

**CHAPTER 17**  
**ENVIRONMENTAL CONSIDERATIONS**

## CONTENTS

<b>Section</b>		<b>Page</b>
17--01	ENVIRONMENTAL IMPACT STATEMENTS	1
17- 02	METHODS OF ENVIRONMENTAL EVALUATION, GENERAL CHECKLIST	1
17--02.01	CONSULTED AGENCIES BY THE ENVIRONMENTAL STUDIES OFFICE FOR THE PREPARATION OF AN ENVIRONMENTAL EVALUATION	2
17--02.02	DATA SOURCES	3
17--03	ENVIRONMENTAL FACTORS	4
17--03.01	PHYSICAL ENVIRONMENTAL FACTORS	4
	A -- Air Factors	4
	B -- Water Factors	5
	C -- Land Use Factors	7
	D -- Wildlife Factors	8
	E -- Auditory Factors	9
	F -- Visual Factors	10
	G -- Construction Factors to Consider During Design	11
17--03.02	SOCIAL ENVIRONMENTAL FACTORS	11
	A -- Cultural Factors	11
	B -- Recreational Factors	12
	C -- Open Space Factors	13

## CHAPTER 17

### 17-01 ENVIRONMENTAL IMPACT STATEMENT

The National Environmental Policy Act (NEPA) of 1969 (P. L. 91-190) established a broad national policy to promote efforts to improve the relationship between man and his environment.

The NEPA further requires that all policies, regulations and public laws of the United States and Puerto Rico shall be interpreted and administered in accordance with those policies and goals.

Section 101(a) of the NEPA clearly states these policies and goals and declares that it is the continuing policy of the Federal Government, in cooperation with State and local governments as well as concerned public and private organizations, to use all practicable means to create and maintain environmental conditions under which present and future generations can exist in productive harmony with nature.

The NEPA also established the Council on Environmental Quality with the authority to prepare and issue guidelines for the implementation of Section 102(2) (c). This section requires that "... all agencies of the Federal Government must include in every recommendation or report on proposals for legislation and other major Federal actions, significantly affecting the quality of the human environment, a detailed statement by the responsible official on:

1. The environmental impact of the proposed action,
2. Any adverse environmental effects which can not be avoided should the proposal be implemented,
3. Alternatives to the proposed action,
4. The relationship between local short-term uses of man's environment and the maintenance and enhancement of long term productivity,
5. Any irreversible and irretrievable commitment of resources which would be involved if the proposed action is implemented".

In actions where the location studies reveals no feasible and prudent alternative to avoid the use of land from a publicly owned park, recreation area, wildlife and waterfowl refuge or any land from a historic site, a 4(f) statement will be prepared and included in the Environmental Document. The 4(f) statement supports the determination in which the action will include all possible planning to minimize harm. Reference should be made to FHPM 7-7-2 Part 20.

Guidelines have been established for carrying out the intent of these requirements and these guidelines have been adopted by the Department not only in the preparation of Environmental Impact Statement, but also in the general environmental evaluation of all projects (see FHPM 7-7-2, Section 1653(f) of 49 United States Code, Section 470(f) of the United States Code, and Section 309 of the Clean Air Act of 1970; September 7, 1972).

The type of Environmental Impact Statement required for a project will be determined by the Environmental Studies Office in conjunction with the Federal Highway Administration.

### 17-02 METHODS OF ENVIRONMENTAL EVALUATION, GENERAL CHECKLIST

The first step in the preparation of the environmental evaluation of any highway project is the recognition of the protection and enhancement of the environment that is of increasing importance and must be fully considered.

The Environmental Studies Office in coordination with government and private organizations is responsible for preparing all phases of the Environmental Impact Statement and

4(f) Statement when required. It is of particular importance that the designer will make full use of any environmental comments received from the Environmental Studies Office during the review of the Design Reports.

