cast manhole covers, road gulleys and frames for drainage purposes [(90.5) Xh]

11 Road note 25 Sources of white and coloured aggregates in Great Britain. 1959, HMSO [12 Yp]

12 AJ Information sheet RIGID PAVEMENTS 1424, AJ 9.11.66 [Sfb 1961: (14) CI/SfB 12]

Information sheet Landscape 35

Section 10: **Elements of landscape construction**

Trim and change of level

This information sheet by SHIRLEY ANDREW *describes methods and detailing for separating areas of paving and other surfaces and for steps, ramps and ramped steps*

1 Trim

Purpose of trim

1.01 Trim used with paving generally has one or more of the following purposes:

1 To protect the edges of the paving and/or to prevent lateral spread of the base **1**.

2 To mark boundaries between paving and other surfaces—grass, water, roads.

3 To define areas of paving.

4 To form construction joints.

5 To collect surface water.

6 To control traffic.

7 To mark changes of level.

Choice of material, method of construction and detailing of trim depends on its intended purpose, required appearance, cost, durability and permanence.

Appearance

1.02 The appearance of an area of paving can be enhanced or spoilt by the treatment of its trim. Special care should be taken to choose materials which are in character with the paving and its surroundings.

Cost, durability and permanence

1.03 These factors usually have to be considered together as they are interrelated. Initial cost tends to rise with choice of the more durable materials. However, if initial cost is balanced with subsequent maintenance costs, choice of more expensive materials is often justified.

Permanence

1.04 The permanence of trim as distinct from durability must be decided. Sometimes it is appropriate for paths to use a trim material with greater permanence than that of the path paving (eg granite setts used as edge treatment to a gravel path), but generally the permanence of the trim materials should be same as that of the paving.

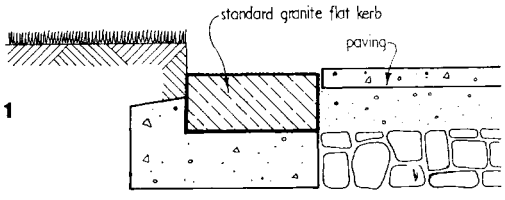
2 Materials

Precast concrete

2.01 Precast concrete kerbs are either hydraulically pressed or cast in moulds; the former are said to be more durable. They are cheaper than natural or reconstructed stone. Standard dimensions and profiles are illustrated in **2**.

Precast reconstructed stone

2.02 Some manufacturers produce reconstructed granite kerbs. They are made of hydraulically-pressed precast concrete using ordinary granite aggregate and conform with the British Standard[2].



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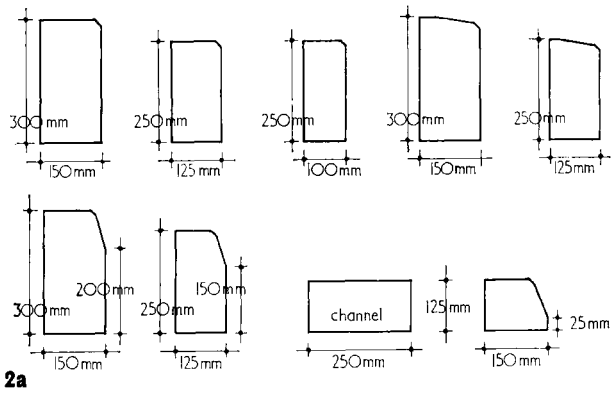

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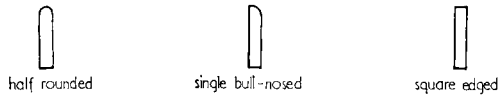

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1 *Use of kerb, set flush with paving, to prevent spread of the base*

2 *Standard profiles and dimensions to* BS 340[1]

a *Precast concrete kerbs and channels;* **b** *Precast concrete path edgings. Available sections:* 915 *mm* × 760 *mm*, 810 *mm, or* 860 *mm.*

Natural stone

2.03 Natural stone kerbs are usually of granite or whinstone. They are extremely durable but cost considerably more than precast concrete. BS 435[3] specifies standard dimensions, profiles and finish.

Brick

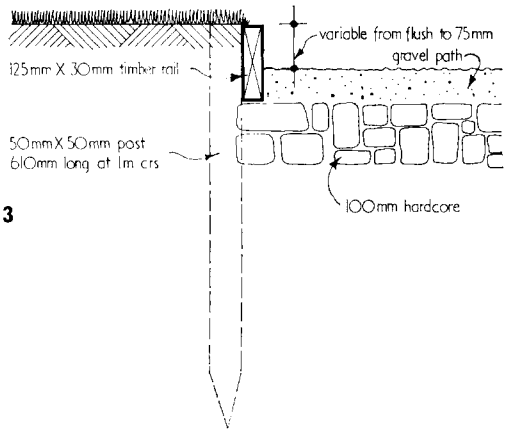
2.04 Requirements for brick used as trim or edging to paving are basically as for brick paving itself. See information sheet LANDSCAPE 34.

Granite and whinstone setts

2.05 Requirements for granite and whinstone setts used as trim or edging are basically as for paving. See information sheet LANDSCAPE 34.

Timber

2.06 Suitable hardwoods are elm, larch and oak. Softwoods should be pressure-creosoted.



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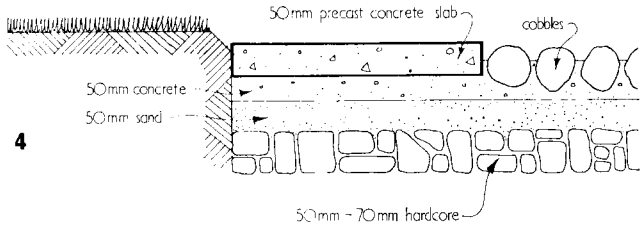

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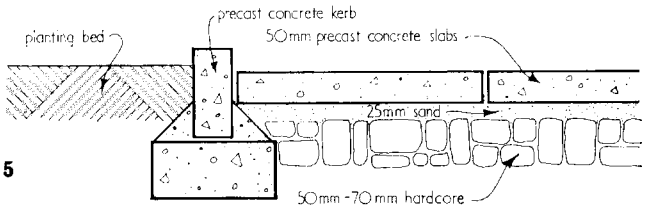

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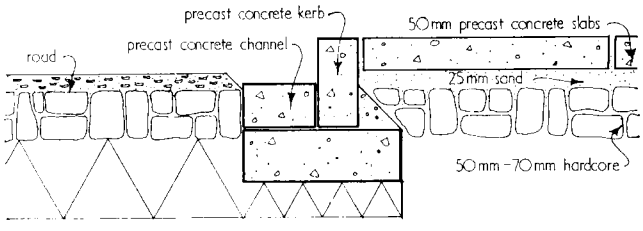

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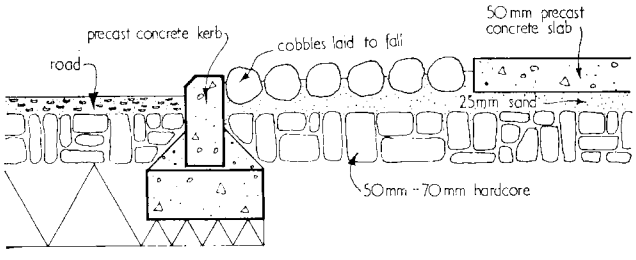

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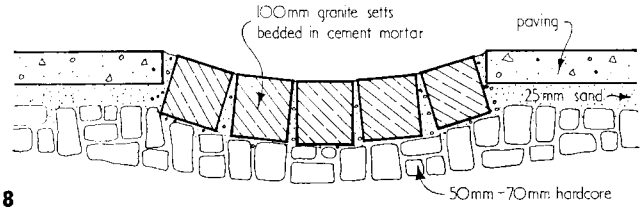

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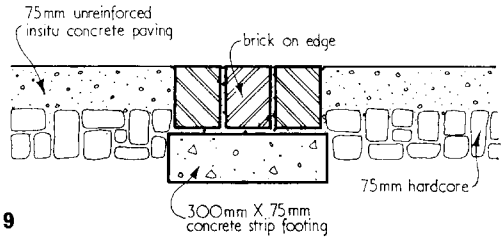

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3 *Junction of gravel path and rough grass using continuous timber rail kerb*

4 *Junction of cobble paving and grass using precast concrete slab as mowing border*

5 *Junction of precast concrete paving and planting using standard precast concrete kerb (see* BS 340[1])

6 *Junction of precast concrete paving and road using standard precast concrete kerb and channel (see* BS 340[1])

7 *Junction of precast concrete paving and road using standard precast concrete kerb and separating border of cobbles laid to fall to road*

8 *Granite setts used as surface water collecting channel in paving*

9 *Brick on edge used to form joint between bays of in situ concrete paving*

10 *Precast concrete or natural stone treads and brick or granite sett risers on a concrete base. Treads should be 50 mm thick*

11 *In situ concrete steps. A non-slip finish can be provided by brushing with a stiff broom before hardening, by hand tamping, by the addition of carborundum to the top surface or by inserting strips of non-slip material*

12 *Steps formed with timber risers on long inclines not steeper than 1 in 12. Risers should not exceed 100 mm if they are to be negotiated by prams*

3 Change of level

Steps

3.01 Rise should be between 80 mm and 150 mm and a going should be not less than 300 mm. Projection of treads over risers should never exceed 15 mm otherwise there is a danger of people tripping. Satisfactory gradients are between 1:2 and 1:7. Various constructions and details are illustrated in **10** and **11**.

Eleven steps is a comfortable length for a series of flights with landings 1 m to 2 m wide. Flights should not exceed 19 steps.

Ramps

3.02 For short distances a pedestrian ramp may be as steep as 1 in 6·5. For wheelchairs and prams the gradient must not exceed 1:10 (1:12 is more desirable). Surfaces should always be non-slip and surface water should be shed across the width of the ramp.

Ramped steps

3.03 On long ascents, ramped steps should be considered. Inclines should not be steeper than 1 in 12 and risers should be only about 100 mm if perambulators are to use the steps **12**. If only for pedestrian traffic, three or four steps can be introduced between ramp sections. Steps can be formed in the same way as illustrated in **10** and **11**. Nosings must be clearly defined to ensure that users see the steps.

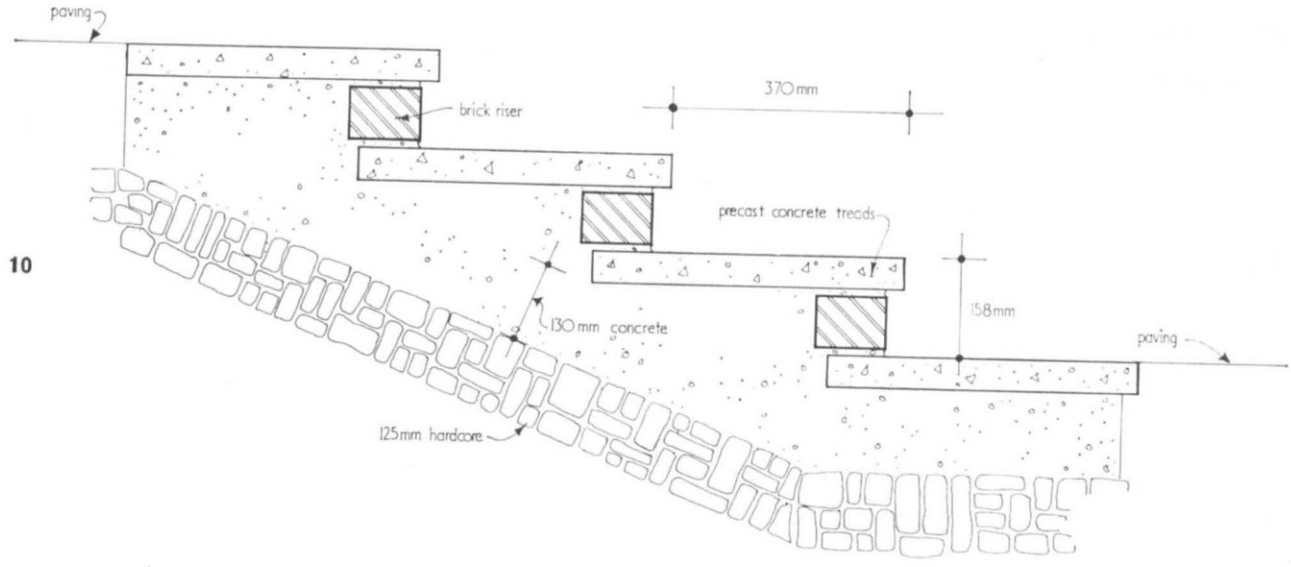
4 References

BRITISH STANDARDS INSTITUTION

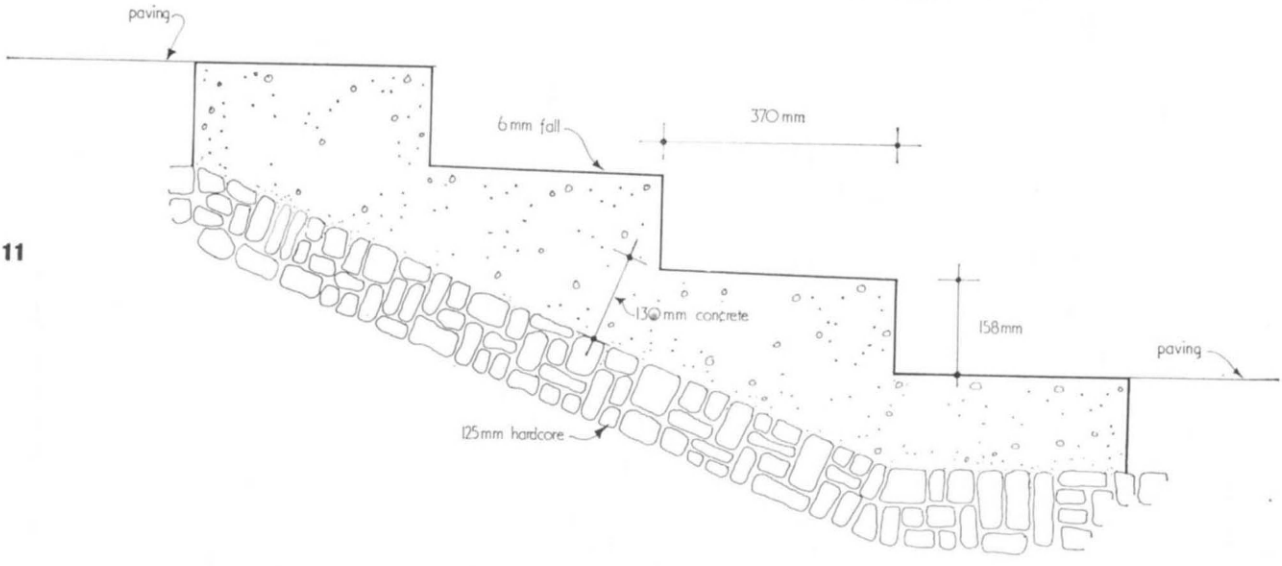
1 BS 340:1963 Specification for precast concrete kerbs, channels, edgings and quadrants [(90·22)Ff]

2 BS 1217:1945 Cast stone [Yf3]

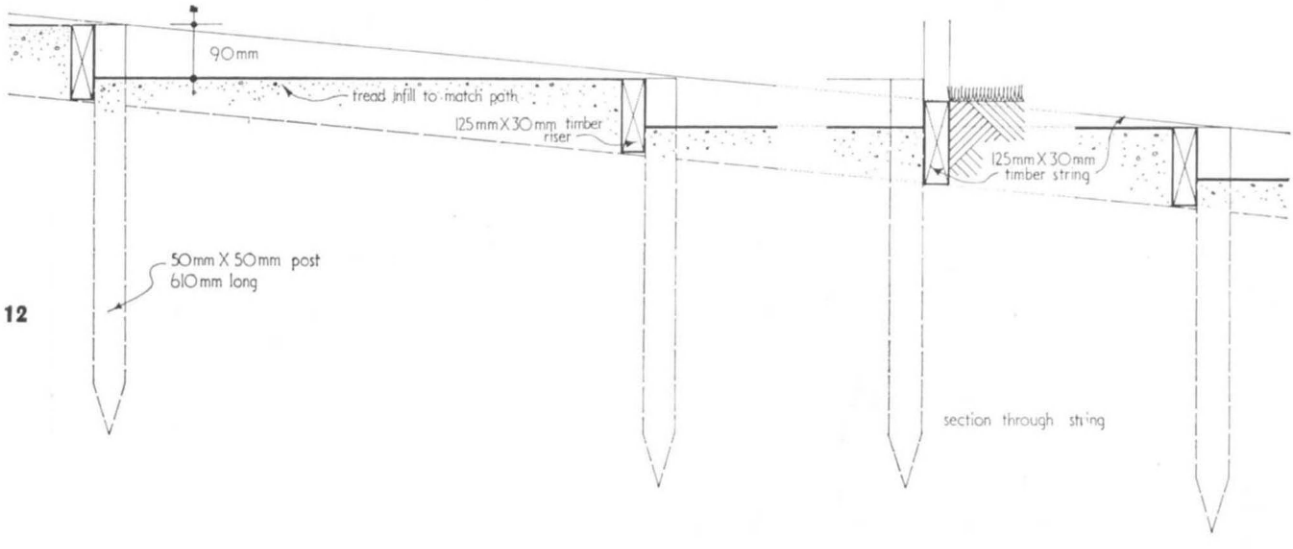
3 BS 435:1931 Granite and whinstone kerbs, channels, quadrants and setts [(90·22)Fe1]


paving
brick riser
370mm
precast concrete treads
158mm
paving
130mm concrete
125mm hardcore

10


paving
6mm fall
370mm
130mm concrete
158mm
paving
125mm hardcore

11


90mm
tread infill to match path
125mm X 30mm timber riser
125mm X 30mm timber string
50mm X 50mm post 610mm long
section through string

12

Information sheet Landscape 36

Enclosures and barriers

This information sheet by SHIRLEY ANDREW *is a guide to the choice, design and construction of walls and fences, and also refers to other forms of enclosure and barriers such as ground formation.*

1 Forms of enclosure

1.01 This information sheet covers:
walls, including screen walls and retaining walls
fences
ground formation, including earth banks and depressions.
Other forms of enclosure are dealt with in the following information sheets:
trees—information sheet LANDSCAPE 6
hedges—information sheet LANDSCAPE 8
water—information sheet LANDSCAPE 33
paving—information sheet LANDSCAPE 34
bollards—information sheet LANDSCAPE 39.

2 Functions

2.01 Enclosures or barriers may fulfil the following functions: to form a *physical* barrier; to form a *visual* barrier; to form a *noise* barrier; to form a wind break; or to define space.

Physical and visual barriers

2.02 Unless both physical and visual barriers are needed (ie for both security and privacy) physical barriers need not block the view **1**. The precise function of physical barriers must be established. For example are they required to keep people in or out, or animals in or out, or both? If animals are the only objective and it is undesirable to block the view then a cattle grid may serve the purpose adequately.

Sound

2.03 Motorways in urban areas have emphasised the unpleasant effects of excessive noise where people live, work or play. Traffic noise[1] recommends that sound barriers should be of 'imperforate construction with a surface density of not less than 8 kg/m^2'. To be most effective the barrier should be as close as possible to the noise source or in some cases to the recipient. A barrier midway between the two is least effective. The barrier should be at least three times as long as the distance between it and the recipient. A technique involving the use of protractors for establishing noise reduction due to screening and distance is described in the same bulletin.

Wind

2.04 Where a site is exposed and requires a wind break, it should first be established whether the barrier must fulfil other functions such as security. Where the only function is that of wind break, trees forming a shelter belt would be suitable. See information sheet LANDSCAPE 8.

Space definition

2.05 Where spaces must be defined, ie for different uses or to control traffic flow or to mark boundaries, choice of form of enclosure will again depend on whether other functions must also be performed.

Screen walls

2.06 The need often arises for enclosure for security, or the defining of space without presenting a complete visual barrier. This is where the *screen wall* should be used, as its surface perforations can provide interesting large scale texture.

3 Choice of enclosure

3.01 Choice of the most suitable form of enclosure is governed by some of the following considerations:

Function

3.02 Table 1 relates forms of enclosure with function.

Permanence

3.03 There may be design reasons for using a cheaper and less permanent material (eg post and wire fence is simpler and quicker to erect and take down than a cast in-situ concrete wall.)

Durability

3.04 Durability must be considered in relation to resistance to wear and vandalism, to weathering, and to required life of the enclosure. There is no point choosing a material which will last 100 years when it need only last five.

Relationship with other landscape elements

3.05 In choosing material and form of an enclosure attention should be paid to related elements of landscape and to local character.

Local techniques

3.06 Many parts of the country still use construction techniques passed down from generations (eg Pembrokeshire stone hedging, para 4.32). Local techniques use readily available materials and are more likely to blend with the character of the area. But choice should also relate to function, cost, permanence etc.

Availability of materials

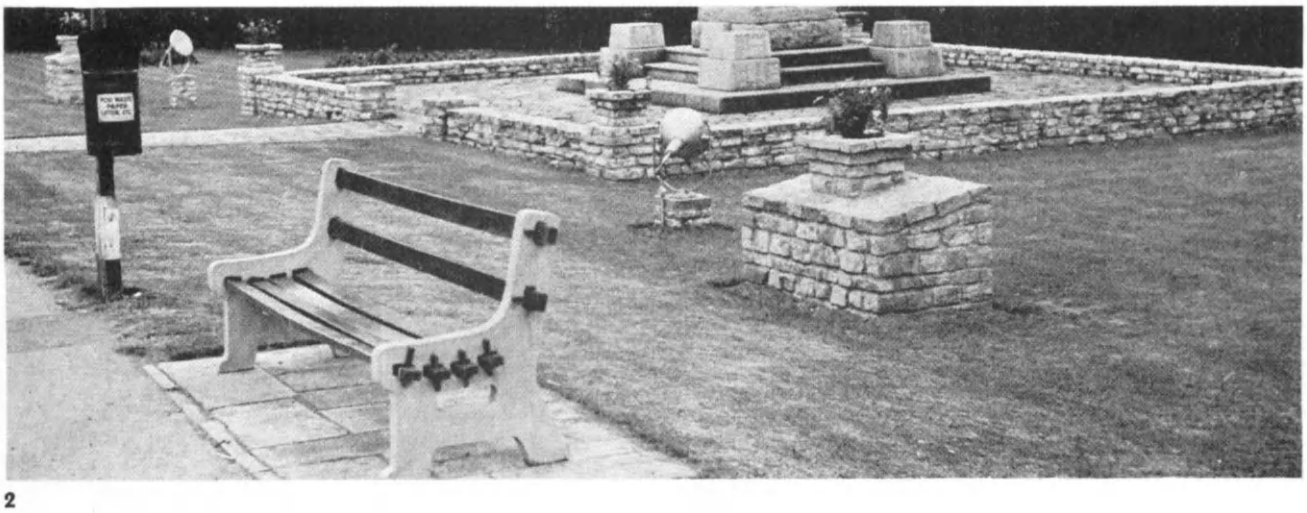
3.07 Check local availability of materials, particularly where time and cost are important.

Table 1 Function related to choice of barrier

Form of enclosure	Physical barrier (security)	Visual barrier (privacy)	Noise barrier	Windbreak	To define space	Durability	Climbable	Permanence	Remarks
Trees	×	√	×	√	√	high	×	high	
Walls: brick, stone, concrete	√	√	√ (i)	√	√	high	×	high	(i) if properly placed and sized
Fences: timber	√	√	√ (i)	√	√	low	× (ii)	low	(i) if properly placed and sized (ii) depending on design
Fences: precast concrete with timber panels	√	√	√	√	√	med	× (i)	med	(i) depending on design
Fences: precast concrete with wires	√	×	×	×	√	high	√	med	
Metal: wrought iron and mild steel	√	×	×	×	√	high	× (i)	high	(i) depending on design
Chain link and woven wire fence	√	× (i)	×	×	√	med	√ (ii)	med	(i) woven wire can be a directional visual barrier eg glare fences on motorways (ii) chain link if large mesh
Strained wire fence	√	×	×	×	√	med	√	med	
Guard rails	√ (i)	×	×	×	×	med	√	low	(i) only for the law abiding
Hedge bank	√	× (i)	×	√ (ii)	√	med	√	med	(i) unless very high (ii) if high enough
Ha-ha	√	×	×	×	×	high	√	low	
Cattle-grid	√ (i)	×	×	×	×	high	×	high	(i) for animals
Hedge	√ (i)	√	×	√	√	med	×	med	(i) if spiky eg hawthorn, blackthorn
Bollards	×	×	×	×	√	high	√	med	

1 *Landscape is enhanced by this simple functional fence made of readily available materials*
2 *'Municipal rustic' mini-walls are pretentious and fussy compared to 1 above*

1



2

Local site conditions

3.08 Abnormal site conditions, eg extreme exposure or unstable soil conditions, should be considered when choosing form and materials. See information sheet LANDSCAPE 1.

Cost and upkeep

3.09 The constraint of minimum capital cost should be considered in relation to subsequent upkeep. Generally the more durable the material the higher its capital cost is likely to be.

4 Walls

Materials

Clay bricks

4.01 It is often assumed that any building brick will serve for a garden wall. In fact the free-standing wall is more vulnerable because it is exposed to the weather on both sides. Brick used for these walls must have a high frost-resistance and low soluble salts content. BS 3921:1965[19] defines different types and properties of bricks and blocks and it should be used with BRS Digests 65 and 66 (second series)[4]. Brick manufacturers can advise on suitable types of brick and a rough guide can be obtained by inspecting garden walls on similar sites.

Clay engineering bricks

4.02 These have high compressive strength, and are resistant to frost and sulphate attack. They are therefore very suitable for use in free-standing walls. The impermeability of engineering bricks makes them useful as dpcs.

Sandlime bricks

4.03 Sandlime bricks are made with siliceous sand (or crushed siliceous rock) and lime, and formed by pressing under steam pressure. See BS 187 : 1967[12]. Class I Special Purpose should be used.

Flintlime bricks

4.04 Similar to sandlime bricks except that crushed flint is used. They have high crushing strengths and cost much less than clay facing bricks.

Concrete bricks

4.05 See BS 1180[16]. Special purpose backs are used where bricks are liable to be exposed to temperatures below freezing when saturated with water. But it is advisable to consult the manufacturer as class A (ii) bricks (for external facing work) are commonly used for free-standing external walls and appear to be quite suitable.

Concrete blocks

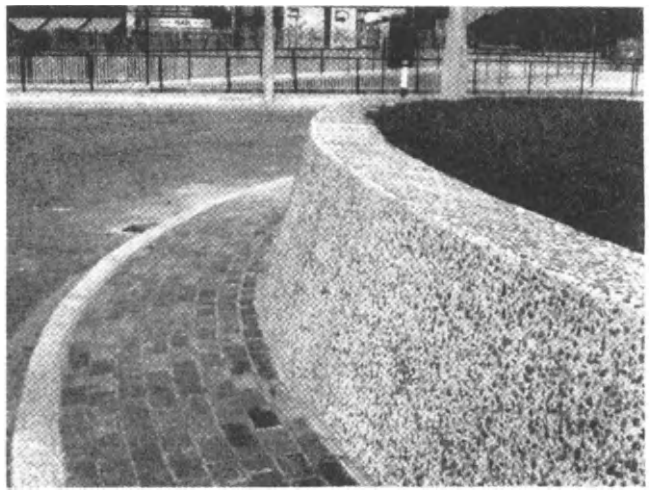
4.06 A wide range of concrete blocks, for bedding in mortar, is available for free-standing external walls. BS 2028, 1964[20]; specifies types, properties and intended uses. See AJ special issue Concrete blockwork AJ 8.4.70 [CI/SfB Ff].

In-situ concrete

4.07 Materials should be in accordance with BS 12[10] and BS 882, 1201[13]. Sea-sand could be used for unreinforced walls as the damp associated with salt in sea-sand does not matter, and efflorescence is less important on light grey wall surfaces **3**. The cost of formwork is the limiting factor in using in-situ concrete for free-standing walls. There should be sufficient walling to re-use the formwork many times.

Natural stone

4.08 Most building stones are suitable for external free-standing walls provided appropriate form of construction is used (see para 4.31). Local stone is usually cheapest. Of all walling materials it is one of the most effective.



3 *In situ retaining wall, Elephant and Castle, London*

Brick wall construction

4.09 *Foundations* The loading on a free-standing wall is usually less than a building wall, but it is still necessary to provide a stable base for the wall on soil.

4.10 Foundations must therefore be taken to a level where frost or moisture movement will not occur. On average soils, in areas with normally hard winters, a depth of 460 mm to 610 mm should be adequate. In a mild coastal climate or in ground protected from frost, or on rock; this depth may be reduced.

4.11 Foundations too near the surface may interfere with planting against the wall. For a brick wall 230 mm thick and 2 m high a concrete strip footing (1:2:6 mix) between 460 mm and 530 mm wide by 150 mm thick should be adequate **4**.

4.12 *Damp-proof course* External free-standing walls should be kept as dry as possible, by means of a dpc. It should be laid 150 mm above ground level, but planting against the wall will raise the soil level, and in this case the dpc should be inserted at a higher level.

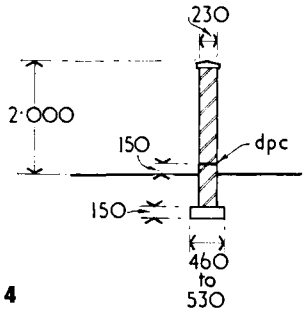
4.13 Where there is a risk on a windswept site of a wall being blown over at the horizontal dpc joint, consider using two courses of engineering bricks laid in cement mortar.

4.14 *Mortar* Materials for mortar are covered by the following British Standards: BS 12[10], BS 146[11], BS 915[15], BS 890[14] and BS 1198–1200[17].

4.15 *Joints* Jointing can mar the appearance of a wall. There are several traditional techniques for finishing the joints **5**. The joints of new walls should not be pointed unless the required colour of the mortar makes it expensive to use.

4.16 *Copings* The purpose of a coping is to prevent water penetrating the top of a wall. It should also throw the water clear of the wall face.

4.17 *Wall thickness* For sheltered sites a wall 230 mm thick without piers should be adequate for heights up to 2 m. An unbuttressed 230 mm thick wall usually looks better than a 115 mm thick wall with piers. Walls on exposed sites or walls of considerable height or length should be structurally designed.



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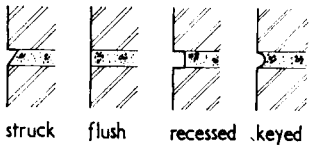
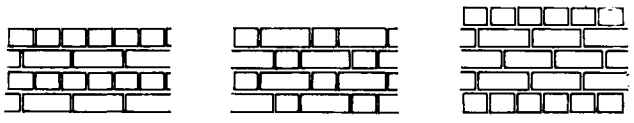
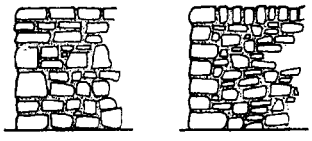


5

4 *Section through a typical 230 mm wide brick wall 2 m high*
5 *Common methods of finishing brick joints*

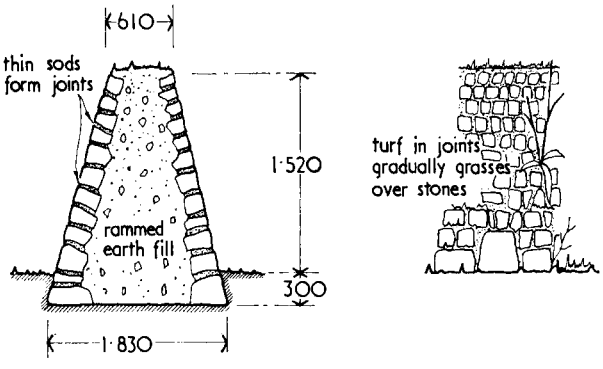


6 *Typical bonds for freestanding brick walls*



7 8

7 *Coursed rubble wall*
8 *Random rubble wall*



9 *Pembrokeshire stone hedging*

4.18 *Brick bond* Traditional bonds suitable for free-standing walls 230 mm thick are illustrated in **6**.

Concrete block walls

4.19 *Foundations* For principles see paras 4.09 to 4.11. A block wall 203 mm thick would normally use a concrete strip footing (1:2:6 mix) between 460 mm and 530 mm wide by 150 mm thick.

4.20 For dpcs see para 4.12. For joints see para 4.15 and for copings see para 4.16.

4.21 *Mortar* A mix of one part Portland cement to one part lime to 5 to 6 parts dry sand should be used. Where masonry cement and dry sand are used a mix of 1:4–5 is suitable or where Portland cement and dry sand with plasticiser are used a mix of 1:5–6.

