Chapter 14

Aesthetic Considerations in Transportation Systems Evaluation
14.1 INTRODUCTION

In many countries including the United States, roadways have been built without adequate attention paid to aesthetics during design, as most emphasis was placed on speed, safety and efficiency. In recent years, however, many transportation agencies have begun to give transportation aesthetics due consideration. Both federal law and federal transportation regulations promote the preservation of natural beauty along the nation’s highways. Title 23, Section 752.2 of the Code of Federal Regulations state “Highway aesthetics is a most important consideration in the Federal-aid highway program. Highways must not only blend in with our natural, social, and cultural environment, but also provide the pleasure and satisfaction in their use [Federal Register, 1996].

The renewed interest in aesthetics is borne out of a strong federal emphasis on context sensitive design (CSD) and led to the publication of FHWA’s Flexibility in Highway Design. CSD strives to balance aesthetic, community, and environmental needs with traffic safety and function, through an interdisciplinary and collaborative approach that invites input from stakeholders. Such federal initiatives for improved contextual design have encouraged many state DOTs to place greater emphasis on the role of aesthetics on existing and proposed transportation facilities. As such, several states have also embarked on programs to enhance aesthetic quality of the transportation systems by developing and implementing guidelines for integrating aesthetics into design of such facilities. For example, the Ohio State Governor and Department of Transportation, in 1999, announced a design aesthetics initiative that incorporates “inexpensive” design elements into transportation project planes, and to improve the look of the interstate system in that state.

The construction and operation of transportation projects typically have a profound visual impact on the surrounding developed or natural environment. Such impacts may be in the form of a good blend with surrounding environment (or lack thereof) or obscuring an aesthetically pleasant natural or man-made feature. Whether a proposed transportation facility or improvement is located in an urban or rural setting, it is important to consider the magnitude of the facility’s aesthetic impacts on the surrounding environment. An aesthetically pleasing transportation system is important because it makes such systems more compatible with their environment or community, make the system and its environment more attractive, and add an element of local surroundings into the design.

This chapter discusses the element of transportation systems that affect overall visual quality, outlines the steps involves in estimating the aesthetic impacts of transportation improvements, and provides some case studies of transportation system aesthetic impacts in the United States and other countries.
TRANSPORTATION PROJECT TYPES THAT TYPICALLY AFFECT AESTHETIC QUALITY

There is a large range of transportation project types, depending on the mode, scale, physical characteristics, etc. For any given type of improvement, there are many ways in which such stimuli can adversely affect aesthetic quality, such as:

1. Addition of sizeable new physical elements on the visual landscape through construction of new transportation facilities
2. Blocking of existing visually pleasing features (such as landmarks, open space, community features) through new construction of (or improvements to) transportation facilities
3. Removal of existing visually pleasing features in right-of-way through new construction of transportation facilities or expansion of existing facilities
4. Addition of visual clutter to the landscape (particularly in urban areas) due to provision of new transportation features such as road signs, overhead traffic sign posts and lines, etc.

On the contrary, transportation system improvements, if planned appropriately, can also augment aesthetic appeal of the environment in which it is located. This may take any of the following forms:

1. Removal of slum areas due to facility construction or expansion
2. Provision of lighting (in urban areas)
3. Provision of landscaping (such as medians with flowers)
4. Consistency of form and function of physical facility with surrounding environment

TOPOLOGICAL ELEMENTS OF TRANSPORTATION SYSTEMS THAT AFFECT VISUAL QUALITY

In an approach to assess the visual quality of urban based transportation improvements, Lynch [1960] identified a number of primary topological features that affect system “legibility”, or the ease with which the various system components can be recognized and organized into a coherent pattern as follows:

- **Paths.** These represent linear landscape elements along which vehicular or pedestrian travel occurs. Examples are the roadway, sidewalks, iron railings that separate the sidewalk from the carriageway, etc. It has been found that this topological feature (particularly, the roadway) plays a dominant role in people’s perception of visual quality in urban areas [Lynch, 1960]. It is not certain, however, that the same could be said for highway facilities in rural areas.

- **Edges.** Like paths, these also represent linear elements of the landscape, but are seen as boundaries. Examples include walls of adjacent property. It has been found that highways tend to be perceived as edges or boundaries that segregate parts of the city or landscape [TXDOT, 2001].

