Measurement of Community Values: The Spokane Experiment

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Experience in working with citizens advisory committees has shown that better communication between the citizen and professional planner is needed. To accomplish this new planning tools are needed to assess and combine more accurately intangible or difficult to define factors with tangible or easily measurable factors in preparing specific proposals.

This is a pilot study and description of such a tool for determining the relative importance of four tangible and five intangible factors and a means of applying these measures of importance in selecting the most acceptable one of three hypothetical roadway solutions. The method requires the assumption that frequency of citizen preference for one factor over another is directly related to importance of that factor. It further assumes that the average measure of a set of tangible factors is equal to the average measure of a set of intangible factors. Using this "equality of averages" assumption, tangible and intangible factors can be assigned a value within a common scaling system. By combining these common system values with measures of the relative importance of the factors involved, an evaluation table can be prepared which provides a total weighted score for each alternative solution.

Included is a resumé of further SMATS research on value measurement.

•THE history of the planning process is cluttered with failures to include intangible considerations in decision-making. Failure to include intangibles in the decision-making process stems from the difficulty in defining, formulating or grasping satisfactorily these factors, from the difficulty in obtaining valid measures of these considerations, and from the failure to apply social science techniques to this problem. Modern decision-making is moving from the austere considerations of tangible factors expressed in cost only to an affluent society's consideration of both cost and the so-called intangible aspects. This additional constraint on decision-making has produced public hearings and citizen committees, the development of rating techniques, and an increased responsiveness to the wants and desires of the community. Existing methods for "measuring" intangibles are not sufficiently objective or dependable to be of much real use in decision-making.

MEASURING RELATIVE IMPORTANCE OF TANGIBLE AND INTANGIBLE FACTORS

Part of the problem of measurement is the way in which intangibles are viewed. People seem to assume that objective truth exists and must be somehow measured. For measurement purposes it would be more appropriate to view intangible considerations as being the result of the physical, social, economic, psychological, etc., stimuli interacting with the individual or group. This interaction requires an internal adjustment which predisposes the individual or group to react in a given way to a particular

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set of intangible considerations. Since the only measurable aspect of these intangible considerations is response behavior, measurement of these intangibles means measurement of this response.

The decision-making process, ideally, takes into account factors of cost, possibility of physical accomplishment, legality, political implications, social implications, and economic aspects. Many of these are intangibles, existing in the mind of the decision-maker and/or as overt responses of those affected by his decisions. Where a decision must satisfy the desires of a group, the decision-maker will be aided by knowing how that group will respond to each alternative. Practical measurement of intangibles need be only a measure of the probable group response to a particular set of tangible and intangible considerations.

Two steps required to mix tangible and intangible considerations logically in the decision-making process are: (a) measurement of the relative importance of the tangible and intangible considerations involved; and (b) a measurement of the extent to which each consideration is realized in each alternative. The first portion of this report describes a method of determining the relative importance of selected considerations and initial measurement results. The second section shows a method for measuring the extent each consideration is realized in each alternative and how both steps are combined through an "equality of averages" assumption in the decision-making process.

Measuring Attitude Strengths

The Successive Test Attitude Measuring Scale (STAMS) method is simply a means of developing the relative importance of a series of transportation considerations in terms of the responses of an individual or group. Relative importance is determined by finding out the frequency one consideration would be selected as most preferred over all others being evaluated. To calculate the STAMS unit (SU) rating for each transportation planning consideration, each consideration is compared with each other consideration to determine which is the more important. With the results of these comparisons the STAMS value of each consideration is calculated.

Method of Calculating STAMS Units

To illustrate the method of calculating the relative importance of several transportation planning considerations, the following example is helpful:

One thousand persons were tested for their responses to three transportation planning considerations A, B, and C. When transportation planning considerations A and C were compared to see which component of the couplet was considered more important, 800 selected A and 200 selected C. This provided the following sample proportions for A and C, respectively: 800/1000 = 0.8 and 200/1000 = 0.2.

