Techniques for Setting Research Priorities

W. Campbell Graeub, Thomas C. Hood, and Kenneth W. Heathington

The identification of research needs in all areas of transportation is a continuing and vital function of more than 150 TRB committees. Most of these committees perform the task as one of their continuing activities throughout the year, but some of the committees have formal subcommittees that collect statements of research needs, others hold workshop conferences in which such statements are developed, and still others may assign certain subject areas to individuals for detailed development. The TRB committees prepare an estimated 250 such statements each year.

Not uncommonly, the committee effort ceases with the development of the needs statements and their publication as TRB Circulars or Special Reports. Normally, however, whether published or not, they represent a part of a continuing cycle of activity directed toward finding solutions to the problems identified.

A mere listing of research needs is inadequate, even if that represents the extent of committee activity directed toward a solution of the problem. The total cost of undertaking the research on such lists invariably far exceeds available funds. This demands that priorities be set and that research costs and the potential benefits be assessed. In certain cases, solutions would be of great benefit, but the likelihood of success is small and the research costs large; in other instances, the success is almost certain, the research costs are moderate, and the benefits are great.

W. Campbell Graeub is engineer of public transportation, TRB staff; Thomas C. Hood is associate professor, University of Tennessee; and Kenneth W. Heathington is director, Transportation Research Center, University of Tennessee.

TRB has used a number of methods to set priorities for research projects and to establish research programs.

Some time ago, the Committee on Freeway Operations prepared a list of high priority areas (Highway Research Circular 132). A list of suggested project titles was sent to committee members, and they were asked to add other titles of their choosing and then to provide priority index numbers. Because small decimal index numbers are awkward to work with, a monetary base was used instead. Respondents were told they had $1 million and could spend it any way they wished. To check the respondents for possible bias, and to cross-check the method, questions were also asked on independent assessment to project work, urgency, range of effect, and success. Correlation and regression analyses were made. The monetary allocation was found to be as good a prediction of priority as any other subjective methods. An important advantage was that it provided a simple indicator of magnitude of priority.

Over the years, TRB has sponsored workshop conferences that are aimed solely at producing research project statements and establishing priorities for such work. For example, in a workshop on highway maintenance research needs, 20 research problems in nine major maintenance areas were identified (FHWA-RD-75-511). Estimates of research costs, benefits, and time requirements for each project were obtained by a Delphi technique analysis. A national highway maintenance research program was developed that was based on priority research problems as defined by benefit/cost ratios.

As part of another effort, a TRB group selected the top-priority statement of research needs from each section and the top-priority statement from each committee to form its list of recommended projects. Some advocates of such a selection process argue that it provides a more equitable way of bringing to the surface projects that may not be thought of as being in vogue.

Similarly, in a workshop held on research needs for evaluation of urban public transportation, 57 research project statements were independently developed by small, subject-specific workshop groups. Each workshop designated each project as having high, medium, or low priority and selected two as its top-priority projects. The conference, as a whole, chose not to rank the projects beyond the determination of the workshops (1).

Another way of establishing a list of projects is the method employed by the National Cooperative Highway Research Program (NCHRP). Every year, NCHRP solicits statements of proposed projects that undergo careful review by TRB and Federal Highway Administration staff and evaluation for conflicts with past or ongoing research. These statements are then sent to the members of the American Association of State Highway and Transportation Officials' Select Committee on Research. The members are asked to rate each project for high, medium, or low priority. The arithmetic ranking of this rating process is used as the basis for selecting the recommended research program for the next year. Final program approval is obtained by ballot from each state.

Still another procedure was recently described by Hood and Heathington (2).

The Public Transportation Section was the target population for testing an application of the Delphi technique. Each committee chairperson in the section prepared statements of research topics prior to the section's mid-year meeting. The persons attending the mid-year meeting provided a captive population of transportation experts who could evaluate the prepared statements. Administering the research topic questionnaires in a conference setting to a relatively small group of 50 persons produced quick turnaround time between administrations.

Several months preceding the meeting, statements of research topics were solicited from the chairpersons. A letter requested at least 10 statements of needed research in each committee's area (the first round). The project directors formulated additional statements, eliminated duplicate statements, and reduced the number of statements to 40. These statements were placed in a questionnaire format. The questionnaire asked respondents to evaluate each statement on a 7-point Likert-type scale from "urgently needed information" to "information not needed at this time." In addition, respondents were asked to select the top 10 projects and to rank them in order of their preferred priority.

The questionnaire (the second round) was administered to all persons attending the general session on the first day of the meeting. The ratings and rankings of the 40 statements were calculated that day. A second questionnaire (the third round) was prepared by using the same format, but this time including only the top 20 proposals. The questionnaire showed the average rating given to each proposal by respondents (printed under the proposal number). The original proposal number on the first questionnaire was retained, and proposals were presented in the same order as on the first questionnaire. After administration of the third round of proposal ratings, rankings and ratings were calculated for each statement. The fourth and final round used paired comparisons of the eight top-ranking statements, as well as Likert-type evaluations of the eight statements. The paired comparisons required each respondent to compare each proposal with every other proposal and choose which one in each pair he or she preferred. The use of paired comparisons made possible an exact rank ordering of the statements and an estimate of the relative distance between the ranks by using standard scores (3). In addition, this questionnaire requested biographical information from the respondent: type of employer, educational background, and years in the transportation field.

