

# Highway Location and the Environment

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## INTRODUCTION

For decades the highway location team has based consideration of alternatives on such basic factors as right-of-way and construction costs, length of alternative routes, number of structures required, number of homes displaced, benefit cost ratios and other traditional considerations. This approach, originally applied to rural projects, gradually crept into use in urban highway location studies. At first the methods were not challenged but eventually the public began to become discontented.

In the early 1960's we began to lose our credibility. Indiscriminate use of park lands, recreation areas, historic sites and other environmentally-significant lands was taking place. The attention that was being focused on economic and social impacts of public works projects was a manifestation of growing public concern over the quality of our environment and our way of life.

The list of major parks and historic areas that were threatened was a long one and includes many sites of national significance:

Vieux Carre in New Orleans  
Rock Creek Park in Washington  
The Georgetown Waterfront  
Federal Hill in Baltimore  
Lynn Woods in Boston  
Breckenridge Park in San Antonio  
The Hudson River Valley  
Tincum Marsh near Philadelphia  
The Florida Everglades  
The California Redwoods  
and the now-famous Overton Park case in Memphis.

Yet in almost every case the highway proposal that brought about each of these controversies had been planned in good faith and designed in

accordance with long-standing practice to provide long-term economic benefits to the users and the community at the least possible cost.

#### FEDERAL ENVIRONMENTAL ACTS START IN 1960's

In response to growing public demand, Congress enacted a series of legislation and the Federal Highway Administration issued Policy and Procedure Memorandums clarifying these:

- (a) In 1966 Section 4(f) of the Department of Transportation Act called for special efforts to avoid taking land from parks, wildlife refuges and historic sites.
- (b) The Federal-aid Highway Act of 1968 included directives to incorporate into highway planning the "economic and social effects" and impact of the highway upon the environment.
- (c) Following the 1968 Act, the Federal Highway Administration revised PPM 20-8 which set forth Public Hearings and Location Approval procedures. Twenty-three social, economic and environmental effects were listed to illustrate some of the areas which the State Highway Departments should consider in evaluating locations and designs.
- (d) The National Environmental Policy Act of 1969 attempted to prevent environmental neglect. The now-famous Section 102 of that Act requires all Federal agencies to submit detailed statements which assess the impact on the human environment of any proposed project. The statements are to be circulated to other agencies and the public for review and comment.
- (e) The Federal Highway Administration initiated PPM 90-1 in response to Section 102 to provide guidelines to highway departments and field offices to assure that the human environment is carefully considered and national environmental goals are met when developing Federally-financed highway improvements.
- (f) The Federal-aid Highway Act of 1970 contained Section 136(b) designed to make sure that each state would fully consider the impacts of any and all proposals for highways within the state.
- (g) PPM 90-4 presents guidelines for action plans to insure that adequate consideration is given to possible social, economic and environmental effects of proposed highway projects and the decisions upon which such projects are based.

While the 1968 Highway Act, for the first time dictated policy that the multitude of factors which highways effected directly or indirectly must receive due attention, many continued to view the requirements of the act and the policy and procedure memorandums that resulted as mechanical exercises giving little attention to some of the areas of concern.

## ENVIRONMENTAL IMPACT STATEMENTS EVALUATED

In 1972 James B. Sullivan and Paul A. Montgomery of the Center for Science in the Public Interest attempted to find out how well requirements of the National Environmental Policy Act were being met. The authors conducted a survey of 76 final 102 environmental impact statements filed through June of 1972 for proposed urban highway projects. The contents of each of the final environmental statements were checked against the list of federally-required evaluations.

The response of local agencies to these requirements was varied. Some of the 76 statements did not mention problem areas or denied that the highway development would have any adverse effect. Others affirmed that the highway would have a positive or negative impact but did not give supporting evidence.

### *Standardized Statements*

Indicative of the tenor of these studies was their reliance on standardized statements to diminish potentially-serious environmental degradation. One-third of the statements asserted without qualification that all highways increase the health and safety of the general public.

### *Problems Omitted*

Some problems were neglected in a significant number of statements. Thirteen percent did not mention air pollution. Thirty-four percent failed to consider community disruption. Forty-four percent did not discuss the disposition of citizen comments and 67 percent made no mention of the impact on taxes or the tax base.