When transportation planning considerations B and C were compared, 889 selected B and 111 selected C as more important, providing the proportions 0.889 and 0.111, respectively. The remaining relationship, between transportation planning considerations A and B was determined with 333 preferring A and 667 preferring B. Their respective proportions were 0.333 and 0.667.

STAMS units were calculated by successively comparing each consideration or attitude with all others being measured. This is accomplished in the following steps:

1. Initially, C was assigned a one SU value. The SU measure for each other factor with respect to C was calculated by dividing the couplet proportion of that factor by the couplet proportion of C (note: f denotes response frequency).

$$A = \frac{\frac{fA}{fA + fC}}{\frac{fC}{fA + fC}} = \frac{fA^*}{fC} = \frac{800}{200} = 4 \text{ SU}$$

*Computation is more direct by using the response frequencies.

$$B = \frac{889}{111} = 8\ SU$$

and by definition, C = 1 SU

These figures were placed in the "uncorrected" table as shown in the following diagram:

UNCORRECTED	C	B	A
A	4.00		
B	8.00		
C	1.00		

2. Columns B and A were filled in in the same manner, except that B and A were successively treated as a one SU value as C was in Step 2. Completion of these calculations produced the following uncorrected table:

UNCORRECTED	C	B	A
A	4.00	0.50	1.00
B	8.00	1.00	2.00
C	1.00	0.13	0.25

3. The uncorrected table was corrected by applying the column relationships for any consideration arbitrarily assigned a one SU value. In this case C was selected and the relationships in Column C were used to correct the other columns (each column value was multiplied by the number in parentheses under the column label).

CORRECTED	C (1.00)	B (8.00)	A (4.00)
A	4.00	4.00	4.00
B	8.00	8.00	8.00
C	1.00	1.00	1.00

Measuring Values

The STAMS method was tested on three groups: 14 staff and city hall employees, 35 Citizens Advisory Committee members, and 23 Spokane Community College freshmen. The findings from the largest group, the Citizens Advisory Committee, are reported in detail. The following nine transportation planning considerations were weighted by the STAMS method.

Transportation Planning Considerations

Travel Time Cost (TTC)—TTC refers to the value that you place on your time and that of your passengers. It can include the value you place on convenience or inconvenience; your increased or reduced earning power; and/or the amount of free time you have available.

Vehicle Operation and Maintenance Cost (VOMC)—VOMC includes the costs of gasoline, oil, tires, wear and tear on the vehicle, etc. Roadway design can either increase or decrease these costs to the user.

Accident Cost (AC)—AC involves lost time, vehicle repair costs, medical bills, loss of income, property damage, insurance rates, etc. The kind of roadway facilities provided can have an important influence on the frequency and severity of accidents.

Economic Cost (EC)—Transportation costs of both the vendor and consumer are often an important part of the cost of a goods or service. EC includes the cost of transporting personnel, raw materials, finished products, food, and fuel on the roadway system. This can mean a gain or loss in sales or employment due to the superior or inferior competitive position of the local businesses.

Construction Cost (CC)—CC includes the cost of right-of-way, structures, design, roadway, relocation, and any other costs involved in providing the physical roadway facility. Increased or decreased construction costs can mean an increase or decrease in gasoline taxes.

Social Factors (SF)—A roadway facility can have a positive, negative, or little social effect on the community. It can either break up or define a neighborhood; it can separate or bring together different kinds of development; it can separate or bring people together; it can shape development. This can have an important influence on how well people enjoy their community.

Appearance (A)—Appearance can have either a positive or negative effect on the roadway user, immediate neighbors, and the entire community. It refers to the landscaping and structural design of roadway facilities as they appear when completed and in use. Appearance can affect either positively or negatively the desirability of the area as a place to live or do business.

Governmental Costs (GC)—GC involves the cost of changing or not changing school, police, and fire protection areas, as well as the gain or loss of property from tax rolls. It includes the maintenance of roadway facilities, and the increased or decreased costs of providing municipal services as a result of the roadway. An increase or decrease in these costs can mean an increase or decrease in property taxes.