Table 1 presents summaries of the eight proposal statements in the fourth round. The Z-scores in the table are those calculated from the paired comparisons. The Z-scores place each score on the same quantitative dimension so that direct comparisons can be made. The five proposals at the top are clustered together. The bottom three projects ranked considerably lower. Within the top five proposals, the top two are clustered and the next three cluster.

Table 1 also lists the average rating of the research proposal on the 7-point scale. In comparing the average rating with the Z-score of the paired comparison, it is apparent that the latter offers a clear rank order of the proposals. Furthermore, the Z-score gives a quantitative estimate of how far apart the proposals are from one another. Ratings produce ties, do not give a clear estimate on the distance apart, and cluster around a narrow and common score.

The project proposal that ranked consistently above the others was one to study the effects of transportation system management (TSM) in urban areas. The second-ranking proposal concerned various aspects of paratransit. Third was a study of the transfer problem. Fourth was improving cost-effectiveness records on service to the

Table 1. Results of tests of eight proposal summaries.

Description	Z-Score	Average Rating on 7-Point Scale
Research to determine the measurable effects of TSM on urban areas; before-and-after studies of transit operating efficiency and improvements as viewed by operator, passenger, and the community at large	0.332	5.7
Research evaluating demonstration projects in the area of paratransit focused on the issues of how the projects overcome regulatory barriers, overcome insurance problems, contract for public transportation services, develop continuing funding sources, involve citizens and community groups, and evaluate themselves	0.313	5.6
Research designed to determine the impacts of transfers on ridership for various modes, various transfer timings, and various service frequencies	0.272	5.3
Research to develop and report comparable cost-effectiveness data for programs that provide service to the elderly, the handicapped, and low-income persons	0.251	5.4
Research to determine the effect of labor constraints in innovations in the transit field	0.255	5.5
Research to evaluate the impact of an energy shortage on transit use	0.055	5.1
Research to determine how labor negotiations and agreements affect the successful coordination of transportation services	0.036	5.4
Research designed to categorize and evaluate the effectiveness of various passenger information systems deployed in intermodal transfer facilities across the United States	0.000	5.0

elderly, low-income persons and the handicapped. The fifth- and seventh-ranking proposals raised questions about the impact of labor on transportation services. Sixth was the study of impacts of an energy shortage on transit use. Eighth was on the effectiveness of information systems in intermodal transfer facilities.

The collection of data on participants allows exploratory comparisons between projects favored by different types of workers. Although the sample size was small, the type of employer, field of training, and age appear to have some effect on the rating of topics.

The application of the Delphi method to the evaluation of short statements of proposed research projects resulted in a consensus. Eight proposals were selected, all of which achieved better-than-average ratings on a 7-point rating scale. The use of paired comparisons established a priority ranking among the eight proposals that would enable decisions makers to evaluate precisely how the group, as a whole, would order the proposals. The paired comparison system of ranking was much more precise than either an average-ranking or an average-rating technique.

Arithmetic comparisons of the rating scores for various subgroups of the sample suggest that the composition of the group rating the proposals makes a difference. Type of employer, work activity, and amount of experience in the transportation field appear to be important when taken as single predictor variables. A more systematic, vigorous study that uses a larger, well-defined population and multivariate analysis should examine the combined impact of various background variables on the ratings of research proposals in transportation.

The foregoing discussion highlights varying techniques of setting research priorities. The techniques described were generally adopted to suit the conditions and needs at the time. There is a strong indication that the technique selected can considerably influence the results.

It would seem prudent for research administrators to recognize the strengths and weaknesses of the various techniques that can be used for setting research priorities. Applications of two or perhaps three techniques to a set of project statements may be a sound approach. Comparing the results of the techniques applied to the same set and administered by the same evaluators will provide additional information for establishing a research program.

References

1. Research Needs for Evaluating Urban Public Transportation. TRB, Special Report 155, 1975.
2. T. C. Hood and K. W. Heathington. Using the Delphi Technique to Set Transportation Research Priorities. Transportation Research Center, University of Tennessee, 1978.
3. A. L. Edwards. Techniques of Attitude Scale Construction. Appleton-Century-Crofts, New York, 1957, Chapter 2.

TRB Committee Member Bellomo Named to Head ASCE Urban Group

Salvatore Bellomo, vice president of Alan M. Voorhees and Associates and a member of three TRB project panels, has been appointed chairman of the Urban Transportation Division of the American Society of Civil Engineers (ASCE). A registered professional engineer in the District of Columbia and four other states, Bellomo is a fellow of the Institute of Transportation Engineers and a member of ASCE, the American Public Works Association, and the National Association of Environmental Planners. He is also a member of the U.S.-Soviet Delegation on the Enhancement of the Urban Environment, Subgroup on Transportation.

Bellomo teaches at several universities in the metropolitan Washington, D.C., area, and has lectured at other universities in the United States and overseas.

Executive Director for AASHTO

The American Association of State Highway and Transportation Officials (AASHTO), located in Washington, D.C., seeks applicants for the position of executive director of AASHTO. The responsibilities of the position include execution of the AASHTO program, including the administration of funding and budgets; guidance of programs and committee work; and supervision of staff of approximately 15. Further, the responsibilities include liaison with the transportation community at all levels of government and industry.

All applicants must have a background in administrative responsibilities and should have extensive experience in transportation or governmental relations. A degree in an appropriate discipline would be desirable. Key require-