NONUSER EFFECTS IN HIGHWAY PLANNING

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This paper is a partial review of a nonuser highway impact evaluation project that focused on the development of corridor-location planning information through the active participation of local citizens. The objective was to formalize potential community concerns regarding the relative importance of the most commonly encountered nonuser impacts (both beneficial and detrimental) of corridor location. This information, gathered on a statewide basis, shows the extent of regional variation in the values attached to each of the items and thereby provides state highway planners with data showing the communities' trade-off ratios for the impacts of road-building. Relative weights for nonuser impacts are thus established by the citizens themselves.

•THIS RESEARCH effort was designed to serve as an initial step in the development of a formalized corridor-selection criterion taking nonuser factors into account. The primary purpose is to indicate the nature and extent of regional variations in citizen's concerns regarding potential highway construction based on a relative trade-off of such concerns. After a review of the existing body of literature concerning the evaluation of alternative highway proposals, the principal conclusion was that such techniques found in the literature fail to consider adequately the total impact of highway planning. Within each evaluative criterion, the weakness manifests itself in 1 or more of 3 possible ways:

1. The approach fails to consider all effects;
2. The approach fails to solicit public cooperation and participation in evaluating the effects relative to each other in a manner that can be aggregated; and
3. The approach is unrealistically subjective, thereby hiding the evaluation process from public review, and, consequently prohibiting a post-decision evaluation of the technique.

This deficiency served as a starting point for the development of a set of structural and operational hypotheses that functioned as the opening phase in the identification and quantification of the total impact of a corridor. These formed the heart of the research effort around which a methodology was developed to test their validity. Utilizing extensive field work, the research team established a set of highway-oriented beneficial and detrimental impact weights for the 13 operating planning regions in Connecticut. These weights, as analyzed in a follow-up phase by the regional planning directors, portray the local attitude toward highway impacts and tend to mirror the existing value structure of the community. Further effort enabled the investigators to establish a "regional profile" for each participating area within the state.

The principal findings of this study are as follows:

1. Considerable variations in highway-related concerns exist among geographically definable regious within the state;
2. Certain factors, especially those that pertain to economics, health, and safety, are consistently rated as important by all regions;
3. There is some evidence that a difference exists in highway-related attitudes between individual citizens and local, organized groups;

Sponsored by Committee on Social, Economic and Environmental Factors of Transportation and presented at the 50th Annual Meeting.

4. Through citizen participation, a relative evaluation of highway construction can be ascertained by a properly constructed questionnaire (sensitivity analysis);
5. A format can be developed that will allow for the inclusion of these findings within the decision-making flow; and
6. Local representatives can be encouraged to participate in a manner that serves as a mutual learning experience, i.e., for both the planner and the citizen.

As a corollary to these findings, it is interesting to point out that, when numerical weights are presented on a statewide level by using regional population figures as the aggregation mechanism, there is a great deal of similarity between the citizen's answers and those supplied by state highway planners. The single largest instance of variation appears with respect to the importance attached to the various harmful effects of pollution. An initial review of data given in Tables 1 and 2, however, shows the extent of differences in concerns of professional regional planners with their lay citizen constitutiencies. For example, the amount of open space that may be taken by a highway is ranked 17 by professional planners and 8 by members of their commissions. On the other hand, the effect of a highway on neighborhood stability is ranked 4 by professional planners and 23 by lay members. This observation and others of this type, as important as they are, do not provide the major emphasis of this paper. A subsequent analysis of the results from the main report will carefully look at the concerns of professional planners relative to the concerns of members of planning commissions.

One of the major developments of this study, as indicated in finding 6, has been the active involvement of local citizens throughout the state that resulted in a useful mutual learning experience. While the research team ascertained the relative numerical importance of highway-related impacts, the participants, in turn, by assessing their attitudes toward highway construction, began to recognize the trade-offs that are involved in the corridor-selection process. For example, one may consider aesthetics as highly important to the community; however, when it is evaluated relative to the economic stability of the area, aesthetics may be considered in an entirely different light.

OPERATIONAL HYPOTHESES

In partial support of these findings, it is useful to see both the initial operating hypotheses and some of the key statistical work that was developed in the regional profile phase. The following are the operational hypotheses that refer to the anticipated responses from the questionnaire.

1. That representatives of the general public can perform the physical operation required by the questionnaire and establish the relative impact weights;
2. That individuals, acting as representatives of the community with the proper qualifications and guidance, are both articulate and cognizant enough of their own values to be able to describe them in a way that can be applied to corridor route-location decisions (In establishing relative impact weights based on these values, it is recognized that these will tend to change with time as alterations occur in both the individual's information system and the circumstances that surround a particular corridor proposal. As a result, any statement of impact weights must be periodically updated in order to account for these fluctuations.);
3. That significant variations in community values and weights will exist among geographically identifiable regions (These variations are strong enough so that a properly developed test instrument can detect them in a way that is meaningful for highway investment decision-making. This hypothesis, if substantiated, would lend support to the corollary that such variations also exist among localities within the test region.);
4. That area residents possess the potential to feel differently regarding the beneficial as opposed to the detrimental impacts of a highway as they might affect the same factor (This potential will manifest itself in a different relative ranking for a beneficial or a harmful effect of a given factor on the community. Such variations in ranking are strongly influenced by the present conditions of the social and physical environment that exists at the time the corridor decision is being made.); and
5. That the weights, as described by the participants, can be viewed by impartial persons trained in the area, who can comment authoritatively on the validity of the re-

sults and provide verbal explanations relating them to regional characteristics that will yield an in-depth profile of the community value structure as it relates to highway construction.