Influence on Neighboring Property (IONP)—Roadways can raise or lower the value of neighboring land by affecting the ease of reaching the property, changing local and regional travel patterns, and by the effect of noise and fumes. As a result of roadway facilities, some citizens will experience economic gains or losses.

Item weightings were established using an item preference couplet inventory i. e., comparing each consideration with each other consideration. Each respondent was supplied with a complete definition and careful verbal description of each transportation planning consideration. The inventory was administered to the Citizens Advisory Committee.

Sample Size—Thirty-five persons completed the inventory. This sample size was considered adequate to test the measuring technique.

Inventory—The inventory consisted of two forms, A and B. Form B was the same as Form A, except the sequence of consideration comparison was reversed and the item order rearranged. Each of the nine transportation planning considerations was paired randomly with the remaining eight, providing a total of

$$(N)\ (N - 1) = (9)\ (9 - 1) = 72 \text{ couplets}$$

When considered as unidirectional, there are 72/2 = 36 couplets.

To avoid social pressures, the completed Citizens Advisory Committee questionnaires, Forms A and B, were not signed. Inventory Forms A and B were handed out in envelopes and Forms A and B were matched by the same serial number. The respondents were instructed to complete Form A and drop it in a "ballot box" before starting on Form B. To assist in test supervision, Form A was green and Form B was pink. Of the 37 forms administered to the Citizens Advisory Committee, only two were rejected for unsatisfactory completion.

TABLE 1

ORIGINAL PASS 35 CITIZENS ADVISORY COMMITTEE

Consideration	EC	SF	IONP	TTC	AC	CC	GC	A	VOMC
AC	4.85	7.77	4.85	3.37	1.00	6.75	9.00	6.75	4.38
TTC	1.12	1.33	0.71	1.00	0.30	1.80	1.92	0.95	1.70
IONP	1.70	1.26	1.00	1.42	0.21	1.50	2.50	1.26	1.92
SF	1.06	1.00	0.80	0.75	0.13	0.95	1.33	0.71	1.09
EC	1.00	0.95	0.59	0.89	0.21	1.59	2.18	0.67	0.80
VOMC	1.26	0.92	0.52	0.59	0.23	1.30	1.59	0.75	1.00
A	1.50	1.42	0.80	1.06	0.15	1.65	2.18	1.00	1.33
GC	0.46	0.75	0.40	0.52	0.11	0.56	1.00	0.46	0.63
CC	0.63	1.06	0.67	0.56	0.15	1.00	1.80	0.61	0.77

Respondent Comprehension—Respondent comprehension appeared satisfactory on all items. Some commented that at first they had to refer to the definitions sheet, but later they were able to answer without this reference. Examination of the completed forms indicated no apparent minunderstandings of the nine item definitions. Most respondents seemed to develop their own definition or understanding of the listed transportation planning considerations.

Analysis of Citizens Advisory Committee Data

The completed interview forms were examined for completeness. Form A and Form B were paired using the assigned serial number. Results were put on the same summary sheet. In the analysis, each couplet was treated as unidirectional. This provided two responses for each of 36 couplets.

The SU values for each transportation planning consideration were calculated in the following manner:

1. All studied transportation planning considerations were compared in couplets to determine which the respondent felt was more important.
2. A preliminary ranking of the transportation planning considerations was accomplished using frequency of preference. A convenient centrally ranked item (EC) was selected and assigned a one SU rating.
3. The STAMS rating for each other transportation planning consideration was determined by dividing its couplet proportion by the couplet proportion of the one SU consideration (EC).
4. Step 3 was repeated for each transportation planning consideration, successively setting each equal to one SU and relating it to all others. This process resulted in the uncorrected 9 × 9 matrix (Table 1).
5. The STAMS ratings resulting from Step 4 (Table 1) are corrected by the inter-item relationships in Column EC. EC was selected to be the one SU factor. This correction produced the succeeding corrected 9 x 9 matrix (Table 2).