The following non-exclusive list of "Social, Economic and Environmental Effects", represents many of the factors to be considered as interrelated in the environmental evaluation:

1. Conservation and preservation of Natural, Ecological and Scenic Resources
2. Displacement and Relocation of Individuals and Families
3. Regional and Community growth
4. Community Cohesion
5. Public Facilities Service
6. Air and Water Quality
7. Noise Pollution
8. Aesthetics and Other Values

These topics on the above list are investigated and reported upon by the Environmental Studies Office.

17-02.01      **CONSULTED AGENCIES BY THE ENVIRONMENTAL STUDIES OFFICE**

**FOR THE PREPARATION OF AN ENVIRONMENTAL DOCUMENT**

Puerto Rico Planning Board  
G.P.O. Box 9447  
Santurce, Puerto Rico 00908

Puerto Rico Aqueducts and Sewers Authority  
G. P. O. Box 7066  
Santurce, Puerto Rico 00916

Environmental Quality Board  
G. P. O. Box 11488  
Santurce, Puerto Rico 00910

Department of Housing  
G. P. O. Box 20591  
Río Piedras, Puerto Rico 00928

Public Parks and Recreation Administration  
G. P. O. Box 3207  
San Juan, Puerto Rico 00910

Department of Commerce  
G. P. O. Box 4275  
San Juan, Puerto Rico 00905

Department of Education  
G. P. O. Box 795  
Hato Rey, Puerto Rico 00919

Puerto Rico Water Resources Authority  
G. P. O. Box 4267  
San Juan, Puerto Rico 00936

Department of Health  
G. P. O. Box 9942  
Santurce, Puerto Rico 00908

Department of Natural Resources  
G. P. O. Box 5887  
Puerta de Tierra, Puerto Rico 00906

Institute of Puerto Rican Culture  
G. P. O. Box 4184  
San Juan, Puerto Rico 00905  
Puerto Rico Economic Development Administration  
G. P. O. Box 10163  
Santurce, Puerto Rico 00908

**MUNICIPALITIES IN WHICH PROPOSED PROJECT IS LOCATED**

U. S. Department of the Interior  
Office of the Secretary  
Southeast Region, 148 Cain Street, N. E.  
Atlanta, Georgia 30303

Environmental Protection Agency  
Regional Office II  
Federal Building  
26 Federal Plaza  
New York, New York 10007

U. S. Department of Health, Education and Welfare  
Region II, 26 Federal Plaza  
New York, New York 10007

U. S. Department of Agriculture  
Soil Conservation Service  
Caribbean Area  
G. P. O. Box 4868  
San Juan, Puerto Rico 00936

U. S. Department of Housing  
and Urban Development  
Commonwealth Area Office  
G. P. O. Box 3869  
San Juan, Puerto Rico 00936

U. S. Coast Guard Commander  
7th Coast Guard District  
Federal Room - 1012  
51 SW, 1st Avenue  
Miami, Florida 33130.

U. S. Army Corps of Engineers  
San Juan Area Office  
400 Fernández Juncos Avenue  
San Juan, Puerto Rico 00901

**17-02.02 DATA SOURCES**

In addition to the U. S. G. S. Topographic Survey maps and aerial photographic coverage, soil maps, land use map inventories, zoning maps, master plans, historic site inventories, regional growth projections and geologic maps should be used during the preparation of the Environmental Evaluation.

The Design Area shall have a copy of each Environmental Impact Statement and its disposition so that recommendation for measures to minimize possible environmental damage can be included in the plans and specifications.

From the above data, the Design Area designer should assemble a check list of the environmental factors considered. With the list available, the designer is then prepared to make a field inspection of the project.

The importance of the field inspection can not be over-estimated for it is at this point that the designer will be able to expand or reduce his environmental checklist. A number of basic decisions will be the product of these field trips.

Following the on-site inspection of the project the designer should seek the expert opinion of specialists such as planner, environmental engineers, soil engineers and landscape architects within the Department as well as representatives of state agencies on various environmental factors in the review of the project.

In addition to providing basic data, agencies contracted during the Environmental Evaluation can also provide the designer with the preliminary data to find the techniques and procedures related to solving the expected problems.

