

ENVIRONMENTAL IMPACT STATEMENT PREPARATION

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ABSTRACT

The evaluation of the environmental effects of man's activities has long been neglected. In particular, the effect on the environment from both long and short term road system construction has not been evaluated. A procedure is presented which allows the evaluation of the effects of road system construction on the environment.

Introduction

As man acts to structure the environment, better procedures are needed to enable evaluation of the short and long term effects of engineering projects which may alter the environment. Impetus has been added for preparation of environmental impact statements in the United States by the National Environmental Acts (NEPA) of 1969. The NEPA became law in 1970 and it requires a detailed preparation of environmental statements. All federal agencies in the United States are required to submit statements covering any federal action that affects or alters the natural environment. No such requirement is made at the Federal level in Canada, nor do the provinces make such demands. It is of interest that some municipalities do insist on having such statements and the city of London is a good example.

The result of this NEPA has been the preparation of many "Environmental

Impact Statements.” A partial list can be found in the 102 Monitor [1]. Several model environmental statements are presented in the literature [2, 3, 4]. The paper by Leopold *et al.*, [2] describes a very comprehensive and general approach to the preparation and resulting evaluation of impact statements, however, there is no absolute or perfect format for preparing an environmental impact statement. As many factors should be considered as time and money permit and the area under study in general dictates what factors should be considered and the degree of emphasis that should be placed on each.

This article describes an approach for road systems which looks into environmental consequences. It indicates the type of information required and ways of obtaining it and presents a timetable and a suggested report format.

IMPACT STATEMENT FORMAT

As a technical presentation, the environmental impact statement should be broken down into the following broad categories:

1. Statement of Objectives
2. Technological Possibilities for Achieving the Stated Objectives
3. Proposed Actions and Alternatives
4. Environmental Characterization Report Prior to Initiation of Action
5. Identification of Impact and Analysis of Magnitude and Importance
6. Assessment of Impact
7. Recommendations

Since much of the information required and used in an environmental impact statement is qualitative rather than quantitative, it is best represented in a matrix (table) form. All important parameters should be assessed by a relative scheme such as negative (detrimental), gen (no effect), plus (good) or by an arithmetic scheme of rating from 0 (bad) through 10 (good) in terms of magnitude and importance.

To complete such an environmental statement, experts in the field of Environmental Engineering, and Environmental Studies are required. As one might gather from the topics that should be evaluated, these experts must have experience in Biology, Microbiology, Botany, Geography, Geology and Environmental Engineering. To fulfill this requirement, professional assistance must be sought from many specialists to make a meaningful environmental assessment.

As a typical plan or approach some of the consideration required in an “Environmental Impact Statement” associated with road construction has been prepared. This approach was developed by the authors for Damas and Smith Consulting Engineers who had to develop a road construction model for the Pond Mills area in the City of London which had the least Environmental impact and the maximum benefit to the community. Because Environmental

Impact Statements do take a general form other professionals will certainly benefit from our experience.

Statement of objectives—For road system construction or modification this phase of the presentation covers in a broad sense the problem which usually involves the evaluation of the effect on the environment of a number of proposed alternate routes, and the selection of the alternative which has the least environmental impact (which scheme results in minimal damage to the environment). Thus the design layout for all alternatives must be completed prior to a complete and detailed environmental analysis. At times they can be completed concurrently.

Technological possibilities for achieving the stated objective—In general for road systems this particular phase of the statement can be omitted. In urban transport systems where consideration might be given to other than surface transportation, this section is included.

Proposed alternative and actions—This phase of the report details the alternative transportation or road schemes. For the example each road system modification should have a specified designation, eg. A, B, C, D, E.

Environmental characterization report prior to initiation of action—This part of the statement is an attempt at defining the present situation insofar as data and time permit. What are the important land areas, historical sites, etc. that would be affected by road system modification. Remember a properly developed area combines a proper mixture of the old with the new i.e. old buildings and new and any changes should not really destroy this relationship.

Identification of impact and analysis of magnitude and importance—This phase of the environmental impact analysis details the environmental factors to be considered. For road systems the following list of suggested topics to be evaluated are:

- effect on potential land use
- effect on water drainage
- effect on vegetation
- effect on animals
- noise potential
- effect of salt run-off
- air pollution potential
- temperature effect of traffic
- changes in area as it relates to its value (property use, etc.)