TABLE 2

ORIGINAL ITERATED PASS CORRECTED ON ECONOMIC COSTS FOR CITIZENS ADVISORY COMMITTEE

Consideration	EC	SF	IONP	TTC	AC	CC	GC	A	VOMC	Total	Avg. STAMS	$\bar{D}/\sigma D$
AC	4.85	8.24	8.25	3.77	4.85	4.25	4.14	10.13	5.51	53.99	6.00	0.62
TTC	1.12	1.41	1.21	1.12	1.46	1.13	0.88	1.42	2.14	11.89	1.32	0.58
IONP	1.70	1.34	1.70	1.59	1.02	0.95	1.15	1.89	2.42	13.76	1.53	0.75
SF	1.06	1.06	1.36	0.84	0.63	0.60	0.61	1.07	1.37	8.60	0.96	0.80
EC	1.00	1.01	1.00	1.00	1.02	1.00	1.00	1.01	1.01	9.05	1.00	0.00
VOMC	1.26	0.98	0.88	0.66	1.12	0.82	0.73	1.13	1.26	8.84	0.98	0.59
A	1.50	1.51	1.36	1.19	0.73	1.04	1.00	1.50	1.68	11.51	1.28	0.64
GC	0.46	0.80	0.68	0.58	0.53	0.35	0.46	0.69	0.79	5.34	0.59	0.66
CC	0.63	1.12	1.14	0.63	0.73	0.63	0.83	0.92	0.97	7.60	0.84	0.60
												$\bar{\bar{D}}/\sigma D$ = 0.66

TABLE 3

CITIZENS ADVISORY COMMITTEE MEMBERS

Range	Obs.	Exp.	χ^2
0.00 - 0.19	59.0	49.0	2.04
0.20 - 0.39	86.0	77.0	1.05
0.40 - 0.59	52.0	42.0	2.38
0.60 - 0.79	16.0	21.0	1.19
0.80 - 0.99	8.0	7.0	0.14
1.00 +	30.0	56.0	12.07

Sum χ^2 = 18.87
df = 5
Significant at 0.01 level.

6. The corrected SU ratings in Step 5 are averaged to determine the average SU rating for each transportation planning consideration.

Findings

An examination of the Citizens Advisory Committee STAMS ratings (Table 2) for the nine transportation planning considerations disclosed average ratings ranging from 0.59 SU for GC to 6.00 SU for AC. It was found that EC, VOMC at 0.98 SU, and SF rated at 0.96 SU did not differ practically. TTC and A had similar SU ratings of 1.32 and 1.28, respectively. CC rated at 0.85 SU and GC at 0.59 SU were the lowest. AC, the highest rating of 6.00 SU, was significantly above the next highest rating of 1.53 SU for IONP.

To determine whether the successive estimates of each STAMS rating for each item differed significantly from chance, the following application of $\sqrt{pa/N}$ was used:

$$\frac{D}{\sigma D} = \frac{D}{\sqrt{\frac{pq}{N_1} + \frac{pq}{N_2}}} = \frac{D}{\sqrt{PQ\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

where

D = difference in proportions,
σD = standard deviation of the proportions,
N_1 = number of cases in one of the proportions, and
p = larger one of the proportions.

P is calculated by combining the two sets of data. The right-hand form of the equation was suggested where less than 100 cases were involved and when q, the smaller proportion, was small.

The $\bar{D}/\sigma D$ column (Table 2) gives the average of the 36 possible calculations for each row. $\bar{\bar{D}}/\sigma D$ gives the overall value for the matrix. Values of 1.96 and 2.57 would mean a difference significant at the 5 and 1 percent levels, respectively. A value near 0.67 would be expected to be the average value.

If the order of the considerations is reversed, a relatively homogeneous group of respondents would change their item preference more frequently the closer the two considerations were in SU ratings. In other words, crossovers in the selection of any one of two considerations will be more frequent as the STAMS ratings of the two considerations approach equality.