- **Districts.** These are distinctive areas of a community that have a consistent feature or underlying character. An example is a shopping mall, a residential area, park, etc. Traffic analysis zones, a concept used widely in transportation planning, may be considered an example of such districts.
• **Nodes.** These are typically points on the transportation network that link that paths, or may symbolically represent the geographical center or centroid of each district or traffic analysis zone. An example is an intersection of streets or sidewalks. It has been found that interchanges and intersections are perceived as nodes or gateways to precincts that are usually identified in terms of their land use [TXDOT, 2001].

• **Landmarks.** These are generally regarded as point locations, but are typically viewed externally from a considerable distance. It has been found that landmarks such as major bridges are typically used as a reference point for orientation, within an area of a community [TXDOT, 2001].

Lynch’s study focused on the assessment of the visual quality of urban areas and the impacts of external stimuli (such as transportation improvements) on visual quality in such areas. While these concepts were developed primarily for urban areas, they may be considered applicable to the evaluation of aesthetic impacts in rural areas. The perception of highways as edges, intersections as nodes to different precincts, and use of major features as landmarks for orientation are observations that bolster the argument for context sensitive design of transportation facilities.

### 14.4 METHODOLOGY FOR AESTHETIC IMPACT ASSESSMENT

The steps involved in estimating the magnitude of aesthetic impacts of a proposed transportation facility is best carried out using the framework (Figure 14-1) tailored on the steps outlined by Forkenbrock and Weisbrod [2001].

![Figure 14-1: Methodology for Aesthetic Impact Assessment](image-url)
The various steps involved in the assessment of aesthetic impacts are provided below.

1. **Definition of the Study Area.** Transportation system changes typically impact not only the immediate surroundings of the facility but also affects a wide area well beyond the facility boundaries. All areas which are visible from the proposed facility, or from which the transportation facility is visible, may be considered in the definition of the study area. Definition of the study area involves the geographical delineation of the boundaries within which the analyst intends to solicit perspectives of residents, commuters, and workers regarding aesthetic impacts of the proposed facility. For highways and railways, the study area may take the form of a corridor, while for facility terminals, this may be in the form of a circular area around the facility.

2. **Transportation Alternatives.** The next step is to consider one of several transportation improvement alternatives that have already been identified well before the stage of aesthetic impacts analysis. For instance, a river crossing may be achieved using a suspension bridge or a cable stayed bridge. Also, a mountain may be traversed using a tunnel or by excavating an open section though it. It is unlikely that aesthetic considerations alone would have enough influence to sway the decision to adopt one alternative over another, unless in cities where road users have profound influence in the development of their infrastructure systems.

3. **Presentation/Description of Aesthetic Impacts.** This step involves a description of the physical features or operation of the transportation system. This is best done using two dimensional (or better still, three dimensional) graphical illustration of the still structure by an artist, using photomontage techniques, or computer modeling. If computer modeling is used, simulation software developed by Silicon Graphics or Harvard Graphics may be used. Also, GIS software such as ESRI’s Arcview or Intergraph may be used. Other simulation software describe the various views encountered as one drives along the roadway, and thereby offer the viewer a perspective that is more dynamic than mere sketches or still computer images. Alternatively, images of existing similar facilities at other locations with similar environments may be used to describe the aesthetic impacts of the proposed transportation improvement. Such images may be obtained through photography or photogrammetry.

   The selection of appropriate simulation media depends on the scale of the project and physical environment, number of alternatives, availability of resources, and knowledge of the techniques. For small transportation projects that cover a small area and involve only a small number of alternative designs, a simple low-cost artists rendering may be more appropriate to present the aesthetic impacts. On the other hand, for a large number of transportation alternatives, where each alternative is extensive in terms of scope and coverage, and where each alternative is expected to have significant aesthetic impact, the use of computer simulations is recommended [Forkenbrock and Weisbrod, 2001]. Regardless of which medium is chosen, it is important that both the proposed transportation system and its environment are adequately represented. Forkenbrock and Weisbrod [2001] offer criteria for the selection of appropriate medium for this describing the aesthetics of a proposed transportation system:
(i) **Versatility:** the simulation medium should be able to depict the environment with and without the transportation system change

(ii) **Accuracy:** the simulation medium should be fairly accurate in its representation of the environment and transportation system

(iii) **Objectivity:** The simulation medium should be free from any bias that its user may have.

(iv) **Operational Criteria:** The production time, costs and staff capabilities needed to effectively use the medium should be considered.