METHODOLOGY

The instrument used to determine the impact weights was a 20-page questionnaire that was directly administered to the participants. The questionnaire included 6 categories, with 5 potential impacts included in each. The 6 categories were looked at separately from a potentially detrimental and beneficial impact. Each impact was described in a general way that indicated that the event presumably would occur. There was also a general category that allowed the respondent to directly compare each of these broad categories. An abstract highway example was given at the beginning to provide the proper frame of reference.

The source of the 30 categorical impacts came first from an extensive review of previous highway route-location hearings and the concerns that these revealed over a considerable period of time. A second source included national and state attitude studies as well as an evaluation of existing academic activity. In the questionnaire, respondents' attitudes were indicated by having them make the appropriate notational response. This response employed a 2-stage rating system that was designed to provide a guide to the intensity system.

Three steps were involved in the administration and evaluation of the questionnaire:

1. It was administered separately to the 13 regional planning directors and to the planning staff of the Bureau of Highways of the Connecticut Department of Transportation.
2. It was then administered, in group sessions, to representatives from the 13 regional planning areas. In the usual case, the size of the sample group ranged between 10 and 25 respondents for each region.
3. Finally, the tabulated results were returned to each of the planning directors in order that the weights and relative rankings might be reviewed by him. The purpose of the ensuing analysis was to provide descriptive material that could help explain the relative concerns and the actual or potential variations in attitudes within the region.

RESULTS

Part of the material used to test these hypotheses is given in the accompanying tables. These provide a detailed description of the ordinal variation that exists in the regional weights obtained during the survey phase of the general study (20). They point out both the extent and the quality of the variation by centering on a review of the fluctuation in the rankings of the items. These changes in rank mirror the range of deviation associated with the actual weights presented in the main report.

The items being ranked, which appear as the row entries, are hypothetical, potential highway impacts and were developed after an extensive review of transport-related material. The participating groups included representatives from the 13 operating regional planning agencies as well as the planning directors and members of the Connecticut Bureau of Highways. As a result of the addition of noncommission participants in the totals for the planning regions, it must be pointed out that these responses do not necessarily reflect the formal views of the planning agencies, nor are they endorsed by them. The agencies retain the freedom to accept or reject the conclusions reached and to comment on them in any way they feel appropriate. The purpose of this approach was to facilitate contact with leading members of the community who would consider the impact of highway construction from a regional point of view. The planning agencies provided a vehicle through which such contact could be made on a group basis and, therefore, the responses obtained should be viewed with this limited purpose in mind.

The first 2 tables give the rank order of appearance for each of the 30 potential impacts as they were evaluated by the 15 participating groups. This presentation considers the impacts from both the detrimental and beneficial points of view. The second group of tables analyzes the observed variation in rank among the 13 planning regions. This analysis concentrates on 3 pieces of information regarding each of the 30 items: What

was the extent of variation in the rank? Over what range did the variation appear? How important is a given item in the value structure of the participants?

Table 1 gives the order of rank assigned to the hypothetical detrimental impact of each item classified according to the participating group. These groups are noted by the column headings. Following the 13 columns that give the responses obtained from the regional planning representatives are 2 columns that give the responses of the 2 supplemental groups, the highway planners and the regional planning directors. The latter set of answers was developed on a statewide basis through the use of weights derived by applying regional population percentages. The final column gives the rank order of appearance assigned by the aggregate of regional respondents with the summation process again accomplished through the application of population weights. The row entries are the 30 items arranged in groups with their order of appearance the same as in the questionnaire. The numerical rankings themselves are derived from the weights tabulated for each group. The items are ranked from top to bottom with the most important item ranked 1 and the least important item, as indicated by its relative weight, ranked 30. Table 2 gives the rank ordering of the potential beneficial impact.

The observations given in Tables 1 and 2 are given in Tables 3 and 4 according to variability in ranking of items by the 13 planning regions. The 2 supplementary groups are