TABLE 4

COMBINED STUDY RESULTS

Consideration	Pilot Test 14 Civil Service		Cit. Adv. Com. 35 Members		Freshman SCC 23 Students	
	SU	Rank	SU	Rank	SU	Rank
AC	10.81	1	6.00	1	5.40	1
TTC	1.63	2	1.32	3	2.09	2
IONP	1.46	3	1.53	2	1.74	3
SF	1.23	4	0.96	7	0.94	9
EC	1.00	6	1.00	5	1.00	7
VOMC	1.20	5	0.98	6	1.13	6
A	0.61	8	1.28	4	1.39	4
GC	0.79	7	0.59	9	0.98	8
CC	0.29	9	0.84	8	1.24	5

To test the "crossover" hypothesis, differences in STAMS value ratings between all of the transportation planning considerations were calculated. The frequency of crossovers was determined for each of seven SU differences interval categories.

A χ^2 test was used to evaluate the hypothesis (Table 3). The test of the crossover hypothesis showed that the closer the two considerations were in STAMS ratings, the more crossovers. This was supported at the 1 percent level of significance.

Table 4 shows the STAMS units and ranks for the Citizens Advisory Committee and two other groups tested. In all administrations of the inventory, AC was clearly the most important. TTC and IONP in all instances were rated over the other considerations. GC and CC usually received the lowest ratings except where the Spokane Community College Students considered construction costs 1.24 SU. Appearance was considered above EC by both the nongovernmental groups, but of lesser importance by the pilot test group of civil servants.

Conclusions and Discussion

Evidence from three tests of the scaling method indicates STAMS units are reasonably stable. The data also support the crossover hypothesis, which would be expected if dealing with probabilities.

The STAMS units can be easily converted to relative probabilities by the following formula:

$$P_i = \frac{SU_i}{\sum_{i=1}^{n} SU_i}$$

where

P_i = the relative probability that consideration i would be picked as more important, and

SU_i = the SU rating of consideration i.

This was not used, however, since the STAMS values later become part of a weighted score.

Although from a methods standpoint these results are encouraging, it is apparent the transportation planning considerations used in these initial tests are far too general and ambiguous to be of much use in planning. A serious application of the procedure would require a better definition of the transportation planning considerations and an identification of the comprehensible components of these considerations. The STAMS ratings would be based upon a comparison of the components rather than the total considerations. The STAMS rating for each transportation planning consideration would be the sum of the component ratings.

The preparation of scales to measure the extent to which each intangible transportation planning consideration is realized in a particular alternative requires use of methods previously described as well as those common in the fields of psychological and sociological measurement and questionnaire construction. It is proposed that measurement of transportation planning considerations be developed by the following method:

1. Identify the component factors in each transportation planning consideration. Through research of the literature, expert judgment, and preliminary tests, component factors in each transportation planning consideration should be identified and carefully defined. Where possible, definition should involve observable and measurable characteristics. Each component must be small enough to be comprehensible to the average layman. As a result of this analysis the original transportation planning consideration might require modification and redefinition.

2. Determine by STAMS approach the relative importance of each component factor in developing the consideration measuring scale, using the responses of a jury of experts.

3. Establish the relationship between measurable physical facts and the extent to which a jury of experts indicates each component factor is realized in a series of roadway alternatives. Use a multiple regression equation to establish the relationship between the component factor jury ratings and the observable and measurable character-

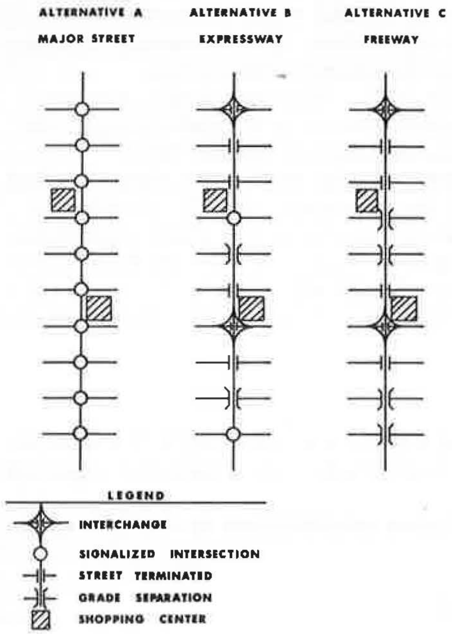

Figure 1. Roadway alternatives.

istics. This analytic process will help define and provide a means by which each component factor can be measured with an empirically developed scale.