### 17-03 ENVIRONMENTAL FACTORS

For the purpose of this Chapter, natural and physical environmental factors include air, water, land and wildlife, while the social factors include recreational needs, aesthetics, noise and the preservation of historic and prehistoric sites.

The evaluation and identification of the impacts of air, noise and water, the economic and social environmental factors, such as "economic activity, employment, public health and safety, residential and neighborhood characteristics and location, religious institutions, properties values, housing replacement, education and displacement of families and business" is developed by the Environmental Studies Office in consultation with other offices inside the Department and other agencies as well.

#### 17-03.01 PHYSICAL ENVIRONMENTAL FACTORS

The visual impact to the physical environment related to a highway project should be of a major concern to the environmentalist and the designer. The designer in rural areas must make every effort to preserve the existing natural environment with the objective of creating an attractive highway. In the urban areas there may be a natural environment to preserve or enhance. In this situation the designer should provide enough right of way on which to do the landscape development necessary to improve the physical environment.

##### A. Air Factors

A highway project can contribute to air pollution during and after the construction. The designer may obtain general information through the Air Quality Division (Office of Environmental Studies). At a local level the Environmental Quality Board should be contacted for broad guidelines and specifications with regard to air pollution abatement as covered under clearing and grubbing (non burning disposal techniques). Demolition contracts in urban and suburban areas require special consideration. The designer should also be aware of air pollution abatement references within the general specifications.

Every highway project individually considered, as well as the overall transportation plan shall be consistent with the State Implementation Plan. The SIP is to specify the plan of action for achieving the Act's (Clean Air Act of Puerto Rico) objectives, i.e., reduction in emissions levels requisite for meeting the National Ambient Air Quality Standards (NAAQS) and the prevention of excessive increases in emissions in the future in order that the NAAQS be maintained and that significant deterioration of air quality be prevented. In addition, in the SIP, a plan of action is established requiring an strategy to provide for incremental reduction in transportation system emissions as expeditiously as practicable. This strategy can include (where serious problems with air quality exists) transportation control measures and highway design criteria for the reduction of motor vehicle emissions. In order that every project be consistent with the SIP, it must form part of the established strategy or meet the basic objectives of the plan. The consistency determination must be part of the air quality study prepared for each individual project in the Environmental Impact Statement.

Several guidelines are currently available relating highway design to vehicle emission pollution. However, as new information becomes available, the Division of Air Quality Studies may be consulted for additional data and criteria.

Air pollution may be intensified by unpredictable meteorological events such as temperature inversions, turbulences inhomogeneity of the atmosphere or non-characteristic wind patterns and criteria (peak hours) traffic condition. In general, air pollution due to vehicle emissions can be reduced by avoiding steep grades, conditions requiring acceleration and deceleration, and highway segments having poor air circulation (in which a channelization effect is created) due to man made and/or topographical features alongside it, particularly in urban and suburban areas. Unfortunately for the air quality those highway segments offer a solution to noise pollution, therefore, this problem should be studied concurrently. Air pollution projections and suggested study techniques may be found in the following written material:

1. Highway Air Quality Manual  
USDOT, FHWA
2. California Line Source Mathematical  
Mathematical Model — User's Manual
3. Fundamentals of Air Quality  
Department of Transportation  
Federal Highway Administration  
Washington, D. C. 205590
4. "Workshop of Atmospheric Dispersion Estimates"  
U. S. Public Health Service Publications  
999-AP-26 avail. BTIS
5. Clean Air Act for Puerto Rico  
Commonwealth Environmental Quality Board

#### **B. Water Factors**

A highway project can contribute to water pollution in a number of ways both during and after construction.

Pollutants such as plasticisers, lead, lubricants and fuels are readily identified as potential pollution factors. However, since pollutants are defined as many natural or man-produced substances that are detrimental to a waterway, one of the major pollutants is from soil erosion. The designer must be aware of the content and use of all the Department specifications to control soil erosion, stream conservation, water pollution abatement, solid waste disposal, restoration of disturbed areas and temporary water pollution control.

The use of construction timetables in conjunction with the use of erosion control specification remains in an absolute necessity although the effects of water pollution can be minimized through the recognition of these problems during design.