TABLE 1

ORDINAL RANKING OF THE DETRIMENTAL-IMPACT ITEMS CATEGORIZED BY PARTICIPATING GROUP

Item	Regional Planning Agency[a]													Other[a]		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Aesthetics																
Visual quality of highway	24	12	13	17	13	22	21	13	16	18	13	21	19	16	11	15
Blend highway into background	15	10	10	16	19	20	17	11	13	15	9	16	21	9	5	12
Aesthetic value of right-of-way	16	11	14	10	18	16	18	10	12	13	11	18	18	12	20	13
Temporary aesthetic effects	30	30	30	30	30	28	30	30	30	30	30	29	30	30	30	30
Aesthetic effects of pollution	14	8	17	3	7	10	12	14	10	7	3	8	5	15	7	9
Economics																
Number of jobs	5	2	6	8	10	3	5	5	1	1	8	4	3	3	3	4
Number of welfare recipients	20	21	18	24	24	13	19	7	14	8	26	11	12	8	15	18
Property values	1	3	3	6	5	2	4	4	4	2	5	3	2	2	9	2
Temporary economic effects	21	17	27	27	26	24	29	23	28	28	24	20	28	29	28	26
Level of income	6	1	4	9	9	8	3	16	6	3	12	5	4	1	14	6
Political																
Municipal services	10	18	11	19	14	26	16	19	19	22	25	14	17	20	22	17
Public participation in government	25	28	15	23	16	29	24	28	27	27	29	25	27	25	23	27
Financial capability of government	11	15	9	21	23	25	14	18	18	23	23	12	16	21	16	19
Community security	18	26	12	26	21	27	13	22	21	26	22	9	23	24	27	22
Satisfaction with government	29	29	29	29	29	30	25	29	29	29	27	30	29	28	24	29
Land use																
Pattern of land development	7	13	7	4	11	5	6	2	8	12	10	17	8	4	19	7
Number of business firms	12	6	19	12	22	7	10	1	7	9	18	7	9	7	25	10
Amount of open space	8	16	8	2	3	12	2	12	9	10	2	13	15	6	17	8
Number of housing units	9	9	20	11	8	9	15	8	15	16	7	10	20	11	12	11
Number of historic sites	23	22	21	13	20	23	9	20	22	14	17	28	22	18	26	20
Health and safety																
Access to emergency facilities	3	7	1	5	4	4	7	3	3	5	4	2	7	10	8	3
Effect on national defense	27	20	26	28	25	17	27	17	25	17	28	26	24	26	29	28
Health effects of pollution	2	4	2	1	1	1	1	6	2	4	1	1	1	13	1	1
Personal or group stress	13	14	16	7	12	11	11	15	11	11	20	15	10	17	2	14
Safety on adjacent highways	4	5	5	15	2	6	8	9	5	6	6	6	6	5	6	5
Social-psychological																
Community cohesiveness	17	19	22	20	6	18	20	21	17	21	15	22	13	23	10	16
Personal or business contacts	26	25	28	25	27	21	28	25	26	19	19	24	26	27	21	25
Neighborhood stability	28	27	24	18	15	15	23	24	20	24	16	27	14	22	4	23
Barrier effects	22	24	25	22	17	19	26	26	23	25	21	23	25	19	13	24
Community-oriented contacts	19	23	23	14	28	14	22	27	24	20	14	19	11	14	18	21

[a]1, Capitol; 2, Central Connecticut; 3, Central Naugatuck Valley; 4, Connecticut River Estuary; 5, Greater Bridgeport; 6, Litchfield Hills; 7, Midstate; 8, Northeast; 9, South Central; 10, Southeastern; 11, Southwestern; 12, Valley; 13, Windham; 14, state highway officials; 15, regional planners; and 16, state.

TABLE 2

ORDINAL RANKING OF THE BENEFICIAL-IMPACT ITEMS CATEGORIZED BY PARTICIPATING GROUP

Items	Regional Planning Agency[a]													Other[a]		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Aesthetics																
Visual quality of highway	22	16	19	27	25	18	23	12	19	17	18	22	19	20	19	19
Blend highway into background	18	12	12	17	21	20	25	15	16	14	15	21	15	13	13	16
Aesthetic value of right-of-way	16	9	13	15	19	14	22	9	15	4	14	10	14	15	20	13
Temporary aesthetic effects	30	30	30	30	30	30	30	28	29	28	30	28	30	30	28	30
Aesthetic effects of pollution	11	10	8	11	17	12	17	10	8	5	12	7	5	17	14	10
Economics																
Number of jobs	3	1	2	10	1	1	1	2	2	2	6	1	1	3	1	2
Number of welfare recipients	12	17	11	16	10	13	15	8	14	8	26	5	13	6	10	14
Property values	8	5	5	5	7	7	6	4	6	3	8	8	3	5	9	7
Temporary economic effects	27	19	28	29	29	19	26	21	27	23	27	24	25	28	30	28
Level of income	1	4	3	9	2	5	2	7	4	7	9	2	2	1	6	3
Political																
Municipal services	14	18	17	4	18	15	13	23	18	26	19	13	17	18	24	17
Public participation in government	24	21	22	14	24	29	18	26	25	29	29	23	21	27	25	25
Financial capability of government	17	15	18	7	14	21	11	19	20	24	23	12	12	12	18	18
Community security	21	25	21	8	16	23	14	25	24	27	25	15	24	23	23	23
Satisfaction with government	29	29	29	23	27	28	29	30	30	30	28	30	28	22	26	29
Land use																
Pattern of land development	4	8	6	1	5	6	9	3	9	10	3	18	6	2	11	5
Number of business firms	9	6	15	12	13	4	7	1	10	13	11	9	8	8	17	9
Amount of open space	7	14	9	6	6	9	10	13	7	9	2	16	11	4	15	8
Number of housing units	10	11	16	22	8	11	12	16	13	20	7	14	23	16	4	11
Number of historic sites	28	24	26	20	28	26	16	29	26	19	13	29	27	29	27	26
Health and safety																
Access to emergency facilities	6	7	4	3	3	8	4	5	3	11	4	4	7	10	7	4
Effect on national defense	26	23	27	28	23	17	28	18	28	21	24	26	22	26	29	27
Health effects of pollution	2	3	1	2	4	2	3	6	1	1	1	3	4	9	2	1
Personal or group stress	13	13	14	19	9	10	8	14	11	12	10	11	10	14	3	12
Safety on adjacent highways	5	2	7	13	15	3	5	11	5	6	5	6	9	7	5	6
Social-psychological																
Community cohesiveness	15	20	10	18	11	16	19	17	12	15	20	20	16	19	8	15
Personal or business contacts	25	26	25	25	22	27	27	24	22	25	21	27	26	25	22	24
Neighborhood stability	19	28	23	24	12	22	20	20	23	22	16	25	18	11	12	21
Barrier effects	23	22	24	26	20	25	24	22	21	16	22	19	29	21	21	22
Community-oriented contacts	20	27	20	21	26	24	21	27	17	18	17	17	20	24	16	20

[a]1, Capitol; 2, Central Connecticut; 3, Central Naugatuck Valley; 4, Connecticut River Estuary; 5, Greater Bridgeport; 6, Litchfield Hills; 7, Midstate; 8, Northeast; 9, South Central; 10, Southeastern; 11, Southwestern; 12, Valley; 13, Windham; 14, state highway officials; 15, regional planners; and 16, state.

omitted from this calculation because the participants were drawn from a separate universe and their answers were given from a slightly different point of view.

