

Chapter one

Introduction

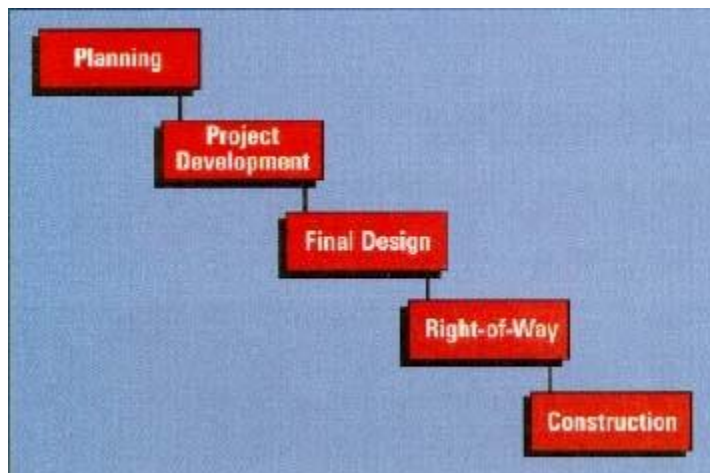
Highway design is only one element in the overall highway development process. Historically, detailed design occurs in the middle of the process, linking the preceding phases of planning and project development with the subsequent phases of right-of-ways acquisition, construction, and maintenance. While these are distinct activities, there is considerable overlap in terms of coordination among the various disciplines that work together, including designers, throughout the process.

It is during the first three stages, planning, project development, and design, that designers and communities, working together, can have the greatest impact on the final design features of the project. In fact, the flexibility available for highway design during the detailed design phase is limited a great deal by the decisions made at the earlier stages of planning and project development.

- Successful process includes designer and community involvement from the beginning.

The Stages of Highway Development

Although the names may vary by State, the five basic stages in the highway development process are: planning, project development (preliminary design), final design, right of way, and construction. After construction is completed, ongoing operation and maintenance activities continue throughout the life of the facility.



✓ Planning

The initial definition of the need for any highway or bridge improvement project takes place during the planning stage. This problem definition occurs at the State, regional, or local level, depending on the scale of the proposed improvement. This is the key time to get the public involved and provide input into the decision making process. The problems identified usually fall into one or more of the following four categories:

1. The existing physical structure needs major repair/replacement (structure repair).
2. Existing or projected future travel demands exceed available capacity, and access to transportation and mobility need to be increased (capacity).
3. The route is experiencing an inordinate number of safety and accident problems that can only be resolved through physical, geometric changes (safety).
4. Developmental pressures along the route make a reexamination of the number, location, and physical design of access points necessary (access).

Whichever problem (or set of problems) is identified, it is important that all parties agree that the problem exists, pinpoint what the problem is, and decide whether or not they want it fixed. For example, some communities may acknowledge that a roadway is operating over its capacity but do not want to improve the roadway for fear that such action will encourage more growth along the corridor. Road access may be a problem, but a community may decide it is better not to increase access,

- Increased public involvement in highway planning and development is essential to success.



- **Factors to Consider During Planning**

It is important to look ahead during the planning stage and consider the potential impact that a proposed facility or improvement may have while the project is still in the conceptual phase. During planning, key decisions are made that will affect and limit the design options in subsequent phases. Some questions to be asked at the planning stage include:

- How will the proposed transportation improvement affect the general physical character of the area surrounding the project?
- Does the area to be affected have unique historic or scenic characteristics?
- What are the safety, capacity, and cost concerns of the community?

Answers for such questions are found in planning level analysis, as well as in public involvement during planning.

Figure 1.1
Factors to consider
in planning.



✓ Project Development

After a project has been planned and programmed for implementation, it moves into the project development phase. At this stage, the environmental analysis intensifies. The level of environmental review varies widely, depending on the scale and impact of the project. It can range from a multiyear effort to prepare an Environmental Impact Statement (a comprehensive document that analyzes the potential impact of proposed alternatives) to a modest environmental review completed in a matter of weeks. Regardless of the level of detail or duration, the product of the project development process generally includes a description of the location and major design features of the recommended project that is to be further designed and constructed, while continually trying to avoid, minimize, and mitigate environmental impact.

The basic steps in this stage include the following:

- Refinement of purpose and need
- Development of a range of alternatives (including the "no build" and traffic management system [TMS] options)
- Evaluation of alternatives and their impact on the natural and built environments
- Development of appropriate mitigation

In general, decisions made at the project development level help to define the major features of the resulting project through the remainder of the design and construction process. For example, if the project development process determines that an improvement needs to take the form of a four lane divided arterial highway, it may be difficult in the design phase to justify providing only a two lane highway. Similarly, if the project development phase determines that an existing truss bridge cannot be rehabilitated at a reasonable cost to provide the necessary capacity, then it may be difficult to justify keeping the existing bridge without investing in the cost of a totally new structure.