4.22 *Wall thickness* For sheltered sites a wall 203 mm thick without piers should be adequate for heights up to 2 m. Walls 102 mm thick may be used, with piers 460 mm × 203 mm at 2·3 m centres.

4.23 Expansion joints (vertical) 12 mm thick should be formed at 4·6 m centres.

In situ concrete walls

4.24 Cast in-situ free-standing external walls should usually have reinforcement. A reinforced wall would roughly be about half the thickness of the equivalent unreinforced wall. A mix of 1:2:4 is usually suitable; concrete should be poured in layers about 300 mm at a time and well tamped.

4.25 *Foundations* Requirements similar to brick walls. A strip footing 150 mm thick by 450 mm wide for a reinforced wall and 600 mm wide for an unreinforced wall should normally be adequate. It is advisable to pour the bottom 150 mm of the wall with the foundation.

4.26 Dpc should be included.

4.27 Expansion joints should be formed at about 4·5 m centres in an unreinforced wall and at about 9 m in a reinforced wall.

4.28 *Reinforcement* Mesh reinforcement is ideal, placed against both faces of the wall with about 25 mm cover.

4.29 *Wall thickness* As a rough guide, a wall 2 m high can be 150 mm thick if reinforced, and 300 mm thick if unreinforced. Where sites are exposed or subsoil conditions unfavourable, the wall should be structurally designed.

Natural stone walls

4.30 Types of stone construction vary throughout the country, eg flint walls, common in the chalk districts, and Kentish rag. Stone walls can be broadly classified as either rubble or ashlar construction; rubble being most usual for free-standing walls. Rubble walls are those built of thinly bedded stones of irregular shapes as in random rubble **7** or squared as in coursed rubble **8**. Ashlar is the term given to stones which are dressed with a scabbling hammer, or sawn to blocks of given dimensions.

4.31 Stone wall construction should be guided by local tradition. Foundations (see para 4.19), other than on rocky sites, will normally be required and may be one or two courses of large long stones or a concrete strip footing. Copings should be stone on edge or thin flatstone copings.

Pembrokeshire stone hedging

4.32 This local traditional type of wall is basically a stone-faced earth bank **8**. Top soil and roofs are first removed and the first layer of stones laid on well-compacted soil about 300 mm below ground level. Stones are graded to size with largest stones at the bottom. As the wall proceeds thin sods of turf are laid in the horizontal joints. Stones are laid on edge rather than on the flat and may be laid horizontally or at 90° to the batter of the wall. The centre of the wall is filled with soil which must be very thoroughly compacted: failure to do so will result in settlement later. As a guide the width of the wall at its base should be equal to its height.

Retaining walls

4.33 Except for simple low walls (ie not exceeding 1 m) it is wise to seek the advice of a consulting engineer. The following notes are a general guide.

4.34 *Materials* Brick is the traditional material for retaining walls in landscape work. Precast concrete blocks are a more recent development. On larger scale work where there is considerable soil pressure, concrete cast in situ either reinforced or unreinforced is often used on grounds of cost.

4.35 *Construction* Every retaining wall must withstand soil pressure behind it and must permit drainage of moisture through it from the retained soil. It must also take up expansion along its length. To cope with soil pressure retaining walls are generally either laid to a batter or constructed with greater thickness at their base.

4.36 The usual method of drainage at the base of the wall is to backfill with hardcore and provide weepholes through the wall: open perpends at 1 m intervals in the course above ground level for low brick retaining walls or 75 mm or 150 mm pots for larger scale walls.

5 Fences

Choice

5.01 The principles deciding which type of fence to use and where to use it (ie function, permanence, durability, relationship with other landscape elements, local techniques, availability of materials, local site conditions, and cost and upkeep, are dealt with in para 3.02 to 3.09. Well-known and well-tried forms of fence are shown in **10** to **20**.

Timber

5.02 Sweet chestnut, larch, oak and western red cedar are commonly used timbers and generally need no treatment. Ash, beech, birch, Douglas fir, elm, hornbeam, lime, Austrian, Corsican and Scots pine, silver fir, spruce and sycamore are quite suitable provided they are properly treated with preservative. Timber for fencing should be stripped of bark for it can form traps for water, thus precipitating decay.

5.03 Wrought softwoods must have some form of protective treatment such as creosote. Painted finishes require a priming coat, two undercoats and a finishing coat, with repainting at regular intervals.

Preservative treatment

5.04 Commonly used methods of applying preservative treatment include:

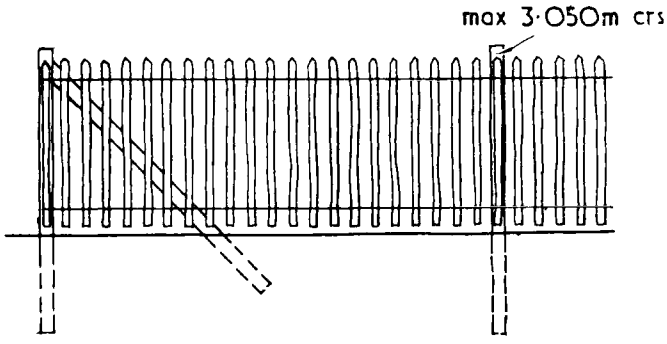
Pressure application Thorough but often impracticable where treated timber must be cut or worked in situ.

Dipping Often used for the ends of posts but gives little more than surface protection.

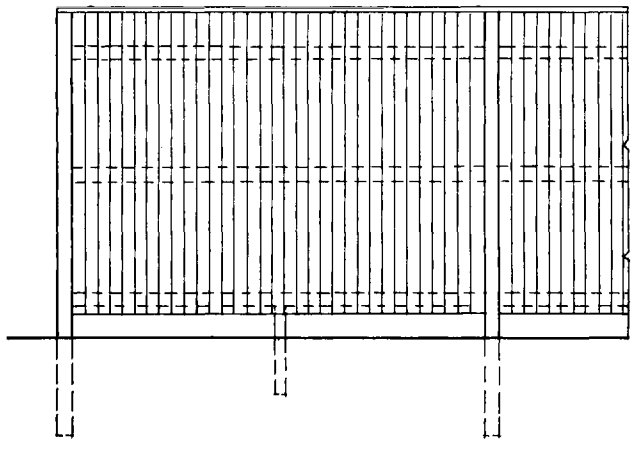
Brushing or spraying Gives only surface protection and requires reapplication at regular periods.

Open tank method Timber is immersed in cold creosote which is heated to 94°C, maintained for several hours and then left to cool, allowing the timber thoroughly to absorb it. Recommended for all ends of posts and non-durable timbers.

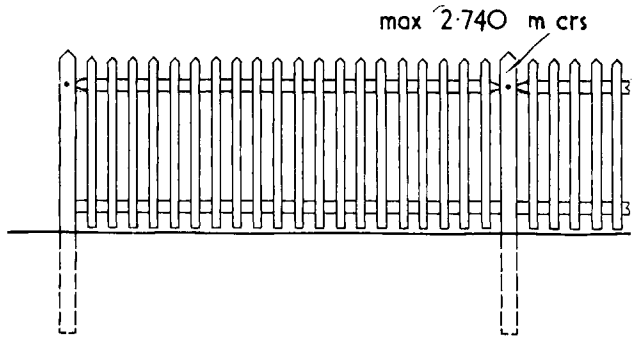
5.05 All ends of posts and other timbers buried in the ground should be treated with preservative and the treatment carried up the post for 300 mm. Certain timbers such as sweet chestnut, larch and oak are resistant to impregnation and should be treated with coal tar by the open tank method.



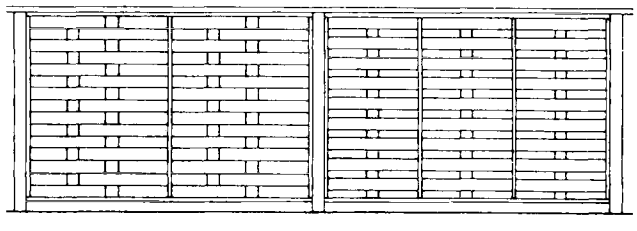
10 *Cleft chestnut paling fence*



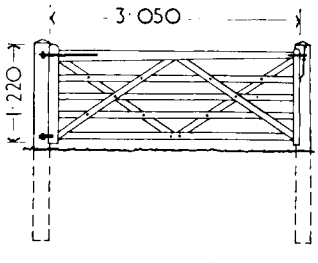
11 *Closeboarded or sawn oak paling fence*



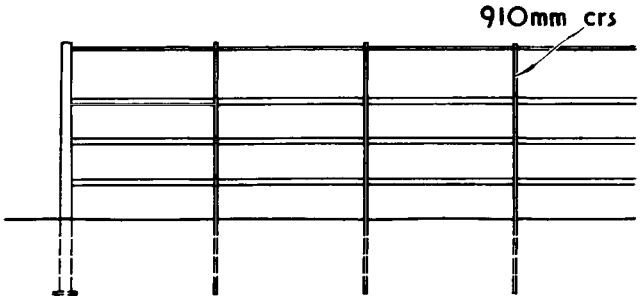
12 *Timber palisade fence*



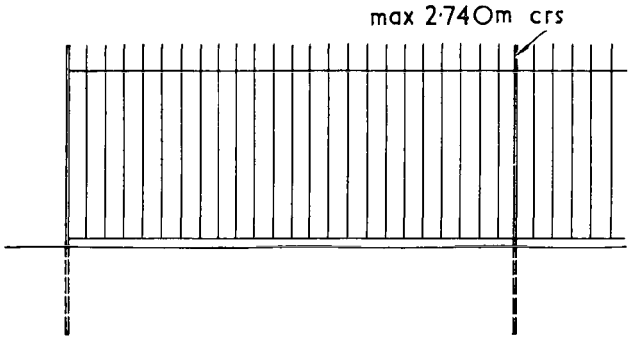
13 *Woven wood fence*



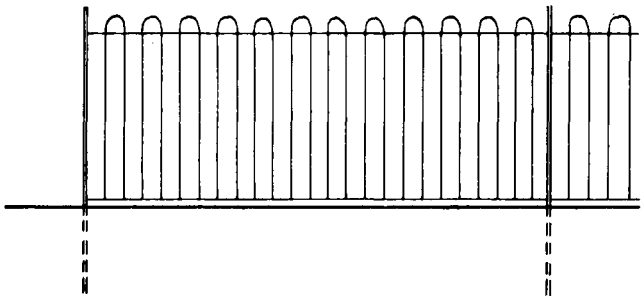
14 *Diagonally braced timber farm gate 3·05 m wide by 1·2 m high*



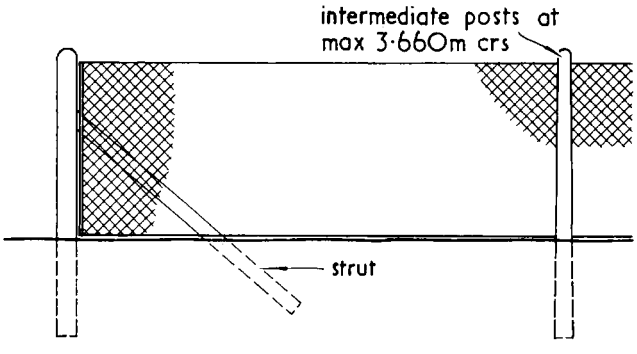
15 *Continuous bar fencing*



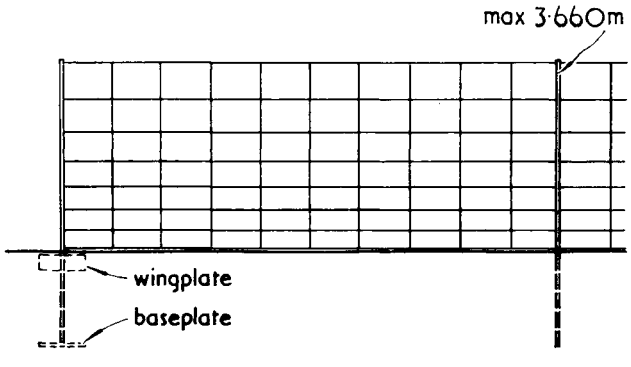
16 *Vertical bar fencing (unclimbable)*



17 *Vertical bar fencing with hairpin tops for use in children's playgrounds*



18 *Chain link (diagonal mesh) fencing*



19 *Woven wire fencing*

Construction

5.06 Holes for posts should be as small as possible and filled with well-rammed excavated soil. Where the soil is not suitable for consolidation, posts should be set in concrete for half the depth of the excavation and the rest filled with well-rammed excavated soil.

Precast concrete

5.07 Precast concrete for fencing is usually used with other materials (eg strained wire fencing and close-boarded fencing, where the boards are timber and the posts and rails concrete). BS 1722 parts 1 to 6 and 10[18] covers types of fence incorporating concrete posts.

Metal

5.08 Ornamental wrought iron fences were popular in the late 18th and early 19th centuries. Wrought iron design then flourished not only in one-off examples but also in mass-produced castings from foundries **24**.

5.09 Most metal fences today are mild steel. BS 1722 : part 8:1966[18] and BS 1722: part 9:1963[18] specify recommended construction and erection. Tables II to V taken from these British Standards list relevant dimensions.

Protection

5.10 Mild steel rusts easily and should therefore be properly protected and subsequently maintained. BS 1722 describes standard ex-works finishes and recommended protective treatments on erection and subsequently.

Continuous bar fencing

5.11 This form of fence **15**, often used as a barrier to farm stock, is also suitable for separating parkland from driveways. Horizontal members are available in round and flat bar sections. See table II for recommended sizes. Standards may be flat, T or I section. Continuous bar fencing is factory-made and gates to match are also available.

5.12 Slight falls can be taken up by fencing but the manufacturer should be consulted. Fencing usually runs parallel with the ground. Slight curves on plan can be taken up but bars can be bent in the works to suit specific situations.

Table II *Dimensions of continuous bar fences*

Purpose	Height of fence mm	Standards		Number of horizontals	Length of pillar mm
		Depth in ground mm	Distance apart mm		
Sheep	1000	300 to 450	900	4	1500
General	1200	350 to 530	900	5	1750
Extra strong	1400	350 to 610	900	6	2000

Vertical bar fencing

5.13 This form of fence **16** is often referred to as unclimbable. For playgrounds the type with hairpin tops **17** should be used as the other type can be dangerous if children attempt to climb them. Vertical bars are available in circular or square section and may terminate in spikes, blunt tops or wrought iron spear heads. The standards are generally mild steel like the railings but precast concrete posts are also used. Raken panels of fencing can be specially manufactured to take up site falls. Spaces between verticals should not be less than 100 mm and not more than 120 mm. See BS 1722[18] part 9 for dimensions.

Chain link fencing

5.14 This form of fence **18** is commonly used as a barrier to farm stock. Materials, dimensions and construction are specified in BS 1722: part 1: 1963[18] from which table III is taken. Straining and intermediate posts may be of timber, precast concrete or mild steel.

Woven wire fencing

5.15 As with chain link, this form of fence **19** is most generally used for farm or estate work. Materials, dimensions and construction are specified in BS 1722: part 2: 1963[18] and table IV is taken from this. Straining posts, struts and intermediate posts may be of timber, precast concrete or mild steel.

Strained wire fencing

5.16 As above, this fence is commonly used for farm work. Materials, dimensions and workmanship for three types of strained wire fence (general pattern, dropper pattern and Scottish pattern) are specified in BS 1722: part 3: 1963,[18] table V is taken from this. Posts may be of timber, precast concrete or mild steel **20**.

Table III *Chain link fences*

Applicability	Height of top of fence at posts (mm)
House garden fronts and divisions	1000
Children's playgrounds	1200
General agricultural	1200
House gardens, playing fields and recreation grounds	1500
Highways and railways	1500
Commercial property	1800
Industrial security fencing	2100

Table IV *Woven wire fences*

Applicability	Height of top of fencing at posts (mm)	Number of horizontal wires
Light general purposes	760 to 800	5 to 8
Sheep	900	6
Cattle and sheep	1100	8

Table V *Strained wire fencing*

Height at top of wires (mm)	Number of horizontal wires
830	3
1000	5 or 6
1200	6
1400	7 or 8

Other materials

Plastics

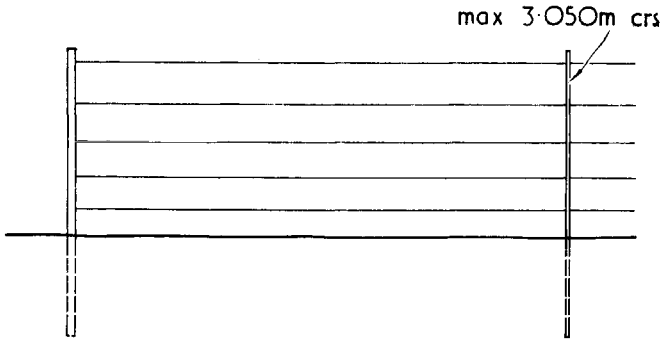
5.17 Proprietary systems of post and rail fences are available using unplasticised polyvinyl chloride rails fixed to timber or pc or plastic coated posts. Plastic-coated chain link fencing is also available.

Gates

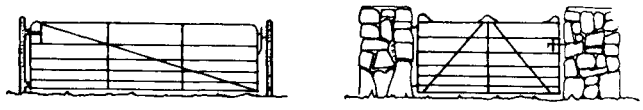
5.18 'A gate must appear as the way through a fence or wall. It is part of its function to state visually that there is a possible entrance **14**, **21**, **24**. If the gate looks stronger than the fence that flanks it, it will, in aesthetic terms, contradict its function. Many gates, sensible enough in themselves, look ridiculous because they ignore this principle.

Guard rails

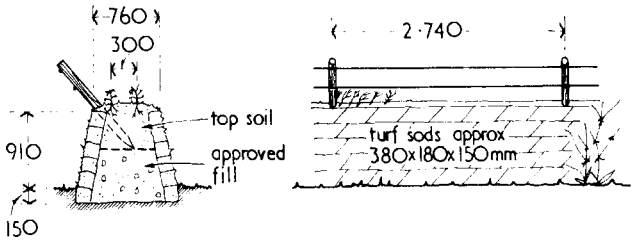
5.19 Very small forms of enclosure are used to discourage movement off a given circulation area ie to protect flower beds, lawns or other areas of planting, or to preserve privacy. These should not form visual barriers and need not be particularly robust, though they should be strong enough



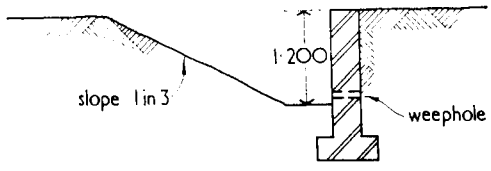
20 *Strained wire fencing*



21 *Tubular steel farm gates up to 4·25 m wide by 1·2 high*



22 *Section and elevation of hedge bank*



23 *Section through traditional ha-ha*

24 *Ornamental iron work at Beaminster Church*

to remain in position and undamaged when sat on or when children climb on them.

6 Ground formation

6.01 Where the function of a barrier is visual only or is a wind break, enclosure can be created simply by reshaping the contours into slopes and hollows or forming earth banks.

Hedge bank

6.02 This traditional technique is basically an earth bank. Turf sods roughly 150 mm thick × 380 mm × 180 mm are cut as parallelograms and laid on one of the long sides. The base of the new bank is stripped of turf to a depth of 150 mm and prepared to slopes. Turfs are built up in bonded courses and the centre filled with well-rammed soil as work proceeds. The height of a bank is about equal to its width at the base and the fences of the bank are battered. High banks are rarely built and it is more usual to provide a fence along the top and to one side. Rough posts about 75 mm diameter and 1·4 m long are driven into the top of the bank at an angle at 2·75 m intervals and two strands of no 8 galvanised wire fixed to them **23**.

Ha-ha

6.03 The ha-ha is a ditch which provides a physical barrier without obstructing the view. Although much used by the 18th-century landscape architect in this country it is supposed to have been devised by the French. A traditional ha-ha is usually one about 1·2 m deep with retaining wall on the garden side and with the other side sloping up from its base at about 1 in 3 in order to allow maintenance **24**.

7 Hedges

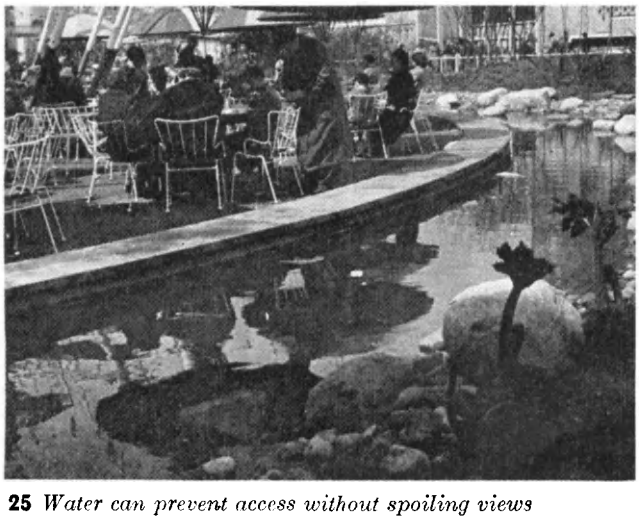
7.01 The use of hedges for enclosure is dealt with in information sheet LANDSCAPE 8.

8 Trees

8.01 Trees form an effective shelter belt against the wind. See information sheet LANDSCAPE 6.

9 Bollards

9.01 Bollards are a traditional method of forming an enclosure to prevent vehicles encroaching on pedestrian areas while maintaining the flow of pedestrian traffic. See information sheet LANDSCAPE 39.



25 *Water can prevent access without spoiling views*

10 Water

10.01 Water can be an effective physical barrier while, like the ha-ha, not interrupting the view **25**. See information sheet 33.

11 References

1 GREATER LONDON COUNCIL Urban design bulletin. Traffic noise. London, 1970. The council [MS]

2 BEAZLEY, ELISABETH Design and detail of the space between buildings. London, 1960 (3rd impression 1968), Architectural Press (68:90) *Price £2·10*

3 WEDDLE, A. E. (editor) Techniques of landscape architecture. London, 1967, Heinemann Ltd. [08] *Price £4·50*

4 BUILDING RESEARCH STATION Digests 65 and 66 (second series): The selection of clay building bricks 1 and 2: 1965 and 1966, HMSO [Fg 2]

MINISTRY OF AGRICULTURE, FISHERIES AND FOOD

5 Fixed equipment of the farm leaflet 6: Permanent farm fences, 1969, HMSO [260(90–21)]

6 Fixed equipment of the farm leaflet 7: Cattle grids for private farm and estate roads, 1962, HMSO [260]

7 Fixed equipment of the farm leaflet 8: Farm gates, 1964, HMSO [260(90–3)]

8 Fixed equipment of the farm leaflet 17: Preservation of timber and metal, 1968, HMSO [260]

9 MINISTRY OF TECHNOLOGY Forest Products Research Laboratory leaflet 11: The hot-and-cold open tank process of impregnating timber, revised February 1964, HMSO [Yi]

BRITISH STANDARDS INSTITUTION

10 BS 12:1958 Portland cement (ordinary and rapid hardening) [Yq2)]

11 BS 146:1968 Portland blast furnace cement [Yq2]

12 BS 187:1967 Calcium silicate (sandlime and flintline) bricks [Ff1]

13 BS 882:1201:1965 Aggregates from natural sources for concrete (including granolithic) [Yp1]

14 BS 890:1966 Building lines [Yq1] *Price £1·0*

15 BS 915:1947 High alumina cement [Yq2]

16 BS 1180:1944 Concrete bricks and fixing bricks [Ff2]

17 BS 1198–1200:1955 Building sands from natural sources [Yp3]

18 BS 1722: part 1: 1963 Chain link fences, part 2: 1963 Woven wire fences, part 3: 1963 Strained wire fences, part 4: 1963 Cleft chestnut pale fences, part 5: 1963 Close-boarded fences including oak pale fences, part 6: 1963 Wooden palisade fences, part 7: 1963 Wooden posts and rail fences, part 8: 1966 Mild steel or wrought iron continuous bar fences, part 9: 1963 Mild steel or wrought iron unclimbable fences with round or square verticles and flat studs and horizontals, part 10: 1963 Anti-intruder chain link fences, part 11: 1965 Woven wood fences [(90·21)Yy]

19 BS 3921: 1965 Bricks and blocks of fired brickearth, clay or shale [Fg2]

20 BS 2028: 1964 Precast concrete blocks [Ff]

12 Sources of information

Brick Development Association, 3 Bedford Row, London wc1 (01-242 1836)

British Precast Concrete Federation, 9 Catherine Place, London sw1 (01-828 8746)

Cement and Concrete Association, 52 Grosvenor Gardens, London sw1 (01-235 6661)

Timber Research and Development Association, Hughenden Valley, High Wycombe, Buckinghamshire (Naphill 3091) *or* 26 Store Street, London wc1 (01-636 8761)

Building Centre, 26 Store Street, London wc1 (01-636 5400)

Information sheet Landscape 37

Section 10: **Elements of landscape construction**

Services

This information sheet by SHIRLEY ANDREW *describes usual practice for laying public utility services underground and their effect on design of paved areas.*

1 Recommendations

Location of public service

1.01 In 1946 a joint committee set up by the Institution of Civil Engineers and the Institution of Municipal Engineers prepared a report[1] recommending standard practice for location of public utility services under paved areas. This information sheet is based on the latest edition of this report.

Co-ordination

1.02 The report of the joint committee recommends that the work of the various statutory undertakings be co-ordinated by the engineer of the appropriate highway authority. In minor and private housing schemes architects can fill this role satisfactorily if the problems of the undertakings concerned are understood.

Ascertaining requirements

1.03 Their various requirements should be established before any planning. Each undertaking will want to plan its work programme in advance and to order materials, delivery of which may take a considerable time.

Preliminary drawings

1.04 Copies of preliminary drawings should be forwarded to the undertakings for them to show their requirements more precisely. This is the time to raise any queries, as alternative positions for mains may be equally satisfactory.

Departure from recommendations

1.05 In order to ensure that mains are under footways, one may depart from recommendations of the joint committee and delay laying mains until kerbs have been laid in case there are any changes in the scheme.

2 Services

Electricity

2.01 Cables are laid directly into the ground, except in particularly busy streets and across carriageways where they are drawn through 100 mm diam earthware ducts (older 75 mm ducts are still in use).

Low voltage
Low voltage cable should be at a minimum depth of 450 mm below paved surface. Runs are usually restricted to 122 m lengths as long runs are wasteful in area.

High voltage
High voltage cables of 22kV and over are subject to agreement with the highway authority. Underground link disconnecting boxes are required at intervals on the low voltage system, usually at street interscctions, with a pavement cover 760 mm × 610 mm. High voltage cables are of armoured cable with file covers.

Gas

2.02 Access is rarely required to gas service pipes and then, only to valves or to pumping pipes to remove condensate. Covers are usually 230 mm × 230 mm.

Mains
Mains are usually cast iron or steel, 100 mm minimum diameter. They should be laid 610 mm to 760 mm deep.

Service pipes
Service pipes are usually steel, 25 mm minimum diameter. They should be laid 460 mm to 610 mm deep.

Water

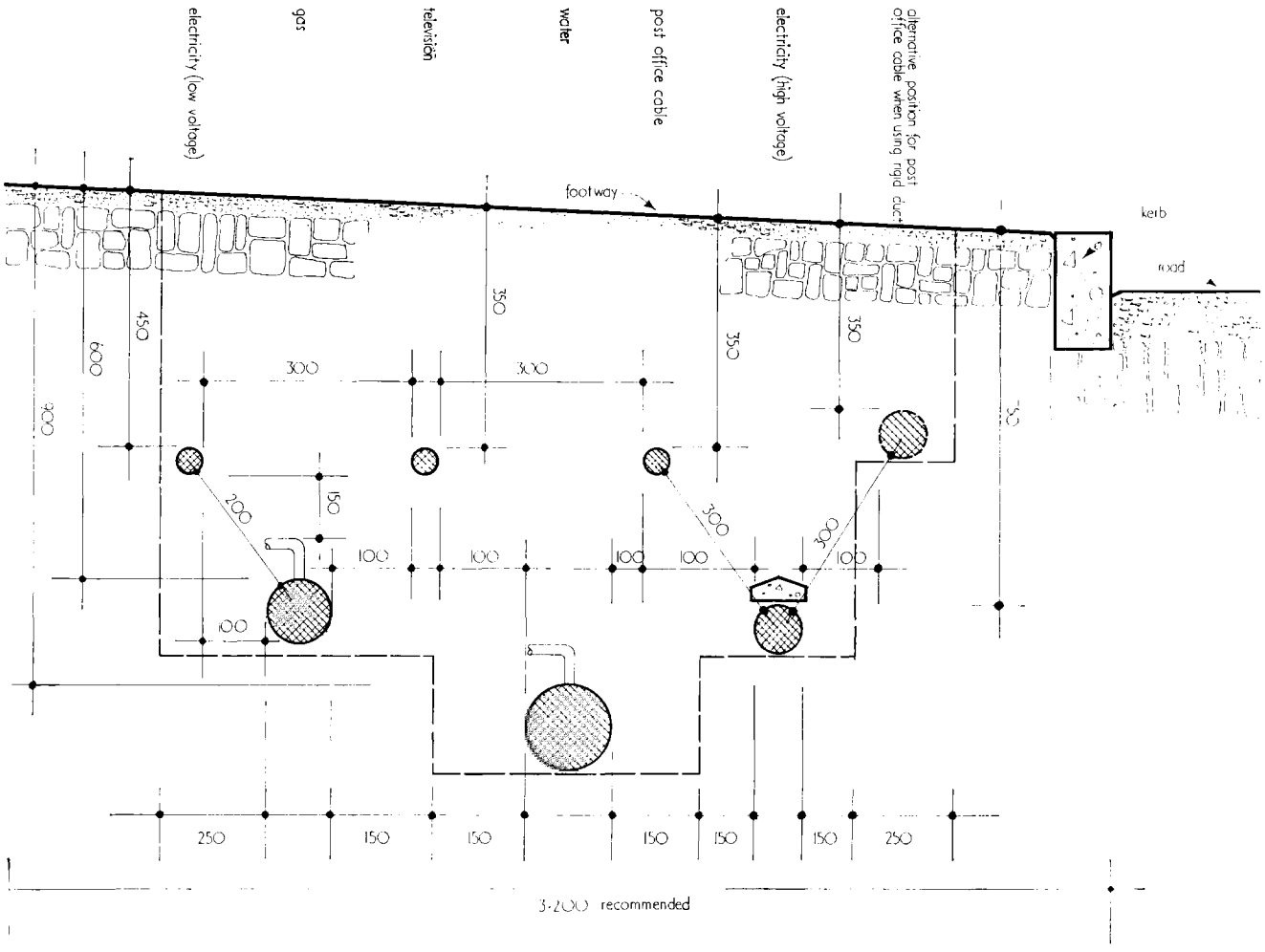
2.03 Cover required for water service is given in **1**. Access is indeterminate and is required for repair and fixing new branches. Easily removable paving is desirable over water mains and at least 1·2 in diameter clear space should be left around stopcocks above ground.

Mains
Mains are mostly of spun or vertically cast iron and steel, sometimes asbestos. They range in size between 50 mm and 3·35 m diameter but are commonly between 75 mm and 300 mm; about half of all mains being 100 mm.

Communication pipes
Communication pipes are lead or polythene between 12 mm and 50 mm diameter.