### *Repetition of Identical Phrases, Statements and Reports*

The researchers described the repetition of identical phrases, paragraphs and even full pages in impact statements of differing urban highways. Highway engineers in St. Louis, for example, described the positive attitude of the public toward their proposed urban highway in the identical words used by highway engineers in Omaha.

Sullivan and Montgomery stated that in claiming that their proposed highways would not involve an irreversible or irretrievable com-

mitment of natural resources, engineers in Reading, Pennsylvania; Waterloo, Iowa; St. Louis, Missouri; Omaha, Nebraska; Philadelphia, Pennsylvania; Gadsden, Alabama; Tulsa, Oklahoma; and Chesapeake, Virginia, all used the same comment: "If the facility is no longer needed for transportation purposes or a greater need for the area it occupies arises, the roadway can be converted to the needed land use."

As a final example, in the local agencies' assessment of the relationship between short-term uses and long-term effects of the proposed highway, identical wording was used by the engineers in Baltimore, Maryland; Tulsa, Oklahoma; St. Louis, Missouri; Gadsden, Alabama; Omaha, Nebraska; Chesapeake, Virginia; and Madison, Wisconsin. According to one Department of Transportation staff member who reviewed these 102 statements, it is as though some states "turn in the same reports for several projects and just change the names."

It is little wonder, if facts like these are true, that the public has lost confidence in the highway engineer's ability to realistically assess the impact of a project that he has conceived.

## APPROACHES FOR EVALUATING ENVIRONMENTAL ALTERNATIVES

How then does one evaluate highway alternatives from an environmental standpoint? Many approaches have been set forth. Some quite similar. Some quite different. We have heard of:

- (a) The value-impact matrix technique
- (b) Trade-off analyses
- (c) Sensitivity analyses
- (d) Break-even or equivalent analyses
- (e) The surrogate or team approach or
- (f) The model approach using indicators to reflect the degrees of accuracy

### *Public Displeased with Evaluation Approaches*

The public is left cold by some of these procedures particularly when they are accompanied by reports full of over-worked phrases and paragraphs that appear that they have been spewed from a computer.

In the past, we have shown the public engineering-type drawings and complex tables. More recently graphic portrayal of individual items of consideration have helped the location team, the public and the decision-maker in understanding the individual problem areas that must be considered in an impact analysis.

More important than the analysis approach is the need for an interdisciplinary team including expertise from areas affected by the proposed project. Depending upon the specific conditions, these will include specialists ranging from sociologists and planners to ecologists and agronomists.

## EXAMPLES OF ENVIRONMENTAL STUDY PROBLEMS AND SOLUTIONS

I would like to briefly describe two separate and distinct studies that illustrate some of the problems facing us today and the techniques that can be utilized.

### *Interstate 70—Glenwood Canyon*

The first of these involves a section of Interstate 70 between Gypsum and Glenwood Springs in western Colorado. While Colorado residents value economic opportunity and a safe year-round highway system, they also love the natural beauty of their state. When the highway department actually built a section of Interstate 70 to the east of Glenwood Springs, its failing crib walls and the contractor's insensitive scarring of the Colorado River for a borrow pit made even highway supporters recoil in horror. From that point on, it was a matter of organizing opposition to the prospects of the desecration of the unique and scenic Glenwood Canyon.

The highway department had assumed that the highway would be built on the location providing the safest, shortest, most level, least costly route which also was the most protected from heavy winter snows. For this reason, no documentation of the rationalization for the route or alternatives or consideration of environmental impacts seemed necessary.

Environmentalists utilizing the leverage of the National Environmental Policy Act put forth several alternatives and challenged the highway alignment on the basis that it did not satisfy the requirements of the act which had been enacted subsequent to the original determination of the alignment through the canyon. The National Environmental Policy Act therefore was a major reason for this study.

The FAI 70 study in Colorado involved comparison of the social, economic and environmental impacts of two alternatives for Interstate 70. The northernmost alignment followed the existing U. S. highway through Glenwood Canyon. This was the alternative originally favored by the state highway department. Due to the unique character of Glenwood Canyon and the opposition to the alignment that arose,

alternative proposals were developed for a more southerly route over Cottonwood Pass bypassing Glenwood Canyon.