4. Measure the extent to which a given transportation planning consideration is realized in a particular alternative by combining the relative weights and measures of the component factors and preparing a total transportation planning consideration "score." This total score serves to show the extent to which a particular transportation planning consideration is realized in a given roadway alternative.

APPLICATION OF STAMS UNITS IN THE DECISION-MAKING PROCESS

It is one thing to measure the relative strength of values and another to apply them in the decision-making process. The use of tangible and intangible factors in this process requires two steps: (a) determination of the relative importance of the various planning considerations, and (b) measuring the extent to which each planning consideration is realized in each alternative. The method of determining the relative importance of each consideration was described previously; this section shows a method for measuring the extent each consideration is realized in each alternative and how both steps are combined in the decision-making process by use of an "equality of averages" assumption.

The nine transportation planning considerations used in the initial tests might be divided into two groups; those appearing to be tangible, and those appearing to be intangible. In the past, transportation planning has been dependent on tangible costs to evaluate alternatives. Because of this, accident costs, travel time costs, vehicle operation and maintenance costs, and construction costs have been well documented and valid estimates can be calculated. The largely intangible values such as influence on neighboring property, social factors, economic costs, appearance, and governmental costs have been difficult, if not impossible, to include as factors in the decision-making process.

To show how the STAMS unit may be applied in decision-making, three hypothetical roadway proposals are evaluated (Fig. 1). For the sake of description, it will be assumed that adequate rating scales for influence on neighboring property, social factors, economic costs, appearance, and governmental costs have been developed. (For purposes of describing the alternative evaluation technique, judgmental ratings were made up; actual application would require development as described in the text.)

Each roadway alternative traverses approximately the same residential area and must accomplish the following:

1. Connect two points five miles apart.
2. Handle a 24,000 ADT.
3. Have a DHV of 2650 for an 11 percent peak hour with a 60-40 directional split carrying 5 percent trucks.

TABLE 5

RAW CONSIDERATION MEASURES

Consideration	Alternative A Major Street	Alternative B Expressway	Alternative C Freeway
Tangible Type:			
AC, $	336,000	285,000	130,000
TTC, $	1,752,000	1,226,400	963,600
VOMC, $	1,883,400	1,664,400	1,752,000
CC, $	274,990	624,368	843,040
Intangible type:			
IONP	80	65	95
SF	75	15	15
EC	50	80	64
A	60	20	90
GC	50	80	30

Although many solutions are possible, the introduction of a new major street, expressway, or freeway will be evaluated. The alternatives will have the following characteristics:

1. Major Street (at-grade intersections will control the design—two signalized intersections per mile).
2. Expressway (two signalized intersections, two interchanges, two grade separations, and other intersections terminated).
3. Freeway (no at-grade intersections, two interchanges, four grade separations, other intersections terminated).

Table 5 indicates the raw measures of each planning consideration. The raw tangible measures are the cost estimates. The raw intangible measures are hypothetical scale values for each alternative for each consideration.

Computing the Comparative Rating

To use the measures of each transportation planning consideration in the evaluation of three roadway alternatives, it was first necessary to develop a relative score. One is the highest alternative relative score with each other alternative being rated equal to, or less than, one. Where a low value is favorable, that alternative value is placed in the numerator (this was used with AC, TTC, VOMC and CC). Where the higher measure is considered favorable, that number is placed in the denominator (this was the case with IONP, SF, EC, A, and GC).