Data given in Tables 3 and 4 are arranged in the following format. The first column gives the variation classification, which is discussed in detail later. The second column gives the rank order of variation and is based on the number of places that the item varies in rank as assigned by the individual regions. Here the items are arranged from the least to the most variable. The third column gives the written description of the potential impact. The fourth column gives the number of places that the item varies according to the responses obtained from the participating regional representative. This place variation is further described in the following column that shows the range over which the rank of the item varied. For instance, in Table 3, the least variable item was the potential temporary harmful aesthetic effect of highway construction. This particular item varied only 3 places in rank, with the range of this variation being from 28 to 30.

The remaining 3 columns give the number of times the impact factor appears in each of 3 arbitrary groupings. The first indicates the number of times that the item ranked between the first and the tenth most important in the hierarchy in a particular region. Items falling in this category are relatively important. The next indicates the number of times that the impact factor was between the eleventh and twentieth most important item in a particular region. Items in this particular grouping are conditionally impor-

TABLE 3

ANALYSIS OF THE PLACE VARIATION OF THE DETRIMENTAL-IMPACT ITEMS AMONG THE 13 PLANNING AREAS

Variation		Item	Number of Places Varying	Range	Number of Times the Impact Factors Appear		
Classification	Rank				Relatively Important (1 to 10)	Conditionally Important (11 to 20)	Relatively Unimportant (21 to 30)
Stable	1	Temporary aesthetic effects	3	28 to 30	0	0	13
	2	Property values	6	1 to 6	13	0	0
	3	Satisfaction with government	6	25 to 30	0	0	13
	4	Health effects of pollution	6	1 to 6	13	0	0
	5	Access to emergency facilities	7	1 to 7	13	0	0
	6	Aesthetic value of right-of-way	9	10 to 18	2	11	0
	7	Number of jobs	10	1 to 10	13	0	0
	8	Personal or business contacts	10	19 to 28	0	2	11
	9	Barrier effects	10	17 to 26	0	2	11
Conditional	10	Personal or group stress	11	10 to 20	2	11	0
	11	Blend highway into background	12	10 to 21	3	9	1
	12	Effect on national defense	12	17 to 28	0	4	9
	13	Visual quality of highway	13	12 to 24	0	9	4
	14	Temporary economic effects	13	17 to 29	0	2	11
	15	Pattern of land development	14	4 to 17	9	4	0
	16	Number of housing units	14	7 to 20	7	6	0
	17	Safety on adjacent highways	14	2 to 15	12	1	0
	18	Aesthetic effects of pollution	15	3 to 17	9	4	0
	19	Public participation in government	15	15 to 29	0	2	11
	20	Amount of open space	15	2 to 16	8	5	0
	21	Neighborhood stability	15	14 to 28	0	6	7
Volatile	22	Level of income	16	1 to 16	11	2	0
	23	Community security	16	12 to 27	1	3	9
	24	Municipal services	17	10 to 26	1	9	3
	25	Financial capability of government	17	9 to 25	1	7	5
	26	Community cohesiveness	17	6 to 22	1	8	4
	27	Community-oriented contacts	18	11 to 28	0	7	6
	28	Number of historic sites	19	9 to 28	1	3	9
	29	Number of welfare recipients	20	7 to 26	2	7	4
	30	Number of business firms	22	1 to 22	8	4	1

TABLE 4

ANALYSIS OF THE PLACE VARIATION OF THE BENEFICIAL-IMPACT ITEMS AMONG THE 13 PLANNING AREAS

Variation		Item	Number of Places Varying	Range	Number of Times the Impact Factors Appear		
Classification	Rank				Relatively Important (1 to 10)	Conditionally Important (11 to 20)	Relatively Unimportant (21 to 30)
Stable	1	Temporary aesthetic effects	3	28 to 30	0	0	13
	2	Property values	6	3 to 8	13	0	0
	3	Health effects of pollution	6	1 to 6	13	0	0
	4	Personal or business contacts	6	22 to 27	0	0	13
	5	Satisfaction with government	8	23 to 30	0	0	13
	6	Level of income	9	1 to 9	13	0	0
	7	Access to emergency facilities	9	3 to 11	12	1	0
	8	Number of jobs	10	1 to 11	13	0	0
Conditional	9	Temporary economic effects	11	19 to 29	0	2	11
	10	Personal or group stress	11	9 to 19	5	8	0
	11	Community cohesiveness	11	10 to 20	1	12	0
	12	Community-oriented contacts	11	17 to 27	0	7	6
	13	Effect on national defense	12	17 to 28	0	2	11
	14	Aesthetic effects of pollution	13	5 to 17	7	6	0
	15	Number of business firms	13	1 to 13	8	5	0
	16	Blend highway into background	14	12 to 25	0	10	3
	17	Aesthetic value of right-of-way	14	9 to 22	4	8	1
	18	Safety on adjacent highways	14	2 to 15	10	3	0
	19	Barrier effects	14	16 to 29	0	3	10
	20	Amount of open space	15	2 to 16	9	4	0
Volatile	21	Visual quality of highway	16	12 to 27	0	8	5
	22	Public participation in government	16	14 to 29	0	2	11
	23	Number of housing units	17	7 to 23	3	8	2
	24	Number of historic sites	17	13 to 29	0	4	9
	25	Neighborhood stability	17	12 to 28	0	6	7
	26	Financial capability of government	18	7 to 24	1	9	3
	27	Pattern of land development	18	1 to 18	12	1	0
	28	Community security	20	8 to 27	1	3	9
	29	Number of welfare recipients	22	5 to 26	4	8	1
	30	Municipal services	23	4 to 26	1	10	2

tant. This means that their rank within the value structure of a region is conditional on the appearance and importance attached to the other potential impacts. This particular group, in part, can be looked on as a residual where all those items that are not important or unimportant are to be found. The third shows the number of times that a particular impact factor was rated between the twenty-first and thirtieth most important item within a given region. Items in this grouping are relatively unimportant.

