COMPARATIVE ANALYSIS OF STATE DOT RESEARCH MANUALS
EVALUATION OF COMMUNICATION IN RESEARCH MANAGEMENT SYSTEMS

Report

Prepared for

New Jersey Department of Transportation

Hindy Lauer Schachter

School of Industrial Management/National Center for Transportation and Industrial Productivity
New Jersey Institute of Technology
Newark, New Jersey

October 1995/January 1996
ABSTRACT

This report presents a comparative study of the research manuals being developed in three states--New Jersey, New York and Virginia--and currently in use at the NCHRP. The report focuses on alternative designs for soliciting and prioritizing problem statements. Information comes from analyzing manuals and draft manuals, interviewing program administrators and reading a Feb. 1995 study of the NCHRP (Apogee Research, Inc. Strategic Direction for the NCHRP and Other AASHTO Research Activities).

The study finds that NJDOT's manual shows a clear sense of the bureau's mission. The text describes a well-developed research process that is less specific and formalized than New York's, but more specific and formalized than Virginia's. The second section of the report ("New Jersey") discusses strengths and weaknesses of the manual as they appear to an outsider. It shows which aspects of the process appear clear to an outsider and where such a person might have questions and want a change of wording or further details. The research bureau can use this analysis to
decide if it wants to provide greater detail on a particular point or if it prefers a more informal presentation to encourage greater flexibility.

The report makes three recommendations. These focus on 1) increasing the strategic direction of the solicitation and prioritization process, 2) facilitating outsider participation in problem-statement development, and 3) investigating whether the research staff would benefit from inserting explicit prioritization criteria into the manual.

The 1991 Intermodal Surface Transportation Efficiency Act (ISTEA) led the Federal Highway Administration (FHWA) to institute rulemaking changes to increase state research program autonomy and accountability. Section 420.207 of 23 CFR requires state transportation departments to develop a process that identifies research, development and technology transfer activities. This change allows the FHWA to concentrate its stewardship role on the policies states use to implement their activities rather than on project-specific approvals.

Since many states had no formal research process in 1991, the regulations gave them an opportunity to plan a research management system. Responses would vary depending on goals, audiences, outside environment (e.g., state law) and internal agency structure and culture. The National Cooperative Highway Research Program's (NCHRP) Interim Guide for Developing a State
Transportation Research Manual offers several suggested texts, stating explicitly that "[N]ot all options are expected to be desirable to all states. Each state must determine which options meet the needs ... of their agency".

Issues of detail and specificity, for example, are matters each state may handle differently. More detail encourages central control and uniformity of response but it also can breed rigidity or a dichotomy between text and practice. Minimizing detail encourages flexibility but it can lead to less clarity on what the organization expects. In deciding how much detail to include managers have to understand their own environments but they can also benefit from learning about a range of communication strategies.

Optimally manual developers examine options both from expert and newcomer perspectives. They aim to produce a work of interest to administrators placed inside and outside the research bureau, a work that helps to create informed supporters throughout the organization. Although most technology-dependent organizations see research as an important activity, their executives often do not understand this function as well as they do operations or human resources. An effective manual provides information to them on the research process.
An expert orientation means asking the following questions: What content and style do my technical background and work experience tell me are necessary to articulate the agency's goals? Would my presentation appear meticulous to an expert?

A newcomer's perspective involves asking: How would the content and style of this section appear to someone unschooled in the agency's work--a new agency member or an outsider who had to deal with the Bureau? Are the procedures clear? Is the material free from usage that might offend or exclude readers?

Preparing the manual is an excellent opportunity to examine the entire solicitation and prioritization process. Questions include: How can the bureau combine a bottom-up process of idea generation with some strategic direction as to which problems have high priority? From whom should the bureau solicit problem statements? How can the bureau encourage widespread participation from those with relevant experience and concerns? How can the bureau maximize agency interest in the advantages of research?

To answer these questions administrators in any state want to know: How are other agencies handling these issues? Do they have ideas that might help me? No matter how
strong a given state's approach any research division can find ways to improve by looking at alternatives from other programs.

This report compares how three states--New Jersey, New York and Virginia--and the NCHRP handle their problem statement solicitation, review and prioritization processes. All the processes diverge at several junctures. New York's is more formalized than NJDOT's which, in turn, is much more formalized than Virginia's. While some of these variations may be deliberate responses to environmental differences, others may have occurred by default. Administrators simply followed past practice or the first approach that appeared feasible. Learning from other states allows decision making from a broader base of potential choices.

The report has six sections. The first describes New Jersey's solicitation, review and prioritization process as it appears to an outsider reading the June 1995 NJDOT Research Process booklet. The second and third describe New York's and Virginia's processes, respectively.