Identification of easily erodible soils, predictable internal and surface drainage patterns, stream channel characteristics and local geologic features are necessary in the environmental evaluation.

During construction, the rapid stabilization of disturbed areas through revegetation is of primary importance. Both temporary and final soil erosion control must be considered by the designer (Reference should be made to FHPM 6-7-3). However, it should be noted that the excess fertilizer run off from seeded areas may increase phosphate in adjacent waterways to the point of becoming a pollutant.

The range of water related factors involved in any project may include alteration of streams marshes and other wet lands, boating on navigable streams water supplies, potential floodings conditions and possible alteration of water tables.

The effect of overloading existing combined sewer systems which might result in untreated sewage by-passing treatment plants should also be investigated.

In addition to the Water Quality Division (Office of Environmental Studies), the designer should consult with the local offices of the U.S. Soil Conservation Service. This organization can be particularly helpful in the design of sedimentation basins (The designer should also be familiar with the **Guidelines for Erosion and Sedimentation Control Planning and Implementation**, prepared by the Office of Research and Monitoring, U. S. Environmental Protection Agency, Washington, D. C. 20460 and **Suggestions for Temporary Erosion and Siltation Control Measures** prepared by the U. S. Department of Transportation Federal Highway Administration).

The standard method of soil stabilization such as seeding, sodding and mulching, together with the use of jute mesh and other erosion control mats or netting are all helpful.

In certain areas of highly erodible soil or highway hydraulic gradients, the use of these common revegetational procedures may not be sufficient to permit stabilization. In these cases, granular fill slope protection, subsurface drainage or retaining structures should be considered with the aid of the Division of Soil Engineering.

The proper design of drainageways must provide for anticipated design flow together with adequate protection of the terrain and low maintenance characteristics.

Special care must be exercised in the design of energy dissipators so as to prevent additional erosion problems.

If the project must encroach upon natural waterways or impoundments, a special effort must be made to design all works in a manner which will lessen the impact on these areas.

Special consideration must be given to the methods of crossing live streams by construction equipment, together with the specifications of materials when such temporary crossings are necessary.

Stream relocations must be designed with full knowledge of the conditions which are conducive to erosion as well as those protective procedures available to eliminate or alleviate this problem.

Natural impoundments or other bodies of water with erodible banks require stabilization through the use of vegetation or slope protection techniques due to wave action, although in many cases the problem is not as critical as with moving water.

Wetlands, due to their high environmental value should be avoided wherever possible. Highway projects bisecting wetland areas often cause problems due to disturbance of the ground water table by the highway fill. If such situations arises, heavy fills without adequate cross drainage structures should be avoided. Minor elevation changes of ground water create ecological problems which may result in the death of mature vegetation adjacent to the highway. This problem may be alleviated through the use of equalizing culverts.

With regard to the final deposition of water collected on a project, particular attention should be given to the final discharge so that physical damage to adjacent properties is avoided and the resultant water is as free of pollutants as possible.

The office of Soil Engineering should be consulted in matter relating to drainageway design, bank and channel protective lining design and roadside drainage channel design. Also, the designer should be familiar with the following literature:

1. Excerpts from the Michigan Department of State  
Highways and Transportation  
Program for Soil Erosion and Sedimentation Control  
As prepared for the Water Resources Commission Under  
Act 347 P. A. 1972



FOR

Designation as an Authorized Agency State Highway Commission

2. Shore Protection Guidelines  
Department of the Army  
Corps of Engineers  
Washington, D. C.
3. Standards and Specifications for Soil Erosion and Sedimentation  
Control in Developing Areas  
U. S. Department of Agriculture Soil Conservation Service
4. Puerto Rico Highway Authority  
Standard Interim Specifications for Road and Bridge  
Construction 1971 Issue

**C. Land Use Factors**

Land use as it relates to ecological value, productivity and economic value should be a basic factor in the environmental evaluation of a highway project.