To further clarify the importance of these 3 columns, let us continue with the example of the place variation for the temporary aesthetic effects given in Table 3. This particular impact was not rated in the top ten in importance by any of the participating regions, nor was it ever considered in the conditional group. All of the rankings assigned to this particular item indicate that it belongs in the category of impacts that can be considered relatively unimportant. This would indicate that the values associated with this particular impact are relatively less essential when comparison is made to the entire spectrum of potential effects.

The row items are classified in the first column according to the number of places that they were observed to vary. This classification is based on a division into 3 groups, which gives an indication of the extent of stability to be expected from the value associated with the item as the potential impact moves among regions. The first group contains those impacts that are regarded as stable in nature because their number of places varies 10 or less between the high and low rank extremes. The stable nature of the observed ranking would tend to indicate that highway planners could count on a uniform level of importance being attached to a particular item as potential projects move among impacted regions. This particular level of importance depends primarily on the worth of the item itself and is least affected by external forces that can significantly alter the assigned weights.

The second set of impacts are those that vary between 11 and 15 places in their ranking. Items in this category are classified as conditional because the follow-up analysis indicates that they tend to depend on the current circumstances within the region, which partially affect the present importance attached to the item. Such surrounding conditions might include elements of the existing political or economic climate as well as the general character of the area itself. This character would be reflected by whether the region is urban or rural, whether it is industrial or white-collar oriented, and what residential traits it has such as personal income, age, and educational background. All of these surrounding conditions could have various effects on the ranks assigned to particular potential impacts.

The third category contains items that varied 16 or more places in their relative ranking. These items are volatile in their weights and are considered extremely unpredictable for planning purposes as a corridor moves from one region to another. These items might derive their volatile nature from several regional characteristics. First, there might be a highly emotional aspect associated with a particular item in a given area. This would occur where the item was of vital personal or community concern so that its existence was made known to a majority of the participating respondents. Second, this extensive variation might reflect strong local character traits that tend to place emphasis on one or more aspects of the community effect of highway construction. Third, in addition to being emotional in character, the issue may well have a topical, local, or national application that reinforces the importance of the item within a specific region. In evaluating volatile impacts, highway planners would do well to direct a sizable amount of their investigative work on these items, if their existence can be anticipated as a result of highway construction.

TABLE 5

CROSS CLASSIFICATION BY THE CHARACTERISTICS OF RANKING

Classification by Extent of Variation in Rank	Classification by Importance[a]		
	Relatively Important (1 to 10)	Conditionally Important (11 to 20)	Relatively Unimportant (21 to 30)
Stable (1 to 10 places)	0	Z	0
Conditional (11 to 15 places)	Z	Z	Z
Volatile (16 to 30 places)	X	Z	X

[a]0 = most reliable for planning purposes; X = most strongly influenced by regional character; and Z = predictability for planning purposes dependent on relative importance of other items and surrounding conditions.

Data given in Table 5 further emphasize the importance attached to the coordinate

classification structure. The columns in this table again give the relative importance of the particular item. A given impact is classified as important, conditional, or unimportant in its grouping according to where it appears a majority of the time. The row categories classify the items according to their extent of variation, with the 3 classifications being stable, conditional, and volatile. The meaning of the 2 conditional entries should be fully understood. The column, "Conditionally Important," refers to the relative position assigned to a particular item as it is compared to other items contained in the 2 extreme categories. The row entry refers to regional characteristics or circumstances that surround and influence the extent of variation.

Three sets of cordinates deserve particular attention by highway planners. The first is indicated by 0 and refers to items that are stable in variation and either important or unimportant in their grouping. Items in these cross classifications can be viewed by highway officials as containing the highest degree of predictability for planning purposes. On the other hand, the impacts in the coordinates marked by X are those effects that are both volatile in their variations and either relatively important or unimportant. These impacts are the most deceptive from a planning standpoint. The concern attached to these items can be strongly affected on occasion by the characteristics of the region or the emotional nature of the item within the particular area. Consequently, planners, who are unaware of the potentially volatile nature of the item, may feel the importance of the item can be relied on to a far greater degree than is actually justified. As a result, where variations occur they can be the source of severe conflict and misunderstanding within the decision-making process. These particular effects should be given conscious attention by highway officials; their appearance in specific areas possess the potential of generating significant amounts of either opposition to or demand for the construction of the proposed facility. The third set of coordinates marked by Z expresses various degrees of uncertainty. Those potential impacts that contain an element of conditionality are to be reviewed with skepticism because their value depends, at least in part, on factors that are external to the impact itself. As a result, little can be said about these items a priori except that they can be expected to vary in functional relationship with the observable characteristic of the region affected.

There is a tendency for this system of analysis and classification to be affected by the extreme rankings that might be assigned by 1 or 2 regions (Tables 3 and 4). For example, although an item may be rated important in 11 out of 13 regions, it can appear much more volatile than it really is if the remaining 2 regions rated the impact in the relatively unimportant range. This would allow the item to have nearly a 30 place variation in its rank. Consequently, in order to correct for this possible deception, if an item is contained in 1 of the 3 groupings 11 or more times, then some verbal notation will be made in the following analysis that the extent of variation may not be as severe as it appears. Although this process is admittedly arbitrary, it allows for some justifiable corrections, where particular regional traits may be so overriding that the item is assigned a level of importance that places it at odds with the majority of participating groups.