Telephones

2.04 Polythene cables are laid in ducts or straight in the ground. Earthenware duct in units of one, two, three, four, six and nine ways, all with 90 mm bore is the most popular. Asbestos cement ducts with 50 mm and 80 mm bore and 50 mm pvc ducts are used on housing estates. Polythene cables of up to 100 pairs are often used without ducts.
Distance between jointing chambers should not exceed 155 m. When beneath a footway minimum depth for protected cable is 230 mm; for steel ducts 350 mm; and for



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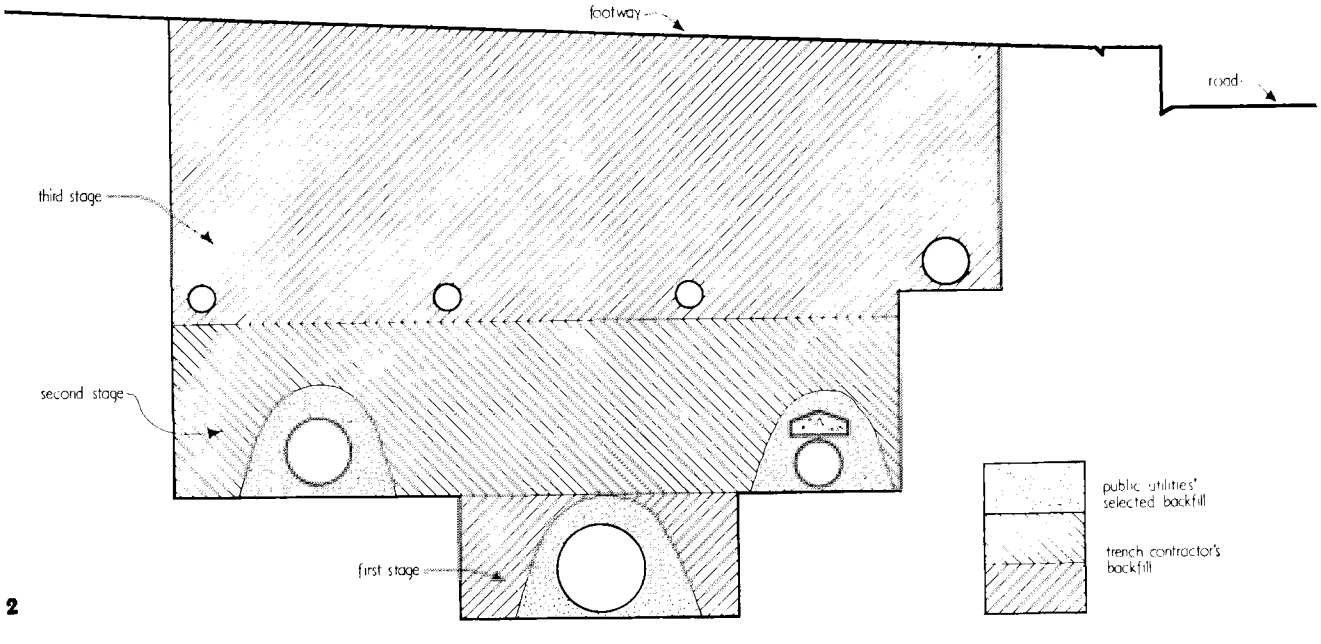
1 *Cross-section through paved footway showing arrangement of public utility services and minimum depths and spacings between services recommended in* MPBW R & D *bulletin*[2]
2 *Cross-section through common trench for public utility services recommended in* MPBW *bulletin*[2]. *The trench would be back-filled in three stages as indicated*



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self-aligning ducts 350 mm for one-way ducts and 460 mm for multiple-way ducts. When beneath a carriageway, the minimum depth is 610 mm in each case. Cover sizes range from 25 mm × 710 mm to 2·300 mm × 710 mm.

3 Planning

Location of services

3.01 It is usual to locate services under footways or verges rather than carriageways:

1 So traffic will not be disrupted during emergency repairs, routine maintenance or provision of additional services.

2 Because footways and verges over services can be constructed in materials that facilitate taking up and re-laying and are less likely to suffer damage.

The uses of small scale units rather than in-situ paving also makes it easier to fit in access boxes and markers.

Services under carriageway

3.02 The laying of distribution mains in duplicate, one on each side of a road, will obviate the need of lengthy service connections under carriageways. If it is necessary for services to cross roads, they should be laid before the carriageways are constructed.

Order for laying services

3.03 Normally mains should be laid between the road boundary and the kerb in the following order: electricity, gas, water, telecommunications (see **1** and **2**).

Space for services trench

3.04 When laying distribution and service mains, the joint committee recommends a width of not less than 3·2 m on both sides of the street so that:

1 Services can be laid out in an orderly way

2 There is room for link disconnecting boxes and jointing pits in electricity and telephone systems

3 There is room for valves and hydrants in the water system

4 There is room for siphon pipes in the gas system

5 There is room for maintenance access to various services without interfering with others.

If the footway is wider than 3·2 m the arrangement in **1** should still be used in case of future road widening.

It is possible to accommodate moderately sized services in as little as 1·8 m width.

Sewers

3.05 Sewers cannot be grouped with other services and generally have to be given priority of position as they are far less flexible. They have to be laid in straight lines and at uniform gradients between manholes (a manhole is necessary at each change of direction) and therefore often bear no relationship to local surface levels. They are commonly laid under carriageways.

Where many branch connections will be required after the construction of the carriageway, there can be advantages in providing a sewer under the verge or footpath of each side of the road.

The common trench

3.06 In 1968 a study group of an advisory committee appointed by the Minister of Public Buildings and Works published a report[2] on the accommodation of utility services within a common trench. Dimensions and profile proposed for the trench are shown in **1.** The intention being to excavate, lay the services shown at the bottom of the trench, backfill, lay the remaining services and complete backfilling.

Recommended minimum clearances between services are given in **1**. The arrangement shown in **1** generally accords with the proposals of the 1946 joint committee. In addition a strip 610 mm wide on each side of the trench is allocated for junction boxes, valves and so on. Additional services such as district heating or oil pipes are excluded because of the excessive trench width and organisational problems which would arise, instead separate trench is recommended.

4 Trench construction

Backfilling

4.01 Most paving failures result from faulty compaction of trenches. They should be filled in 230 mm layers with approved granular material. Flooding during backfilling should not be permitted. The soil should be spread and compacted at its natural moisture content. Compaction should preferably be done with power driven rammers.

Proximity of trees

4.02 Trenches should be kept as far as possible from trees with at least 1·5 m clearance of trunks. Service pipes can be tunnelled under large roots if necessary. Small roots, if cut should be trimmed square and tarred. It is advisable to keep service pipes well away from certain trees eg poplar, elm and willow, as damage from roots can occur as far as 3 m below ground surface.

5 References

1 INSTITUTION OF CIVIL ENGINEERS and INSTITUTE OF MUNICIPAL ENGINEERS. Report of joint committee on location of underground services. London. 1946. Institution of Civil Engineers, revised edition 1963 [(D2)]

2 HMSO (AJ review 26.2.69 p556) Co-ordination of underground services on building sites: 1 The common trench. MOPBW Directorate of Building Development, London. [(D2)] [90·5)(Af)]

Information sheet Landscape 38

Section 10: **Elements of landscape construction**

Car parking

This information sheet by SHIRLEY ANDREW *deals with open-air car parking which may or may not be associated with buildings. It does not include underground, covered or multi-storey car parks. For these see* (AJ *22.6.66*) *Design guide, car parking buildings and its associated information sheets in* AJ *29.6.66 and 6.7.66. All CI/SfB 223*

1 Design requirements

1.01 Decisions on space standards, layout, surface treatment, drainage and so on for car parking areas depend on some or all of the following factors:

Permanence

1.02 The intended life of a car park determines the importance of its siting and cost.

Cost

1.03 Land is expensive in urban areas, and car parks are often considered unfortunate necessities to be squeezed into as small an area as possible. If more than the minimum space is available, car parks can be made more acceptable landscape elements. If there is sufficient space, tree and shrub planting can be included and car parking spaces can possibly be distributed in two or three separate parking areas rather than one larger area. It is pleasant to be able to park under the shade of a tree in summer and cars in the shade are not nearly so noticeable as those in the open.

1.04 Car parks should be surfaced to cope with the nature and intensity of expected use. If surface treatment is suited to use, maintenance costs can be kept low. It is better not to introduce areas of grass in paved parking areas; they are costly to maintain because of all the edges which require trimming. However, trees and shrubs growing out of paved areas require only occasional pruning once established.

Nature and intensity of use

1.05 Intensity of use and the kind of user should be assessed. Space allocations and layouts which follow are mainly for cars, but other vehicles should be considered: mini-buses, charabancs, small commercial vehicles and cars towing caravans or boat trailers. Large commercial vehicles should be separate from parks for private cars, and clear signs should be posted to avoid confusion.

Intermittent use

1.06 Some car parks are used every day, often by one set of vehicles during the day and another in the evening. Other car parks may be needed only at weekends (eg for sport) in summer time only or only on special occasions.

1.07 In planning car parking for other than daily use every effort should be made to interrupt the normal state of the surroundings as little as possible. If the area must be surfaced, stabilised grass (para 5.07) may be sufficient, retaining the appearance of the surrounding grass. If tarmacadam is used then round river gravel of a pleasant colour such as mid-brown rolled liberally into the surface will result visually in a much softer and less obtrusive area.

Siting

1.08 Any site chosen for a car park must relate to its environment visually.

1.09 Sites should be readily accessible from public roadways and have entry points which are obvious to drivers so as to give warning of their existence. Exits should be placed so that sight lines permit safe re-entry to public roadways.

Site conditions

1.10 It is essential that a site for a car park be well drained or readily drainable. Otherwise a completely paved area is very costly to drain, and other forms of surface treatment will not stand up to wear if continually water-logged.

1.11 Sloping sites are acceptable; if the slope is more than slight, access roads should preferably run up and down the site so that the parking places are as flat as possible. This is both safer for parked cars and easier for parking. If sloping parking positions are unavoidable, access road width should be increased to facilitate difficult manœuvres for backing up-hill into or out of a parking place. In such cases, slope limit is governed by acceptable road gradient. Normally this should be a maximum of 1:20, but gradients up to 1:10 are tolerable over short distances.

1.12 Where space permits cars are far less obtrusive if parked irregularly, especially under trees.

2 Space requirements and layout

Space requirements

2.01 The publication *Cars in housing* [2][1] recommends that as at least 50 per cent of garages in the UK have internal dimensions of 4·87 m × 2·44 m; the most popular cars can be accommodated within this space and size is not likely to change. Only 5 per cent of cars are larger, while a considerable number are smaller. It would therefore seem reasonable to make bay sizes about 4·87 m × 2·44 m in general parking areas. Although the majority of vehicles will fit the 4·87 m × 2·44 m bay size, larger vehicles will sometimes be encountered and a few spaces should be provided for them. In any case, in irregular layouts there are bound to be places where larger or smaller vehicles fit in better.

2.03 Where a car park is unsupervised space is likely to be used less economically.

Layout

2.04 Various layouts are illustrated in **1**, **2**, **3** and **4**. The aisles in angled parking **1**, **2** and **3** must be one-way. This is safer than the two-way aisles in **4** and it is easier to park forward and requires less manoeuvring. A further possibility for dividing a large area is as **2** or **3** but with the next bay reversed.

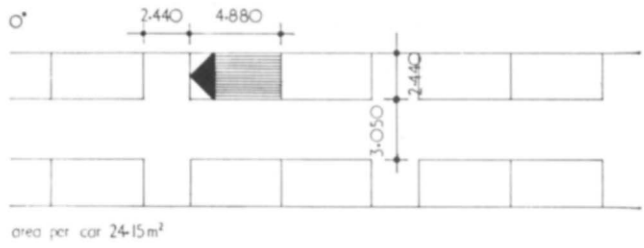
2.05 When space is available it is obviously advantageous to provide pedestrian areas. These can be raised to give safety and define parking space. In planning this type of layout it should be remembered that a car will extend about 760 to 1000 mm beyond its wheels at the back and about 610 to 800 mm in front **5a**, **5b**. If space is not vital, pedestrian islands can be ideal for tree planting.

Marking parking bays

2.06 Although marking parking bays may appear wasteful when compared with the ways cars can be arranged in supervised car parks, in unsupervised parks more economical use of space can be achieved. If large or badly parked vehicles take up more than their fair share of space, small vehicles can sometimes fit in the remainder.

2.07 If parking is supervised, only an indication of alignment at front and possibly back of the cars without width indicators is required. If spaces are metered, then they must be clearly marked out.

2.08 Marking of parking bays can be a way of adding interest to a large area of paving. In areas of concrete, tarmacadam or gravel, bricks or setts can be used either as continuous lines or to mark corners.



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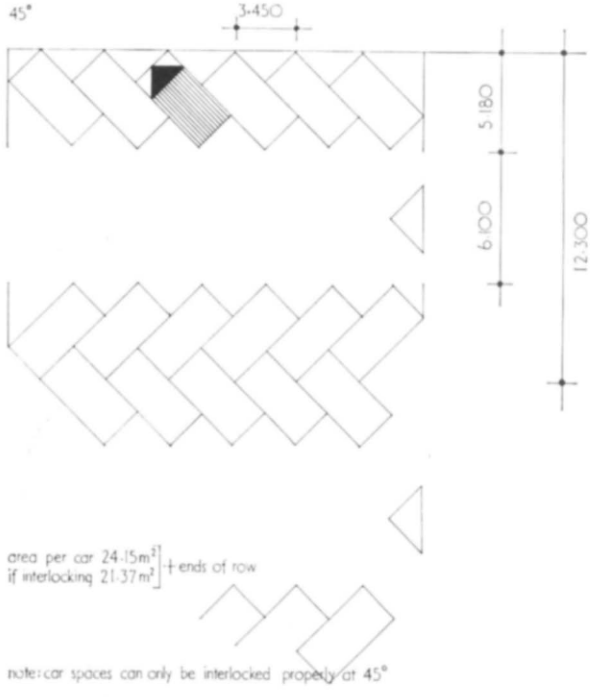

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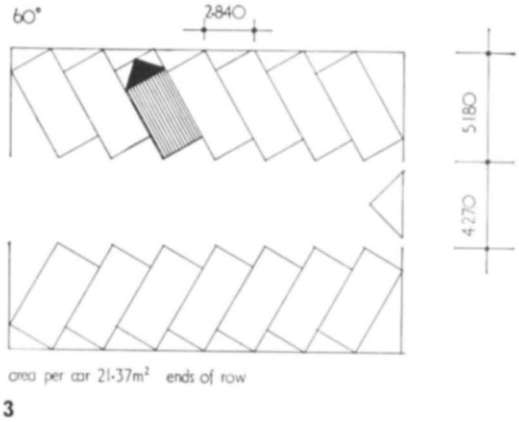

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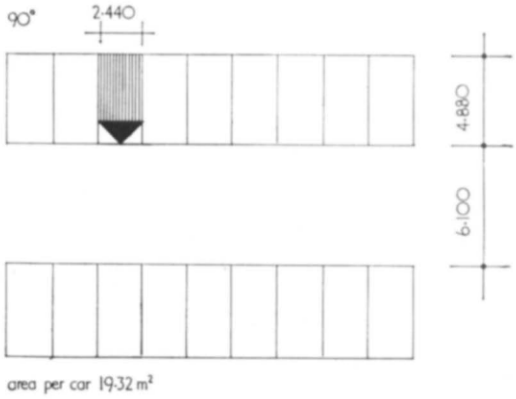

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3 Lighting, signs, payment systems

Lighting

3.01 The whole of a parking area can be lit in the same way as secondary roads (see information sheet LANDSCAPE 40). The lighting standard adopted can be the lowest as cars travel slowly but it should be adequate for pedestrian safety.

Directional signs

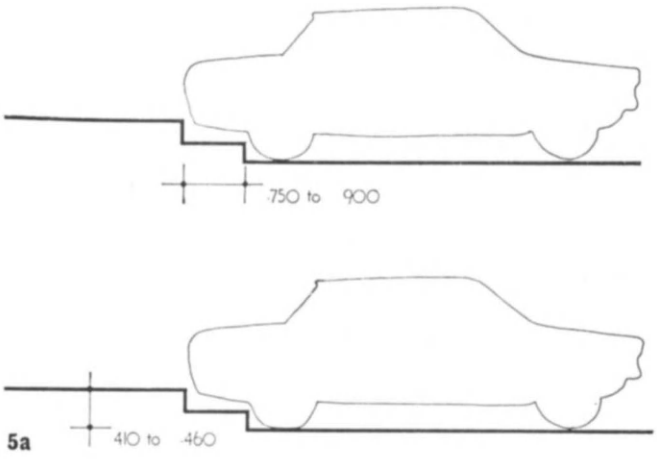
3.02 In all but the smallest car parks drivers must be given directions as clearly and as soon as possible if congestion is to be avoided during peak periods. Ideally layouts should permit extra exits to be made available at peak times. Signs should be more than 2 m above ground to prevent their being obscured by pedestrians but they should not be located much higher than this otherwise drivers may not be able to see them.

Payment

3.03 When a flat rate is charged, payment should be made on entry to avoid congestion; entry is often staggered whereas exit is in peaks. Payment at entry also eliminates the possibility of a driver being locked in if the mechanism jams or he has not got the necessary coin.

4 Planting

4.01 The most desirable and maintenance-free planting in parking areas is trees and shrubs. Trees provide shade in summer and improve the aspect of a car park by visually breaking up the appearance of a sea of metal. Shrubs are useful as hedging to screen off parking areas or, where space permits, to define some of the rows of parking.



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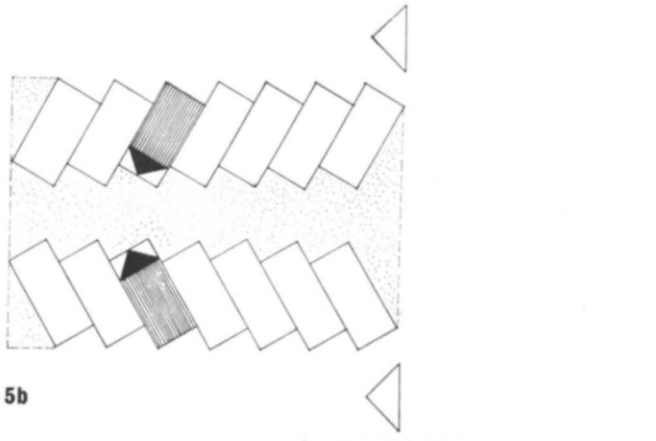

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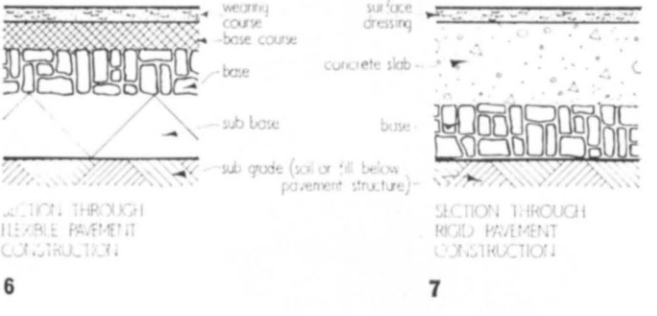

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1 *Parking parallel to traffic flow*
2 *Parking at 45° to traffic flow*
3 *Parking at 60° to traffic flow*
4 *Parking at 90° to traffic flow*
5a *When raised pedestrian areas are provided, remember that a car projects beyond wheelbase. Difference in level should be too great to prevent bumper riding over higher area*
5b *Tinted area shows possible raised pedestrian path*
6 *Flexible pavement construction*
7 *Rigid pavement construction*

4.02 In urban situations and particularly in congested areas where large car parks are usually required, planting may be affected by atmospheric pollution in several ways.

4.03 Information sheets LANDSCAPE 6 and 7 contain lists of trees and shrubs with an indication of those suitable for situations where they will be exposed to town smoke and industrial fumes. Such species are suitable for car parking areas, but it should be noted that deciduous trees with large leaves may cause problems in autumn; intermittent maintenance is needed to keep drainage clear. Some trees should not be used. (See list 1)

List 1 Trees that should not be used in car parks because they drop gums or berries or heavy leaves.
Lime varieties—*Tilia platyphyllos*
Tilia platyphyllos 'Rubra'
Tilia euchlora
Maiden hair— *Gingko biloba*
Horse chestnuts—*Aesculus hyppocanastum*

5 Construction

Bases and sub-bases

5.01 For other than the lightest traffic a suitable foundation must be provided, onto which the surface treatment of the parking area is applied. For flexible surface treatments (gravel, cold asphalt and coated tarmacadam) the component parts of the foundation are illustrated in **6**. For unit pavings (bricks, setts and cobbles) the foundation is basically the same. For a rigid pavement (eg concrete slab) the component parts of the foundation are illustrated in **7**.

Flexible pavements

5.02 For guidance on construction of parking areas surfaced with flexible pavements see information sheet 1423 (AJ 9.11.66).

Unit pavings

5.03 Where bricks, setts or cobbles are used to pave the surface of a parking area the construction of the base and sub-base is as for flexible pavements. See information sheet 1423 (AJ 9.11.66).

Rigid pavements

5.04 For guidance on the construction of parking areas surfaced with in situ concrete see information sheet 1424 (AJ 9.11.66).

Surface treatment

5.05 Choice of surface treatment is governed by the intended life of the parking area, the intensity, nature and intermittency of use, site conditions and of course cost (capital and maintenance). The following common methods of surface treatment are set out in roughly ascending order of permanence, durability and construction cost.

Grass

5.06 Grass is suitable for parking on if use is intermittent or not intense, but the area must be well drained. Ideally the grass should be coarse and kept mown or scythed. Long grass is more sparse and weak and much more easily damaged.

Stabilised grass

5.07 To give a more durable surface grass can be stabilised with bitumen. Newly planted grass seed is spread with sand to a depth of about 30 mm and sprayed with bituminous emulsion. The emulsion should be a non-toxic water based type and used at the rate of 0·75 litres/m². After the grass has appeared a further topping of about 6 mm stabilised gravel or sand should be given. The grass grows through this and forms a dense sward.

Stabilised gravel

5.08 Gravel surfaces can be stabilised by sealing with bituminous emulsion and rolling fine gravel into the surface.

This provides a surface more impervious to weeds and not subject to displacement by traffic like loose gravel. Bituminous emulsion to BS 434:1960[2] is sprayed on at rate of 1·5 litres/m² and blinded with coarse dry sand. After a few days a second layer is sprayed at the rate of 1 litre/m² and blinded with fine pea gravel (approx 6 mm diam; 1 m³ spread over 160 to 190 m²) and rolled with a 300 to 500 kg. roller.

Firepath pots

5.09 Firepath pots are precast concrete paving units, usually hexagonal or circular in shape, 100 mm thick with a hole in the middle. This hole and the spaces between pots are filled with soil and grass is grown. The result is an unobtrusive paved surface suitable for light traffic **8**. For notes on construction see information sheet LANDSCAPE 34 table VII.

Gravel

5.10 Gravel may be used as a surface treatment either sealed or unsealed. For notes and construction details see information sheet LANDSCAPE 34 para 1.42 and table VII.

Tarmacadam

5.11 Standard specifications for traffic areas using a tarmacadam surface treatment are given in *Specification for road and bridge works*[3]. General guidance is also given in information sheet 1423 table III (AJ 9.11.66).

Asphalt

5.12 Hot rolled asphalt is commonly used for areas of heavy traffic and is a two-course surface treatment (ie a base course and a wearing course). General guidance is given in information sheet 1423 table III (AJ 9.11.66), standard specifications in *Specification for road and bridge works*[3].

Unit pavings

5.13 Unit pavings such as bricks, precast concrete or granite setts and cobbles are suitable surface treatments for parking areas. They are unlikely to be economical for other than small areas, and must be laid on a suitable sub-base and base. For a description of materials and laying techniques see information sheet LANDSCAPE 34.

Concrete pavements

5.14 Concrete (rigid) pavements are dealt with in information sheet 1424 (AJ 9.11.66).

Surface water drainage

5.15 Surface water drainage for paved surfaces is dealt with in information sheet LANDSCAPE 134 paras 3.5 to 3.37.

Trim

5.16 See information sheet LANDSCAPE 35.

References

1 MHLG Design Bulletin 12. Cars in housing 2, HMSO, 1967.
2 BSI BS 434:1960. Bitumen road emulsion (anionic). The Institution.
3 MOT. Specification of road and bridge works. HMSO, 1963.

8 *Firepath pots give fairly unobtrusive paved area. Grass can be grown in holes in pots. Suitable for light traffic*

Information sheet Landscape 39

Section 10: **Elements of landscape construction**

Street furniture

This information sheet by SHIRLEY ANDREW *is a guide to the design, choice and layout of street furniture in the urban landscape*

1 Design principles

General

1.01 Although the term *street furniture* covers a wide variety of items, from litter bins to lighting standards, most of them have the common characteristics that they are relatively small in scale in the urban environment and tend to be present in large numbers—for example, parking meters.
It is mainly because of these characteristics that street furniture so often emerges as a disruptive element in the landscape. But there are of course other reasons, such as lack of design sensitivity, and the fact that several different authorities are often responsible for the various items.

1.02 Poor design, and the difficulty of locating the better designs, have also had an effect. However, the situation is steadily improving, largely as the result of the efforts of bodies such as COID which not only actively encourages good design but publishes a guide to aid selection[1].

1.03 The following notes cover the general principles to be observed in choosing and siting street furniture.

Function

1.04 The first rule should be to establish that an item of street furniture is really necessary in the situation under consideration.

Siting and layout

1.05 Successful results are easier to achieve when the landscape designer is responsible for the several items of street furniture which may be required, because in this way it is often possible to group them coherently.

Form and appearance

1.06 When the landscape designer is responsible for all street furniture it should not be difficult to ensure that there is design continuity, or at least design sympathy, between the design of individual items. Even when other authorities are involved in the provision of street furniture, for example letter boxes and bus shelters, it is highly desirable that consultation should take place and that the landscape designer should co-ordinate the work.

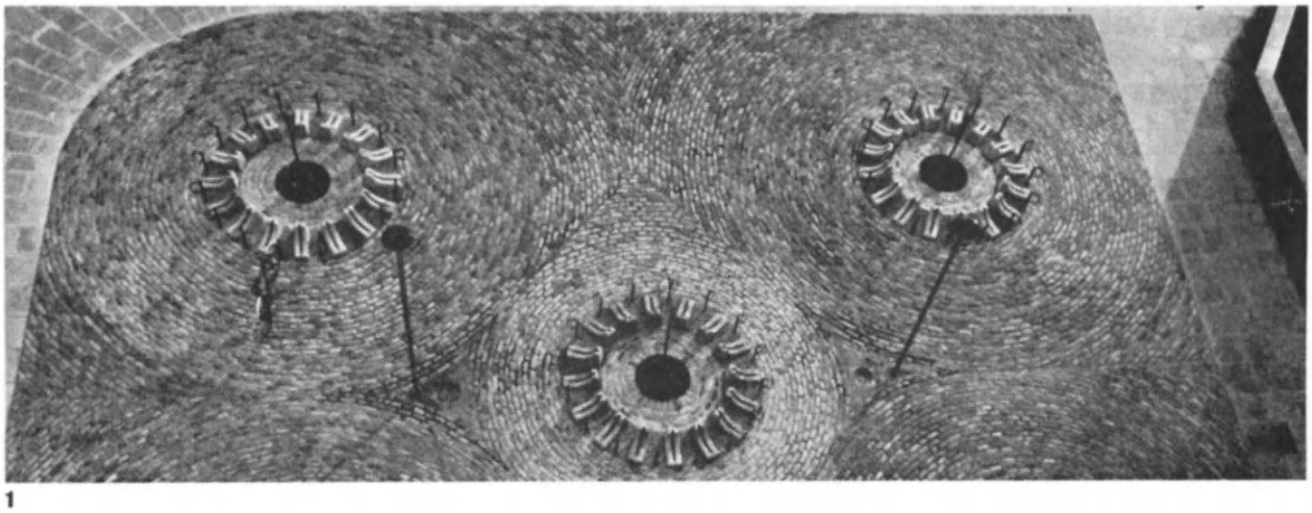
1.07 The apparent size of an item of street furniture in relation to its surroundings is what constitutes scale. While actual size is governed by function and sometimes also by statutory requirements, it is important to select individual items that combine to provide the right scale in any given situation.

1.08 Practical considerations influence the choice of materials (see para 3 below), and colour is often dictated by the nature of the material.

1.09 As a general guide colours should be as neutral as possible unless the function of the street furniture demands otherwise.

1.10 Design does not finish with the selection of the appropriate items of furniture, and their layout. Most items either stand on the ground or are fixed to walls, and the detailing of these junctions is highly important. Where the base of a fitting is on (or comes through) paving, for example, it is essential that the paving be properly finished around it, and relaid if necessary. Street furniture should look as if it has always belonged with the street rather than having been thrust upon it **1**.

1 *It is not enough for street furniture to be well designed and correctly laid out; equally important is the problem of incorporating fittings into surrounding surfaces so that they 'belong', and do not obtrude. This successful example is part of Lecture Halls at Cambridge, by Casson, Condor & Partners*



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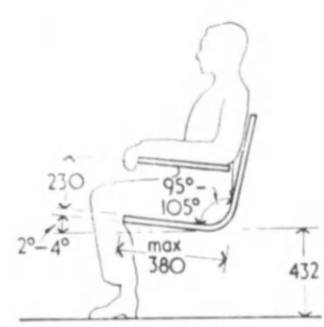
2 Choice

2.01 Table 1 is a checklist of the factors to be taken into account in the choice of suitable street furniture.

Table 1: Checklist for choice of street furniture

Function	List functions to be served by each item of street furniture and note the conditions required to enable these functions to be carried out effectively. See para 3
Durability	Check climatic and exposure conditions for effects on materials and construction. Check likelihood of vandalism and other exceptional conditions
Permanence	Related to durability. Requirements for street furniture at fairs and exhibitions may differ from those of more permanent situations
Intensity of use	Consider in relation to durability and permanence
Cost	Consider first cost in relation to maintenance
Local character	Check limitations on choice of materials imposed by local character



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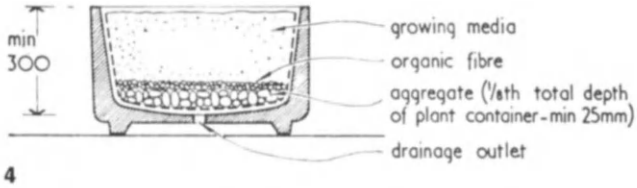

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3 Street furniture types

Seating

3.01 Sitting areas should be located in sheltered positions and where they are not too close to traffic.
On the other hand when people are sitting down they often like to be able to watch nearby activity such as traffic, shopping or children's play areas.

3.02 The form of seating is influenced by the nature of the material used: a hardwood bench should differ in form from a precast concrete seat. But ergonomic considerations should always be the basis of good design **2**.

Materials
3.03 Usual materials are hardwood (Burma teak, iroko, oak, afrormosia, African mahogany, African walnut, utile, afzelia, agba and keruing), precast concrete, and metal (aluminium, mild steel, cast iron). Cast iron is not much used these days because of cost. Softwood is suitable provided it is adequately protected with a paint system and subsequently repainted regularly. A fairly new development is the use of polyvinyl chloric in plank form. Most seating design uses a combination of at least two of the above materials **3**.

Plant containers

3.04 Plant containers are useful in defining spaces and forming enclosure. They can also define changes of level. As a general rule they should not be used where plants will grow naturally in the ground. In locating plant containers care must be taken to ensure that the conditions will be favourable for the plants. The main consideration is adequate light (sites under balconies for example are not generally desirable). It is advisable to avoid traffic fumes and wind.

3.05 The general principles of plant container design are illustrated in **4**.

Materials
3.06 Plant containers can be constructed in bricks, precast concrete blocks, setts, or formed of in situ concrete, provided suitable arrangements for drainage are made in the detailing. See AJ information sheet LANDSCAPE 36 for notes on types of brick and construction principles.

3.07 Proprietary plant containers are available in precast


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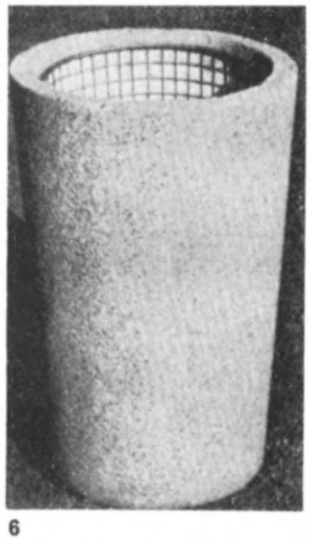
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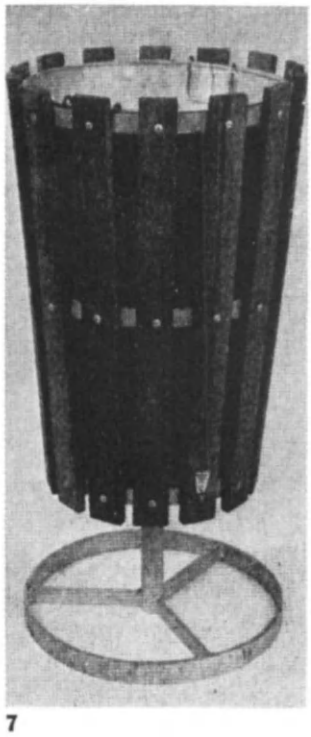
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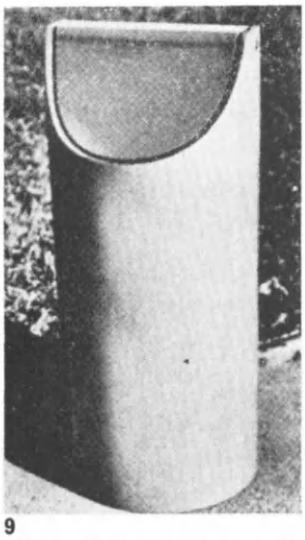

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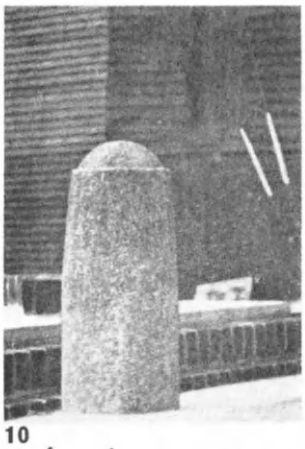

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2 *Critical seat dimensions*
3 *Bench consisting of hard wood slats on galvanised or nylon-coated steel frame (Street Furniture Ltd)*
4 *Basic principles of plant container design*
5, 6, 7, 9 *Proprietary litter bins made, respectively, of stainless steel and precast concrete (Abacus Municipal Ltd); timber (Furnitube Associated Products Ltd); and glass fibre (Abacus Municipal Ltd)*
8 *Freestanding concrete base with sackholder, suitable for situations requiring temporary or movable litter bins (Bowater Packaging Ltd). Wall mounted types are also available*
10, 11 *Contemporary concrete bollard and traditional metal bollard*
12 *Car park post, hinged at base, with special locking mechanism (Le Bas Tube Co Ltd); and* **13** *collapsible post (Borer Engineering Co)*

concrete, clay or terracotta, natural stone (usually in granite or marble but also in Portland and York stone), asbestos cement and metal. Where metal is used it is important that the interior should be coated with, for example, a bitumastic paint to prevent toxic metallic salts affecting the plants. Generally metal containers (galvanised iron, zinc, lead or aluminium) are more appropriate to window boxes. Timber is also used but always with a waterproof lining **7**.
Glass fibre is mainly used in the manufacture of reproduction antique urns although there is no reason why this material should not be used for contemporary designs.