Valuable agricultural lands such as prime and unique farm lands are recognized as a diminishing resource and should be so identified and avoided if possible. Prime farmlands are those whose value derives from their general advantage as cropland due to soil and water conditions. Unique farmlands are those who derives from their particular advantages for growing specialty crops.

Efforts should be made to assure that these agricultural lands are not irreversibly converted to other uses unless other public interest override the importance of preservation or otherwise outweigh the environmental benefits derived from their protection. These benefits stem from the capacity of such agricultural land to produce relatively more food with less erosion and with lower demand of fertilizer, energy and other resources. In addition, the preservation of agricultural land in general provides the benefits of open space, protection of scenery, wildlife habitat and in some cases controls on urban sprawl.

The United States Department of Agriculture as well as the United States Soil Conservation Service personnel should be consulted in order to obtain assistance in identifying these agricultural lands before the preparation of the environmental impact statement. Reference should be made to paragraph 101(b) (4) of the National Environmental Policy Act as interpreted by the Council of Environmental Quality in their August 30, 1976 memorandum.

Wetlands constitute a land use category which require a great deal of careful consideration by the designer in order to avoid major negative environmental impacts.

Marshes (fresh, salt and estuarine), swamps and bogs are all wetlands which are valued for ground water recharge basins, wildlife refuges and open space. These areas are recognized as producing high quantities of food basic to the ecological "food chain" as well as being the headwaters of many watersheds. Due to their low human occupancy, they are often regarded as logical areas for highway development. However, they are rated high on the environmental scale and should be completely avoided wherever possible.

Other detrimental effects on wetlands and water impoundments are discussed under Water Factors.

The social use of land is directly related to its environmental value. Therefore, land with a potential for needed open space or recreation must be considered in relation to the highway project impacts.

The designer should obtain copies of local "master plans", and use them together with expertise of local planning boards in order to evaluate project alternates with regard to long range planning.

Woodland areas may have more than commercial timber value. With increasing demand for convenient recreation areas, the designer should consider multiple use values of woodlands as well as the aesthetic impact of the project on such areas. The designer should consult the Department of Natural Resources and also be familiar with the Master Plan for the Commonwealth Forests of Puerto Rico.

The construction demands for selected granular material and other earth fill often requires large volumes of borrow, which in turn can result in the alteration of sizeable acreages of valuable land. In such instances, the environmental impact of a highway can extend far beyond the limiting right of way. The designer must therefore consider the economic as well as the physical environmental aspects of such an action with regard to long-term impact on a non-renewable natural resource.

In instances where the designer must encroach on areas of high environmental value, conservation techniques designed to ameliorate the environmental impact should be sought from the appropriate local agencies.

Borrow pits and waste areas often contribute to a major impact in the environment. While it is usually impossible for the designer to know where the contractor will establish these areas, he should participate in the review of plans submitted by the contractor during the construction. Such controls should be covered in the environmental commitments of the environmental evaluation. At the time of review, the designer should contact the local municipalities to make certain that the Department's recommendations do not conflict with local ordinance or solid waste managements plans.

On occasion, borrow or spoil areas may be within the construction limits. In these cases, the designer should carry out the detailed design as part of the prime contract.

In some cases, the preservation of a unique natural area or cultural site may be carried out through the use of minor adjustments in line and grade. Where geometrics permit, such a design change may prove to be both an economic and environmentally sound approach to the problem.

#### **D. Wildlife Factors**

The continuing reduction of the habitat of many forms of wildlife is reflected in the public concern for a highway environmental impact. This impact can range from the obstruction of the trout spawning movement through a culvert to small ground water table changes which can contribute to major ecological impact on large wetland areas.

An inspection to the area within a project site will be done in an earlier stage of the preparation of the environmental evaluation. This inspection will be done by the Environmental Studies Office in coordination with the Department of Natural Resources. This measure is undertaken in order to avoid, as much as possible, the negative effect of a highway corridor upon endangered flora and/or fauna.

In the event that the highway corridor cannot avoid the area where the endangered flora and/or fauna is located, the designer will coordinate with the Department of Natural Resources personnel in order to use appropriate abatement measures to prevent negative impacts upon this area.