ANALYSIS OF DETRIMENTAL PLACE VARIATION

Table 3 gives an analysis of the place variation of the detrimental-impact items among the 13 planning regions. The first 9 items are classified as stable because the extent of their place variation is 10 or less. Within this stable category, 4 of the entries were considered relatively important, 4 were considered relatively unimportant, and 1 was considered conditionally important relative to the appearance of other items in the questionnaire. It should be immediately apparent that the respondents in all regions were consistent in the way they regarded certain items and were able to separate purposefully those impacts that were of a vital nature from those that were, in comparison, not so crucial to the characteristics of the area.

The 4 items that were stable-important were highly personalized and reflected the potential harmful effect of a highway on the individual within the affected community. These items included effect on property values, health effects of pollution, accessibility to emergency facilities, and number of jobs. Each of these personal items apparently

possesses an element with which the respondent could personally identify. On the other hand, the stable-unimportant items are less personalized and refer more to the quality of life within the community. These are temporary aesthetic effects, satisfaction with government, and barrier effects of highway construction. An exception would appear to be the effect on personal or business contacts, which possesses an individual aspect. Because the respondents were asked to reply by using their town of residence as a frame of reference, the appearance of this item in this particular coordinate position is in part a reflection of the separation of the town of residence from the town of employment on the part of the average respondent. Clearly, these 4 items can be counted on as generating relatively less public concern in the location process, especially where the residents of the affected area correspond most closely to the characteristics of the sample group.

The next set of 11 items contains those impacts whose importance is conditional on the current circumstances that exist in the test region. Surrounding conditions, such as the current local issues of topical interest, may well have been the cause of the more extensive variation observed in the rankings assigned to a particular item. Of the 11 items, 5 could be considered to be conditional-important. These would include pattern of land development, number of housing units, safety on adjacent highways, aesthetic effects of pollution, and amount of open space. All of the items, except safety, are physical and relate to the impact that a proposed highway can have on the tangible environment that surrounds the region.

Three of the items can be considered to be conditional-conditional: personal or group stress, blending the highway into the background, and visual quality of the highway. The latter two are design aspects, and their appearance in this coordinate indicates that they are important but are flexible and dependent on other aspects of the community involved. Finally, 4 of the items could be considered to be conditional-unimportant. These include effect on national defense, temporary economic effects, effect on public participation in government, and effect on neighborhood stability. All of these were rather strongly unimportant, except the last, which had several entries contained in the conditional-conditional coordinate. The ambiguity attached to this item might be expected from a group of regions that ranged between rural and urban in nature.

Generally, the items in the conditional variation category refer to either physical or aesthetic aspects of the affected community. The major exceptions to this observation are 3 semi-personal items and 1 item that refers to the relationship between individuals and the government. Each of these entries, however, is subject to the correction factor noted earlier because the majority of responses are located in 1 of the 3 importance categories. Consequently, the extent of place variation is strongly affected by the extreme responses obtained from only 1 or 2 of the participating regions. Each of these items appears to be highly stable in its response pattern. Safety on adjacent highways tends to be more stable-important, personal or group stress tends to be stable-conditional, and both temporary economic effects and public participation in government tend to be stable-unimportant.

The final variation grouping contains 9 items that are highly volatile. Each of these items varied at least 16 places, resulting in most of them being considered at least once in all of the 3 importance categories. This grouping includes level of income and number of business firms and is considered to be volatile-important. The effect on municipal services, effect on financial capabilities of government, community cohesiveness, community-oriented contacts, and number of welfare recipients fall into the volatile-conditional coordinate. Finally, community security and historic sites are considered to be volatile-unimportant. Clearly, a majority of the items refer to the community as a whole, and the extent of their variation is partially attributed to the emotions that momentarily surround these community-oriented elements. When disturbance from external forces threatens, these items could be expected to serve as significant rallying points for the development of opposition to proposed highway plans. Most of these items were not consciously valued by the respondents, unless there was some element already existing in the community that had brought the importance of these items to the attention of the participating group. However, where this element exists, it is clear that the participants were able to single the item out for particular attention and to give it extra weight within the decision-making flow.

Only the effect on the level of income could be considered more stable than it initially appears. Without inferring more knowledge than is available, it would appear to be safe to say that this item could be considered at least conditional in variation and important in its value to the community.

ANALYSIS OF BENEFICIAL PLACE VARIATION

Table 4 gives the regional rankings assigned to the beneficial effects of the 30 factors. The first category contains 8 items that can be considered stable in their place variation. Within the category, 5 items are stable-important. These include effect on property values, health aspects of pollution, effect on level of income, accessibility to emergency facilities, and effect on number of jobs. As with the deterimental effects, each of these items is personal in nature; the only new addition is the effect on level of income, which was volatile-important for the detrimental effects.

The remaining 3 items, temporary aesthetic effects, effect on personal or business contacts, and effect on satisfaction with government, are stable-unimportant, the same as with the detrimental effects, indicating that they too can be counted on in highway planning. One aspect that should be emphasized, however, is that the coordinate position assigned to the effect on personal or business contacts may be affected by 2 peculiarities. First, the sample group was suburban in nature and tended to consider their town of residence separate from their town of employment. Consequently, the respondents, for the most part, could not visualize that a highway passing through their town of residence would affect their business contacts. Second, regarding the personal aspects of the item, the sample group is a highly mobile middle-class collection of participants who might not place the same emphasis on personal aspects that would be found in more urbanized areas. If existing contacts are broken, the mobility factor would allow the respondents to establish new lines of communication.