The study carried out by the consultants was specifically restricted to the relative socioeconomic and environmental impacts. Studies of engineering factors such as traffic, construction, operation and maintenance costs were carried out by the state highway department.

In this study an attempt was made to forecast the impact of a highway in either corridor upon all elements of the natural and man-made environment. The purpose of the study was to present facts relevant to a public hearing and final decision between the two alternatives by public officials. No attempt was made to quantify all factors by numerical equivalents nor were facts weighed against each other such as trying to equate tons of sedimentation against impact on esthetic character. By considering related sets of factors, differences were noted between corridor alignment and design influences. The study was structured to avoid reliance on assumptions which were most likely to be modified at a later date.

A series of graphical presentations was prepared for the public hearings and for the aid of the decision-makers. These illustrated the various factors considered. The graphic presentations were accompanied by supporting narrative and tabular descriptions.

Land uses through the study area were illustrated. For a rural mountainous project of this type uses were categorized as urban, institutional, park, agricultural, grazing, woodland, rock and water resources. The socioeconomic as well as the physical impacts on these land uses were described in tabular and text form and illustrated in graphic form.

Major public utilities such as electric and gas transmission lines were located and the impact on these illustrated. Similarly, impact on railways through the corridor resulting from disturbance of unstable subsurface areas, blasting, tunneling, and intersection of the alignment with the railway was illustrated.

Public and private lands were identified and land ownership affected by the highway alignments shown. Impact on school service areas and bus routes was shown. Natural and historic factors were inventoried and illustrated graphically in relation to the alignments. The general location of public health and safety facilities in the study area and the alignment relationship to these facilities was shown. Possible hazardous areas such as severe wind and heavy snow areas were illustrated.

The type of vegetation prevalent in the area was illustrated. Within the study area there were 13 species of trees, 26 forbs, 28 varieties of brush and 33 varieties of grasses which are adaptive to various sub-areas. The planting guide or the zonal designations indicating the difficulty that would be faced in revegetating cut and fill slopes along the alignments were plotted.

A summary impact drawing illustrated the areas of most serious disruption of plant material. In addition extensive tabular and narrative comparisons of impact on vegetation were made.

The geologic sequences were inventoried and the impacts on geology of both alternatives were illustrated. These included notation of landslide areas, erosion potential, local joints, areas where undercutting should be avoided, talus slopes and other areas unfavorable to cut.

Winter game ranges were identified. Mule deer and elk are prevalent in the area and the impact upon elk migration was a serious point of contention. Water resources and major water courses were identified. The esthetic character of the alignments was illustrated graphically by establishing a series of reference zones and utilizing an extensive series of photographs depicting the character of these zones.

Even the gradient and curvature of the two alternatives was illustrated graphically. A special simulation model was applied to these factors to determine the fuel consumption and relative emission rates of pollutants from various classes of vehicles operating over the two alternatives.

Lastly, the impact on esthetics of both of the alternatives was illustrated and categorized as to major destructive influence, severe incompatibility, difficult problem area, or minor problem area.

The series of graphic presentations together with the extensive tabular and narrative presentations served to illustrate the environmental and socioeconomic differences between the two alignments in much greater detail than had been documented in the earlier studies which were confined principally to intuition and judgment.

### *West Georgia Tollway*

The second study involves a project for which a location had not yet been selected at the time of the environmental analyses, allowing the environmental studies to be carried out concurrent with the highway location process.

Georgia, the largest state east of the Mississippi River, serves as the focal point for major north-south interstate routes along the Eastern Seaboard. Most of these routes converge into I-75 at Chattanooga or Atlanta resulting in one of the most heavily-traveled interstate corridors in the United States.

In an effort to provide adequately for north-south travel demands through Georgia, the department of transportation undertook a feasibility study for a north-south limited access highway through west Georgia to provide needed relief to the I-75 corridor and at the same time stimulate economic growth for the west Georgia counties.