On occasion, the designer will be faced with unique natural areas which because of unusual ecological conditions, support a rare plant or animal community. Such areas, upon expert evaluation, should be avoided for highway construction if at all possible.

In any evaluation of environmental impact on wildlife, the designer should make full use of the Department of Natural Resources personnel.

Special consideration must be given to the treatment of wetlands and water courses as wildlife areas. Stream channel alterations should be carefully considered to avoid the

destruction of fish habitats. The designer should consider the possibility of recreating suitable fish habitats as part of a project involving stream relocation with assistance from the Department of Natural Resources.

In some cases, established wildlife territories and life patterns may require construction adaptations, such as modified culverts for fish spawning streams. Both aquatic and upland wildlife areas may require special considerations during design and in construction details. Full use of the consultation of professional wildlife management personnel will provide the designer with the criteria necessary to meet habitat requirements.

It should be kept in mind that some controlled access rural highways with wide right of way can be designed to provide wildlife habitats for the preservation of existing unusual or common species of plants and animals, providing their presence does not constitute a safety hazard to the traveling public.

Wildlife crossings are not considered in the design of highways in Puerto Rico. They are not necessary because wild animals such as rats, mongooses, frogs and lizards, which are our common species do not require highway crossings. There is no way to control their pass across the road. Also, their presence will not affect the safety of the users.

Specialized publications, such as the Wildlife Habitat Improvement Handbook, Forest Service, U. S. Department of Agriculture, FSH 2609-11, 1969 or Fish Versus Culverts, Technical Report ETR-7700-5, Forest Service, U. S. Department of Agriculture, 1970 may be of aid to the designer.

In some cases, areas of excavation for borrow, after thorough investigation, might be developed as wetlands or wildlife ponds within the right of way.

#### **E. Auditory Factors**

Noise evaluation techniques and criteria as they apply to highway are still in the development stage.

As yet noise standards are tentative, (see FHPM 7-7-3) and additional research of the physiological effects of various types of noise is needed. (See Highway Noise, A Design Guide for Highway Engineers, C.G. Gordon, et. al., Highway Research Board Report 174, 1971).

The designer should make contact with the Noise Division under the Office of Environmental Studies in addition to any specialized information in order to acquire the most recent guidelines and applicable controls.

The following are considered noise abatement measures: barriers, heavy vegetation, regulation of truck traffic and the modification of highway horizontal and vertical alignments. In many cases, vegetation has been psychologically successful, but has failed as a physical noise abatement measure. There are highways that have a considerable amount of sensitive receptors along them and also have a large volume of truck traffic using them. In those cases, one attenuation measure could be the restriction of truck traffic along the highway during certain hours of the day.

Barriers include earth berms, walls, hills, etc. They affect sound propagation and creates an "acoustic shadow zone". Barriers have been constructed of a variety of materials and in three basic shapes: earth berms, free-standing walls, and combination berm-walls. Evaluation of these barriers has pointed out several crucial features of noise barriers.

- 1) The transmitted noise must be 10 dB less than the diffracted noise.
- 2) The barriers cannot have cracks in them.
- 3) The barriers must be high enough to break the line-of-sight between the observer and source and long enough to prevent noise leaks around the ends.

The use of depressed sections, berms and other physical barriers should be considered in heavily populated areas. However, the designer shall remember that the alignment and grade of a highway is an important factor to be considered to avoid air pollution.

In general, noise control must be considered from both the viewpoint of the adjacent property owner and the motorist. Noise levels will be of prime design consideration in the areas involving hospital, schools and residential areas.