The fourth section turns away from state manuals to examine how NCHRP solicits and prioritizes problem statements. This process is likely to be different than any state's
because of NCHRP's unique purpose, structure and constraints. It aims to address problems that affect many states rather than those specific to one jurisdiction. Complex interorganizational relationships are built into its operation since it is a program of the American Association of State Highway and Transportation Officials (AASHTO) that is administered within the Transportation Research Board (TRB). Problem statement solicitation and prioritization are the responsibility of AASHTO's Standing Committee on Research (SCOR). Administration of projects is the responsibility of NCHRP staff in TRB. Because of these differences DOT officials would not want to replicate the entire NCHRP process but might gain insights from exploring it. The fifth section offers analysis; the sixth gives recommendations for the future.

New Jersey

New Jersey DOT uses a little over two pages to define the problem solicitation, review and prioritization process. Table I on the next page shows the major steps as they
would appear to an outsider who was familiar with them only through reading the manual. Boxes with a single perimeter show steps that involve NJDOT employees; a double perimeter identifies actions involving outsiders as well.

**Soliciting Problem Statements.** The manual devotes one short paragraph to solicitation. It notes that the research bureau periodically solicits potential research project ideas from division directors and their staffs. The ideas can cover any area that the submitter believes will benefit from research. The text does not specify solicitation channel(s) or which vehicles (if any) promote participation by people outside the department.
Table 1: New Jersey Transportation Research Solicitation Process

- Bureau of Research Solicits Project Requests
- Bureau Staff Reviews Ideas and Responds to Requestors
- RUC Prioritizes Research Requests
- Research Staff Refines Requests
- TRC Makes Final Priorities for Key Projects
- Possible Consultation with Outsiders
Reviewing Statements.  Approximately one page covers this section. The manual notes that reviewers contact submitters, perform literature searches, recommend resource categories for each idea, prepare one-page documents summarizing the problem and make a summary table of all proposals to go with the one-page documents to the Research Users Committee (RUC) for prioritization.  Reviewers may contact outsider experts to discuss a particular problem statement.

The text does not specify a time frame for each of these activities. An April-July frame is given for the entire review and prioritization stage but no subsidiary timetable is offered.  No mention is made of a tracking and monitoring system.

The text notes that the staff member has to determine if the problem has sufficient value to continue the review, but the only criteria mentioned are whether the problem is currently under study or has been resolved by prior research. Presumably the potential benefits of the project also interest the department. If so, how should reviewers evaluate quantitative and qualitative benefits? A new reviewer might need guidance. On p. 6, line 2 the word "manpower" is not as inclusive as "labor" or "personnel." ("Manpower" is also used
in item "h" at the bottom of p. 6 and in the "Develop the work Program" flowchart at the start of the manual.)

Prioritizing Statements. About a page covers this stage. The text states that RUC is comprised of division directors who assist in the development of the annual research work program. It is not clear to an outsider whether this means all division directors. If not, how are RUC members chosen? How long is a term? What is RUC's timetable in preparing requests for research projects?

Program and Budget Approval. A short paragraph notes that RUC presents its requests for research projects to the Transportation Research Council (TRC) for approval and inclusion in the next research work program. The Council consists of managers on the assistant
commissioner and executive levels. No mention is made of how the bureau handles small-scale requests for research that come to light between solicitation cycles.

New York

NYSDOT uses 4 1/2 manual pages to define its solicitation process, two pages to describe organizational entities with solicitation responsibilities and six additional pages to describe the research programs (e.g., in-house, NCHRP) for which the bureau seeks problem statements. Table II shows the major steps as they appear to an outsider. Boxes with a single perimeter identify actions undertaken by NYSDOT employees; those with a double perimeter identify actions that involve outsiders. The steps are described below.
Developing Emphasis Areas

Beginning in Fall 1995 the process was scheduled to open with the development of emphasis areas by the Research Executive Board (REB), consisting of executive managers representing each functional area in the agency. Because of extensive managerial changes at NYSDOT the REB did not produce emphasis areas this autumn but plans to develop them before the next solicitation of problem statements.

Emphasis areas are major subjects of importance which must be addressed through research within three to five years. Emphasis areas are developed out of a concern that otherwise research would become fragmented, without direction--a useful collection of projects that rely on happy accident to reinforce each other. Emphasis areas ensure that the building blocks actually build somewhere. For each emphasis area, the department intends to create a technical working group (TWG) to provide expertise and assistance to research personnel reviewing problem statements in that area.
Soliciting Problem Statements

In January on a biannual basis the Transportation Research and Development Board (TR&DB) solicits problem statements from its own staff, contractors, consultants and academics. A call for topics appears in TR&DB's Quarterly Research Digest, which has a circulation external to the department. Through direct mail the research bureau notifies major industry associations and asks them to use their own newsletters to alert their members. Some groups may see solicitations for problem statements three times but mailing costs are relatively small and the department wants to encourage wide participation.