Table 6 shows how the rating for each alternative was calculated in the raw numbers column. The result is shown in the relative score column. Because the relative score eliminates row differences, the row weight was calculated. The row weight is the sum

TABLE 6

COMPARATIVE RATING COMPUTATION—UNCORRECTED TABLE

Consideration	Row Weight	Alternative A		Alternative B		Alternative C	
		Raw Numbers	Rel. Score	Raw Numbers	Rel. Score	Raw Numbers	Rel. Score
Tangible type:							
AC	0.0639[a]	$ 130,000 / $ 336,000	0.39	$ 130,000 / $ 285,000	0.46	$ 130,000 / $ 130,000	1.00
TTC	0.3360[a]	$ 963,600 / $1,752,000	0.55	$ 963,600 / $1,226,400	0.79	$ 963,600 / $ 963,600	1.00
VOMC	0.4517[a]	$1,664,400 / $1,883,400	0.88	$1,664,400 / $1,664,400	1.00	$1,664,400 / $1,752,000	0.95
CC	0.1484[a] 1.0000	$ 274,990 / $ 274,990	1.00	$ 274,990 / $ 624,368	0.44	$ 274,990 / $ 843,040	0.33
Intangible type:							
IONP	0.2762[b]	80/95	0.84	65/95	0.68	95/95	1.00
SF	0.1208[b]	75/75	1.00	15/75	0.20	15/75	0.20
EC	0.2233[b]	50/80	0.63	80/80	1.00	64/80	0.80
A	0.1956[b]	60/90	0.67	20/90	0.22	90/90	1.00
CC	0.1841[b] 1.0000	50/80	0.63	80/80	1.00	30/80	0.38

[a]Uncorrected.
[b]Corrected.

Raw numbers are obtained from measuring scale or cost analysis.

$$\text{Relative score (high is bad)} = \frac{\text{Best measured condition of row}}{\text{Measured condition of alternative}}$$

$$\text{Relative score (high is good)} = \frac{\text{Measured condition of alternative}}{\text{Best measured condition of row}}$$

$$\text{Uncorrected row weight} = \frac{\text{All measures of type in each row}}{\text{All measures of type}}$$

TABLE 7

ROADWAY ALTERNATIVE EVALUATION TABLE

Consideration	SU Weight	Cor. Row Weight	Alternative A		Alternative B		Alternative C	
			Rel. Score	Weighted Score	Rel. Score	Weighted Score	Rel. Score	Weighted Score
AC	6.00	0.05[a]	0.39	0.117[b]	0.46	0.138	1.00	0.300
TTC	1.32	0.27[a]	0.55	0.196	0.79	0.282	1.00	0.356
VOME	0.98	0.36[a]	0.88	0.310	1.00	0.353	0.95	0.335
CC	0.84	0.12[a]	1.00	0.101	0.44	0.044	0.33	0.033
IONP	1.53	0.28	0.84	0.360	0.68	0.291	1.00	0.428
SF	0.96	0.12	1.00	0.115	0.20	0.023	0.20	0.023
EC	1.00	0.22	0.63	0.139	1.00	0.220	0.80	0.176
A	1.28	0.20	0.67	0.172	0.22	0.056	1.00	0.256
GC	0.59	0.18	0.63	0.067	1.00	0.106	0.38	0.040
Total weighted scores				1.577		1.513		1.947

[a]Correction for row weight of tangible row i = $\left(\frac{\text{Mean row wt. intang.}}{\text{Mean row wt. uncor. tang.}}\right)\left(\text{Row wt. uncor. tang. row}_i\right)$

[b]The weighted score is calculated in the following manner: Wt. score = (STAMS) (row wt.) (Alternative$_i$ relative score)

Note: Since the average row weight is established on the intangible items, no row correction is required for those row weights.

of the measures in a given row divided by the total of all like measures. Since the row weights for like tangible considerations and like intangible considerations separately add up to one, the tangible row weights need to be corrected for the difference in the number of rows by a factor of 4/5. (Note: the same kind of adjustment could be made on the intangible row weights, with the tangible rows remaining as originally calculated.)

Roadway alternative evaluation is accomplished by calculating and summing the weighted score column in Table 7. The weighted score column is the product of the STAMS weight times the corrected row weight times the relative score for each alternative. Alternative C has the highest overall score of 1.95. Alternative A received the score of 1.58, and Alternative B, 1.51. It should be recognized, however, since the intangible scores were manufactured for illustrative purposes, their use in this evaluation is merely to show how the method would work if proper measures were available.