Other publications which will aid the designer in projecting potential noise levels within the adjacent environment include:

1. Fundamentals and abatement of Highway Traffic Noise  
Report No. FHWA-HH-HEV-73-7976-1  
U. S. Department of Transportation  
Federal Highway Administration  
National Highway Institute
2. Effect of Highway Landscape  
Development on Nearby Property,  
John H. Brinton, et. al, Highway  
Research Board Report  
No. 75, 1969
3. Highway Noise, Measurement, Simulation  
and Mixed Recreations, William J. Galloway,  
et. al., Highway Research Board Report  
No. 78, 1969
4. FHWA-PD-7658  
Noise Barrier Design Hand Book  
U. S. Department of Transportation  
Federal Highway Administration

In general, while techniques for predicting noise levels and evaluating existing noise abatement barriers are being developed, the designer will find little with regard to the best methods of noise abatement. The designer should use noise abatement techniques such as changes in horizontal and vertical alignment; acquisition of additional right of way or modified grading to try to avoid increasing existing community sound levels rather than attempting to correct it by barriers after basic design is set.

In addition to Highway Noise, a Design Guide for Highway Engineers, (HRB Report No. 117), the designer should consult other Noise Assessment Guidelines, for details on approaches to highway noise analysis. In developing a noise report it is necessary to obtain actual meter readings of existing noise levels.

The designer without background in acoustical engineering will find an excellent basic introduction in Fundamentals and Abatement of Highway Traffic Noise, Bolt Beranek and Newman, Inc.

#### **F. Visual Factors**

The aesthetic quality of the finished highway is discussed or referred to in various places in the Design Manual. However, it should be noted that the visual portions of the highway as well as the offscape views always constitute an environmental impact. Careful consideration of these factors during the environmental impact investigation will prevent the necessity of expensive and sometimes ineffective "cosmetic" treatments in the later development phases.

The highway is viewed both from the adjacent property as well as from the highway itself. Because of this fact, the designer must consider, from both viewpoints, such diverse elements as; the general land forms created by the construction, structures, vegetation, roadside views, street furniture and other appurtenances.

Special consideration should be given to highway directional signs. While such signs are a necessary adjunct to the highway and are tightly controlled by standards, they should not be permitted to create visual "clutter", which can, in itself, be a safety hazard.

#### **G. Construction Factors to Consider During Design**

Temporary environmental effects are significant in some cases. The designer should fully evaluate the effects that construction activities will have on maintenance and protection of traffic, local fire, police, utility services, water, noise and air pollution, etc.; and to prepare plans and specifications that will minimize disruption.

### **17-03.02 SOCIAL ENVIRONMENTAL FACTORS**

In addition to the relatively easily identifiable physical environmental factors, the designer must also take into consideration the impact of the proposed highway on the social environment which may be changed or modified by the project.

Regional and community growth characteristics as reflected by planning projections, must be evaluated.

The effect of the project on the following shall be taken into consideration: public facilities and services, including community protection and emergency services as well as health, education and religious facilities.

Each community possess specific characteristics involving life patterns and economic activity. The designer must consider the effect of the project on these characteristics. The impact of the highway on property values, economic activity and displacement of businesses and people are an integral part of the environmental evaluation. (See FHPM 7-7-5)

In addition to the social environmental effects noted above, the development of cultural resources, recreational facilities and open space are prime areas of concern to the designer and are discussed in detail as follows:

#### **A. Cultural Factors**

Culture, for the purpose of this Chapter, is defined as any physical developments, remains or identifiable sites associated with a particular period of man's social or material development.

It includes historic buildings, structures, landmarks and archeological sites. Paleontological and geological sites must also be considered.

Even though there is no legislation in Puerto Rico for protecting land marks, consultation will be made to the Institute of Puerto Rican Culture by the office of Environmental Studies during the preparation of an environmental document. This measure is undertaken in order to preserve such sites. Actually there is one site in Puerto Rico on the National Registry of National Landmarks but there are 26 potential sites.

In order to preserve or salvage segments of our cultural environment, it is necessary to identify and evaluate areas or sites of prehistoric or historic importance at an early stage of the environmental study.

Information related with cultural background, archeological findings and any activity related with our history and culture are carried through the Institute of Puerto Rican Culture (State Historic Preservation Officer). The Institute should be consulted in the early stages of the environmental investigation and design in order to avoid damages on historical or archeological places. If any non registered archeological findings appear in any stage of construction, the Institute should be notified. A note on this effect should be included to the contract documents of the project.

A number of localities, within the past few years, have collected, and in some cases, published information on surviving examples of buildings having architectural or historic merit.