Growing media

3.08 Plants grown in containers such as concrete tubs are likely to suffer from a shortage of water, aeration or nutriment. The roots will be restricted in their spread. It is therefore advisable to use a prepared mix of loam, peat and sand. It may be necessary to replace some of the soil or add fertilisers from time to time depending on the varieties grown. Plants which do not mind dry conditions will be safer as tubs dry out more readily than the ground. The bottom should have at least 40 mm of coarse aggregate for drainage.

Litter bins

3.09 Despite campaigns to educate the public into better habits the British are among the worst offenders for spreading litter. This particular item of street furniture therefore is likely to become increasingly prevalent. Because of this it is especially desirable to locate bins wherever possible in conjunction with other items of street furniture. Unfortunately if people are to be encouraged to use them their presence must be fairly obvious which goes against the general principle of street furniture design and layout, namely unobtrusiveness.

3.10 When choosing a proprietary litter bin the following should be borne in mind. Bins should be securely fixed either to the ground, to a wall or post (such as a lighting standard). A type of bin with a removable inner container to facilitate emptying is preferable. In many instances, particularly recreation areas in hot weather, litter bins can quickly become smelly and should be provided with covers which should be hinged. Where the emptying of litter bins is infrequent it is important that they are weatherproof. Where vandalism is prevalent it is advisable to choose a fireproof bin.

Materials

3.11 Materials of proprietary litter bins include precast concrete **6**, metal (aluminium, galvanised or plastic-coated sheet steel) **5**, timber (generally used in conjunction with a metal frame) **7**, and glass fibre **9**.

Movable bins

3.12 Occasions such as fairs, carnivals and race meetings give rise to the need for temporary or movable litter bins. These usually consist of free-standing containers on metal or precast concrete supports with disposable paper sacks **8**. Wall-mounted types are also available.

Bollards

3.13 Bollards are a traditional method of preventing vehicular traffic encroaching on to pedestrian areas. They are also useful in defining spaces, for encouraging flow of traffic and for marking boundaries.

3.14 Bollards have the advantage that they do not form a visually continuous horizontal barrier and need not be high.

It is seldom necessary to exceed 1 m in height and less will usually suffice.

Materials

3.15 The function of a bollard (ie that of physical barrier) demands that it be robust. Metal has been much used in the past **10**, but the most prevalent material is now precast concrete **11** and there is a wide range of designs available.

3.16 It is usual to set permanent bollards about 300 mm in the ground depending on height and diameter of bollard and soil conditions. They are set in concrete bases below the ground (1:2:6 mix) which should be sufficiently far below pavement level to allow for the full thickness of the paving material.

Removable bollards

3.17 It is sometimes necessary for bollards to be removable to permit occasional traffic to pass. Proprietary forms are available.

Car park posts

3.18 These are used to mark off parking bays in a parking area and sometimes also to provide a means of locking a parked car in the bay, in which case the posts are hinged at ground level **12**, or drop into containers buried in the ground **13**. See AJ information sheet LANDSCAPE 38.

Tree grilles

3.19 Trees placed in paved areas should be provided with grilles around the base so as to protect the soil while at the same time permitting water and air to get to it. Grilles are generally made of cast iron in sections small enough to handle to facilitate removal for maintenance **14**. Perforated precast concrete sections are also available. Care should be taken in detailing the junction of grille and paving to ensure a neat appearance and avoid misplacement of the grille or damage to the edges of the paving.

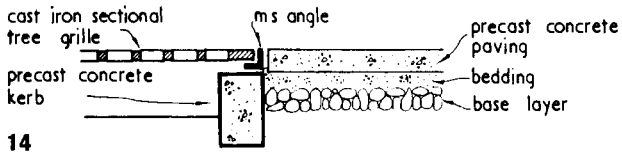
Guard rails

3.20 The function of a guard rail **15** ranges from that of discouraging pedestrian movement off a given circulation area to protecting public footpaths from road traffic. In the former case a minimum barrier is called for; in the latter a sturdy one. Unlike other items of street furniture such as litter bins and parking meters the guard rail is a continuous element and should more easily fit into the urban landscape.

Signs[5]

3.21 The function of a sign is to communicate and its design should therefore ensure instant recognition. If they are to achieve this object, while at the same time being in keeping with the other elements of the urban scene, signs should satisfy the following basic design principles: uniformity of appearance, simple expression of the message, use of symbols in preference to text wherever possible, and use of standard typeface, colours and supporting structures. A multiplicity of signs can lead to visual confusion with the result that the message is not received or, if received, not adequately retained.

3.22 Signs should be grouped together as far as possible, consistent with their purpose. Care should be taken to avoid signs being obscured by other structures or by trees. They should be visible not only during the day but also at night. Where possible they should be fixed to walls or other structures such as bus shelters to minimise the number of free-standing structures.



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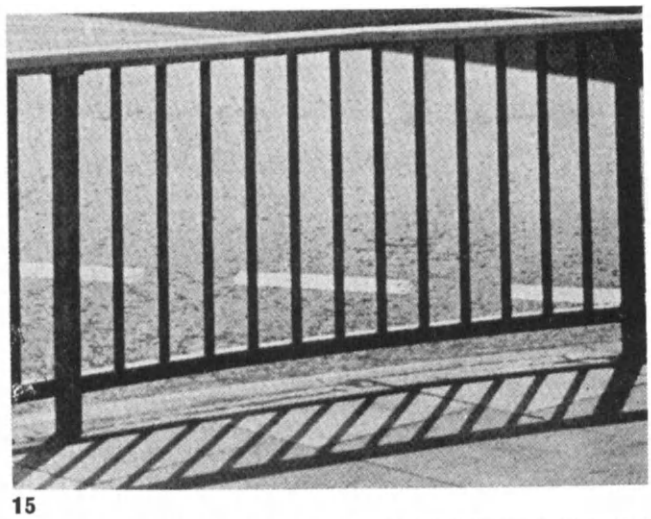
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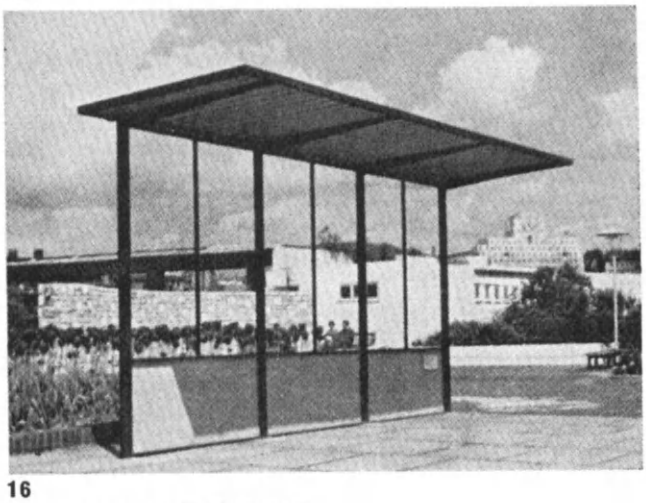
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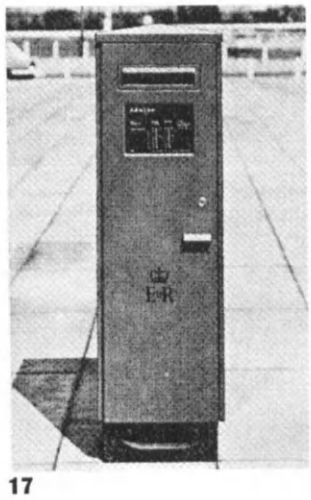
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14 *Section through tree grille at junction with paving*
15 *Guard rails, being continuous elements, are more easily incorporated in streetscape than individual items such as telephone kiosks and bus shelters. Neat example of proprietary aluminium balustrading (Albert Cook & Son)*
16 *Attractive proprietary unit-system type bus shelter (Abacus Municipal Ltd)*
17 *In general, contemporary letter boxes are nondescript in comparison with traditional cylindrical type. This one is an exception to the rule*

Size

3.23 Generally lettering and symbols should be no larger than will enable them to be seen clearly from the appropriate distance.

Mounting height

3.24 Signs in pedestrian areas should be at or above standing eye level. The eye level of a car driver, on the other hand, is below that of the pedestrian and a mounting height of 1·07 m to 1·2 m to the bottom edge of the sign is adequate. Generally variation in mounting height is to be avoided.

Lettering

3.25 Lettering should be bold and generally of simple design. Most traffic signs now employ a sans serif usually lower case. The report of the committee on traffic signs for all-purpose roads[3] is a useful guide to lettering, the spacing of letters and types of sign.

Methods of sign manufacture

3.26 There is a wide range of techniques for producing signs, including the following:

Painted signs

3.27 The traditional method and still quite suitable where only a small number of signs is required. Much depends however on the skill and techniques of the signwriter.

Raised or incised lettering

3.28 Materials for solid letters mounted on or standing clear of a background are usually sheet metal, cast aluminium or sheet plastic. Incised lettering can be formed in stone or, concrete or engraved on metal or cut out of plastic sheet.

Transfer lettering

3.29 Letters are printed on a thin film with water or spirit soluble gum and the layer of paint forming the letters are subsequently slid off the temporary carrier and stuck to the surface of the sign.

Photographic reproduction

3.30 Photographic prints of typesetting is a technique suited to short-life signs for, say, exhibition use. But more permanent signs can be produced by this process by incorporating the prints in a weather-resistant laminated plastic.

Silk screen reproduction

3.31 An economic technique where small numbers are required, modern screen printing can be carried out using glass, metal or timber as the background.

Scotchlite reproduction

3.32 A patented technique whereby a film of Scotchlite is bonded to a suitable background.

Display posters

3.33 The design requirements for display posters are broadly similar to those of signs: they are intended to be easily seen and absorbed. However, the message of a poster is usually less important than that of a sign and while it should be designed and located so as to be easily seen it should not be too obtrusive or its effect on the visual environment will be detrimental.

3.34 Well-designed poster panels for mounting on walls and free-standing units and stands are now available from a number of manufacturers. See *Street furniture from design index* 1970/71[1].

Bus shelters

3.35 There are several proprietary systems of standard bus shelter currently on the market, some of which **16** are much better looking than others. See *Street furniture from design index* 1970/71[1].

3.36 In choosing suitable designs consideration should be given to those which provide for signs on the structure and incorporate other items such as bins and display panels.

Street lighting

3.37 The subject of street lighting is dealt with separately in AJ information sheet LANDSCAPE 40.

Letter boxes and telephone booths

3.38 The traditional cylindrical letter box is a joy to the eye. Unfortunately some of the later designs have been less attractive. A recent design **17**, however, shows a return to the standards of the past.

3.39 Public telephone booths have not in the past been among the more attractive items of street furniture. Unfortunately their function and size ensures that their presence is all too obvious. Again recent designs show a welcome improvement.

Traffic and parking control

3.40 Traffic lights, traffic island standards and parking meters are common items of street furniture over which the independent landscape designer has little or no control. Liaison as far as possible with the responsible authorities is desirable because even if it is impossible to persuade them to re-locate items, the landscape designer will learn in advance where these elements are to be placed and can ensure that other items do not conflict with them.

4 Manufacturers and proprietary products

4.01 Information on materials, products and construction is to be found in trade catalogues. One of the most useful sources of trade information is the Design Centre, 28 Haymarket, London SW1. Information on proprietary products can also be obtained from The Building Centre, 26 Store Street, London WC1 and regional building centres and from trade development associations. See para 5.

5 Reference and sources of information

References

1 Council of Industrial Design. Street furniture from design index 1970/71. London 1970, the council. *Price* £1·00

2 WEDDLE, A. E. (editor) Techniques of landscape architecture. London, 1967, William Heinemann Ltd. *Price* £4·50

3 MOT Traffic signs. Report of committee on traffic signs for all-purpose roads. HMSO.

4 GRAY, NICOLETE Lettering on Buildings London 1960, Architectural Press Ltd. (Out of print)

5 CROSBY, FLETCHER and FORBES. A signs system manual. London, 1970, Studio Vista. *Price* £3·60.

Sources of information

The Design Centre, 28 Haymarket, London SW1

The Building Centre, 26 Store Street, London WC1

British Precast Concrete Federation, 9 Catherine Place, London, SW1

Cement and Concrete Association, 52 Grosvenor Gardens, London SW1

Timber Research and Development Association, 26 Store Street, London WC1

Information sheet Landscape 40

Section 10: **Elements of landscape construction**

Outdoor lighting

When designing lighting layouts, architects often tend to concentrate on means rather than aims. It is a sound rule, in general, to consider the aims first (ie the visual effects desired) and only then the means of achieving them in the simplest possible way. This information sheet by JOHN M. WALDRAM *is, accordingly, divided into parts—aims, and means. It is intended to indicate principles and practice rather than working examples, so that architects may be informed when discussing the technical complexities of urban lighting with specialists*

Aims

1 General

Aspect of city at night

1.01 The aspect of a city at night is very different from its aspect by day. This is wholly determined by artificial lighting and thus notionally controllable, though coherent overall plans are rare (see para 3.08).

Functions of lighting

1.02 Lighting is used to convey information; in particular:
1 For safe movement of traffic, vehicular and pedestrian.
2 For maintenance of public order and to aid police.
3 For public amenity, to display features of the urban scene.
4 For commerce, to advertise and display wares.
5 For the use of buildings of all kinds.

Components of lighting in urban scene

1.03 Components of lighting which compose the urban scene include:

Under public control
1 Public lighting of streets, parks and precincts.
2 Lighting for information and control of movement, eg signals, traffic signs (mandatory and informative); beacons.

Not usually controlled
3 Display and commercial lighting: floodlit buildings, show windows, lighted or self-luminous advertisements.
4 Lighting in buildings (lighted windows).
Lighting units are important elements of street furniture and are visible by day as well as night.

2 Public lighting

Organisation

2.01 Lighting of city streets is the responsibility of the highway authority, usually the city council or county authority. Installation, operation, maintenance and often design are carried out by a department under an engineer responsible to the city or county engineer or, occasionally, directly to the council. The Electricity Board may install and maintain lighting as agents to the council. Where appropriate, the city architect and parks department may also be involved. Lighting of trunk roads is the responsibility of the Department of the Environment, the local or county authority acting as their agent. The principal task of a lighting department is to keep the thousands of lighting units properly maintained.

Technical requirements

2.02 Lighting of public streets is undertaken for reasons primarily of public safety, and is technically complex. Technical requirements are set out in the BSCP 1004: 1963[2], compliance with which is supervised by the DOE and is obligatory where grants from central funds are in question.
1 Design, size, location and lighting of traffic signs, signals and beacons is laid down by the DOE[3] on the basis of the Warboys report[3].
2 Most advertisements require the express consent of the local planning authority[4] who determine its suitability in the interests of amenity and public safety, although criteria of acceptability have not been formulated or officially defined. However, a code[8] has been issued indicating the maximum luminance of signs in various areas for four defined zones: recognised display areas (no limit); major shopping areas; secondary shopping areas; and residential areas and unlit traffic routes. Beyond these limits objection may be expected.

Advisory bodies

2.03 Advice in particular cases is available from the following bodies:
Royal Fine Art Commission for aspects of civic amenity and for buildings, monuments and scenes of architectural or historic importance.
Council of Industrial Design on the artistic design of individual items of street furniture including lighting equipment, for which they issue an illustrated booklet[5] of approved designs.
Association of Public Lighting Engineers on technical question of public lighting.

3 Visual design for night scene

Visual chaos: the city at night

3.01 Cities at night compound the layout of the streets, the architecture of buildings, street furniture, trees and gardens, signs and shop windows, traffic and people: all as revealed by lighting, ideally to produce a memorable whole. However, components to lighting to public streets and spaces are rarely installed with reference to each other or to the total scene, and visual chaos results—a point well illustrated when driving in an unfamiliar city during rush hour on a wet night **1**.

Coherence

3.02 A coherent and memorable city aspect at night is possible only if:
1 Various uses of streets are physically segregated.
2 There is a scheme for all forms of lighting, and it is enforced.

Segregation of function

3.03 Various functions of streets and open spaces can be separated, and enhanced at night by appropriate lighting without conflict of requirements:

1 Provision of walkways and shops at a higher level than the carriageway, and with bridges or subways for crossing the highway.

2 Off-street parking.

3 Provision of pedestrian-only shopping precincts with separated parking and service access.

4 Provision of a 'stoa'—ie with buildings overhanging the footway and supported on columns which visually screen the footway and shops from the carriageway.

5 Separation of pedestrian and vehicle routes in residential areas.

Lighting special features

3.04 Ideally attention should be drawn naturally to important features:

1 Drivers should be able to find their way easily, picking out traffic signals and signs and discerning other road users without being distracted by commercial lighting.

2 Shoppers should be able to find the shops they need quickly.

3 Fine buildings should be well shown or incorporated in surprise views, with less worthy buildings left inconspicuous.

4 Gardens and fountains should display their beauty without distorting the colour of surrounding foliage.

5 Monotonous areas can be enlivened by lighting a few attractive foci—turning them into landmarks.

Floodlighting features

3.05 Floodlit buildings **2** can be striking when seen from unexpected viewpoints or through openings—a floodlit church on a slight rise can appear to float over the whole town, and some engineering works (eg cooling towers, elevated roads and bridges) can be beautiful when appropriately lit at night. Lighting should not be indiscriminate. Each feature should have a dark surround (see para 10).

Commercial lighting

3.06 Commercial lighting is comprised of lighted displays in windows, and luminous advertising signs, each trying to outdo competitors **3**. Traders sometimes mutually agree on restraint, and local authorities may restrain displays on sites away from recognised commercial areas, but usually the desired effect of displays and signs is completely lost. Though signs at right angles to facades of buildings are individually more conspicuous from a road than those on the building face; in the mass they hide and conflict with one another; so a sign on the facade may be as effective without unnecessarily interfering with the scene.

Commercial signs must never confuse or conflict with traffic signs or signals; local authorities and the DOE have powers to have offending signs extinguished.

Traffic signs

3.07 Design, siting and illumination of all traffic signs is officially prescribed and little latitude is permitted.

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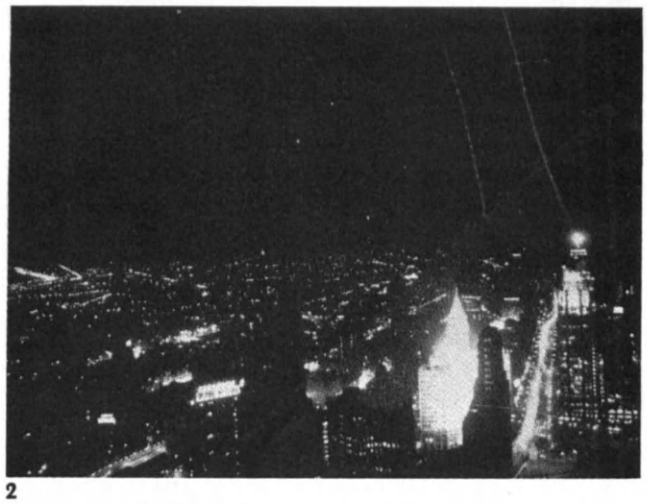

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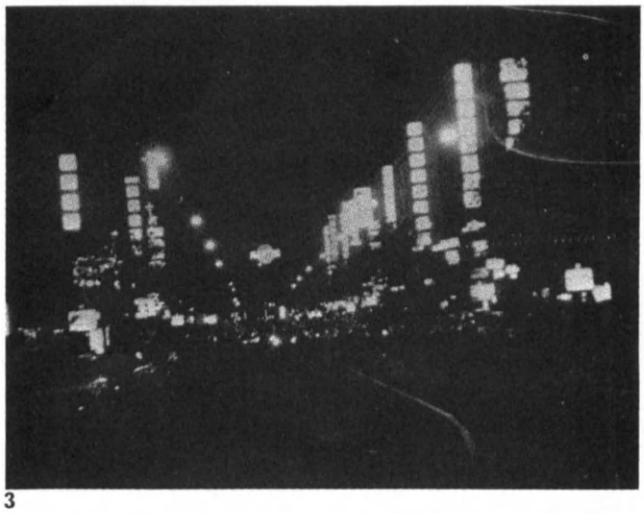

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1 *Confusion of signs, street lighting and traffic directions in a crowded shopping street on a wet night*

2 *Floodlit building giving punctuation and coherence to scene*

3 *Overcrowded advertisement signs mutually interfere*

4 *In Trafalgar Square, illuminated fountains and floodlit building providing visual foci*

However, siting them blindly according to regulations can result in absurdities or confusion.

Overall plan

3.08 It is important when drawing up a coherent lighting scheme to study the complete scene as perceived from key positions. When drivers' needs are considered, it is essential to include all features important to them, such as traffic signs and their backgrounds, so that their effectiveness can be appraised.

Though such planning can be seen in some cities rebuilt after the War, and in concerted action by a group of neighbouring authorities, it is generally rare. Valuable results may be possible however, by individual efforts on a smaller scale.

4 Lighting of city centres

4.01 Special lighting is required in the central areas of cities, for instance: civic centres with the principal municipal buildings and monuments; centres of night life and amusement, or of transport and traffic; shopping and commercial centres; or places of natural resort such as seaside promenades. Smaller towns and suburbs may not possess a large centre, but most have main streets or special vistas, which are natural centres by which the town is remembered.

British standard code

4.02 The Code[2] part 9 discusses lighting of areas of importance, including pedestrian precincts, public car parks, pedestrian subways, and, briefly, floodlighting and decorative lighting. Part 1 gives guidance on the daylight appearance of lighting installations.

Lighting level

4.03 Civic centres should be brighter than surrounding areas. The Code recognises this and provides for two grades of civic centres, specifying lighting levels on the horizontal surface for each. The level of illumination on vertical surfaces and shop windows is more important to the overall impression than the gross amount of light.

Visual foci

4.04 Monuments and fountains often afford natural foci for civic centres and can be most effective when appropriately lit **4**.

Parks and gardens

4.05 Light should not attempt to adorn gardens by way of visible lamps, but to serve it by revealing selected trees and plants, using white light to display their natural colours.

Festive lighting

4.06 Festive lighting may be needed. Provision of appropriate circuits can be made with outlets at public lighting standards and elsewhere. Though temporary, the lighting must be well engineered and capable of resisting rain and wind without failing or offering hazards to the public—this is specially important at seaside resorts.

Lighting equipment as street furniture

4.07 Lighting equipment should look as good by day as by night, and be sited so as not to interfere with day or night views. Guidance on these matters is given in the Code[2] parts 1 and 9. Scale of equipment, especially if column-mounted, must suit that of adjacent buildings. Important vistas must not be cluttered with too many columns; it is often better to use fewer and more powerful units on higher columns where the scale of the surroundings permits. In narrow streets it may be desirable to mount lighting equipment on facades of buildings, though this involves difficulties of wayleaves, maintenance and siting (see para 5.05).

5 Lighting of traffic routes

British standard code

5.01 Technical provisions for lighting traffic routes are controlled by BS CP 1004 : 1963[2] and are outlined in para 7.01.

Architectural aspects

5.02 For lighting equipment a degree of choice is possible; different types and finishes of columns and lanterns are available, and lamps and the colour of the light may be chosen to suit the urban scene; though this is largely governed by technical and economic factors.

Daylight appearance

5.03 Daylight appearance of lighting installations and their relation to their surroundings is discussed in the Code[2] part 1 clause 1.205. Lighting furniture can contribute to more formal situations, but the Code points out that inconspicuousness is generally best and that where safety permits, heights of columns should relate to heights of adjacent buildings. The Code also considers sizes and types of lantern; types of bracket, lantern and standard; and materials and finishes used. The array of lanterns—(whether they are seen against sky or buildings) is also important. Lanterns are usually best not sited directly in front of significant buildings or monuments, nor allowed to interfere with important views. The Council of Industrial Design publishes approved designs of standards, lanterns and brackets[6].

'One-off' equipment

5.04 Situations occasionally arise to justify designing special equipment. This is an expensive solution which should not be lightly undertaken. Where it is necessary to comply with the Code requirements for light distribution, considerable development work must be done and complexities involved in maintenance and stocking of spares should be appreciated.

Siting and fixing

5.05 Incongruous siting of fixtures is more likely to result from failure to consider architectural implications than from technical difficulties. Columns in narrow streets are particularly awkward though attaching lanterns to buildings for an uncluttered effect **5** often presents difficulties too: except in Scotland (where special powers exist), each fixing must be negotiated separately and the results can be aesthetically and technically untidy. It is often impossible to find sufficiently strong fixings on old buildings and wide footpaths limit the use of maintenance equipment. For technical reasons special siting rules apply at junctions and turns, lanterns must not form misleading patterns in perspective.

Street lighting for new buildings

5.06 It is occasionally possible to incorporate street lighting in new buildings. The relevant authority must be contacted to ensure that it forms part of the complete installation. Questions of ownership, access to the equipment, maintenance, electrical supply etc must be resolved.

Where buildings overhang footways to form a 'stoa', footways can be lit independently of the street lighting: the lighting should also be independent of shop windows. Lighting of a colour different from that of the street lighting may be considered; and there may be aesthetic advantage in lighting the footways strongly to silhouette

columns of the 'stoa' against a brightly lit background. Questions of ownership, electrical supply, maintenance, access etc will have to be negotiated here also.

Lanterns parallel with street axis

5.07 Lanterns may be used parallel with the street axis, mounted on building faces. This has special advantages in very narrow streets; and in all cases, lanterns are almost invisible by day and inconspicuous at night. Such systems demand very short spacings and high power compared with a conventional system, and the problems noted in para 5.05 also apply. A system of this type uses lanterns similar to linear floodlights and mounted high on buildings, using either linear tungsten halogen lamps or a special mercury-iodide lamp. This system is best suited to streets of uniformly high buildings.

6 Lighting residential streets

British standard code

6.01 Technical provisions for lighting lightly trafficked streets and footways are controlled (part 3 of the Code[2] outlined in para 7.01). They allow more latitude when siting lanterns and for distribution of light (especially in the case of footways) than requirements for traffic routes.

Minor streets and footways

6.02 The highway authority determines whether streets are to be categorised Group B1, 'lightly trafficked streets' or B2 'footways'. Lighting of the former is the responsibility of the highway authority, whereas footway installations are under the control of lighting authorities who are not highway authorities. Requirements for Group B1 are based on the requirements of vehicular traffic, but footways (B2) make no allowance for vehicles.

Lightly trafficked streets

6.03 Group B1 lighting should reveal the carriageway, footways and junctions, and avoid glare. In addition, heavy shadows as from trees must be avoided, and gardens should be lit to reassure pedestrians and assist police.
Lighting should suit amenities of the district—eg lower mounting height as tall columns are incongruous in streets with low houses. Lower mounting height can be an invitation to malicious damage in some areas. Anti-vandal enclosures of very tough plastic are available and reduce damage.

5 *Lanterns attached to buildings (high-pressure sodium lamps)*
6 *Symmetrical diffusing post-top lantern in residential area*

Where there are good gardens and trees, smaller fluorescent tubes or high pressure mercury fluorescent lamps are to be preferred to low pressure sodium lamps, light from which is devoid of colour rendering.

Footways

6.04 Requirements for footways are aesthetic rather than technical. Installations should be harmonious with surroundings; glare (often the result of long spacings between low mounted units) should be avoided, and there should be no badly lit patches to reassure those using the footway that no one is lurking in the dark. Lamps should be provided with anti-vandal enclosures.

Radburn and other layouts

6.05 The Code[1] does not cover lighting for residential areas not arranged on conventional streets, such as housing on Radburn and similar plans, high-rise blocks or blocks with footways and roads separated. In these areas lighting should primarily be of footways. Diffusing lanterns are often used with a symmetrical distribution of light **6**, and lanterns with canopies to reduce light reaching bedroom windows. Smaller paths, especially between houses, must be well lit for their whole length; small wall-mounted bulkhead fittings may be sufficient. Lighting should facilitate finding addresses.
Where there are carriageways for cars and trade vehicles, they should be lit as for group B1. Where vehicles and pedestrians are segregated, lighting can clearly differentiate the two, eg by using a white light for pedestrian ways and low pressure sodium for vehicular ways. Where there are high rise flats in areas subject to malicious damage, lighting can be by downward directed floodlights fixed to parapets and maintained from the roof by swinging them inboard on hinged brackets. The effect is not unlike moonlight, but lacks the intimacy of lower mounted lanterns and may create areas of dense shadow under overhanging parts.

Means

7 Lighting of streets

British standard code

7.01 The BS CP 1004: 1963[2] is issued in nine parts and indicates sound practice in the lighting of various features of streets, as follows:
Part 1: General principles
Part 2: Lighting for traffic routes } issued together.
Part 3: Lighting for lightly trafficked roads and footways (group B).


5


6

Part 4: Lighting for single-level road junctions and roundabouts.
Part 5: Lighting for multi-level interchanges (to be issued).
Part 6: Lighting for bridges and elevated roads.
Part 7: Lighting for tunnels and underpasses (to be issued).
Part 8: Lighting for roads with special requirements (ie roads in the vicinity of aerodromes, railways, docks or navigable waterways).
Part 9: Lighting for town and city centres and areas of civic importance (including pedestrian precincts, public car parks, pedestrian subways and stairways, and briefly floodlighting and decorative lighting).

British standard specifications

7.02 British standard specification for street lanterns[9] is a construction and performance specification for lanterns suitable for use in conjunction with the Code[2]. BS cover concrete[10], steel [11] and aluminium [12] columns, giving dimensions and performance. They do not specify particular designs.

Lighting of streets: principles

7.03 Technical basis for lighting streets is set out in the Code[2] part 1. Aims of the lighting are to reveal to drivers the run of the road ahead, and the presence and movements of other users of the road. This is best achieved with lighting from discrete sources of light suspended at a significant height above the surface of the carriageway, preferably in positions near the lines of the kerbs. Other considerations, especially reduction of glare, cost and aesthetics, lead to a spacing between lanterns of up to three or four times the mounting height.
The relationship between the geometry of the installation and the light distribution is complex. In general, the less the ratio of the spacing to the mounting height, the less critical is the requirement for light distribution. Therefore, results are better as the mounting height increases and the spacing reduces. However, there are aesthetic and practical disadvantages in short spacings, and the tendency has been to increase mounting heights to reduce the ratio.

Lighting traffic routes

7.04 The usual mounting height for lighting traffic routes is 10 m, though occasionally lower heights are called for (mainly in streets of architectural importance where higher units would be incongruous), or greater heights (usually in very wide or important streets). In multilevel intersections much higher mountings are often used (see para 8.03). Spacing is usually of the order of 20 m to 45 m, and lanterns should emit approximately 12 000 lumens in directions below the horizontal.

Cutoff and semi-cutoff

7.05 Cutoff and semi-cutoff are the alternative techniques for lighting carriageways. In the former, light distribution diminishes sharply to nearly zero above about 75° to the downward vertical; in the latter the diminution is less severe and emits light to higher angles. The respective geometries are linked to the distributions; for cutoff systems, spacings should not exceed 3·2 times the mounting height, but for semi-cutoff systems they may be up to 4·4 times the mounting height. Cutoff systems produce less glare and less light is directed at buildings, but at the expense of shorter spacings. They work best on rougher road surfaces. Semi-cutoff systems are less costly, as spacings are greater; buildings are better lit; advantage can be taken of less rough surfaces; but they tend to be more glaring.
Tables in the Code indicate the maximum spacing for various mounting heights and carriageway widths, with (in the latest amendment) preferred values indicated, for the two systems and for various arrangements of lanterns and widths of carriageway.