Conclusions

The roadway alternative evaluation table, properly accomplished, would be of considerable value to decision-makers. It would give them advance knowledge of the response that could be expected from various community groups tested. It is a tool that will require a large amount of further work, but will not necessitate any significant breakthroughs in social science.

With refinement and improvement, this procedure could also be used as a guide in the design process. The designer would know in advance the best way to spend roadway money to optimize the satisfaction of the consumer.

The reader should be cautioned not to apply the findings of the relative importance of the various transportation planning considerations because the considerations were far too broad and ill-defined to be accurately interpreted by the respondent. Table 7 consists of "manufactured" intangible measures and, consequently, is for illustrative purposes only. Both major steps, determining the relative importance of each transportation planning consideration and measuring the extent to which these considerations are realized in each alternative seem to work out in a satisfactory manner. It seems safe to conclude that the method described shows promise as a useful tool of the planner, engineer, and decision-maker.

FURTHER SMATS RESEARCH

To develop some intangible factor measuring scales a $42,000 study financed jointly by the Federal Highway Administration, the Washington State Highway Commission, the County of Spokane, the City of Spokane, and by citizen subscription, is in process at Washington State University, under the direction of G. A. Riedesel, Highway Research Engineer, College of Engineering, Pullman, Washington. The following is an excerpt from the project prospectus entitled, A Study of the Social, Economic, and Environmental Impact of Highway Transportation Facilities on Urban Communities.

PROJECT DESCRIPTION

A. The Problem

The aesthetic, economic, environmental, and sociological effects and considerations are having increasing influence on the location and construction of urban highways, and the highway locator and designer needs to be familiar and concerned with the affairs of sociology, landscape architecture, community planning and aesthetics.

There is a need for better communication, understanding, and cooperation among all professions and disciplines engaged in highway and community development.

The citizens and officials of the City and County of Spokane, Washington, in cooperation with the Washington Department of Highways, and the Federal Highway Administration are especially interested and involved in a comprehensive transportation study and are desirous of undertaking a study on the subject of this prospectus.

This study will be in the program area of social impact—environmental quality, community effects, and highway transportation as presented by the U. S. Bureau of Public Roads, Office of Research and Development, November 26, 1966.

B. Objectives

1. Write a glossary of professional terms; engineering, architectural, community planning, sociological, governmental, that are necessary for broad discussion of urban development and arterial roadways location and design.
2. Develop a methodology and an outline of procedures for considering and accommodating all the factors involved in urban arterial highway locations and design.

   a. aesthetic—in detail
   b. social and sociological—in detail
   c. engineering—by reference
   d. economic and financial—by reference
   e. legal—by reference

3. Describe a set of desirability standards to be met by various functional classes of urban highways with regard to:

   a. aesthetic
   b. social, environmental, and sociological (including economic impact on the community, both short and long range)
   c. engineering
   d. economic—by reference
   e. legal—by reference

These standards will be for application to any highway location. However, the SMATS people will apply them specifically to their study.

4. Develop a procedure for determining the relative acceptability of a proposed highway location and design:

   a. evaluation and rating by qualified persons (preparation and use of a rating scale)
   b. public hearings
   c. professional conferences

As a result of this study, prototype measuring scales will be produced which should be helpful in evaluating alternatives. Initial efforts will be crude and results will require intelligent interpretation by the user. It is expected that this kind of evaluation procedure will be refined and eventually be of considerable value in better decision making.

WHAT NEEDS TO BE DONE

Further research is needed to define adequately the different consideration scales. At present, the application of any or part of the findings of this study in a practical situation would be hazardous except as an experiment. With development of more accurate and reliable measures and STAMS weightings of the pertinent considerations, an alternative evaluation table could be prepared and used. It is recommended that a large-scale, well-financed, and properly coordinated research program be initiated to develop the appropriate consideration scales, and to test the method in real decisions. Once this has been done, a follow-up study should be made to see how well the method works or would have worked. Through intelligent trial and error, the STAMS method can improve the planning and decision-making process.

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