In many cases, the Institute of Puerto Rican Culture can advise the designer if such publications or manuscripts are available for the area under study.

Examination of the National Register of Historic Places should be carried out at an early stage of the environmental investigation. The National Register is constantly being enlarged by addition of new entries. Historic places are frequently added after the processing of the Draft Environmental Impact Statement. The advisory Council procedures require FHWA and the State Historic Preservation Officer to apply the National Register Criteria to all possible historic sites within the project's area of potential environment impact, at the earliest stage of planning or consideration of the proposed undertaking; therefore potential entries should have been recognized before the preparation of the draft Environmental Impact Statement.

If the Department of Transportation and Public Works before the preparation of an Environmental Impact Statement determines that it is questionable whether a property meets the Nation Register criteria, FHWA shall request, in writing, an opinion from the Secretary of the Interior, Attention: The Keeper of the National Register, National Park Service Washington D. C. 20240, with respect to the property's eligibility for the inclusion in the National Register.

If during construction an archological finding appears the designer might consider a slight modification of alignment which would leave the historical site outside of the construction limits, thus preserving the site. In instances where the designer cannot avoid such a site by adjusting the alignment or grade, special efforts should be made to reduce the highway impact.

While a highway may physically bypass areas of high cultural value, the proximity of the project may still require design modifications due to visual or sound problems. The use of "buffers" consisting of natural barriers or the establishment of artificial berms or structures may be considered as part of the design.

In some cases, such a buffer may be created by modification of line and grade so as to form a barrier with an existing land form or other physical obstruction. Further guidelines relating to Historic Preservation may be found in FHPM 7-7-2.

#### **B. Recreational Factors**

The possible expansion or creation of new recreation areas is not a direct function of this Department. However, the environmental impact of the highway on existing recreational facilities is an important factor within the environmental investigation.

The publication, "Park and Recreational Facilities, Their Consideration as an Environmental Factor Influencing the Location and Design of a Highway", (U.S. Department of Transportation, Federal Highway Administration, Office of Environmental Policy, Environmental Development Division) in 1971, provides guidelines for inventory data required for objective evaluation, major classification of park types and suggested design criteria to be considered, including noise abatement control. This data input is necessary, not only from the viewpoint of overall environmental evaluation, but also as part of the 4(f) review statement required when a highway project affects conservation land. These lands are further defined as "public parks, recreation areas, wildlife and waterfowl refuges and historic sites". (See FHPM 7-7-2). The purpose of the 4(f) Statement is to document the considerations and alternatives studied for the determination that there are no feasible and prudent alternatives to the use of such lands. It also includes all possible planning to minimize harm.

During the evaluation of the environmental impact on recreation lands, the designer should make full use of local and regional personnel of the Parks and Recreation Administration.

The significance of "conservation lands", as defined above, must be evaluated by the agency responsible for the "conservation lands". Such significance must consider social needs for the activity provided, their general contribution to the needs of the community and their accessibility.

In cases where recreational areas cannot be avoided and a Section 4(f) review is required, the designer must develop detailed plans to minimize highway impact. This may involve a monetary settlement with the agency or governmental unit involved as well as the replacement of recreational facilities.

### C. Open Space Factors

Open space, for the purpose of this Chapter, is defined as urban, suburban or rural lands which because of physical or economic factors have remained in an essentially undeveloped condition. The highway may have a positive or a negative impact on such low intensity land use areas. The designer should consider undeveloped open space as an opportunity to further the preservation of such lands rather than as a limiting design factor. The demand for future areas of open space is more difficult to evaluate without the aid of projections of such land use demands by local municipalities and regional planning agencies. The Puerto Rico Planning Board may aid in directing the designer to existing and projected land use studies. The designer should consider the preservation of such open space only with the cooperation of regional and local agencies able to provide advance planning data and guidelines.

In some cases, open space will be created through land severances. The designer should take advantage of these situations by the retention or acquisition of "land-locked" parcels if a desirable pattern of open space will result or if the land is suitable for appropriate landscape development.