✓ Final Design

After a preferred alternative has been selected and the project description agreed upon as stated in the environmental document, a project can move into the final design stage. The product of this stage is a complete set of plans, specifications, and estimates (PS&Es) of required quantities of materials ready for the solicitation of construction bids and subsequent construction. Depending on the scale and complexity of the project, the final design process may take from a few months to several years.

The need to employ imagination, ingenuity, and flexibility comes into play at this stage, within the general parameters established during planning and project development. Designers need to be aware of design related commitments made during project planning and project development, as well as proposed mitigation. They also need to be cognizant of the ability to make minor changes to the original concept developed during the planning phase that can result in a "better" final product.

The interests and involvement of affected stakeholders are critical to making design decisions during this phase, as well. Many of the same techniques employed during earlier phases of the project development process to facilitate public participation can also be used during the design phase.

The following paragraphs discuss some important considerations of design, including:

- Developing a concept
- Considering scale and
- Detailing the design.

➤ Developing a Concept

A design concept gives the project a focus and helps to move it toward a specific direction. There are many elements in a highway, and each involves a number of separate but interrelated design decisions. Integrating all these elements to achieve a common goal or concept helps the designer in making design decisions.

Some of the many elements of highway design are

- a. Number and width of travel lanes, median type and width, and shoulders
- b. Traffic barriers
- c. Overpasses/bridges
- d. Horizontal and vertical alignment and affiliated landscape.

➤ Considering Scale

People driving in a car see the world at a much different scale than people walking on the street. This large discrepancy in the design scale for a car versus the design scale for people has

changed the overall planning of our communities. For example, it has become common in many suburban commercial areas that a shopper must get in the car and drive from one store to the next. Except in the case of strip malls, stores are often separated by large parking lots and usually have no safe walkways for pedestrians. This makes it difficult to get around any other way but by car. This type of design scale is in sharp contrast to preautomobile commercial areas that commonly took the form of "main streets," where walking from one store to the next was the norm.

Trying to accommodate users of the road who have two different design scales is a difficult task for designers; however, designers must always consider the safety of pedestrian and non vehicular traffic, along with the safety of motorists. Both are users of the road. In many road designs, pedestrian needs were considered only after the needs of motorized vehicles. Not only does this make for unsafe conditions for pedestrians, it can also drastically change how a roadway corridor is used. Widening a roadway that once allowed pedestrian access to the two sides of the street can turn the roadway into a barrier and change the way pedestrians use the road and its edges.

The design element with the greatest effect on the scale of the roadway is its width, or cross section. The cross section can include a clear zone, shoulder, parking lanes, travel lanes, and/or median. The wider the overall roadway, the larger its scale; however, there are some design techniques that can help to reduce the perceived width and, thus, the perceived scale of the roadway. Limiting the width of pavement or breaking up the pavement is one option. In some instances, four lane roadways may look less imposing by designing a grass or planted median in the center.

➤ **Detailing the Design**

Particularly during the final design phase, it is the details associated with the project that are important. Employing a multidisciplinary design team ensures that important design details are considered and those they are compatible with community values. Often it is the details of the project that are most recognizable to the public.

A multidisciplinary design team can produce an aesthetic and functional product when the members work together and are flexible in applying guidelines.

✓ **Right-of-way, Construction, And Maintenance**

Once the final designs have been prepared and needed right-of-way is purchased, construction bid packages are made available, a contractor is selected, and construction is initiated. During the right-of-way acquisition and construction stages, minor adjustments in the design may be necessary; therefore, there should be continuous involvement of the design team throughout these stages. Construction may be simple or complex and may require a few months to several years. Once construction has been completed, the facility is ready to begin its normal sequence of operations and maintenance.

Even after the completion of construction, the character of a road can be changed by inappropriate maintenance actions. For example, the replacement of sections of guardrail damaged or destroyed in crashes commonly utilizes whatever spare guardrail sections may be available to the local highway maintenance personnel at the time. The maintenance personnel may not be aware of the use of a special guardrail design to define the "character" of the highway. When special design treatments are used, ongoing operation and maintenance procedures acknowledging these unusual needs should be developed.

❖ **Stages of Highway Development**

- Summaries of the five basic stages in highway planning and development.

Stages	Description of Activity
Planning	Identification of transportation needs and program project to be built Within financial constraints.
Project Development	The transportation project is more clearly defined. Alternative locations and design features are developed and an alternative is selected.
Design	The design team develops detailed design and specification.
Right-of-way	Land needed for the project is acquired.
construction	Selection of contractor, who then builds the project.

Assignment-1

- ❖ How can safety affect the design of highway projects during planning stage and what is the necessity to do environmental impact assessment during project development?