Table III on the next page shows the number of problem statements coming from outside NYSDOT in the last few cycles. Clearly insiders are most likely to respond to the solicitation despite the attempt to involve others.
Table II: New York Transportation Research Solicitation Process

1. Research Executive Board Develops Emphasis Areas
2. TR&DB Solicits Proposals
   - Solicitations Received by Outside Contractors, Consultants and Academics
3. TR&DB Staff Review Ideas
4. Research and Development Council Prioritizes Ideas Proposed by TR&DB
   - Advisory Council Input
5. Research Executive Board Approval
Table III: Number of Problem Statements Generated by Insiders and outsiders for NYSDOT's Research Program

<table>
<thead>
<tr>
<th>Year</th>
<th>Statements Received</th>
<th>Insider</th>
<th>Outsider</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994-1995</td>
<td>52</td>
<td>52</td>
<td>0</td>
</tr>
<tr>
<td>1993-1994</td>
<td>90</td>
<td>47</td>
<td>43</td>
</tr>
<tr>
<td>1992-1993</td>
<td>40</td>
<td>34</td>
<td>6</td>
</tr>
</tbody>
</table>

Insider/outsider balance fluctuates widely over the three year period with no apparent cause for the discrepancies.

Reviewing Problem Statements

All proposed problem statements are tracked by the Bureau's Administration Section and reviewed by a TR&DB staff member. (See Appendix for tracking procedures.) Reviewers have two conversations with problem submitters. After the first conversation, the reviewer discusses the statement with the relevant TWG and departmental unit(s) that would be affected by the
work. If the affected units are not interested in implementing the research, the bureau probably will not pursue the project.

The manual discusses review criteria in two places. The section on research programs identifies five criteria that apply regardless of the funding source: relevancy, urgency, applicability (the probability that the research results can be implemented), duplication and planning (the probability that the project can be completed within budget and on schedule). Appendix material explains in some detail how to quantify the direct dollar benefits of a proposed project. (See Appendix.)

When screening is complete, reviewers write a brief evaluation summarizing the problem and recommending a research classification such as applied or basic, technology transfer, etc. All evaluations appear in a briefing book sent to members of the Research and Development Council (R&DC) and the Advisory Panel. This book is used in prioritizing statements.
Prioritizing Problem Statements

Prioritization responsibilities fall on the R&DC, which consists of mid-level managers from the main office representing each functional area and a mid-level manager from each of the departments' eleven regions. The TR&DB director serves as chairperson. Council seats are open every four years. Functional areas and regions identify nominees who are ratified by the Research Executive Board (REB).

The 1995-1997 cycle inaugurates the use of outsiders to prioritize. For the first time a panel of people from industry, universities, and other government agencies will share thoughts with the R&DC.

Program and Budget Approval

The REB consists of executive managers from each function in the department's main office. The Technical Services Division Director serves as chairperson. While the board has authority to formulate the budget and approve the program, it is less involved in technical issues than the council.
Appropriate allocations of time are included in the budget to accommodate anticipated requests for consultations on small-scale technical-transfer type problems that arise between solicitation periods and cannot wait for the next cycle. This allocation underwrites projects that cost $50,000 or less and take a maximum of a year to complete.

No provision is made for in-house research on larger problems that are brought to the bureau's attention in the middle of a cycle. Bureau administrators note that a lack of in-house accommodation for such problems does not present a major inconvenience as large, conceptual problems are less likely to come to prominence without prior warning. Such problem statements are accepted, however, on an on-going basis for projects contracted to the University Transportation Research Consortium (UTRC), a group of colleges and universities under contract with NYSDOT to provide specialized research. Funding for each UTRC project comes 50% from a federal grant and 50% from the budget of the program area requesting the research.
A 1948 agreement between the Virginia Department of Transportation (VDOT) and the University of Virginia established the Virginia Transportation Research Council which currently employs about fifty-five people, about thirty of them researchers. VDOT supplies over 90% of the Council's funding and the research program focuses on the needs of VDOT's operating units. The August 10, 1995 draft manual takes over four pages to describe a very informal process which puts a premium on the judgment of the research staff and which one administrator described to me as "managed chaos." Table IV shows the major steps in this process. Boxes with a single perimeter identify steps undertaken by Research Council/VDOT employees; boxes with a double perimeter identify steps that also involve outsiders.

Soliciting Problem Statements
The Research Council does not formally solicit problem statements. A presumption exists that contacts both in and outside VDOT enable council workers to identify researchable problems.