City centres

7.06 Part 9 of the Code permits lighting of city centres by large diffusing lanterns of higher power than usual and often at greater mounting height than in normal streets. In these cases requirements for light distribution are relaxed.

Siting lanterns

7.07 Part 2 of the Code provides for siting lanterns in various patterns:
1 Road of normal width—staggered arrangement.
2 Wider roads—opposite arrangement.
3 Dual carriageways—combinations of opposite and central or twin central. Trees may necessitate central lighting on narrower roads.

Lightly trafficked roads

7.08 Lighting to group B1 roads is generally similar to that for traffic routes, but with a mounting height normally 5 m, or where special reasons apply, eg wide roads, 6 m. Corresponding spacings are 33 m and 40 m respectively, ± 10 per cent. Light distribution is not rigidly laid down but 3000 to 5000 lumens (not lower hemisphere) at 5 m high and 5000 to 8000 lumens at 6 m must be provided.

Footways

7.09 For group B2, footways, mounting height must not exceed 13ft (3·962 m) (this is included in the definition of motorways in the Act); spacing must not exceed 60 m and is normally much less. A light distribution ranging from 900 to 3000 lumens from a simple diffusing lantern is usual.

8 Lighting particular features

Bridges

8.01 Lighting of bridges is discussed in part 6 of the Code[2]. Distribution of light from lanterns on bridges often has to be specially designed; a cutoff distribution is imperative. Objects on bridges may have little or no background against which they can be seen; lanterns on a humped bridge may form a confusing pattern against which vehicle lights can be lost. Bridges crossing railways or navigable waterways must not show lights which could confuse with signals or beacons.
Appearance of lighting equipment on bridges is important. The Code[2] discusses the view both from points on the bridge and from the side. Best views are often skew, and columns, especially in staggered formation, can present an unpleasing array. The relationship of lighting equipment to bridge parapets is also important, and the best solution may be to keep equipment clear of the structure. Lighting from parapets seldom succeeds. See para 12.03.

Vehicular tunnels

8.02 Lighting vehicular tunnels presents many problems and specialist advice is essential at the early planning stage. Part 7 of the Code[1], dealing with tunnels, has not yet been published.

Lighting tunnel interiors
Lighting equipment is usually placed in the haunches of tunnels or, occasionally, on roofs. Lighting is usually with fluorescent lamps in continuous diffusing fittings providing about 150 to 200 lux by day, and reducing to about 50 lux by night. Fittings should be waterproof, sealed against ingress of dirt and corrosion resistant

Short tunnels
Short tunnels, ie those through which daylight penetrates and where the exit can be seen from the entry, present no great problems to the entering driver and lighting as described above is usually sufficient.

Long tunnels
Long tunnels where the exit cannot be seen from the entry, or where daylight from the exit does not effectively penetrate through present problems at the entry. The great range of brightness in daylight prevents drivers entering the tunnel from seeing obstructions just inside until entering and too close to avoid a collision. (It is not, as often thought, a problem of the time taken by the eyes to adapt.)
To overcome this, entry zones must provide an intermediate level of brightness, such that when outside, drivers can just see into this zone, and when in it, they can just see into the tunnel. The luminance of the zone must be about 600 apostilb and its illumination about 1000 lux. Length of the zone is usually around 60 m. Lighting should not be graded along the length of the zone. There are several techniques for lighting the zones:

Fluorescent lamps: If these are used the zone will require 20 or more continuous rows of tubes according to the width, switched in sections to accommodate various weather conditions.

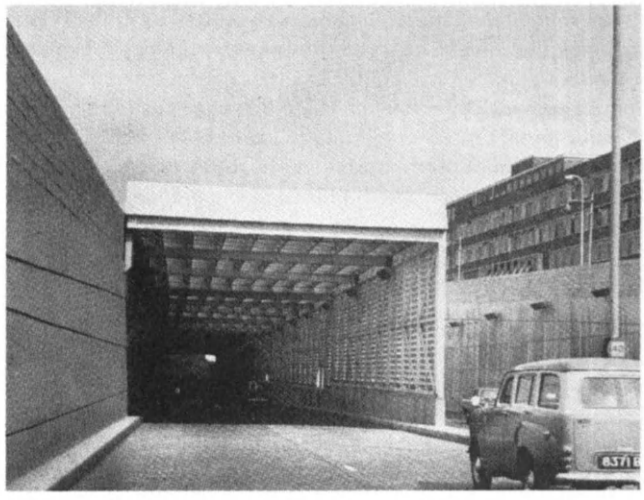
Lamps with high light output: Usually low-pressure sodium, placed at haunches and incorporated with continuous fluorescent tubes, which are used for night lighting. In tunnels with a curved entry zone they can be used to light the wall to form an effective background; careful location of this is essential.

Daylight can be used by providing an enclosure outside the tunnel with a louvred roof designed to exclude all sun and admit sufficient daylight to provide the necessary light. Capital cost is high, but operating cost, apart from cleaning and painting, is small. Artificial light is needed at night, and it is necessary to deal with snow which may fall through the louvre **7**. A shorter daylight louvre combined with an artificially lit zone within the tunnel proper may be used.

Tunnel surfaces
All tunnel lighting systems depend upon the provision and maintenance of light surfaces, which must permanently resist adverse atmospheric conditions including damp, diesel exhaust and frequent cleaning; and should not become electrically charged (as plastics do), which attracts dirt. Dark ceilings have no visual advantages, but may be necessitated when acoustic damping is provided on the roof. Carriageway surfaces should be dark outside the portal and light within the tunnel. All surfaces should be permanently maintained at the designed reflection factors.

Multi-level interchanges

8.03 The problem consistent with multi-level interchanges is that conventional lighting appears as a confusing constellation of lights. A method widely used is to provide lanterns on masts 25 to 35 m high and spaced 75 to 100 m apart. The result is to reduce the visual clutter **8**.



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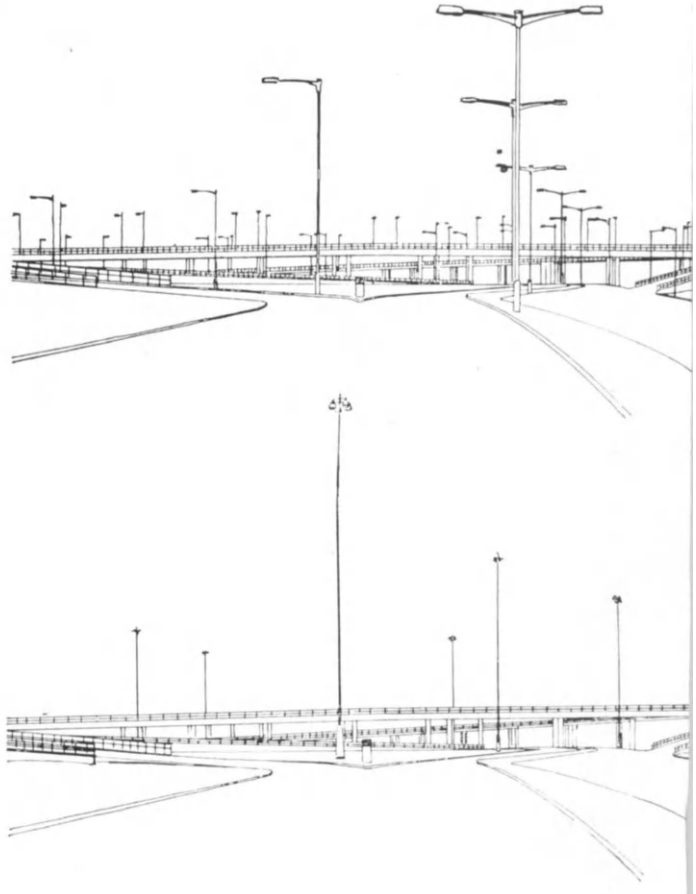

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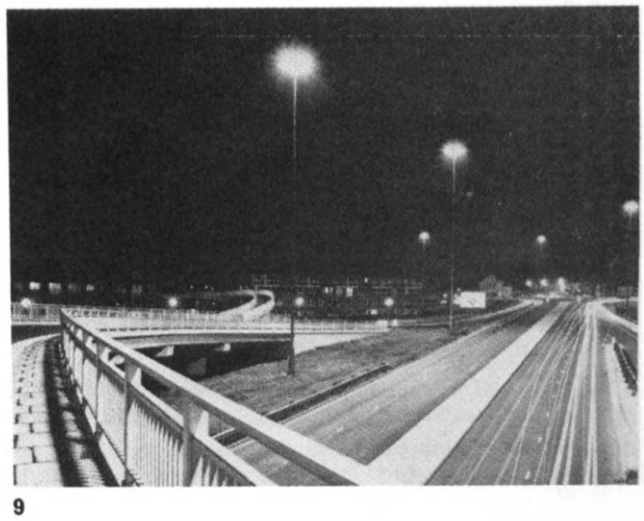

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7 *Vehicular tunnel with louvred entry to use daylight to reinforce entry zone lighting*
8 *Multi-level interchange perspectives showing conventional lighting giving considerable clutter, and lighting by high masts showing orderly aspect*
9 *Night view of multi-level interchange using high masts*

A common arrangement is three to six 400 to 1000 W HP mercury fluorescent or HP sodium lamps to a mast (several units to a mast avoids trouble if a lamp fails). Such a system should provide illumination to 50 lux over the whole area. Slender high tensile steel masts are inconspicuous. Costs have been found comparable with those of conventional lighting if one mast can replace seven to 10 conventional lamp columns **8**, **9**.

9 Lighting for other features

Lighting of large areas

9.01 Method of lighting depends upon the use and shape of the area, nature of surrounding buildings etc. The Code[2] part 9 discusses methods and gives examples.

Areas bounded or traversed by streets may be sufficiently lit by the street lighting installation, upgraded if necessary.

Intersections of several streets may be lit by large diffusing lanterns each with three or four large discharge lamps (high-pressure mercury vapour fluorescent, high-pressure sodium or mercury iodide) mounted on columns higher than usual—12 to 15 m high.

Pedestrian areas are often lit by diffusing lanterns using high-pressure mercury vapour fluorescent lamps, or several tubular fluorescent lamps, on fairly low columns (4·5 to 6 m high) distributed throughout the area. Where there are balconies or side galleries with walkways below them, such lanterns can be set on parapets of the gallery which give good height for lighting areas below them[4]. Illumination below such galleries or similar canopies can also be by fluorescent lamps on soffits.
Pedestrian areas may be floodlit from adjacent buildings; but this should be done with caution as severe glare may result. See para 6.05 (high rise flats).

Car parks can be lit by floodlighting equipment mounted on columns located to light along principal tracks and to avoid dense shadows between cars. They must not be liable to be struck by cars. White light should always be used to enable car colours to be recognised; low pressure sodium should never be used.

Large areas can advantageously be lit by multiple units on high masts—25 to 30 m high. See para 8.03.

Gardens and parks

9.02 White light is best for illuminating gardens, as coloured light produces colour distortions.
Sodium lamps should be avoided for lighting adjacent gardens.
Lighting equipment in gardens must be proof against accidental disturbance and vandalism, and accessible to maintenance staff only. Accessible low-mounted equipment must be particularly well designed to avoid any possibility of shock even if damaged; sunk units must be thoroughly watertight and precautions taken to avoid overheating. Units at ground level should be sited so that people cannot walk over them, nor cast shadows on the lighted beds when walking past them.

Flower beds are often lighted by low 'mushroom' units set in the beds, screened so that they do not emit visible light directly. Floodlights can be directed across beds, and will also light taller shrubs than can be accommodated by 'mushroom' units. Small PAR reflector lamps (para 10) can be used bare in suitable holders.

Trees are best shown by light which reaches their foliage directly from concealed sources; either floodlights from a distance or by projectors placed below them, preferably well away from trunks and directed upwards through foliage, possibly placed in sunk waterproof glazed boxes.

Paths in gardens can be treated as footways.

Large grassed gardens may be lit by a high mast system.

Fountains and pools

9.03 Best lighting effects for fountains and cascades are produced by submerged equipment, though cascades may be effectively floodlit. Choice between elaborate changing water and light displays and very simple displays using white light only will depend on cost and occasion **4**. Colour changing and changing jets require a control room with programmers, electrically controlled valves etc. Colour changes are best effected by separate fittings with different colour screens; motor-driven colour wheels have been used, but they are elaborate and costly.

10 Floodlighting

IES Report

10.01 Techniques of floodlighting are discussed in IES technical report 6[6] which should be consulted.

Principles

10.02 Floodlighting is the technique of lighting exteriors of building **10** or monuments by projecting beams of light on them. To obtain satisfactory modelling with floodlighting, the principal direction of light should make an angle of approx 45° to 60° with the principal direction of view. This is to show changes in illumination of moulded surfaces and shadows cast by mouldings and projections, to enable the form of the building to be picked out. Views from the same direction as the projected light ('down light') look flat and featureless. It is preferable that light should reach the building coherently from one principal direction.

Location of floodlights

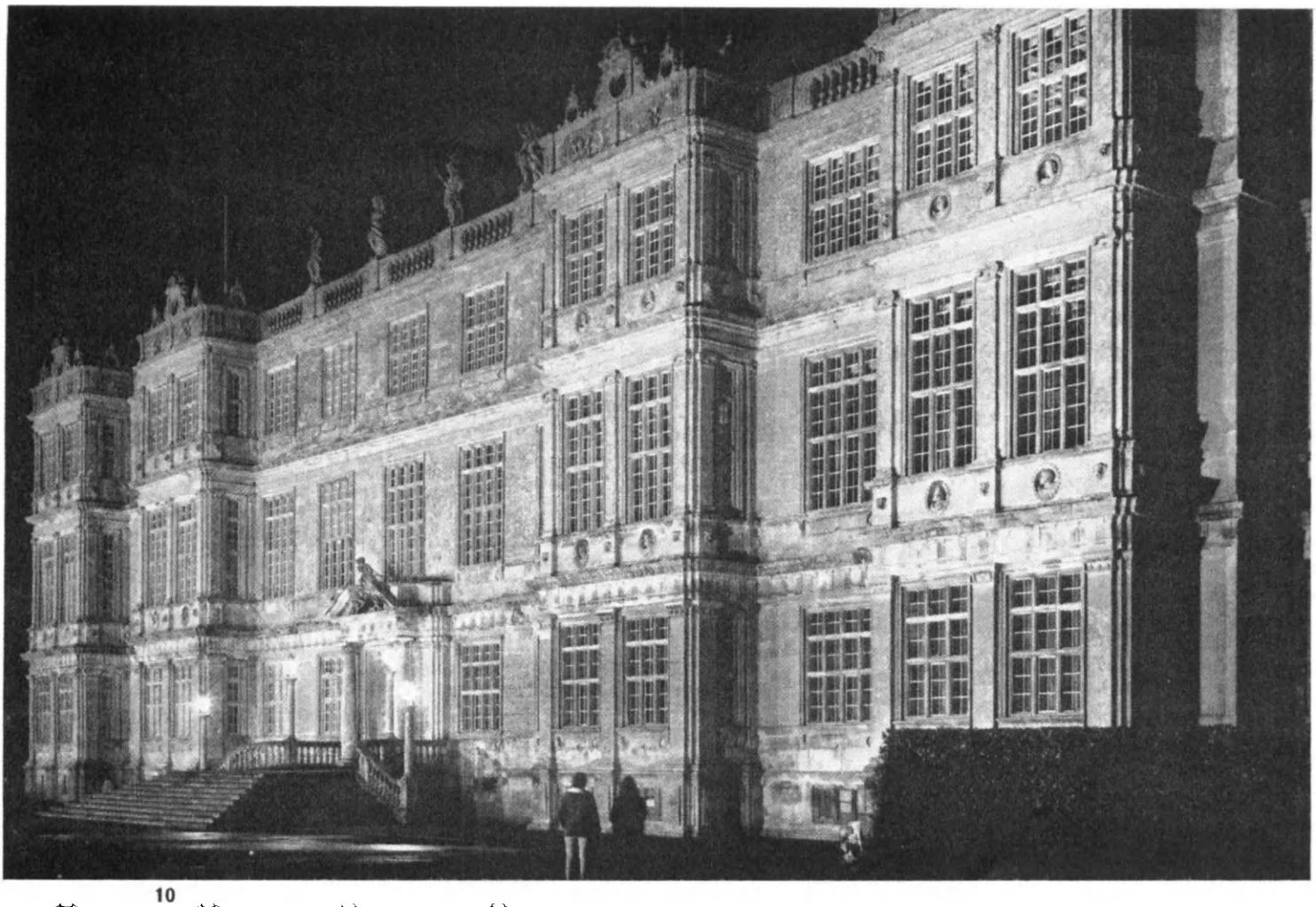
10.03 To produce coherent lighting source does not imply the use of only one projector or group of projectors; it is possible and usually convenient to use many, but the directions in which they project light should be co-ordinated. It is often desirable to provide some light in directions opposed to the principal modelling direction.
Best results are obtained by locating narrow beam projectors some distance from the building or monument. This is not always possible; in extreme cases equipment may be required on the façade—lighting from close offset. On such occasions lighting from underneath projections eg cornices, inverts natural daylight shadows, falsifies proportions and gives the façade a 'surprised look'.
Lighting must never be sited where it can cause glare to drivers of vehicles or to the public in important places, or throw shadows from moving objects.

Monuments

10.04 Floodlighting monuments and statuary from close offset is usually disastrous especially with faces lit from below. Light should fall appropriately, eg it is ridiculous if figures marching forward with high purpose have light on the backs of their heads and their faces in darkness.

Colour

10.05 A single colour can be used (or two or more colours



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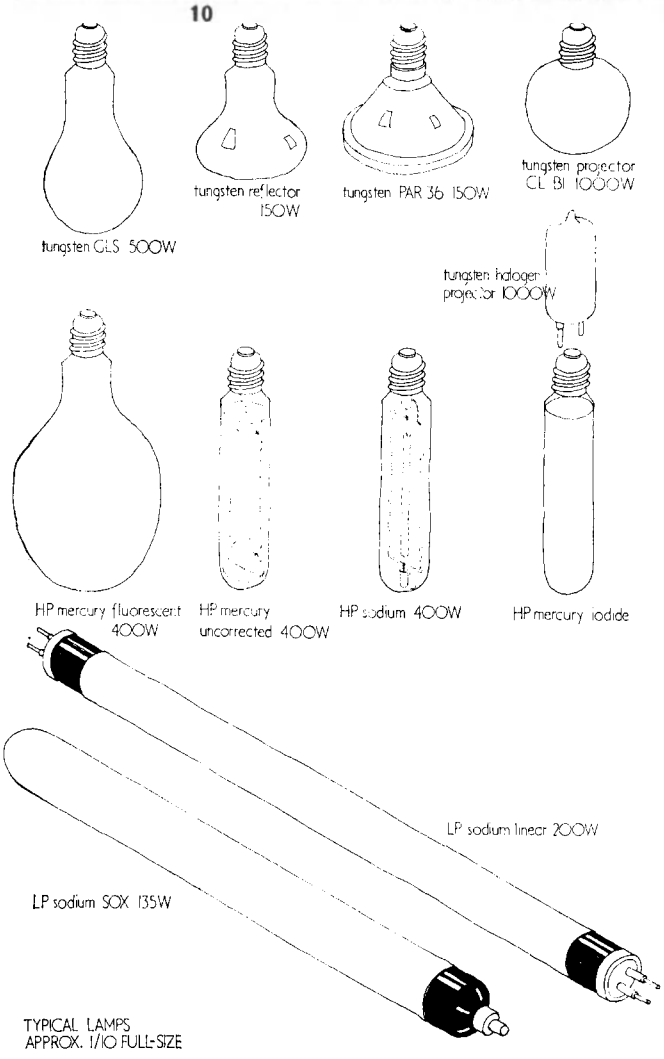


10 *Floodlit building: Direction of incidence is from directly in front; viewed from side. Better results would have been obtained by lighting from 45° to side, since principal viewpoint is from directly in front; with present lighting the effect is too flat*

11 *Comparison of lamps typical in urban lighting; approximately* $\frac{1}{10}$ *full size*

provided they are from different directions), but with great discretion if a building is not to appear tawdry: multi-colour effects are best suited to temporary displays. Single-colour floodlighting can be used to contrast with the colour of light used, say, for adjacent street lighting. It is pointless to floodlight coloured surfaces with light of a colour which they do not reflect well, eg to use light from mercury lamps (which is greenish) on red brick.

Amount of light

10.06 The amount of light needed for floodlighting a building depends upon:

1 Brightness of its surrounds.

2 Its surface finish.

3 Cleanness of surface.

IES technical report[6] tabulates recommended values for various surfaces. For fairly dirty surfaces the values should be multiplied by 3; however, the usual result of floodlighting dirt is to reveal it, and it is better to have the surface cleaned.

Floodlighting equipment

10.07 Details of floodlight equipment and performance are given in manufacturers' catalogues. Floods are available giving symmetrical and asymmetrical beams of differing

widths and intensities. Floodlights with stray light shields which project a beam with no spill light avoid lighting irrelevant nearer objects and disclosing positions of floodlights. One type projects an adjustable rectangular beam to fit the building.
Floodlights using linear tungsten halogen lamps and giving fan beams with different widths in perpendicular directions are specially useful for medium and close effects, and are, moreover, very small and easily concealed, though they run very hot. For short throws, sealed beam lamps of the PAR type are very useful. See para 11.

Installation and maintenance

10.08 Floodlights, though concealed from principal viewpoints and inaccessible to the public, must be accessible for maintenance. Back opening fittings often aids access. Some fittings have aiming stops that allow them to return accurately to the correct position following maintenance. Where there is no convenient fixing for floodlighting it is often legitimate to provide one on a column or pole.

11 Lamps

Principal types

11.01 The principal types of lamps used for outdoor lighting **11** are:

Tungsten filament lamps
There are four types:
1 General lighting service (as used for domestic lighting).
2 Reflector (blown and PAR sealed beam types); these have a bulb formed as a reflector and project a beam of light.
3 Projector with small filaments for use in projectors.
4 Tungsten halogen (projector and linear); linear type lamps are used in floodlights to give a fan-like beam.
Tungsten halogen lamps are brighter than conventional tungsten filament lamps, and have longer life.

Low pressure fluorescent tubes
1 Standard type (as used in domestic fluorescent fittings).
2 Window type; lamp incorporates white reflector which leaves a window; has greater brightness than usual.

Low pressure sodium lamps
These lamps provide a yellow monochromatic light devoid of colour rendering:
1 SOX type; the most efficient of all lamp types, with U-tube.
2 Linear type; somewhat less efficient, but suits certain fittings.

High pressure lamps
1 High-pressure mercury (uncorrected type); has a short line source and gives a greenish light of poor colour rendering.
2 High-pressure mercury fluorescent, has a large bulb and provides a white light of good colour rendering.
3 High-pressure sodium; has a short line source, very efficient with a warm yellow light of good colour rendering.
4 Mercury iodide; a similar lamp but with a purplish-white light of good colour rendering.
All lamps except tungsten filament lamps require auxiliary apparatus to enable them to start and run. For details the manufacturers' catalogues should be consulted.

Lamp characteristics

11.02 Characteristics of lamps vary over a great range and the choice of the most appropriate for a given purpose often

Table 1 Comparison of lamp characteristics

Lamp type	Size and shape	Source luminance	Light package	Colour appearance	Colour rendering	Luminous efficiency	Life	Lamp price	Operating cost	Main uses outdoors
Tungsten general lighting service	Small	Very high	Long range	Good	Good	Low	Short	Low	High	Floods; signs
Tungsten reflector			Small	Good	Good	Low	Short	Low	High	Small floods
Tungsten halogen linear	Very thin and long	Very high	Long range	Good	Good	Low	Short	Medium	High	Floods
Low-pressure fluorescent tubes	Very long	Very low	Low	Very good	Very good	High	Short	Low	Low	Signs; some floods; tunnels
Low-pressure sodium	Very long	Low	Long range	Yellow	None	Very high	Long	Medium	Very low	Streets; tunnels; floods
High-pressure mercury uncorrected	Thin, long	High	Long range	Blue	Poor	High	Long	Medium	Fairly low	Floods
High-pressure mercury fluorescent	Large	Medium	Long range	Good	Good	High	Long	Medium	Low	Streets; floods
High-pressure sodium	Thin, long	High	Large	Yellow	Good	High	Fairly long	High	High	Streets; floods
Mercury-iodide	Thin long	High	Large	Good	Good	High	Fairly long	High	High	Streets, floods
High-tension cold cathode	Very long	Low	Varies	Many	—	Fairly low	Very long	High	Medium	Signs

calls for specialised knowledge. The most important characteristics of a lamp are as follows: (See also table 1).

1 Source size and shape.
2 Source luminance (brightness).
3 Light 'package' available from one lamp.
4 Light colour appearance and colour rendering.
5 Luminous efficiency.
6 Life.
7 Lamp price.
8 Operating cost (depends on efficiency, life and price).

12 Impossibilities and misconceptions

Lighting without sufficient offset

12.01 Lighting surfaces from light sources almost in their own plane is frequently attempted. The result is that only the portion of the surface adjacent to the lamp is brightly lit, and the remainder almost unlit; if discrete units are used, the presence of each is disclosed by a conspicuous 'scallop' near it. Moreover, the lighting shows up the slightest irregularities in the finish. Wall-washing units are commercially available for lighting from a fairly small offset; but these require an offset of about one third of the lighted depth of wall, and for discrete units a spacing of not exceeding twice the offset.

Lighting roads from kerbs

12.02 It is often suggested that streets would be better lit from kerbs than from columns; this is an exaggerated variant of the previous case. Lighting from the kerbs themselves is impossible; the only part of the carriageway which would be lit would be the channels, and equipment at such a level is quickly so soiled as to become inoperative.

Lighting roads from parapets

12.03 This is discussed in the BS CP 1004: 1963[2] Part 6, appendix A. It is very difficult to make the centre of the carriageway bright, especially in wet weather. The number of units and the power required are both much greater than for a conventional system and the maintenance in some cases has proved to be prohibitively costly. The system has succeeded in underpasses with assistance from lighting by lanterns to higher levels **12**. On pedestrian ways, people are lit from the waist down when lighting is in balustrades. Equipment is very vulnerable. Used in balustrades to steps and ramps, there may be a problem of glare.

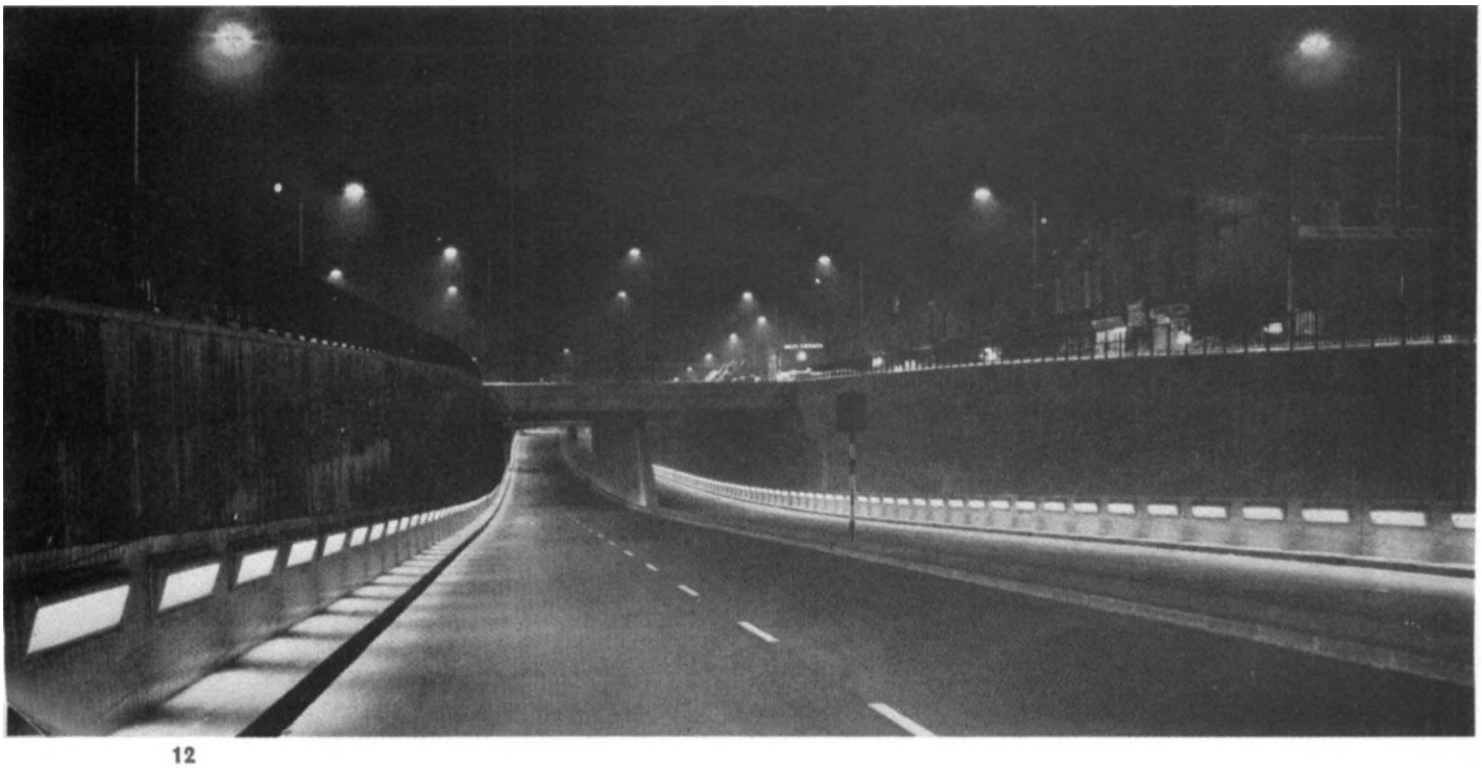
Precise control of light

12.04 Proposals are often made which involve projection of light over long distances or very precise control of light—sometimes in an attempt to light something only a few degrees from a direction in which glare must be avoided. Such installations are possible, eg on sports fields, but require expensive precision equipment; they should be avoided.

13 References

1 BS CP 1004: 1963. Street lighting [12(90.63)(N)]
2 Traffic Signs Manual. HMSO 1967 S.O. Code No 55-408 [12(90.71)]
3 Traffic Signs 1963: Report of the committee on traffic signs for all-purpose roads. HMSO 1963 S.O. Code No 55-403 [12(90.71)]
4 The Town and Country Planning (Control of Advertisements) Regulations 1969. HMSO statutory instrument 1969 No 1532 (HLG 44536) [05(AjK)]
5 COUNCIL OF INDUSTRIAL DESIGN Street Furniture from Design Index. London, 1970 [12(90.7)] *Price £1*
6 THE ILLUMINATING ENGINEERING SOCIETY IES technical report 6: The floodlighting of buildings. London 1964 [9(90.63)] *Price £1*
7 ELECTRIC SIGN MANUFACTURERS ASSOCIATION: Journey into light. London, 1964 [(90.63)(N)]
BRITISH STANDARDS INSTITUTION
8 BS 1788: 1964. Specification for street lanterns for use with electric lamps [12(90.63)(N)]
9 BS 1308: 1957. Concrete street lighting [12(90.63)(N)]
10 BS 1840: 1960. Steel columns for street lighting [12(90.63)(N)]
11 BS 3989: 1966. Aluminium street lighting columns [12(90.63)(N)]

12 *Underpass lit by low mounted units. Note number required compared with conventional lighting on the upper roads which make substantial contribution to underpass roads*



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Information sheet Landscape 41

Section 10: **Elements of landscape construction**

Indoor plants and window boxes

This information sheet by ALLAN HART *notes functions of indoor planting and window boxes, describes planting techniques and maintenance procedures, and lists readily available plants with their characteristics*

1 Indoor planting generally

Introduction

1.01 In 1842 the Wardian case was invented. It was a device, basically a glazed air tight box, that enabled plants to be transported over long distances and for long periods, with no ill effects. Today such controlled environments are on the scale of buildings; an example is the Ford Foundation Centre in Manhattan which has an indoor garden occupying more than half the total space **1**.

Functions of indoor planting

1.02 Indoor planting has many uses:
1 To relate internal spaces **2**
2 To link internal and external spaces
3 To give privacy, screening and visual barriers
4 To demarcate boundaries
5 To compliment or contrast in form, texture or colour surrounding materials, surfaces and objects.

Planting distances

1.03 Indoor plants are best planted in groups or massed together. They can either be placed directly into suitably sized containers or in individual pots which are then sunk into containers. The latter makes for easier replacement, should individual plants die or become too large for their position. Indoor plants are usually not as long lived as temperate shrubs and allowance should be made for their replacement. It is normal practice to allow about 600 mm between larger varieties and 150 mm to 250 mm between dwarf types.