The next category contains 12 items that are conditional in their variation because they depend in part on existing circumstances in the community. Because several community-oriented impacts appear, this category is not as physically or aesthetically oriented as it was for the detrimental effects. Four of the items are conditional-important, including aesthetic effects of pollution, effect on number of business firms, safety on adjacent highways, and amount of open space. Five of the items are classified conditional-conditional, including personal or group stress, community cohesiveness, community-oriented contacts, blending highway into background, and aesthetic value of right-of-way. Three items are conditional-unimportant, including temporary economic effects, effect on national defense, and barrier effects of highway construction.

Two additional characteristics are associated with the conditional category. First, it contains 3 items that are apparently assigned by the extreme rankings of 1 or 2 planning regions, including temporary economic effects, effect on community cohesiveness, and effect on national defense. Each of these items can be considered to be more stable than it would initially appear to be when only its range of variation is considered. Second, 7 items also appear in the conditional category for the detrimental effects. These include temporary economic effects, effect on personal or group stress, effect on national defense, aesthetic effects of pollution, blending highway into background, safety on adjacent highways, and effect on open space. The majority of the additions to the conditional category involve increased stability on the part of items that were volatile for the detrimental effects.

Finally, the volatile category contains 9 items that showed extreme elements of variation as witnessed by their fluctuation in rank. Of these items, pattern of land development can be considered to be volatile-important and 5 can be considered to be volatile-conditional, including visual quality of highway, number of housing units, financial capability of government, number of welfare recipients, and effect on municipal services. The last classification contains those items that are volatile-unimportant, including effect on public's participation in government, number of historic sites, neighborhood stability, and community security. In this volatile category, 2 items can be considered to have greater stability than would be initially apparent. These are effect on public participation in government and effect on pattern of land development. Only 5 items

appeared in this volatile category for both beneficial and detrimental effects, and a significant amount of interchange apparently took place between the volatile and conditional categories as the respondents moved from one side of the ledger to the other.

REVIEW OF OPERATIONAL HYPOTHESES

It would appear from the analysis of place variation that some preliminary comments can be offered regarding the substantiation of the operational hypotheses. In particular, several of the hypotheses could be considered as verified in full or in part. The first hypothesis concerned the physical ability of the participants to perform the operation and develop a set of relative impact weights. That this operation can be performed by representatives of the public is evidenced by the 200 valid responses that were obtained at various regional planning meetings. For the most part, the people were not confused by the mechanical operation and were willing to cooperate with a project that they felt would lead to substantial benefit for their particular region. The point is recognized that the participants can be considered to be above average in their ability to perform this operation. However, the hypothesis regarding the public's ability to participate in such an activity seems in part established. The remaining task would be to simplify the techniques, so that the questionnaire could be administered on a random sample basis, if this particular method is chosen as the future selection procedure to follow.

The second hypothesis offered was that participants were sufficiently aware of their own community attitudes to articulate these in a way that would facilitate highway route location decision-making. Again, it appears from the analysis of place variations that this hypothesis has been partly established. This is especially true of those items that were stable in variation and that were assigned to one or more of the importance categories consistently by the participants. If some set of values were not the underlying factors that governed the pattern of selection, the responses would demonstrate considerably less consistency and be more randomly located among the coordinate positions than they have been observed to be. The fact that so many of the items are contained in the conditional or volatile categories indicates that the second half of this particular hypothesis is also plausible in that not only do these weights tend to change over time but they also vary with the supporting conditions that exist within the individual regions.

The third hypothesis stated that significant variations in the weights assigned to the particular items were to be expected among the participating regions. This particular hypothesis is again substantiated by the extent of place variation. This is most fully revealed by the fact that some of the items vary by nearly 20 places between the extreme high and low rank assigned by various regions. The extent of variation is often accounted for by recognizable area characteristics in the regional profile sections of the main report. Consequently, the evidence of variation is significant in that it lends support toward the plausibility of the hypothesis.

The fourth hypothesis stated that the respondents possessed the capability to feel differently regarding the potential beneficial as opposed to the potential detrimental effect as it might appear with respect to the same item. Evidence that this hypothesis has also been established is given in Tables 1 and 2 by the order in which particular potential impacts were ranked. In no instance was the rank order identical for the beneficial and detrimental effects and, in many cases, there were substantial variations in rank assigned to a particular item for the beneficial as opposed to the detrimental effect. This was especially true with those items that were conditional in nature in both their place variation and in their ranking. Such items, along with those contained in the volatile category, are related to both current circumstances and emotional conditions existing within the test region. Consequently, the importance of the item varies substantially within a region from the rank assigned on one side as opposed to the other in the weighting process.

The fifth and final hypothesis concerned the ability of the planners to review the results and to offer comments regarding their validity within the appropriate region. Substantiation of this hypothesis can only be hinted at through the quality of the testimony offered by the planning director as it relates to the analytical profile of his particular region. However, it should be noted that the plausibility of the 4 previous hypotheses

offers the planner the opportunity for analysis based on regional characteristics because the extent of variation itself was significant enough to facilitate this type of review.