On June 5, 1973 the department retained consultants to undertake environmental analyses and route location studies for the highway. The route would extend from the Florida line near Tallahassee to the Tennessee line south of Chattanooga, a distance of over 340 miles.

In carrying out the environmental analysis the consultants were to:

- (a) Identify environmental factors within and along the corridor;
- (b) Itemize and graphically indicate areas where exceptional sensitivity in design would be required;
- (c) Suggest areas where specific construction procedures could be used to mitigate potentially adverse environmental impacts which could not otherwise be avoided;
- (d) Indicate areas or factors which could be environmentally enhanced; and
- (e) Measure those impacts which could be quantified and evaluate nonquantifiable environmental factors.

In addition a separate evaluation was to be undertaken for areas falling within 4f land definition such as public parks, recreation areas, game refuges and historic sites.

In order to develop a freeway alignment sensitive to human and environmental values as well as transportation objectives, careful coordination of engineering, planning, socioeconomic, esthetic, and ecological factors was necessary at each stage in route evaluation.

Consequently the consultants assembled an interdisciplinary team of over 50 specialists in the areas of highway location; soils, geology, hydrology, and water resources; traffic operations and transportation planning; plant life, fish and game; natural and historic resources; regional and urban planning; agriculture, economics and sociology; air quality and noise control; landscape architecture; and construction, public utilities and right-of-way.



During the course of the environmental analyses, the consultants worked closely with regional area planning and development commissions in establishing contacts with affected agencies, communities and organizations within the highway corridor. The consultants' staff established contact with over 150 agencies and individuals in gathering environmental and socioeconomic data.

Concurrent with the environmental inventories, the consultants' engineering staff, making use of colored aerial photography and topographic mapping undertook extensive field reconnaissance to inventory physical conditions which would affect the engineering character of a route location and profile.

The consultants were specifically directed to develop route location alternatives within a corridor adopted by the transportation board on the basis of the earlier feasibility studies. They were, at the same time, to analyze socioeconomic and environmental effects of these alternatives. To achieve these objectives, the team, utilizing the inventories of existing conditions developed by their respective disciplines, reviewed alternative alignments together so that a simultaneous give-and-take could occur among the disciplines.

Many potential impacts were identified during this phase of the study which would not have been recognized by individuals in any one discipline working alone. Critical conflicts were thus avoided during the early stages of route location. The result of the location process by team effort was presented in a series of overlays on an aerial-photo base showing the alternative route locations and the major environmental resources within the corridor.

The manner in which the alternatives avoided or impacted these resources was illustrated graphically. It is interesting to note that with more than 125 parks and recreational sites falling within the corridor, which would have necessitated preparation of a 4f statement if directly affected by the project, only two were impacted. In both instances alternative routes had been developed which could eliminate direct impact on the parks if selected for final route location following the public hearings.

Specialists from different disciplines reached different conclusions from the same set of interrelated facts, reflecting differing value judgments. In areas where clear value differences existed during the team location approach, one or more alternative locations were established. For example, in the high farm value areas one alternative would take a higher percentage of wildlife habitat along wooded streams and another would displace greater acreages of pasture or cropland.

In instances where the tradeoffs between the alternatives were too great to result in a compromise acceptable to all disciplines, both alternatives were retained for presentation at the public hearings. Only in those instances where members of the team from differing disciplines agreed, without major compromise of any one discipline, was a single alignment shown.

The route location alternatives were analyzed in detail to determine the full range of environmental impacts discernible at the location stage of the planning process. The precision with which impacts could be described was a function of the degree to which the details of the proposed project had been developed.

Following the public hearings, as the route location process progressed to the final alignment stage and additional information was available—such as precise interchange and service area location, design details relating to bridges, roadside development and appurtenant structures—resulting impacts were specifically documented. These were contained in a final environmental impact assessment.

## CONCLUSION

Both of these projects illustrate the opportunity afforded to improve not only the planning and design process but the critical documentation indicating project compatibility with the broad range of environmental objectives. To be successful, environmental studies must become an integral part of all phases of a project from conception to construction. The result will be not only an environmental assessment which meets current legislative and policy guidelines, but an approach to highway design which is responsive to public concerns and objectives.