Height

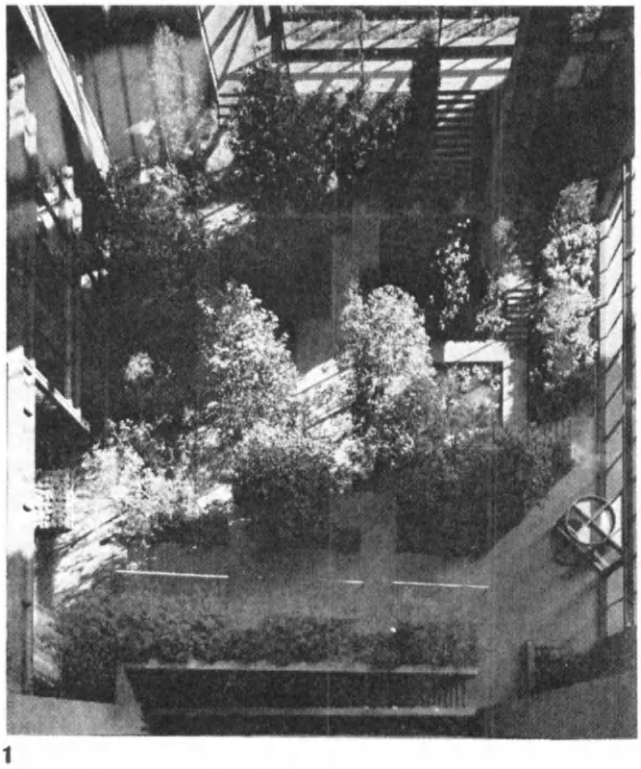
1.04 The critical height is related to eye level. Plants which reach above eye level are seen as screening or as a direction hazard. Indoor plants vary in height from prostrate to 4·5 m to 5 m and can grow to small trees; climbers can reach 6 m to 7 m.

Texture

1.05 At close quarters different textures of shrub can be used to compliment and contrast with different species and building surfaces. Texture can also apply to stems and branches as well as leaves.

Colour

1.06 Majority of plants used indoors are evergreen, as it is more important to have all year round foliage effect.



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1 *Ford Foundation Centre in Manhattan—a mature garden indoors*
2 *Experimental burolandschaft for Home Office at Kew, using planting in containers to demarcate boundaries, relate spaces and give privacy*

2

Available are all the different hues of green, in addition to variegations of gold edging, gold, white spots or blotches (*Dieffenbachia*). Leaves may also be grey or red. Flower colours range from white, pink, yellow to very strong reds and purples. In naturally occurring species and many cultivated plants, colours blend, but hybrid varieties often have harsh unsubtle primary colours. Also there are tropical plants with brightly coloured flowers. Flower colour is often subject to daily change eg those of the Brunsfelsia have buds one day, opening fully the next, and fading on the third.

Character

1.07 Because of the wide range of characteristics, factors such as habit, flowing effects, breadth (in proportion to height) help to distinguish different species and varieties of species that combine several characteristics.

1 *Bare stems:* All foliage and flowers are carried at the top of the plant in the light. These can appear gawky but stems can be hidden by facers.

2 *Facers:* Plants with a complete cover of foliage from base to top.

3 *Stems with character* and plants with groups of erect leaves from the base are very useful for vertical effect.

4 *Bushy spreading plants:* Plants which form a complete dome of foliage.

5 *Picturesque:* Plants with finely divided leaves, on elegant stems or Bromeliades with strap shaped leaves striped in grey, greens, pinks and reds.

6 *Large leaved:* Can be used for exotic effects, make an excellent foil against plain surfaces.

7 *Prostrate:* These are climbing and creeping plants and are useful for covering the surface and sides of containers.

8 *Shrubs which have large flowers* eg Hibiscus. They can be used en masse or individually.

2 Planting requirements

Basic requirements

2.01 Basic requirements for good growth of most indoor plants are: correct temperature; correct light intensity; moisture (either in the form of water or humidity); and suitable growing medium.

Temperature

2.02 Temperature between 10°C and 15°C will suit most plants during winter, though it should remain constant as fluctuations are harmful; 5°C to 8°C should be the maximum fall allowed, and then preferably at night when plants are resting.

Light

2.03 Ideal conditions are obtained with a medium to high level of illumination with indirect sunlight. Poor light promotes etoliated growth (long and spindly) as plants reach for light source. Direct sunlight, particularly through glass—which concentrates heat, can destroy new plant tissue. It is advisable to protect such planting with artificial shade.

Artificial light

It is possible to extend normal daylight hours with artificial light. This is often necessary during winter to improve growth. It is also possible to grow plants in totally artificially illumination by using low pressure fluorescent tubes.

Humidity

2.04 Unless desert type plants such as cacti and succulants are used, then a humid buoyant atmosphere must be provided. An overdry atmosphere results in excessive evaporation of moisture from aerial roots or leaves, causing plants to wilt. The necessary humidity can be obtained by several techniques:

1 By standing plant pots on moist peat filled trays

2 By standing plant pots on pebbles or gravel in a water filled tray. If trays are placed over radiators, evaporation of water in the trays will increase humidity

3 By spraying plants periodically with water. This can be done mechanically with spray lines linked with a water sensitive artificial leaf. When done manually, a hand syringe should be used about once a week.

Growing medium

2.05 Traditionally, plants have been grown in a formula of soil, peat, sand and fertilizers—known as John Innes compost. Recently discovered synthetic mediums, however, are now being more widely used.

Vermiculite

The inert material is first soaked in a solution containing the correct proportions of plant nutrient and trace elements. It has several advantages over John Innes compost:

1 Lightness; weighs only 1/7 that of soil

2 Constant high quality of material

3 Moisture retaining and fully aerated

4 Nutrients can be scientifically controlled

5 Material can be easily sterilised and reused

6 There is little need for repotting plants

Levington compost

A recent development to replace JIC that consists of granulated peat treated to raise the pH to neutral and balanced with trace elements. Its advantages are similar to that of vermiculite.

Soil exhaustion

2.06 Plants in pots generally exhaust nutrients quickly. Plants potted in JIC eventually become pot bound and sickly and should be repotted every one to two years. The top inch of compost should be replaced every nine months.

3 Maintenance

Maintenance of new planting

3.01 During establishment, care must be taken to ensure that extremes of wetness and dryness are avoided. Spraying foliage helps reduce amount of water required until new roots are grown.

Maintenance programme

3.02 Programmes should encourage plants to develop quickly, but without being forced by overfeeding. Climbing and creeping plants may need frequent tying to trellis work or pegging to masonry surfaces with galvanised wire pins. Dead foliage, stems and flowers should be removed as soon as possible as dead plant tissue encourages fungal diseases.

Fungus

3.03 Plants may be attacked by fungal growth if the atmosphere becomes too cold and dry, as plants are then unable to absorb any excess moisture.

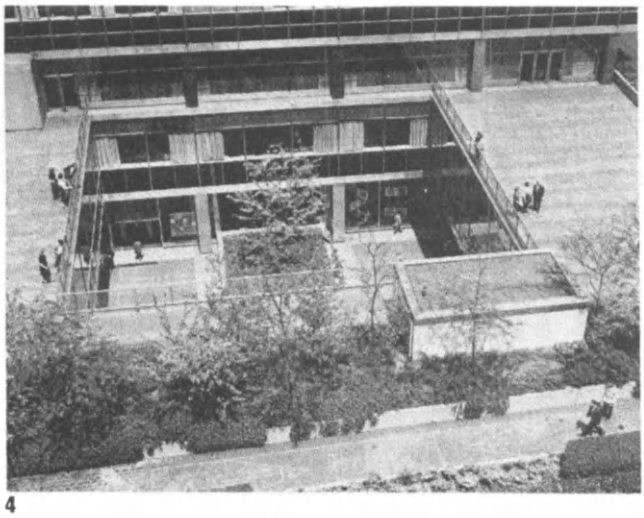
Pests

3.04 A constant surveillance should be kept for:

Red spider mites

These cause a yellowing and papery look to foliage. This is most likely to occur in a warm dry atmosphere, but can be deterred by water spraying under leaves, though an approved chemical spray should be used for heavy infestations.

3



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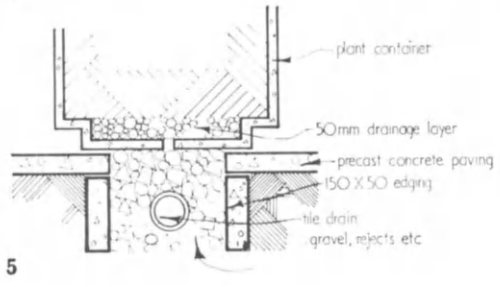

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3 *Indoor plant containers*
4 *External plant containers as part of landscape layout for paved areas*
5 *Drawing shows technique recommended for draining external plant containers in paved areas*

Green fly
These quickly develop into large populations on growing points and may need spraying with an approved chemical several times.

Scale insects
These look like tiny flat mussels and are found on stems and leaves. They are best removed by brushing with cotton wool soaked in methylated spirits.

Mealy bugs
These are tiny blobs of cotton wool-like material containing eggs and young bugs. Plants with hairy leaves are liable to damage, and the bugs should be painted with diluted methylated spirit.

Using chemicals

3.05 Chemicals used for pest control should be non-toxic to human beings, birds and animals.

Contract planting services

3.06 There are a number of firms who will plant and maintain indoor displays on a contract basis, which usually includes replacement of plants at no extra cost.

4 Plant containers

Function

4.01 Plant containers are best used when they form part of a landscape layout for paved areas **4**; or when a flexible layout is required.

Siting

4.02 For planting to succeed in containers, they should be sited with consideration for the following points:
1 Containers are most logically positioned in totally paved areas
2 Planting needs overhead light, and if light intensity is too low or from the side, growth will become 'drawn' (etoliated)
3 Containers should not be placed under balconies or other projections that will deny light and moisture to planting
4 Containers should be positioned away from draughts, windswept areas, traffic fumes, road spray (salt) etc.

Dimensions

4.03 Dimensions will depend on whether the container is intended to be fixed in position or portable. For containers fixed in position any size will suit provided a minimum depth of 600 mm is allowed for tree planting and 300 mm for shrubs. Portable containers intended for manhandling should not exceed 600 mm × 600 mm × 300 mm when filled with compost.
Containers intended for seasonal displays must be dimensioned to allow for metal basket inserts.

Container planting

4.04 Plants are grown in wire basket containers at the nursery and the whole basket is placed in the container on site. There are several advantages:
1 Easy to maintain
2 Easy to transport
3 Easy to ensure all year round planting effects—evergreen plants in winter that can be replaced with spring bulbs as they come to flower.

Drainage

4.05 All containers should be provided with base holes to allow surplus water to escape. Permanently positioned containers can be placed over tile drains under paving **5**. Portable containers should be provided with a drip tray if there is any danger of paving being stained. All containers require a drainage layer of gravel or crushed brick to a depth of at least 50 mm.

Maintenance

4.06 Planting in containers generally requires more water than in other circumstances. This is because there is usually an excess of evaporation caused by heat radiated by adjacent paving. Provision should be made for water standpipes within a reasonable distance. If containers are sufficiently large or closely linked in groups, irrigation by spray line or pop-up sprinklers should be considered.

5 Window boxes and balcony planting

Function

5.01 Planting can be used on multi-storeyed buildings to reduce the feeling of isolation from the ground and sense of exposure. Plants relieve hard lines and edges of windows and with them it is possible to create the illusion of living surrounded by greenery.

External window boxes

5.02 There are several types of external window boxes **6** and **7** available: lead, terracotta, asbestos cement, stone, concrete and wood. Sizes will vary to suit locations, but the minimum recommended cross-section should be about 200 mm × 200 mm. 13 mm diam drainage holes should be positioned in the floor of boxes at 150 mm centres, and provision should be made for disposing of the drained water; either with a weathered cill detail if the box is in situ, or with a zinc drip tray if the box is not. Timber boxes should have waterproof linings, eg zinc.

Positioning

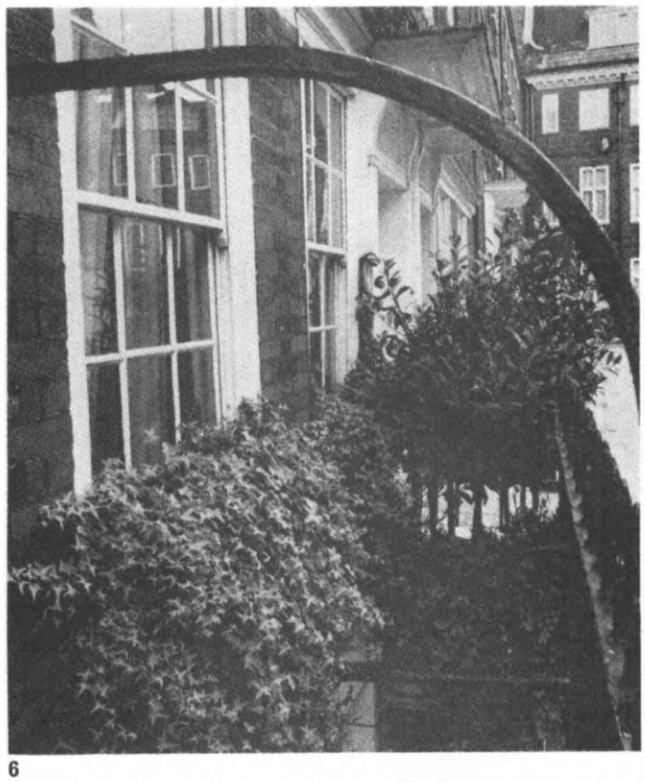
Boxes can be sited on any elevation (provided planting is selected to suit the orientation), and are best positioned below cill level for ease of access and so as not to reduce the daylighting effect of the window. Heavy boxes are secured to tops of cills by their self-weight, but in all other circumstances, adequate fixing should be provided.

Internal window boxes

5.03 There are two types of internal window boxes: those glazed on both sides of the box—closed window boxes; and those against the inside of windows—open window boxes. Both allow for the control of temperature, ventilation, humidity, lighting and shading, though closed window boxes are the more effective, and expensive, of the two. Boxes can be provided with single or double glazing, adjustable blinds, artificial lighting, heating and ventilation.

Construction

Construction of the window room for closed window boxes should be of materials that resist the effects of humidity and are easy to clean. Window boxes can be of wood with a waterproof lining, stone, concrete or asbestos cement. Drainage should be provided as described in para 5.02. The minimum dimension between internal and external



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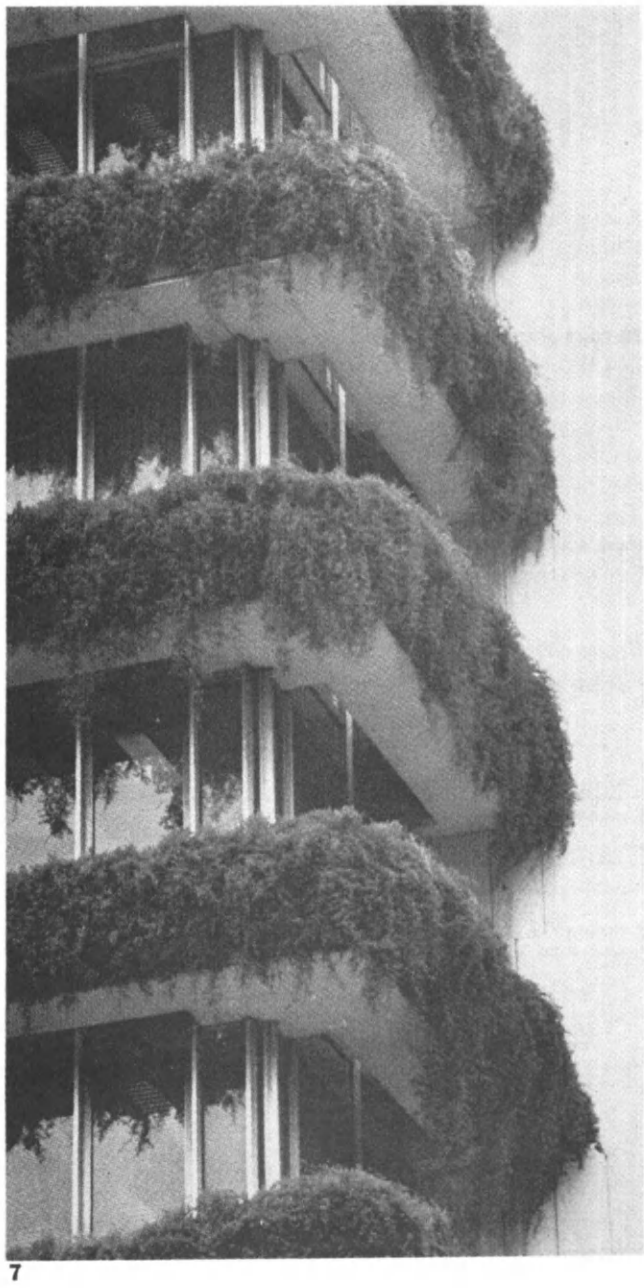

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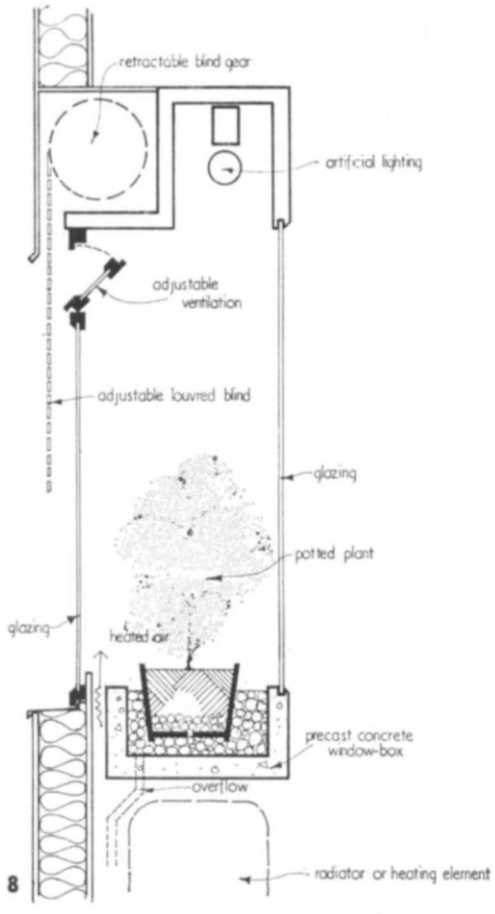
6 *External window box*
7 *Office building in Athens with external window boxes almost completely hidden by planting*



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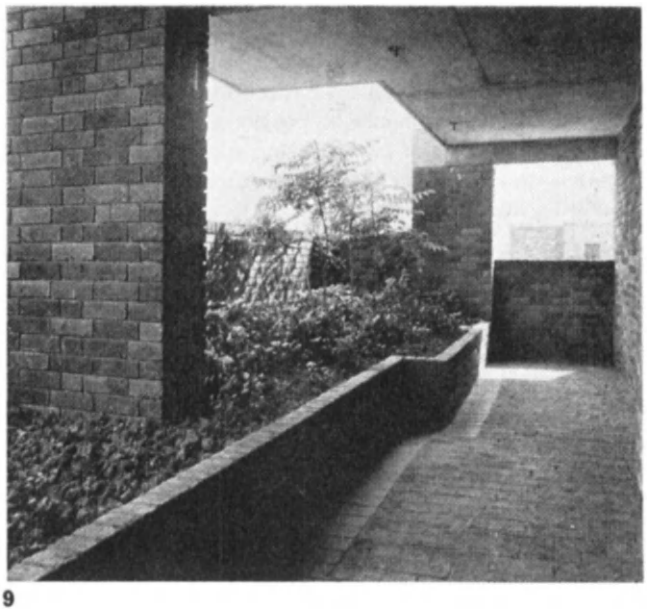
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8 *Drawing to show relationship between various components of an internal closed window box*
9 *Balcony planting (not yet mature) on an access balcony to a housing scheme*

glazing of closed window boxes should not be less than 350 mm **8,** and provision has to be made for cleaning glazing.

Balcony planting

5.04 Balcony planting **9** generally requires less maintenance than other techniques of planting, and water can be provided to planting bed by direct rainfall, and irrigation by rainwater being collected from roof etc and fed by pipes to the beds. This can be done below the surface by perforated pipes. Shallow rooted plants should be used, or roots will find their way into the pipe openings. After the water has passed through the soil it can be collected in a catch pit underneath the drainage layer and conducted down to the next bed. It is likely that these methods will be inadequate during establishment and periods of drought. At these times irrigation can be by overhead nozzles to give total coverage of plant beds. For best results the system should be automated and linked with soil tension meters, to give the optional level of ground moisture.

Planting

5.05 Rootballs, if parched, should be soaked in water for ten minutes before planting. Plants should be placed 150 mm apart and generously watered. See information sheet LANDSCAPE 10 para 10.01 for soil for planting. Most nurserymen's catalogues note orientation, planting distances, planting season, size of mature plants, flowering life and colour. See tables I to V and information sheet LANDSCAPE 7.

Key to abbreviations

Foliage:	P/G pale green	Temperature range:	1 10°C minimum	Light requirements:	A full sunlight
	M/G mid green		2 10°C to 20°C		B indirect sunlight
	D/G dark green		3 20°C		C shade

Common name	Botanical name	Notes	Foliage
Table I Stems with character			
Including plants which produce rosettes of leaves from the base instead of stems			
snake plant or mother-in-law's tongue	*Sanseviera trifasciata var. laurentii*	ABC 123	Strong sword-like leaves of mottled green edged with yellow. Slow and persistent
	The *Bromieliad* family. Many flower, some with multi coloured bracts growing from centre rosettes, others with flowers deeply set into the growing centre of the rosette. Generally long flowering, like semi shade and moderate temperature. Water by filling centre of rosette. Include:		
	Aechmaea fasciata		Large and spreading up to 600 mm across. Leaves pale grey with green band under. 100 mm wide at base with rounded tips
	A. fulgens		Upright long leaves 50 mm across. Green and silver, purple under. Flowers red
	Cryptanthus zonatus		Star fish like 200 mm diam. Stiff leaves with stripes of green, cream and light brown

Common name	Botanical name	Notes	Foliage
Table II Stems			
	Dieffenbachia picta	Needs lots of space B 1	D/G leathery
	Schefflera actinophylla	B 2	Palmate—up to 300 mm across. 7 to 8 lobes per leaf, D/G leathery
indoor lime tree	*Sparmannia africana*	A 1 to 2	Large P/G hairy leaves, white scented flowers in summer. Rapid grower
	Dizygotheca elegantissima	B 2	Leaves dark copper dissected and serrated. Stems marked with cream. Very beautiful. Needs careful attention
	Fatsia japonica (syn Aralia japonica)	B to C 1	Leaves D/G hand shaped. 300 mm to 400 mm across on long stalks. *Fatsias* usually have a single thick stem. Tropical appearance though hardy outdoors in sheltered positions
	Hibiscus rosa—sinensis	A 1	Leaves D/G on woody stem. Flowers are large trumpet shaped, pink to red
	Allamanda cathartica	A 2 to 3	Leaves P/G, large yellow trumpet flowers. Naturally a climber but can be pruned to shrub form
	Brunsfelsia calycina	A 1 to 2	Leaves M/G. Scented blue flowers in summer. Needs pruning to obtain flower bearing shoots
Table III Climbers			
Plants listed are also useful for covering sides of containers. Many climbers, particularly smaller leaved types, can be used as scramblers if shoots are pegged down			
ivy	*Hedera helix*	A 1 to 2	Can be trained to frame windows, through trellis etc
	Hedera helix Chicago	A 1 to 2	D/G
	H.h. sagittaefolia	A 1 to 2	arrow shaped leaves
	H.h. Shamrock	A 1 to 2	Very D/G
	H.h. Spearpoint	A 1 to 2	Small pointed leaves
	H.h. Pittsburgh	A 1 to 2	prolific growth
	H.h. Marmoret	A 1 to 2	Large leaved, blotched and mottled yellowish white
	H.h. Marginata	A 1 to 2	Silver margins
	H.h. Marginata aurea	A 1 to 2	Yellow
	H.h. Glacier	A 1 to 2	Silvergreen
	H.h. Harold	A 1 to 2	Silver/yellow
	H.h. Lutzi	A 1 to 2	Cream and green
canary ivy	*H. Canariensis*	A 1 to 2	M/G, will tolerate hotter-drier conditions than Hedera helix
	Hc: Gloire de Marengo	A 1 to 2	Large yellow variegated ivy
	Hc: Golden Leaf	A 1 to 2	3 pointed transparent green, centre of leaf and veins golden
	Columnea gloriosa Superboa	B to C 3	All columneas are best in baskets. Small hairy leaves like velvet. Red trumpet-like flowers
	C. microphylla	B to C 3	Very small olive green hairy leaves. Trumpet like orange-red flowers
	Cissus Genus containing some 200 species. Temperate plants climb by tendrils		
kangaroo vine	*C. antartica*	B 1 to 2	Leaves P/G when young, D/G with hairs and serrated edges when adult. Quick grower
	C. discolor	B 3	Leaves purple shaded metalic green and silver, crimson undersides Ovate and hanging. 150 mm needs support—humidity and high temperature
kings vine	*C. antartica russikivin*	B to C 1	Vine like habit. Medium to rough textured P/G leaves. thick reddish stem
dwarf japanese fig	*Ficus pumila*	B 1 to 2	Tiny heart shaped P/G leaves with small suckers. Will give thick mass effect to walls if they are slightly textured to enable suckers to cling. Climber or trailer
	F. radicans variegata	B 1 to 2	Leaves green streaked with silver
grape ivy	*Rhoicissus rhomboidea*	B 1 to 2	Trailing or erect. Rapid growth. Leaves P/G glossy, toothed with 3 parted growing tips of silvery pink
chestnut vine	*Tetrastigma voinierianum*	B 1 to 2	Erect or creeping, needs support. Leaves glossy M/G, silver edge. rather limp horse chestnut shape
	Monstera deliciosa Note: *Montsteras*, with *Philodendron* and *Scindapsus* naturally grow on the stems of trees, anchored there by aerial roots which provide support and take up moisture and nutrients. Correspondingly they will thrive better if provided with a material such as cork or sphagnum moss (which must be kept perpetually moist, not waterlogged) into which they can root	B 2 to 3	Can be very vigorous. D/G shiny large leaves with oval holes
	Philodendron andreanum	B 2 to 3	Single stem leaves, large arrow shaped, pale pink then dark purple velvet. Silver veins
	P. elegans	B 2 to 3	Erect slightly twisted with fine aerial roots. Leaves very finely fingered oval, M/G, up to 450 mm wide and 600 mm long
	P. laciniatum	B 2 to 3	Erect twisted with fine aerial roots. Leaves M/G large round cream markings at centre
	P. leichtlini	B 2 to 3	Erect twining leaves, P/G, medium oval with oval shaped holes. Almost appearance of more hole than leaf
	P. scandens	B 2 to 3	Thin fleshy stems, heavily leaved with shiny heart shaped leaves
	Scindapsus aureus	A 2 to 3	Twining stems with aerial roots for support and feeding. Heart shaped leaves, P/G to marble with pale yellow. Needs good indirect light to maintain vareigation
rambling sailor	*Tradescantia albiflora*	A 1 to 2	D/G with red undersides, small and shiny giving dense effect. Purple flowers
	T.a. tricolor		P/G leaves striped cream and pink
	T. fluminensis aurea		White and yellow stripes to P/G
	T. f. variegata		Leaves with silver stripes
	Zebrina pendula	A 1 to 2	P/G striped with silver and with mauve edges and shiny mauve undersides

Common name	Botanical name	Notes	Foliage
Table III continued			
	Z. purpusii	A 1 to 2	Dark brown/purple leaves
	Setcreasia purpurea	A 1 to 2	Thick stems which are hairy and slightly erect. Leaves long and narrow, pale purple
	Peperomias require care when watering—too much causes rotting. Need indirect sun and warm conditions		
	Peperomia glabella		Leaves P/G shiny and rounded, quick grower
	P. serpens variegata		Leaves yellow to P/G small and slow grower
Table IV Bold foliage			
	Monstera deliciosa	B 2 to 3	
	Philodendron andreanum	B 2 to 3	
	P. elegans	B 2 to 3	
	P. laciniatum	B 2 to 3	
	P. leichtlinii	B 2 to 3	
	P. scandens	B 2 to 3	
	Scindapsus aurea	A 2 to 3	
	Fatshedera × *lizei*	B to C 1	
	Fatsia japonica	B to C 1	
	Sparmannia africana	A 1 to 2	
rubber plant	*Ficus elastica decora*	B 1 to 3	Leaves D/G, shiny red undersides. Young leaves are pink. Leaf sheath is red. Erect with thick woody stem. Well grown plants will retain leaves from ground level. Quick growing
fiddle leaf fig	*F. lyrata*	B 1 to 3	Fiddle shaped M/G and glossy. Stiff and large (600 mm long) erect woody stem. Slow growing
flamingo plant	*Anthurium scherzerianium*	A to B 2	D/G oval leaves on long stalks with large red flowers which are long lived
	Aphelandra squarrosa louisae	B 2	Leaves 150 mm long, D/G with bold silver stripes. Flower bracts 50 mm long
Table V Facers			
Many climbers can be used as facers if carefully pruned			
	Plumbago capensis	B 1	Small M/G leaves. Small flowers in August to September. Normally semi-climbing and quick growing. Can be pruned to bush form
	Fatshedera × *lizei*. A cross between *Fatsia-japonica* and *Hedera helix*	B 1	Palmate D/G leaves. Erect with thick green leaves clustered all round stem
	Billbergia nutans	A 2	Narrow grass like M/G foliage. Flowers of green and blue with rose coloured bracts. If grown en masse will form low level facers

Footnotes to tables I *to* V

It is important that these lists are not regarded as a substitute for professional knowledge of plants and plant groupings. They should only be used for a preliminary selection. Plants listed have been chosen for tolerance, good growth without much pruning and to be commercially available. Generally plants should be selected with similar temperature and light requirements. If a group is to be planted within a large container they should also have the same water requirements.

Information sheet Landscape 42

Section 10: **Elements of landscape construction**

Roof gardens

TONY SOUTHARD *discusses not only gardens on roofs but all gardens on artificial structures. He deals with all aspects of such gardens from design and environmental conditions to planting and costs*

1 Why roof gardens?

1.01 Roof gardens dealt with in this information sheet may be located at any level from a few feet below ground to several hundred feet above, but they are all separated from natural ground by a man-made structure.

1.02 Roof gardens are becoming more important for several reasons: full use of roofs in crowded city centres can create extra space for recreation and this is increasingly becoming commercially viable; increasing segregation of pedestrians and traffic in town planning schemes often results in pedestrian levels above ground which can be improved by gardens; roof gardens can enhance the appearance of the seas of flat roofs seen from high buildings, elevated transport systems and so on; they can also reduce isolation feelings of people in high buildings.