4. **Estimation of Aesthetic Impact Levels.** After the aesthetic impact shave been presented, it is sought to identify the level of desirability (or otherwise) for each simulated presentation of the proposed transportation system in its new environment. This is typically done by using a selected estimation instrument such as a simple questionnaire survey. Respondents are asked about their perspectives on the aesthetic appeal of each alternative transportation system. The survey instrument may be a document bearing images of the improvement and mailed out to the users, or internet based user surveys. Use of internet based surveys facilitates the presentation of several alternatives to the respondent using a variety of simulation media. The respondents of the survey should not only be the direct users of the transportation facility, but also all persons who regularly encounter the image of the facility in their regular activities and whose visual perception of the study area are impacted by the presence of proposed facility. These include area residents, local business owners, city officials, and the general public. Each respondent can assess the impacts based on a scale of increasingly or decreasing appeal, for example, 0 (very unappealing visual impact) to 10 (very appealing visual impact). Such responses can be weighted by the length of time each respondent takes in encountering the image each day, and all responses can be collated to generate a single index or value that represents the level of aesthetic appeal of the selected transportation alternative.

5. **Mitigation Measures.** If a proposed transportation alternative (or part thereof) is generally deemed aesthetically unappealing by the respondents, appropriate measures should be taken to mitigate this problem. This may involve amending the design to include certain architectural features, or changing the design in its entirety. Through follow up meetings with the respondents, various mitigation alternatives can be evaluated for their suitability. Furthermore, more effective mitigation measures may be generally more expensive, and it may be sought to identify the optimal measure as that which is associated not with the highest effectiveness, but that with the most cost effectiveness.

6. **Presentation of Analysis Results.** The entire process is repeated for each transportation improvement alternative. Finally, a table of results can be generated to show the following information:
   - Description of each alternative
   - Estimated level of aesthetic impact of each alternative
• Possible mitigation measures for each alternative
• Effectiveness of each mitigation measure for each aesthetically deficient alternative (i.e., estimated “jump” in level of aesthetic impact
• Cost and cost-effectiveness of each mitigation measure for each aesthetically deficient alternative

While this concept was developed primarily for urban areas, they can also be considered applicable to the evaluation of aesthetic impacts in rural areas. Lynch’s 1960 study focused on the assessment of the visual quality of urban areas and the impacts of external stimuli (such as transportation improvements) on such visual quality.

14.5 MITIGATION OF ADVERSE AESTHETIC IMPACTS OF TRANSPORTATION IMPROVEMENTS

The Federal Highway Administration provides general guidelines to improve the visual quality of highway facilities found to be aesthetically deficient at their design stage [FHWA, 2001]. Also, Lynch [1960] offers useful considerations that could be considered during the design (or redesign) of transportation system facilities. These guidelines fall in the following general categories:

1. **Continuity**: This involves the placement of features along a roadway to give it continuity, such as intermittent clusters of selected plants.

2. **Order and Texture**: Visual check points along the roadway impart a feeling of order and texture. These include landmarks which are easily recognized and remembered by those who use the road. Changes in the nature of the landscape occur at landmarks that serve as important orientation elements that may also be associated with cultural significance for a community. Order and texture are also enhanced by attractive vistas from the highway. As such, boring and dull roadside visual environments that offer no interesting features could be avoided during design (or redesign) of the highway alignment.

3. **Sense of Identity**: Auxiliary roadway design features such as street lights, guard rails, bridge parapets, and even traffic signals offer an opportunity for enhancing the aesthetic appeal of the facility.

Through its Design Aesthetics Initiative, the Ohio DOT recommends the use of patterns, colors, texture, and landscaping to make a road, noise barrier or bridge visually pleasing to motorists and residents in the area. In Massachusetts, large vendor signs taller than 30 feet were recently seen as “unsightly intrusions” and prevent roadways from preserving their rural character. As such legislative attempts have been made to limit the size of such signs.
Some recent aesthetic initiatives in states have included the following:
- Use of paved stones to create a decorative walkway
- Adding color tints to concrete surfaces to ensure better blend with their natural environment
- Replacement of unsightly fence structures by ornamental fencing
- Leveling and capping of noise barriers to eliminate unsightly irregularities in their levels
- Planting of trees, bushes and wild flowers along roadways and interchanges
- Use of graffiti-resistant paint for fencing along roadways
REFERENCES


4. TXDOT. [2001]. Landscape and Aesthetics Design Manual, Texas Department of Transportation, Austin, TX.