LEVELS OF APPLICATION FOR REGIONAL RESULTS

The experience of developing and testing the operational hypotheses has revealed a number of limitations that can be overcome in future projects of this nature. Although these constraints are recognized, there appear to be 3 potential levels of use for the information gathered by the field work in the area of community impacts. The first use is most general and is simply to provide broad indicators of community concerns to guide highway planners. These attitudes may be similar to or different from those already held by highway planners. There is some evidence resulting from earlier studies in other states that differences do exist. A second potential use of the information is to develop a community profile. The final approach involves both the quantification of impacts and the construction of actual trade-offs for formal decision-making.

In the first instance, where this technique is used in its most general form, those community values that have high priority can and should be revealed. This can best be accomplished by going into the potentially impacted area early in the planning process. Within the study it has been determined that certain views held by the highway department concerning community priorities may contrast sharply at times with actual attitudes. For example, a highway planner may feel that a community holds historic sites in very high regard. An actual determination of community attitudes may show just the opposite. Such errors can arise from either a lack of information or the existence of inaccurate information that is supplied by influential community groups that do not reflect the local value system over time. This is not meant to imply that minority views and the potential disproportionate impact of highway construction on minority groups should be ignored. Such an initial procedure is designed only to determine in a general manner a hierarchy of impacts for particular communities to be used in the early phases of the decision-making flow where the route alternatives are devised. It is simply a technique to provide the decision-maker, who will still make subjective judgments, with more information.

The second level of use for the information outlining the relative importance of the nonuser effects of highways is the community profile technique, where a descriptive balance sheet of community impacts is developed. In this approach, the impacts on individuals, groups, and community are arranged in general credit and debit categories. This step is designed to enlarge on the first level by assisting the existing route-location process. This is accomplished through the introduction of further information in an organized manner. The basic problem, however, of actually developing trade-offs is also avoided in this second level, leaving the bulk of the evaluative work to subjective decision-making.

In the third level of use, the information gathered from community residents can be utilized in a numerical framework. It should be emphasized that it is recognized that there is no single number on which an investment decision can or should be based; yet, a technique that enables the decision-maker to estimate numerical trade-offs has to be developed in order to minimize the subjective elements in decision-making. The technique that may provide these trade-offs is to create an artificial market for nonuser effects by the use of a 2-phase evaluation process: (a) assess the physical impact in terms of dollar compensation and amortize it over time and (b) attach weights determined by community participation. The compensation need not be paid. However, its weighted magnitude should enter into the evaluation process as if it were to be paid so as to reflect the total effect of the proposed corridor.

This is a bold approach because many are convinced that certain nonuser effects cannot be quantified primarily because a market does not exist for them. Our approach is to create such a market (actually, a quasi-market) by costing the physical act needed to account for the impact and weighting this by the importance of the compensation to the community. For example, if a proposed highway pollutes a lake, the physical effort required to correct or avoid this pollution can be estimated. Next, the dollar cost of cleaning up or preventing the pollution is determined. Finally, this dollar figure is

weighted by the community's evaluation of the relative importance of this correction factor. If the lake is deemed essential to the community by its citizens in terms of water supply, beauty, or any other reason, it will receive a high weight and, consequently, become a strong factor in the corridor-location selection. If, on the other hand, the lake has an extremely low importance to the community, the physical compensation figure would be weighted by a lower relative figure. The resulting index number is entered into the decision-making flow through a matrix format where the item is evaluated relative to other impacts.

EXPERIENCE AND CONCLUSIONS

On the positive side, it was found that the regional planners were most eager to cooperate and participate in this program. These planners may represent a possible avenue for future research of this type. In addition, the administration of the questionnaire itself tends to make community representatives aware of the problems involved in the investment decision-making procedure. It was found that, although this particular questionnaire was difficult, with proper administration approximately 90 percent of the respondents were able to perform the operations. Moreover, by interviewing groups of people, considerable time savings could be realized with only minor reductions in efficiency.

Regarding the limitations of the results, there was some question as to whether there should have been a specific rather than a general highway example used as the frame of reference. This was the most persistent criticism of the test instrument offered by the participants because at times they found it somewhat difficult to view highway construction without reference to a specific corridor. A general approach was followed because a specific example would have tended to exclude too many possible combinations of concerns. A second limitation is that the repetition of this procedure may be extremely costly in a state larger than Connecticut. Third, all of the impacts in each category were assumed to occur. This raised a question of probability versus possibility of occurrence in the minds of the respondents. This may, at times, have led to confusion. Fourth, there is always the problem of whether the respondent's answers change with time and whether he is ever fully aware of his own value system. Fifth, problems of the representativeness of the sample group arise through the implication that the planners and members of the planning commission actually reflect the attitudes of the average citizen. Some comments on this point were provided by the planning directors during the follow-up phase. Sixth, the design questions were not separated from the corridor-location questions. Such a separation might have provided a more optimal questionnaire format. This should be done if the approach is to be repeated in the future. Finally, it may be further argued that the list of 30 impacts excluded some items that may be more important to members of the community or that the grouping of impacts may have affected the final output.

It is apparent at this stage that further research is needed in the area of establishing the magnitude of community impacts. Investigators must move from a general review to the evaluation of specific routes. A new questionnaire may need to be developed that could be administered effectively and easily by highway personnel and responded to by the general public. What is contemplated is something like a "social" origin and destination survey.

Another avenue of research concerns how and at what stage to work this amended procedure into the decision-making process. Because the decision-making effort is a flow with each succeeding step constrained by the preceding decision, some of these nonuser factors would have to be introduced at every stage of official evaluation. Finally, because the responses could change with time depending on surrounding elements, a method would have to be developed that would allow for a continual updating of the general results.

ACKNOWLEDGMENT

This study was financed in part under a grant from the Connecticut Department of Transportation. We express our appreciation to the 13 regional planning directors for their cooperation in this study.

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