2 Contribution of roof gardens

Appearance

Shape

2.01 Roofs can be given interesting form by exploiting structural shapes: eg the many types of pitched roof.

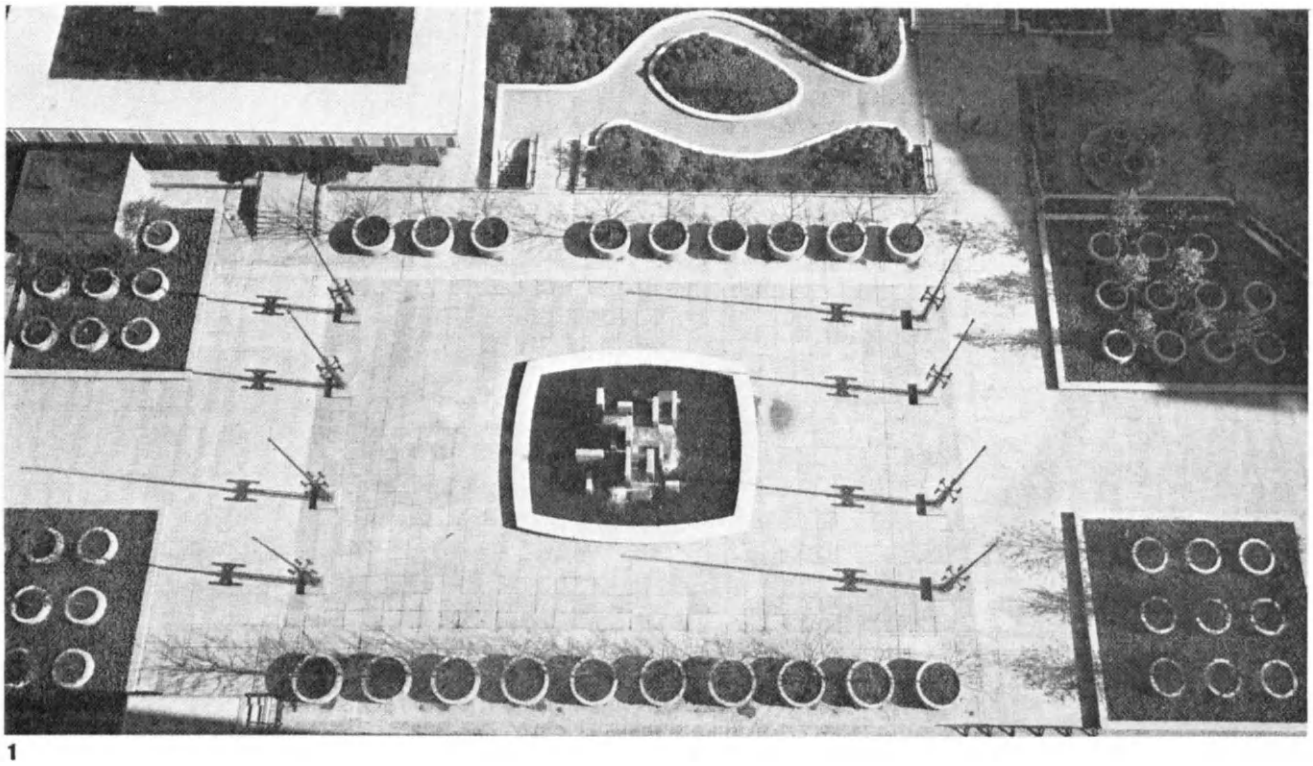
Colour and texture

2.02 Many types of finish can be used singly or in patterned combinations to improve appearance **1, 2** (see para 7).

1 *Use of bold and varied textures and patterns to provide interest from high level*

2 *Willows, mounds of grass and paving to provide varied textures*

2



1

2.03 Living material can provide colour and texture. Initial cost is not high if soil depths are kept to a minimum but maintenance costs are increased. Grass is the obvious material but other low ground cover plants are suitable (see para 10.04).

Uses

Private

2.04 Private roof areas range from tiny paved balconies to extensive roof gardens attached to penthouse flats complete with paving, water, grass, low planting and trees. First requirements are adequate privacy and wind screening; the higher the situation, the more shelter becomes necessary to protect plants and people. If their orientation is correct, screened spaces can become quite hot in summer. They are used mostly for sitting, growing plants, eating outdoors and toddlers play. Lighting can extend the period of use.

Group

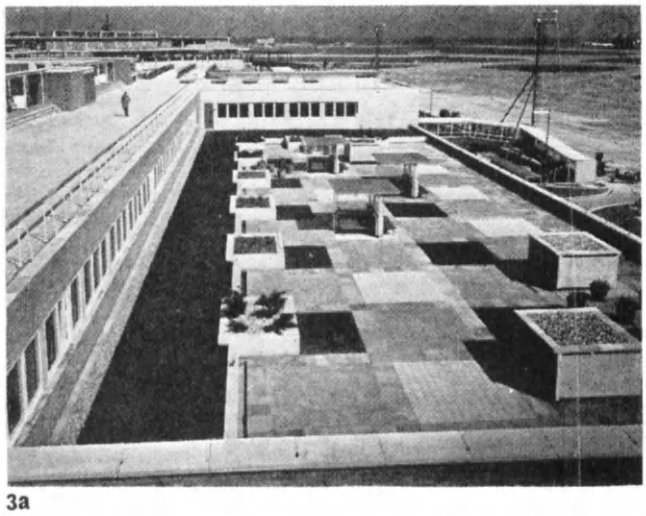
2.05 Group private spaces are those reserved for members of a company, school or other organisation. They are often on roofs of low blocks possibly with higher blocks adjoining. Insufficient privacy may result in spaces not being used, so screening is desirable. Plenty of sitting space is required on benches (preferably with backs and arms for comfort) and on the grass. People do not usually sit on stone, concrete or brick except on the hottest days of the year and then only when such materials have been warmed by the sun for an hour or so.

2.06 If outdoor eating is proposed it is wise to cover at least 50 per cent of tables with a roof of translucent sheeting against rain and glare. Occasionally ball or tennis courts are provided.

Public

2.07 Active uses of public roof spaces include circulation and recreation. Any form of recreation is possible that normally takes place on the ground provided it does not involve excessive loading. Roof areas are most logically used for organised games that require hard surfaces: tennis, roller skating and children's play. Fencing for ball games should be 1 to 3 m higher than at ground level. A netted 'roof' may be worth considering. Lighting will extend the period of use.

2.08 Passive spaces for people to sit, read, munch sandwiches and chat are needed. Grass is satisfactory for summer use, but seats considerably extend the season and are preferred by many even in summer sunshine. These spaces should be sheltered, open to the sun and free of downdrafts caused by taller buildings. They may be screened and tucked away or just slightly withdrawn from main pedestrian routes. Good views are appreciated. On one roof terrace, seats have been dragged out from specially constructed shelters to the exposed edge of the roof because users' prime motivation was the view **3 a, b**.



3a

3b

3a *Seating designed under shelters*
3b *Seating dragged to edge of roof by users so that they can look at view*

3 User requirements

3.01 User requirements are complex and often similar to requirements for the same activities at ground level. Outlined below are some special requirements.

Shelter

3.02 Wind protection makes physical conditions more pleasant for those using roof spaces and prevents tall or slender plants from being loosened or uprooted. Only the toughest species will resist scorching from too much transpiration unless screening is provided. Some species are very wind resistant but even they grow faster and healthier if sheltered.

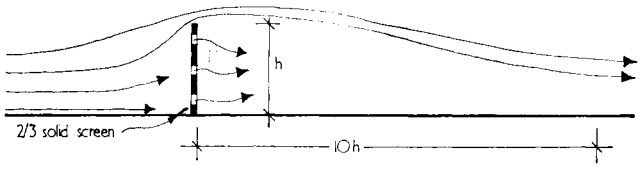
3.03 Shelter is best provided by perforated or slatted fencing which should be as high as possible. Perforations prevent eddying and work best with two-thirds solid and one-third void. Some sheltering effect is felt on the windward side and useful shelter on the leeward side will be felt for approximately 10 times the height of the screen **4**. Effectiveness falls off towards the end of a screen and when wind is not at right angles to it.

3.04 It may be worth considering similar screening in a horizontal position against the face of tall buildings to prevent downdrafts and beneath buildings on stilts to nullify the Venturi effect **5**.

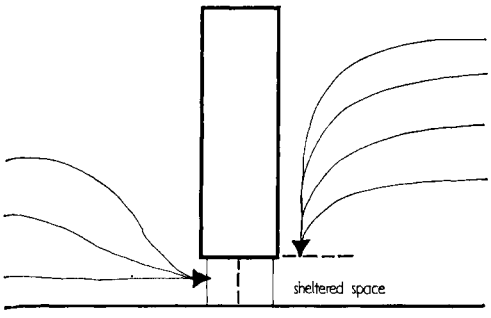
3.05 Privacy from horizontal and vertical view is a similar problem as in open space at ground level, but often acute.

Safety

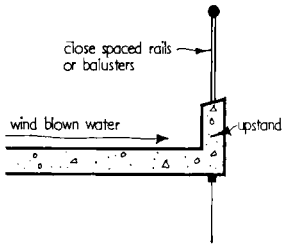
3.06 Normally by-law balustrade regulations apply but where active games are played or if children are encouraged to congregate without supervision, a higher enclosure is necessary.



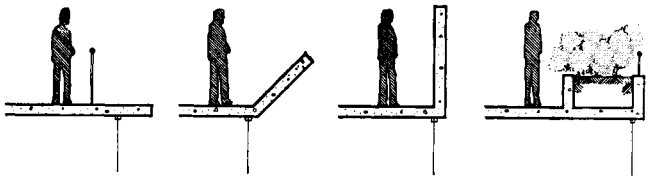
4 Screens can give screening for approximately 10 times their height on leeward side. Some effect is felt on windward side



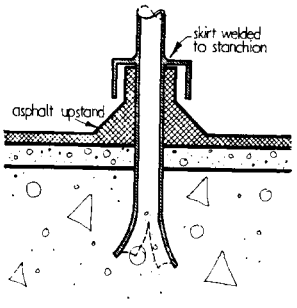
5 Screens are sometimes necessary to prevent downdrafts and Venturi effect



6 Use of balusters and upstand to prevent objects and water falling off edges. Drainage may be a problem at roof edge



7 Ways of preventing vertigo



8 Where waterproof layer must be penetrated, upstands with skirt give safest answer

3.07 Appropriate care should be taken to prevent objects falling off edges of roofs and causing damage below. An upstand is always useful to prevent rolling objects as well as blown surface water going off edges **6**. Spacing of balusters will control the size of objects that can pass through. Active games require very high walls or netting and in some cases a complete cage.

3.08 Some designers suggest that vertigo is a serious consideration in the design of roof gardens. A questionnaire revealed that in no case had any of the designers of 50 or so jobs received a complaint despite only two taking precautions. But those who suffer from vertigo should not be forced close to the roof edges: for example narrow paving adjacent to perimeter balustrades should be avoided. Other precautions are shown in **7**. Derry & Toms in Kensington and the Bonaventure Hotel in Montreal have fully enclosed roof gardens.

Lighting

3.09 Lighting problems are similar to those at ground level. Costs of providing a roof garden may justify more expenditure on lighting to lengthen the hours of use. Internal lighting behind adjacent glass facades can sometimes give enough light by spillage; this can be very attractive if carefully controlled. Other types of light may be general, flood, spot or decorative (see information sheet LANDSCAPE 40).

Access

3.10 Access to roof garden areas may be required for construction, maintenance or fire fighting and ambulance services as well as for activities for which the gardens are intended.

3.11 Construction equipment is principally for moving soil into place and varies from wheel barrows to calf dozers for large areas. In the latter case, weight rather than size may be the biggest constraint. Accessibility and loading can limit movement of semi-mature trees even if their final position presents no difficulty.

3.12 Maintenance equipment includes lawnmowers which can be quite wide as well as heavy. Pavement sweepers are common on roofs; like lawnmowers, they vary from light narrow push types to heavy wide ridable types. A typical ridable one is 1·6 m wide (overall side brooms).

Fire

3.13 Fire access requirements should be checked with the fire officer.

Maintenance

3.14 Soft areas, where no sprinklers are installed need watering by hand or hose and an outdoor tap, preferably in a pit, is required. Many small tools are used for garden maintenance and convenient stores are needed unless contract maintenance is intended. It should be possible to remove grass cuttings, tree and shrub prunings and fallen leaves without inconvenience. In some cases a location for a compost heap is advantageous. Hard areas need sweeping. Pools should have provision for emptying and refilling.

3.15 Eventually some soft areas may have to have their soil replaced. Trees and shrubs may be removed or replaced. Paving needs repair and replacement. All this work may need access for heavy equipment and involves removal of large quantities of dirty materials.

4 Structural implications

4.01 Roof gardens impose extra loads on roofs. The higher the building the greater the problem as additional loads have to be carried down through all floors.

4.02 Live loads may increase due to free pedestrian access and maintenance machinery loads but note roofs at ground level must often be strong enough for fire vehicle access to adjacent blocks and pedestrian use may not increase the loading. Roof edges especially where overlooking processional routes should be designed for crowd loading.

4.03 Dead loads are increased by paving, soil and trees. Allow for weight of soil in wet conditions (the so-called lightweight soils do not give great weight savings when wet). Water up to 150 mm deep is sometimes counted as part of the normal live load and if so it does not increase strength requirements. Heavy loads like trees and associated soil should be related to structure if possible eg located directly over columns.

4.04 Wherever possible fixings should not penetrate the waterproof layer. Where penetration cannot be avoided upstands of the waterproofing and continuous skirts are the safest answer **8**.

5 Environmental problems

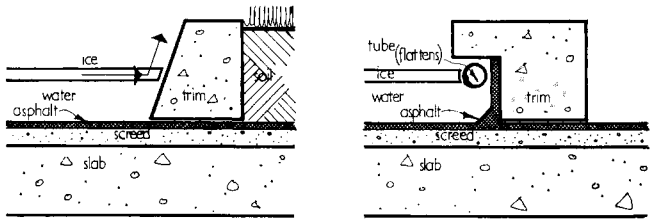
5.01 Noise transmission may prove a problem especially where ball games are to be played on a roof. Thick slabs resulting from loading requirements may help, especially if poured in situ with no holes through them. Screed over soft insulation may provide sufficient discontinuity to solve the problem.

5.02 Exhaust air from buildings is disadvantageous in roof gardens as excessive heat causes too much transpiration in plants. Polluted air, especially from underground car parks may cause plant deaths. In one American case, lime trees had to be replanted every other year due to this. There is no evidence of any species being specially resistant. Smells from various vents can be a problem for humans including vents from kitchens, lavatories, flues and sanitary towel incinerators.

6 Waterproofing problems

6.01 Full asphalt specification is undoubtedly best for the waterproof layer. Three-ply felt is frequently used in US but gives problems. Proprietory plastic expansion joints are more reliable than copper v's. A London borough is experimenting with three coats of cold applied waterproofing over garages, but this is likely to give trouble. Extensive investigation reveals that it is reasonable to omit screed ventilation entirely where a roof is covered with an insulating layer of soil and thermal insulation can be reduced or omitted altogether.

6.02 Damage to the waterproof membrane can be caused by construction and planting work, root action or soil chemicals. The latter is not usually considered a great danger and mechanical damage can be controlled by programming and avoiding heavy machinery. Damage by root action is difficult to control. Swelling roots over the years exert a powerful force which soft asphaltic materials can not usually resist. Protective screed should be laid over the waterproof layer especially if trees are to be planted. The screed will also allow heavy machinery to be used without causing drainage layer gravel to penetrate the waterproof layer (para 8.12).



9 *Ways of preventing ice damage at edges of pools*

6.03 Some designers consider waterproof concrete adequate for situations over underground garages. 'Waterproof' concrete slabs are very seldom waterproof initially, especially in large areas, and never in the long term. Water passing through a concrete slab takes material in solution with it. This can result in an irremovable deposit on car roofs and building owners being sued by angry motorists.

7 Types of surface

Hard

7.01 All surfaces used at ground level are possible on roofs but with certain special limitations.

7.02 Weight is a prime consideration. Asbestos tiles are probably the lightest form of paving. Hollow tiles with open joints are manufactured which allow water to drain below the tile. Patterned or textured screeds are possible. Lightweight aggregate (expanded clay), paving slabs, quarry tiles, loose rounded gravels, wooden duck boards and tarmacadam with rolled-in dressings are other alternatives; the latter should be used with a waterproof layer. It is useful to keep gulleys well away from corners or changes in level as it is in these places that leaves tend to collect in autumn.

Water

7.03 Sterile pools 50 to 75 mm deep give maximum reflection from smooth clear water; a black bottom intensifies reflections. Precautions must be taken against frost when ice expansion can cause problems at pool edges; a hollow plastic or rubber pipe at edges may take up expansion or the trim may be sloped **9**. Water must circulate because stagnant water causes heavy maintenance problems and the surface appears dusty and unattractive; circulation can be achieved by pumping.

7.04 Pools with a balance of organic life (fish, plants and other water creatures) may be shallow provided there is adequate deep water for fish in hot or frosty weather; some plants need deep water for satisfactory growth (see information sheet LANDSCAPE 9). If an even depth is provided, 450 mm is minimum. Almost any material can be used as a pool base but rounded gravel on cobbles is light in weight and most attractive.

8 Soils

Suitable conditions for growth

Light

8.01 There is insufficient light intensity in Britain for most hardy plants to thrive when planted under overhanging structures so such planting should be avoided.

Air

8.02 Air must be present in the larger pore spaces within the soil. This can only happen when soil drains properly and large pore spaces are not saturated. Suitable pore spaces are generally found in natural soils (para 8.07) and such soils or artificial mixtures which provide the right characteristics (para 8.11) should be used. Constant compaction by machinery tends to destroy natural soil structure and eliminate pore spaces. Incorporation of sharp sand or a spongy material such as peat helps.

Water

8.03 Soil water normally reaches roots as rain from above, percolation from the side or from a high water table. During dry periods, upper layers of soil keep moist by upward movement of water from a deep water table or deep roots may extract it direct. The quality and sources of the water affects the range of species which grow satisfactorily. Plant growth is encouraged by stable water conditions though dryer conditions during the dormant season generally do no harm.

Nutrients

8.04 Soil nutrients are primarily nitrogen in the form of nitrates, potassium salts and phosphorus compounds together with minute quantities of trace elements. In natural conditions these elements are provided by breaking down of organic materials which ensures retention of good soil structure by replenishing the properties of humus.

Anchorage

8.05 Anchorage is essential to all plants especially trees and large shrubs. Some larger plants get anchorage in natural conditions by sending down a straight tap root. This is denied them on roof gardens where they rely on getting a large spreading plate of roots to prevent the wind blowing them over. Wind rocking can be lethal as it can cause rot due to soil compression at the base of the trunk or so break the intimate contact between the soil and the roots that the plant cannot replace the moisture transpired through the leaves. Permanent subsoil anchor cables can help tree stability and in lightweight soils trees may be planted in heavy tubs. The deeper and wider the soil area, the better the anchorage.

Natural soil profiles

8.06 Natural soil profiles are classified as follows:

A1 Horizon: 225 mm surface soil (usually greyish brown in colour) with mineral particles, humus, air and moisture, and millions of bacteria.

A2 Horizon: 225 mm transition zone (paler, often light brown sometimes grey) with less organic material

B1 Horizon: 300 mm subsoil (brighter colour mottled orange, red or yellow) heavier and more compact as it has generally not been worked by man or worms

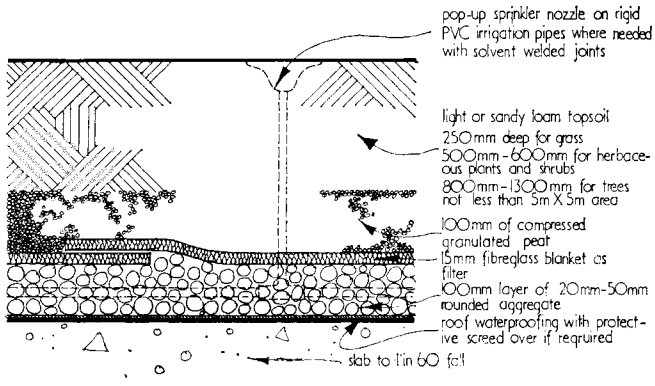
B2 Horizon: subsoil with fragments of broken rock

C Horizon: rock. This is the parent material from which the topsoil and subsoil have been formed by physical, chemical and organic action over millions of years.

8.07 In the poorest and shallowest soils the whole of the A and B horizons may total no more than 125 mm and plant life they support is highly specialised. Natural soil profiles provide all the basic plant needs described under paras 8.01 to 8.06.

Artificial soil profiles

8.08 When choosing an artificial soil profile for a roof garden, natural soil profiles can provide good guidance. Plants to be grown and an estimate of the standard of maintenance to be expected influence the choice of profile.



10 *Basic soil profile for roof gardens. Thicknesses of layers can be varied (see 8.10* et seq *and table* 1)

8.09 The number and range of variables is so great that few absolute rules can be formulated. Topsoil must be the best available quality and should be fed and watered regularly to maintain this quality. The greater the depth of soil required, the greater will be the safety margin during periods of drought or maintenance neglect. The larger the plants to be grown the greater the soil depth needed.

Basic profile

8.10 The basic soil profile now used in many countries and generally agreed to be adequate for long term plant requirements is that developed by N. W. Leichtii for the roof garden over Berne railway station (Grosse Schantze) **10**. The profile can be taken as an example of good practice.

8.11 The slab is cast with its top surface falling at least 1:60 to ensure that stagnant water pools cannot form on the roof. Asphalt waterproof layer is laid direct on the slab. In the Grosse Schantze scheme there is no protective screed over the asphalt.

8.12 A gravel layer ensures long term drainage of excess water. Outlets to surface water stacks must have silt traps and easy access panels. Rigid pvc irrigation supply lines are laid within the gravel layer with stub risers left protruding to receive pop-up sprinklers later (approx 12 m c/c). Joints should be solvent welded.

8.13 The glass fibre layer is a 15 mm plain glass fibre blanket without surface paper or wire reinforcement. This filters out fine soil or peat particles, and prevents them clogging the drainage layer. Next comes granulated peat which compresses to about 50 mm when soil is laid over the top. This acts as water reservoir.

8.14 Topsoil is sandy loam which should not be run over by heavy machinery. This is the growing medium supplying nutrients, water and the like to the plant roots.

8.15 Construction should be carried out in strips about 10 m wide to avoid machinery travelling on soil and compressing it. There is now considerable experience with this soil profile and no reason to believe that it will not fully sustain all forms of plant life for their full life span given adequate maintenance.

8.16 This soil profile may on occasions be too thick, heavy or expensive. It is possible to make it more shallow provided

plants are related to the reduced soil thickness. The designer must realise that maintenance, especially watering, becomes more crucial, plant life spans may be reduced, and the safety factor during droughts is reduced. The latter is the most important as plants 10 or more years old may fail when they are in their prime.

Special mixes

8.17 Lightweight soil mixes can be used when weight is crucial. Peat, vermiculite, plastic foam, or expanded clay aggregate may be included but when wet, the saving in weight is not as great as is often expected. Less anchorage is afforded for tall plants. Constitution Plaza, Hartford, Connecticut, uses 25 per cent topsoil mixed with 25 per cent peat and 50 per cent sand. This has proved very successful.

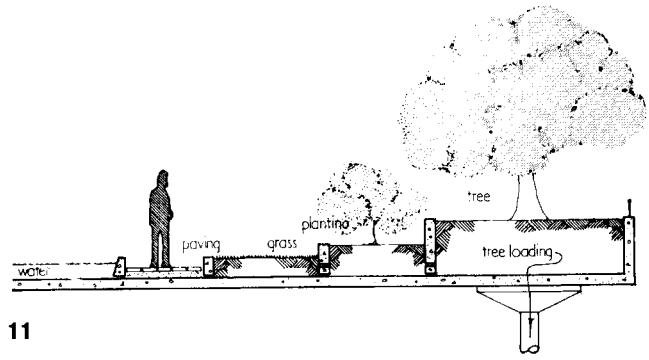
Irrigation

8.18 On the roof of Harvey's Store, Guildford, water was allowed to penetrate gapped kerbing round a shallow pool, providing a high water table throughout the plant beds. Only low plants were used; they were restricted to those liking boggy conditions. Water is kept on the move by use of fountains and the plants never need watering. Damage to kerbs by ice formation is prevented by having sloping sides **9**. By this method, which kept the weight low, maintenance costs are little more than for the same type of planting in natural circumstances.

8.19 On a house at St Feock by team 4, the overall profile was limited to 275 mm above the waterproof membrane. Drought conditions might therefore come about quickly, although they are not common in the West Country. Had the normal drainage system been used there would have been far too little soil left as a growing medium and water reservoir. Lapped secondhand roofing tiles act as a drainage layer, with a half round hip tile along the lower edge of the roof as a main collector drain. Artificial irrigation was installed, based on two rows of overlapping coverage, semi-circular sprinklers along opposite edges of the roof. This was not needed in the first season, but may be essential when the plants mature and a greatly increased foliar surface hangs down the south facing elevation of the house. Supply for 60 m^2 of roof was delivered by a 20 mm bore pipe at 25 N/m^2 pressure with a flow of 10 litres/minute, and water is applied over the area at 8 mm/hour.

Depths

8.20 Varying depths of soil, pools and paving can be combined in several ways **11**, **12**, **13**.



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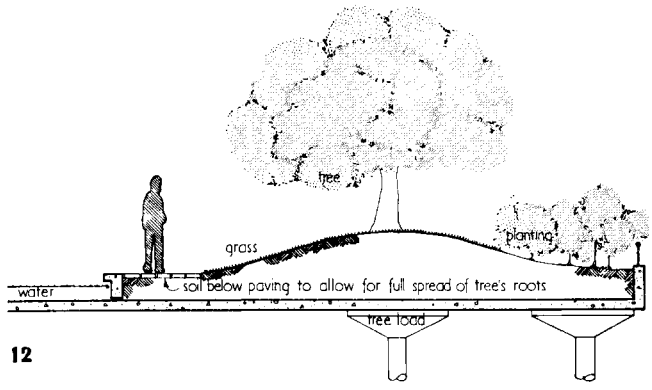

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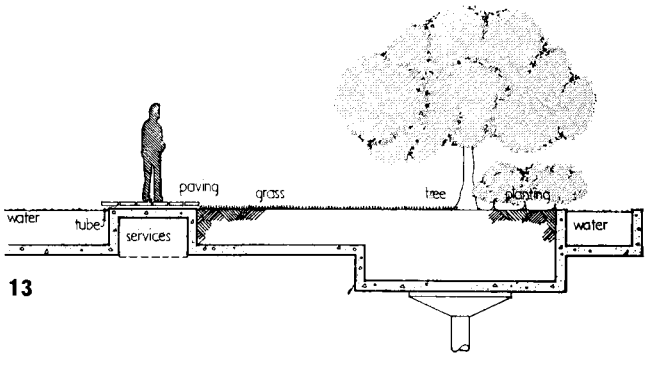


13

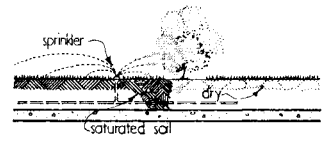
11, 12, 13 *Ways of combining different soil and paving depths in roof gardens*

9 Maintenance

Limiting plant size

9.01 Grass is cut every few days to give a fine lawn, every week to 10 days for a park-like grass area, or once a season if rough grass with wild flowers is required. Machinery varies from narrow hand pushed mowers to wide motorised triple gang mowers which are only used on very large roofs with adequate access, strength and storage facilities.

9.02 Shrubs and trees may need to be reduced in height or density to prevent windblow, especially where anchorage is insufficient or soil depth inadequate for their foliar area. The best method is to thin the plant or tree so that it offers less wind resistance, and has less foliage for the roots to supply with water and nutrients; natural form and height can be retained or enhanced. Plants should be chosen that will not exceed anchorage and transpiration possibilities (see para 10).



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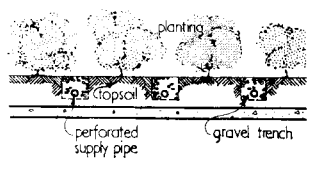


15

14 *Sprinklers should be sited carefully to avoid cut off by shrubs*

15 *Perforated pipes located in underground trenches for irrigation*

Watering

9.03 Watering is best applied by pop-up sprinklers which may water circles or segments. Fixed free standing sprinklers are more trouble-free but unsightly unless situated within a carefully designed planted area. Care must be exercised when siting sprinklers that water does not spray passers by, or end up on neighbours' property.

9.04 Where low planting is envisaged it is best to sight sprinklers in adjacent grass or the sprinkled area may be reduced **14**. Where buildings overhang, soffit sprinklers may be used.

9.05 Rainwater may be piped from roofs to planted areas at lower levels and distributed through perforated underground pipes as in the Lillington Street balconies.

9.06 One system, which is now widespread in Israel but not yet used in this country, gives underground supply based on subterranean droppers (see AJ 18.9.68 p758). George Patton in the US has used perforated pipes below ground in gravel trenches **15**.

9.07 All irrigation systems should be operated by skilled men. Sprinklers are often turned on and forgotten; this can be overcome by supplying them from their own header tank, the capacity of which is just below the water required for a single watering session. The supply pipe to the header tank is restricted so that the tank fills very slowly. Sprinkler spray slowly sinks when the tank empties and enough water has been applied.

9.08 Sprinklers can be automatically controlled by a programme switch. Controls for time of day and period of watering can be built in or sensing devices are available which switch on the system when humidity at ground level drops too low.

9.09 The better the drainage and the shallower the soil, the more watering will be required. Very shallow soils may need watering twice a day in hot, dry situations.

9.10 The more water that passes through the soil profile, the more nutrients are leached out and the greater the need for replacement. Chemical fertilisers can be used but regular application of organic manures as a mulch is desirable to maintain soil fertility, especially when plants are fairly mature. Liquid fertilisers can be applied through the irrigation system by dosing a tank in the supply line.

9.11 Roots of plant material over underground garages in very cold climates tend to become frozen; in the case of evergreens this may prove disastrous. The phenomenon has been successfully overcome on some roofs in Cincinnati, US, by using electric heating cables in the plant beds.

10 Suitable species

10.01 When choosing grasses, plants and trees for roofs the following special considerations must be kept in mind:
1 Maintenance standard to be expected (determine possibility of regular watering in summer)
2 Depth of soil
3 Exposure to wind and draughts (this can be very severe on roofs)
4 Overshadowing or sheltering from rain by buildings
If in doubt, keep to dry soil species. Information sheets LANDSCAPE 6, 7 gives plant characteristics but some particularly suitable species are listed below. The same considerations apply to choosing grass mixtures as at ground level (see information sheet LANDSCAPE 7), except where watering cannot be relied upon. In the latter case dry soil types should be represented in the mixture.

10.02 Some suitable trees are:
Betula vars
Crataegus vars
Platanus acerifolia (needs large soil volume)
Robinia pseudacacia
Sorbus aria
Sorbus aucuparia
Tilia vars
Willows and Poplars might be good where water supply can be guaranteed ie water table system para 8.18.

10.03 Some shrubs which have proved to be specially suitable are:
Galluna vulgaris
Cotoneaster vars
Cytissus vars (short lived)
Erica vars
Euonymus vars
Medera vars
Juniperus vars
Rhus typhina
Sambucus nigra
Ulex vars (fire risk)

10.04 Suitable ground cover plants include:
Cotula squalida
Cotoneaster (low growing vars)
Hypenicum calycinum
Mentha rotundifolia
Thymus serphyllum (on poor shallow soil)
Vinca minor.

11 Costs

11.01 Intuitive estimates of costs of the roof gardens vary from 'practically nothing' to 'prohibitively expensive'. Most architects seem to be frightened of the financial implications, but comparisons are almost impossible to find. Clearly costs vary from one type of structure to another and depend to a large extent on the type of finish or planting on the roof.

11.02 Trying to clear away a little of the mist surrounding this subject the author briefed a structural engineer, Allan Hodgkinson of J. C. Bianco & Associates and a qs Peter Gray of James Nisbet & Partners to prepare comparative costs for various types of 'finish' placed upon two building types (table 1).

11.03 For estimating, it was assumed that the whole of a roof would be covered in the same type of 'finish'. If an estimate is required for a combination of finishes, the figure for the highest additional structural costs should normally be used throughout unless the design relates so closely to the structural grid that special structural measures can be taken in selected places only to deal with heavier loads.

11.04 Allowance has been made for additional costs from increased loading imposed by finishes on the foundation, frame, cross-walls, roof slab and associated internal finishes, with balustrades and additional heights to edge kerbs.

11.05 Roof loadings which are reasonable under normal conditions have been assumed. Loadings must normally be

agreed with the district surveyor or other authority responsible for applying building by-laws.

11.06 Even if a roof is likely to be used for viewing a procession in a street below, it is likely to be subject to crowd loading of only 10 700 kN/m² with about five persons deep at its edges and a 5350 kN/m² overall loading should easily cope with this. However, if a roof is to be used for public meetings and so on and not just casual public use, 10 700 kN/m² loading might have to be assumed overall.

11.07 To simplify calculations it has been assumed that letable floor space would not be lost by increasing column size but that increased loads would be dealt with by increased reinforcement.

11.08 Costs of retaining walls between the various thicknesses of finish have not been allowed for as the complexity of the design drastically affects the quantities and ground modelling might well take up the difference between the constructional thicknesses for trees, shrubs and grass **11** to **13**.