- effect on lakes and ponds in study area
- potential environmental enhancement
- potential effect on historical value of area
- response by residents and/or conservation or naturalists groups in the area of road construction

As an example of the type of analysis that should be done, consider the effect on potential land use of each alternative. The total area involved has been subdivided into a number of areas and the potential of each area on a scale of 0 to 1 has been assessed. Table 1 presents this data. A further

Table 1. Area Land Use Assessment

<i>Potential</i>	<i>Area</i>				
	<i>A1</i>	<i>A2</i>	<i>A3</i>	<i>A4</i>	<i>A5</i>
Recreational	0	0.1	0.3	0.05	0
Domestic	0	0.2	0.2	0	0 (?)
Industrial	0	0	0	0	0 (?)
Conservation Area	0.5	0.3	0.5	0.95	0
Undeveloped Area	0	0.4	0	0	0
Agricultural	0.5	0	0	0	1.0

consideration is the quantity and type of land required by each scheme. Table 2 presents this type of data. In the example being considered only Scheme E presents a saving in land used.

Table 2. Land Requirements (in Areas)

<i>Area Type</i>	<i>Plan</i>				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Conservation	1.4	3.5	1.4	3.7	1.0
Agricultural	0.9	0.9	0.9	2.0	3.1
Developed	15.8	13.7	15.8	13.0	12.25
Total	18.1	18.1	18.1	18.7	16.35

Assessment of impact—This phase of the statement is a summary of the Environmental Impact of the various road schemes or alternatives. The suggestion here is to summarize on a relative scale 0 (no effect), - (detrimental), + (positive) and * (special notation) reserved for those factors for which the impact is impossible to clearly evaluate. Table 3 is an example of such a summary table.

Along with this table is a statement of the reasons for the particular assessment. As an example, a negative was assigned to both alternatives B and C in that high embankments were required for a railway crossing which had the effect of blighting homes in the immediate vicinity. Likewise the possibility of environmental enhancement must always be considered. Past construction may have blighted an area by altering drainage. This must be improved by a new road system such as in alternate D.

Table 3. Summary of Environmental Impact of the Alternatives

<i>Environmental Factor</i>	<i>Alternate</i>				
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
Effect on potential land use	0	-	-	+	+
Effect on water drainage	+	0	+	+	+
Effect on vegetation and animals	0	-	0	-	0
Noise potential	0	0	0	0	0
Effect on salt drainage	0	0	0	0	0
Air Pollution	0	0	0	0	0
Temperature effect of traffic	0	0	0	0	0
Changes in the area as it relates to its value (Blight effect)	+	-	-	+	+
Effect on lakes and ponds in study area	0	-	0	0 (?)	0
Environmental enhancement	0	-	-	+	0

Recommendations—Once a table (matrix) such as Table 3 has been prepared the conclusions or recommendations become more obvious. From an ecological point of view Scheme A results in the smallest changes in the environment.

The timetable for an impact statement is usually controlled by the urgency of the particular project. It should be pointed out that a report as outlined in this article requires from three weeks to three months to prepare, depending on available information and manpower. If original biological data are not available and has to be generated, the time required should be extended to six months to a year. A detailed report should be prepared on all effects the change will have on the biology of the area i.e. plants and animals. An environmental energy balance for the area should be developed.

The required information can be obtained from a number of sources. Then road alternatives are normally prepared by a consulting firm; the assessment of impact on various parts of the environment is left to various experts in the fields (biologists, engineers, etc.) and a report is then compiled.

Summary

A procedure has been presented which allows easy evaluation of not only the traditional economic factors but the very important factor of environmental consequences or impact on a road system. This approach was used on a new road system for the Pond Mills Area in London, Ontario.

REFERENCES

1. Environmental Impact Statement, etc. 102 Monitor. Vol. 1, February 1, 1971.
2. L. B. Leopold, *et al.* "A Procedure for Evaluating Environmental Impact." U.S. Geol. Survey Circular 645, Washington, D.C., 1971.
3. F. C. Olds, "Preparing the Environmental Impact Statement." Power Engineering, p. 46-47, 1971.
4. R. Gillette, "Trans-Alaska Pipeline: Impact Study Receives Bad Review." Science, March 19th, 1971.