Notes on table 1

1 PRICE LEVEL is at early 1971.
2 NO ALLOWANCE has been made for preliminaries and contingencies.
3 BASIS OF CALCULATIONS.
Four-storey maisonettes Estimates based on one bay 9m wide × 5m span between loadbearing cross-walls.
Ten-storey offices Estimates based on one bay 12·5m wide × 5m span between cross-beams of a reinforced concrete framed structure.
Single-storey basement car parks Estimates based on one bay 7·6m × 7·6m between cross-beams of a reinforced concrete framed structure.
4 FINISHES.
Paving Costs allow for pc slab paving at £2·175 laid ie not the cheapest. Alternative finishes can be calculated on a pro rata basis. If paving is used in conjunction with thicker finishes allowance must be made for making up levels or retaining the soil adjacent to paving.
Water Costs allow for enclosing walls to pools average 40 m² in area. No allowance has been made for pumping or filtering plant, fish or plants.
Grass Costs allow for 300 mm topsoil, 75 mm peat, 25 mm glass fibre filter, and 100 mm graded aggregate and turf at £0·660 per m² laid. Cost of grass can vary between £0·150 per m² for seeding to £0·700 per m² for turf, depending on quality.
Shrubs Costs allow for 600 mm topsoil, 75 mm peat, 25 mm glass fibre and 100 mm graded aggregate, and shrubs at £4·720 per m². Costs of shrubs can vary between £1·500 per m² and £4·720 per m². The £4·720 figure should allow a wide choice of species and a proportion of larger plants grown in containers for quick effect.
Trees Costs allow for 1200 mm topsoil, 75 mm peat, 25 mm glass fibre and 100 mm graded aggregate and one tree at £32 per 14 m² but use of advanced nursery stock rather than semi-mature trees has been assumed (ie £32 rather than £70 to £80). With difficult access, these prices would be higher.
5 IRRIGATION.
Costs do not allow for provision of irrigation, which can vary from simple, manually operated systems (about £1 per m²) to sophisticated automatic humidity-detecting systems, or systems which inject fertilisers. Irrigation is normally by sprinklers, which works better on grass areas or narrow shrub areas than on more extensive shrub areas.

Table 1 Additional costs of roof garden compared with normal asphalt covered concrete roof

	Finish	Paving	Water	Grass	Shrubs	Trees
		50 mm precast concrete paving £2·175 per m²	water 300 mm deep 50 mm gravel rejects enclosing walls	turf (£0·660 per m²) 300 mm top soil 75 mm peat 25 mm glass fibre 100 mm aggregate	shrubs (£4·720 per m²) 600 mm topsoil 75 mm peat 25 mm glass fibre 100 mm aggregate	trees (£2·360 per m²) one at £32 per 14 m² turf below trees (£0·660 per m²) 1200 mm topsoil 75 mm peat 25 mm glass fibre 100 mm aggregate
		Per m² roof area £	Per m² roof area £	Per m² roof area £	Per m² roof area £	Per m² roof area £
Four-storey maisonettes	additional structural costs	3·445	3·330	5·050	7·235	10·450
	finish	2·185	3·215	2·065	6·835	6·545
	total	5·630	6·545	7·115	14·070	16·995
Ten-storey offices	additional structural costs	3·960	3·905	7·405	11·885	17·165
	finish	2·185	3·215	2·065	6·835	6·545
	total	6·145	7·120	9·470	18·720	23·710
Ground level over single-storey basement car park	additional structural costs	—*	—*	3·445	5·510	11·425
	finish	2·185	3·215	2·065	6·835	6·545
	total	2·185	3·215	5·510	12·345	17·970

* It has been assumed for the purposes of this exercise that the design of the structure, which will already be designed to be accessible for fire appliances to adjacent tall buildings, will not attract additional costs to support 'Paving' or 'Water'.

Information sheet Landscape 43

Section 10: **Elements of landscape construction**

Space requirements: People and cars

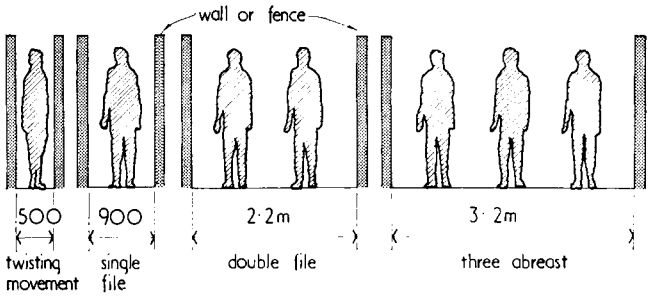
This information sheet has been prepared by HAL MOGGRIDGE, *and is intended to be read in conjunction with information sheets* LANDSCAPE 26 *and* 38. *The table preceding the diagrams showing space requirements has been designed as a general checklist for most circulation conditions*

Table 1 *Checklist of user requirements for external urban space*

Use	Characteristics and/or factors	Specific provisions
General circulation on foot	Narrow spaces induce fast movement. (See information sheets LANDSCAPE 25 and 26)	Variety and interest. Safety. For surface treatments see information sheets LANDSCAPE 33, 34, 35
General circulation by invalids or prams	Slow but flexible	Flat ramps, absence of steps, low kerbs
General circulation by bicycle		Safety precautions for children
General circulation by vehicle	Space consuming see information sheets LANDSCAPE 26 and 28	Ample space required for turning and reversing
General circulation of maintenance equipment, barrows, cutters, etc	Needed everywhere out of doors. See information sheet LANDSCAPE 7	Modern mechanical road sweepers, gang mowers
Pedestrian access to entrances	See information sheet LANDSCAPE 26	
Access round buildings for fire equipment	Bearing capacity and distances from buildings (laid down by fire authorities) see LANDSCAPE 26	Ramped access from roadways for wide vehicles
Seating in selected positions		Shade, shelter from wind, view, intimacy, litter baskets
Leaning on railings	See information sheets LANDSCAPE 25 and 26	A view on the other side of the railing. Western aspect is particularly satisfying for evening use
Outdoor gatherings, debates, functions, in all weathers	Limited to centres of urban areas with easy public access; of little use in suburbs	Avoid narrow exits, which can cause crushing. Plenty of access points. Changes of level—platforms. Statutory very suitable
Outdoor gatherings, debates, functions in dry weather		Define space. Extensive open space all round for access
Collecting water against excessive run off	Low-lying areas into which hard paved areas drain. See information sheet LANDSCAPE 32	Avoid too heavy a soil
Improving temperature gradient of air	All vegetation tends to shade ground surface and produce cooler air at ground surface	
Car parking: occasional use	Suffices for weekend use. Rows may be indicated by trees, shrub belts on low parts. No marking of bays. See information sheet LANDSCAPE 38	
Car parking: continuous use	Space standards fully defined in AJ Metric Handbook section 10. See information sheet LANDSCAPE 26 and 28	
Play	Ball play, running, sandpits	Plenty of level space. Preferably walled. Minimum of special equipment
Open-air eating		Screening against wind, dust, insects. Alternative shelter under cover. Access to tables

1 *Pedestrian movement between walls or fences; all dimensions are sufficient for prams, wheelchairs and bicycles*

a *Requiring careful movement*
b *Allowing free movement*



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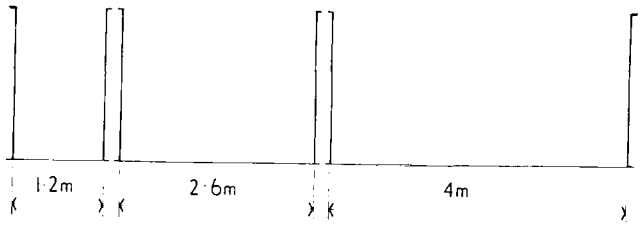
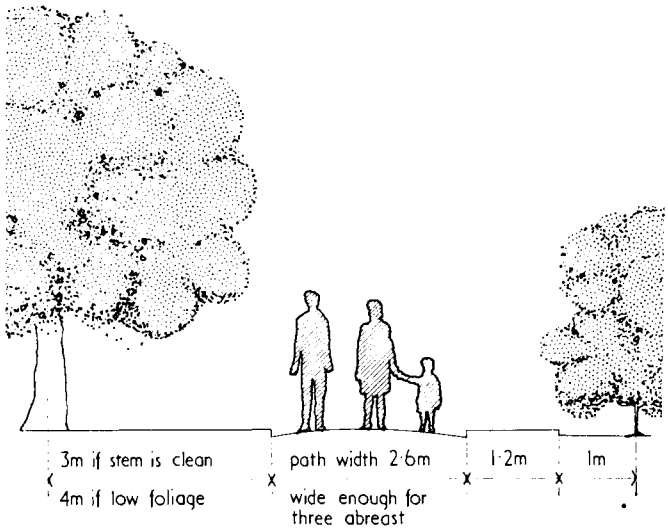
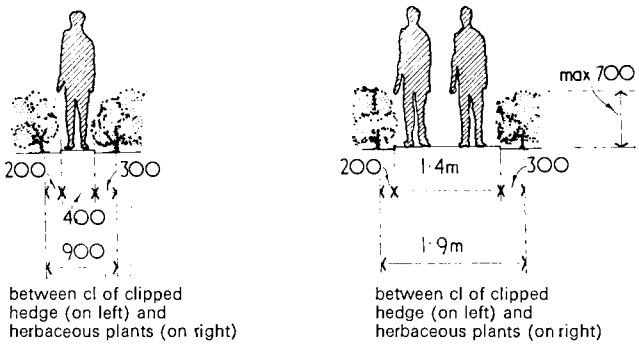


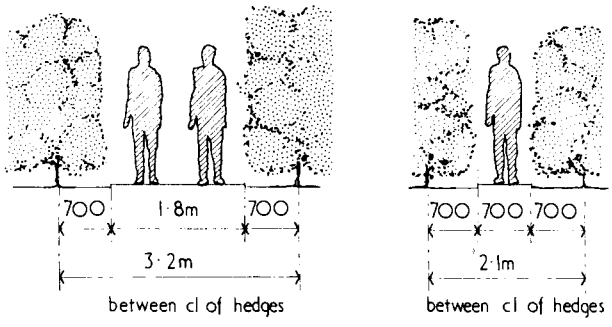
1b



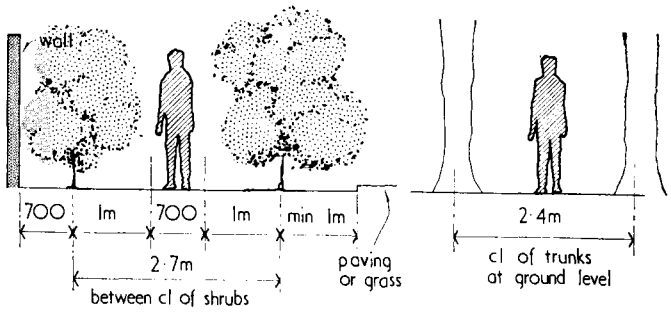
2 *Space requirements for narrow paths across open space*



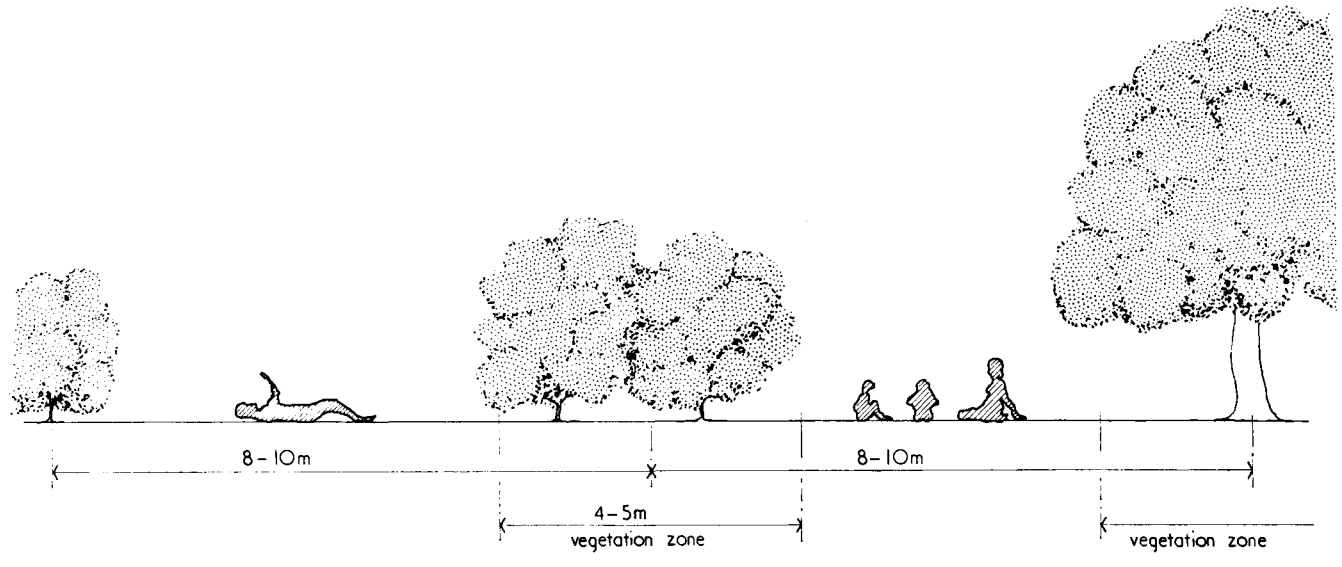
3 *Minimum path widths between low planting (impassable by prams). Planting beds should be at least 400 mm and 600 mm wide for clipped hedges and herbaceous plants respectively*



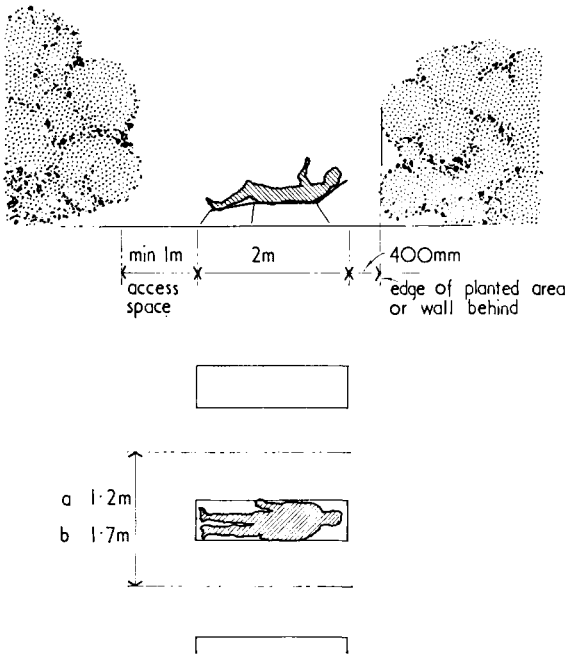
4 *Dimensions shown require careful movement when walking between clipped hedges. For free movement or for prams etc, path widths should be as for* **1b**



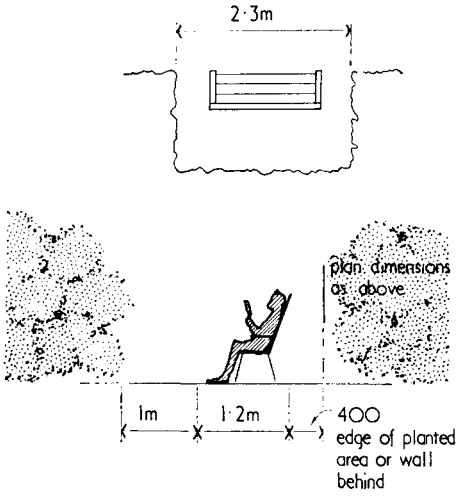
5 *For pedestrian access between free growing shrubs. Dimensions are minimum and where prams are to be used 3 m should be allowed between centre lines of planting*



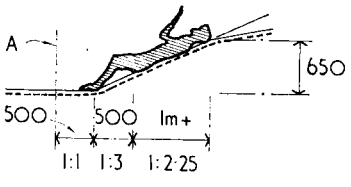
6 *Illustrates distance between individuals or groups in public spaces. Diagram applies to casual groupings in heavily used urban areas*



7 *Sets out minimum space requirements for couch type deckchairs. Dimension a is for an intimate relationship between chairs or for crowded areas, b for where more space is available*



9 *Shows requirements for upright deckchairs and garden chairs; and for a recess for a bench to seat two or three people*

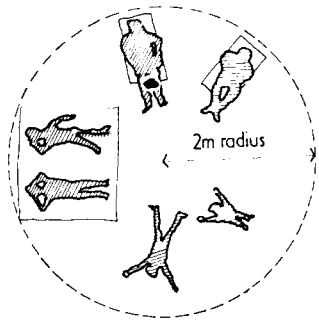


11 *Ground shape for reclining: level section at base is essential for comfort. Different angles must be finished in sweeping curve (shown in heavy broken line). Bottom may form a flat concave curve rising again for a similar bank opposite—in such case, lowest point should be beyond* 'A'

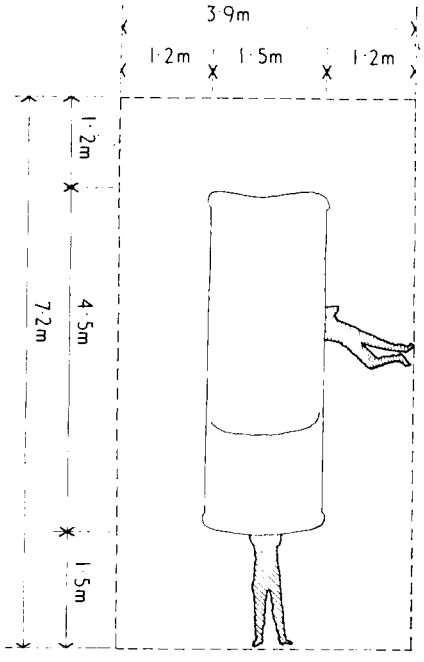
12 *Minimum widths for prams and wheelchairs*

a *Allows for a straight approach from both sides of an opening in wall. No manoeuvre can be attempted within 2·5 m of opening*

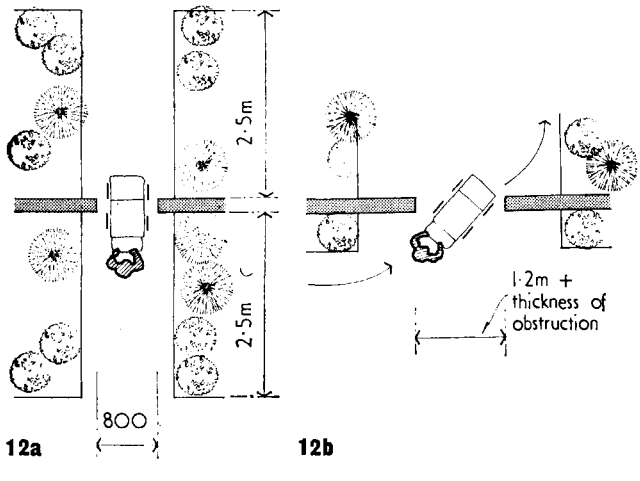
b *This is minimum opening width for any approach other than noted in* **a**. *Diagram also illustrates the greater width of paving required to allow for the manoeuvre*



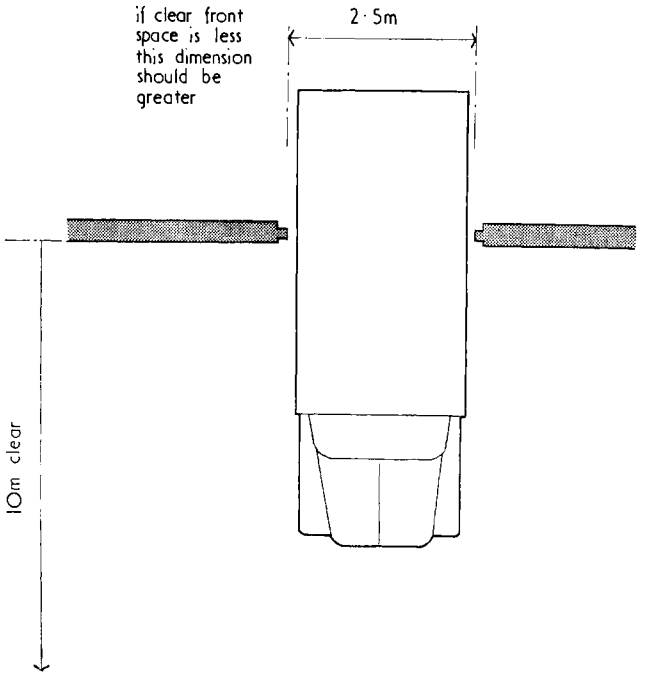
8 *Illustrates area required for family group of six on a lawn or terrace. This dimension excludes access and is also the minimum useful hard paved area for domestic use. For 10 people (the largest convenient single group), dimension should be increased to radius of 3 m; which is minimum useful lawn size for domestic use. Both these dimensions apply equally well to groups sitting in deck chairs on hard-paved surfaces, though if spaces are to allow people to lie out, the radius in both cases should be increased by 500 mm. Ground should be nearly level as slopes as low as 1:20 will cause rolling*



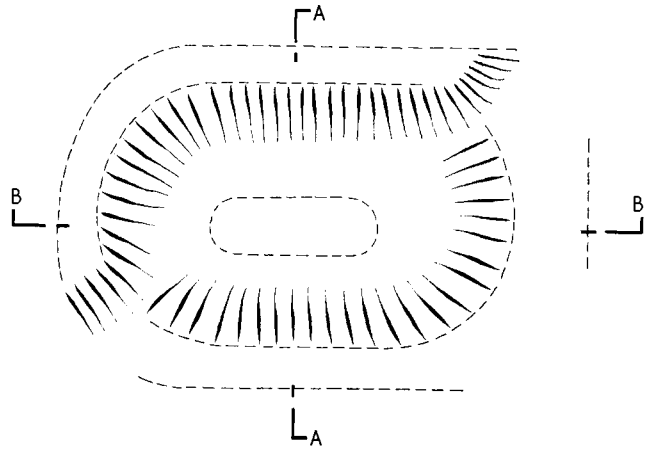
10 *Washing and maintaining cars: dimensions 4·5 m × 1·5 m are for normal family saloons; other cars may need a larger size, but there is no need to increase the space around*

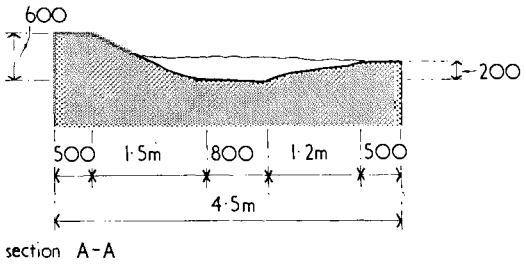


12a **12b**

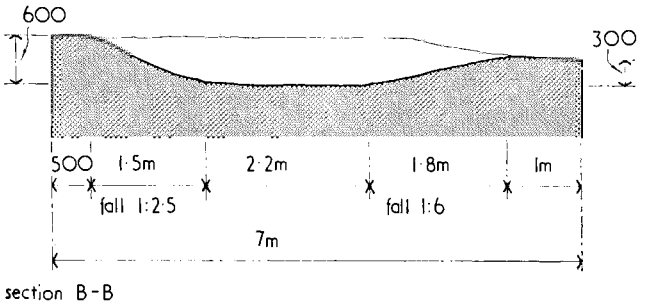


13 *Shows opening width required for lorries manoeuvring backwards. Openings of 2·3 m will allow for free passage of most cars*





section A-A



section B-B

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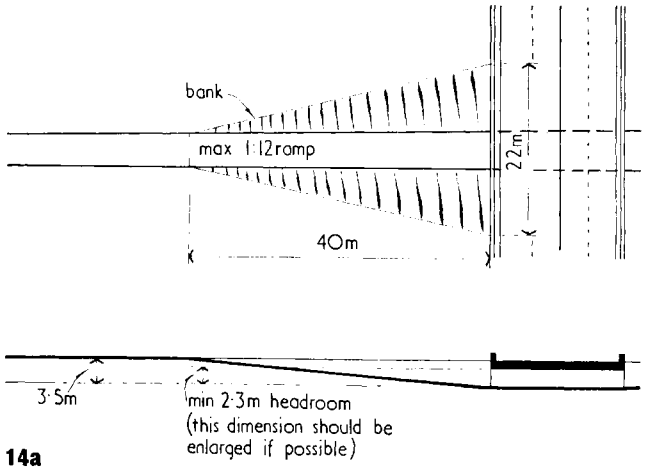
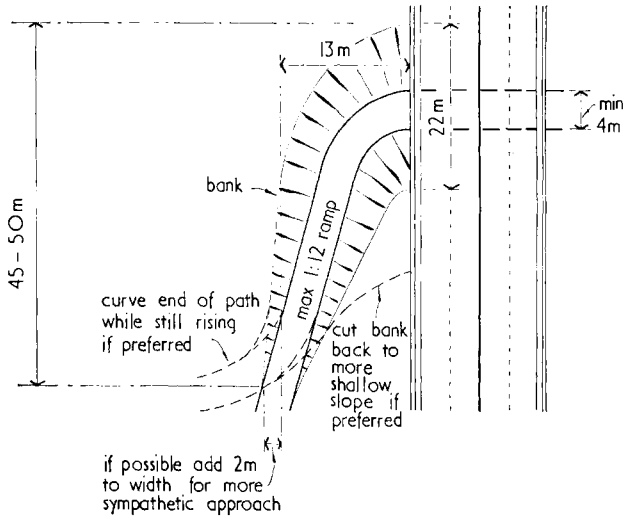
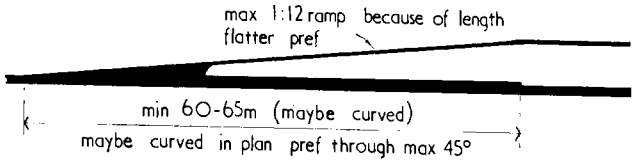


14a



14b



14c

14 *Paths crossing roads: these are recommended minimums where ground is level. Tunnels should never be less than 4 m wide*

a *straight ramp under road*

b *bent ramp under road*

c *bridge and ramp over road*

15 *Play dell for up to four children; an incidental play area suited to any urban location. This diagram is capable of extensive variations. The following are limitations: section* BB *shows maximum length for gradient at 1:2·5, greater lengths should not exceed 1:4 for safety without supervision. Ground finish may be grass or hard. Bottom of dells should be drained and access should be from lower side*

Information sheet Landscape 44

Section 10: **Elements of landscape construction**

Maintenance

This information sheet outlines aspects of maintenance which should be considered at design stage, and lists principles of care of plant growth. Comprehensive recommendations for grounds maintenance are being prepared by BSI *technical committees, and will be published in due course as a British Standard*

1 General principles

1.01 The natural pattern of renewal and growth of plant life must be controlled by sympathetic maintenance. Landscape design will rarely reach maturity until several years after contract completion, and its realisation depends on correct maintenance.

1.02 Maintenance is usually required to be as low as possible. (An exception might be a keen gardener with plenty of time, who enjoys caring for plants.)

Ecology

1.03 Maintenance is minimal if the natural balance of plants and soils is maintained. Poor soil, such as heath, will readily support rhododendrons, azaleas and heathers, but *not* rosebeds or lawns; conversely chalk soils will produce good lawns if clover is accepted, but will *not* support rhododendrons or heather.

1.04 The water table is a significant factor in deciding choice of plants.

Balance and use

1.05 A wild or natural landscape would seem to be the answer to maintenance costs, but if the area is too small, use by people will upset natural balancing factors. Natural landscape is suitable only for large parkland areas **1**.

Cost

1.06 Areas of high use are usually associated with high initial cost and low maintenance—cost of hard paving for pedestrian ways is several times that of a simple grass landscape. But hard areas must be balanced with soft areas from design point of view (see information sheet LANDSCAPE 29).

1 *In some cases natural landscape can be retained without maintenance, as in this rocky pine-covered landscape in Finland*

2 Layout and maintenance

2.01 Maintenance will be reduced if layout design considers the following points.

Grassed areas

2.02 For more detailed information see information sheet LANDSCAPE 7 para 8.

1 Grass areas should be simple in shape and not broken up by plant beds or obstructions **2**.
2 Trees planted in grass areas should be wide enough apart to allow grass cutting machinery to pass through.
3 Allow for mowing margins against walls and beds **3**.
4 Manhole covers should be aligned with grass slope.
5 Consider pop-up sprinklers where expense is justified.

Planted areas

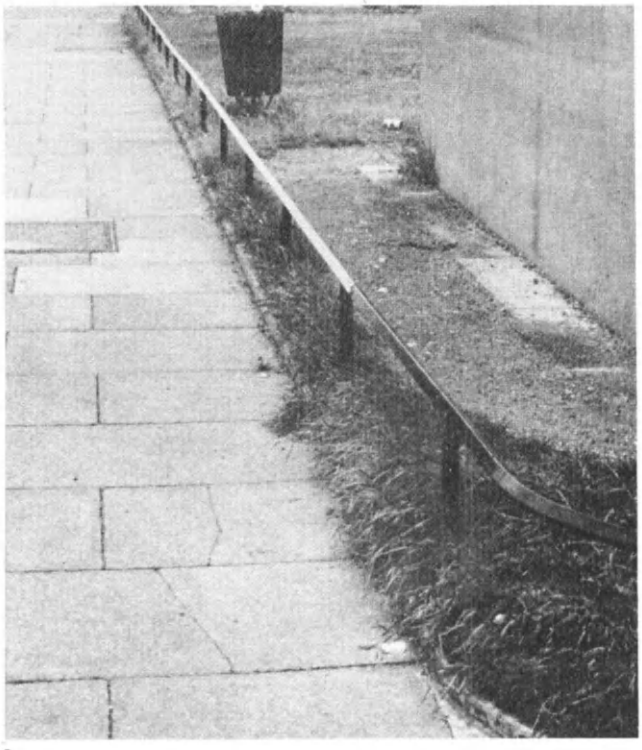
2.03 For more detailed information on maintenance of gardens, see information sheet LANDSCAPE 24 para 2.

1 Choose plants that do not need staking or pruning.
2 Suppress weeds by reducing the area of bare soil.
3 Plant beds should be simple in shape.
4 Allow space for trimming on both sides of hedges.
5 Where project allows initial heavy maintenance, followed by no maintenance, use ground cover.

Hard areas

2.04 For more detailed information, see information sheet LANDSCAPE 24 para 2 for hard areas in gardens, and infor-

2



3

2 *Paving between grassed areas and plant beds allows easy mowing. In comparison knee rails on grass edges* **3** *make mowing difficult and lead to neglect*

mation sheet LANDSCAPE 17 for hard sports areas.
1 In public areas allow for maintenance by mechanical sweepers (eg ramps).
2 Consider subsurface heating to melt snow and ice.

Water

2.05 For more detailed information on water see information sheet LANDSCAPE 9.
1 Ponds should be shallow for easy maintenance, or designed for proper biological balance.
2 Avoid overhanging trees as falling leaves must be cleared from the surface.
3 Circulate water wherever possible.

Edges

2.06 For more detailed information on materials see information sheet LANDSCAPE 35.
1 Edging materials include turf, timber, stone, brick, tiles, metal or plastic trim.
2 Should be clean cut line in vertical and horizontal plane

3 Plant growth and maintenance

3.01 Detailed maintenance of plant types has been considered in the following information sheets:
Grass—information sheet LANDSCAPE 7 para 9 deals with mowing, aeration and rolling.
Ground cover and shrubs—information sheet LANDSCAPE 7 para 3 deals with pruning and maintenance programme.
Screens and hedges—information sheet LANDSCAPE 8 para 3 deals with fertilising and pruning.
Water plants and ponds—information sheet LANDSCAPE 9 para 3 deals with discoloured water and weed control.
Trees—information sheet LANDSCAPE 6 para 3 deals with annual inspection, pruning, tree surgery and vandalism.

3.02 Proper maintenance is essential to plant life, and should be considered under the following headings.

Watering and inspection

3.03 Ensure water supply is adequate for plants in containers.

Weed control

3.04 Weed control includes:
Hoeing—most traditional method.
Mechanical means—ie scything.
Chemical means—weed killers.
Mulching—ie laying on compost to suppress weeds.

Mulching and feeding

3.05 Soil round shrubs should be fed annually with a general fertiliser at the rate of 120 g/m.

Pruning

3.06 See para 307 for relative information sheets on pruning of shrubs, trees and hedges.

Protection

3.07 Lower branches of trees may be destroyed by cattle. Protect by stakes and ties.

4 Maintenance of hard areas

4.01 Though hard surfaces are usually chosen because they will require less maintenance, they should still be swept, cleaned and sealed periodically. They should also be inspected regularly for repairs. Cracks in paving slabs should be treated regularly with weed killer.

4.02 For maintenance of hard sports areas see information sheet LANDSCAPE 17.

References

1 MINISTRY OF HOUSING AND LOCAL GOVERNMENT. Design bulletin 5 Landscaping for flats. 1963, HMSO [(A3f)]
2 INSTITUTE OF LANDSCAPE ARCHITECTS Landscape maintenance, report of symposium held at the RIBA. 1963, The Institute [087 (W1)]
3 CONOVER, H. S. Grounds maintenance handbook. New York, 1958, F. W. Dodge Corporation, second edition [087 (W1)] *£4·17*
4 ANDREW, S. Grass. *Architectural Review*, 1967, March, p234 [Yx5]
5 MCMILLAN, R. C. Problems of maintenance. *ILA Journal*, 1962, April [087 (W1)]
6 HACKETT, B. Maintenance costs and landscape design. *Municipal Journal*, 1953 March 6 [087 (W1)]

Index to handbook

References show the type of section followed by its number. For example, TS 4 *refers to technical study* 4*: Urban landscape review: Housing;* INF 38 *to information sheet* 38*: Car parking*
See also contents list on page 5