Eleven Research Advisory Committees (RACS) meet semiannually and offer suggestions for new areas of inquiry. These suggestions serve as an important source of ideas. The committees are primarily composed of VDOT personnel outside of the Research Council, but the research director also asks university faculty and members of other state/local agencies to serve. Since VDOT's operating units have to accept and implement research findings, their views must carry weight in deciding which problems to investigate. The committees may prioritize suggestions at their fall meeting for inclusion in the upcoming fiscal year's work program.
Research staff also gather input from professional contacts, attendance at professional meetings such as the Transportation Research Board conferences's and communications from
people in VDOT. Because the Research Council gets many inputs the source of a given problem statement may become obscure eventually. People do not always remember who originated a particular idea.

The Research Council is considering sending an electronic solicitation throughout VDOT. If the Council produced a hard copy as well, it would send it to outsiders.

**Reviewing and Prioritizing Problem Statements**

The Council divides research employees into four teams which focus on safety, socio-economics and transportation systems, pavement and structures, and materials and environmental matters, respectively. RACs report to the team with analogous research interests. The structures RAC offers suggestions to the pavement and structures team, the asphalt RAC to the team working on materials and the environment.

The bulk of work program development is done in team settings. Researchers prepare problem statement forms in December; the forms are discussed and prioritized without the use of any formal criteria. The manual does not describe how teams review statements (e.g.,
whether members perform TRIS searches). As noted earlier, a premium is placed on the researcher's own judgment. The assumption is made that each team member knows which search methods and criteria are appropriate.

**Program Approval**

The research director sets budget priorities in January, giving team managers their budget targets. Teams reconcile problem statements with budget targets and the councils administrative officer completes a budget and work program in February. The VDOT commissioner formally approves the budget in April.

Appropriate allocations of time are included in the research budget to accommodate anticipated requests for technical assistance that arise without any chance for formal planning. These allocations allow the council to support technical assistance activity without precipitating an adverse impact on core research. Through pursuing short term projects the staff members contribute to solving many problems for VDOT while gaining insight into the operations procedures of departmental units that are their principal clients.
NCHRP

In a booklet meant mainly for outsiders NCHRP describes its solicitation and prioritization process in about 3 1/2 pages. Table V on the next page shows the major steps.

Soliciting Problem Statements

NCHRP uses about 1 1/2 pages to describe solicitation, a responsibility of AASHTO's Standing Committee on Research (SCOR). March is the solicitation period. Only four sources can submit statements: chief administrative officers of member highway and transportation departments, chairs of AASHTO committees and subcommittees, AASHTO's Board of Directors and the Federal Highway Administrator. State DOT's are the single largest source.

NCHRP does not generate emphasis areas. It sees this activity as a state responsibility. A 1995 analysis of NCHRP notes, however, that too little attention to priority Setting leads to a work program without strong directional sense. The analysis concludes that NCHRP should become more proactive in directing research to form a coherent whole. (Apogee Research. Strategic Direction for the NCHRP and Other AASHTO Research activities)
Table V: NCHRP Research Solicitation Process

1. AASHTO’s SCOR Solicits Problem Statements
2. NCHRP Staff Review Initial- and Second-Stage Submissions
3. FHWA Review Input
4. SCOR Ranks Second-Stage Submissions
5. AASHTO’s Board of Directors Approves Program
6. State Highway and Transportation Departments Vote on Problems
Reviewing Problem Statements

NCHRP uses less than one page to discuss review. Staff perform TRIS searches to see if other people are doing relevant work on a particular problem and check with FHWA to learn its knowledge about work in the particular area. Based on this information NCHRP staff tell each submitter to a) expand and resubmit, b) review, make changes and resubmit, or c) take into account that substantial work has been done in the area before deciding whether to resubmit. The deadline for second-stage statements occurs in the fall before SCOR's November meeting. Any submitter can continue into the second stage regardless of the reviewer's comments. About half of first-stage submitters go on to the second round.

Prioritizing Problem Statements

Two AASHTO committees have the responsibility to prioritize statements. SCOR, which makes the authoritative rankings, consists of two chief administrative officers and two research specialists from each region, a designated chair and vice chair, and six representatives from various U.S.
DOT modal agencies. It takes into account but need not accept the rankings of the Research Advisory Committee (RAC), which consists of a representative from each of fifty-two member departments.

SCOR members vote by mail ballot. Criteria include:
1) Is the problem of mutual interest to all or many states and can it be better handled by a cooperative program than by an individual state?
2) Does the problem represent an immediate research need?
3) Are answers not already available or being sought in other research efforts underway?
4) What is the probability of success of completing the project given its scope, estimated cost and time for completion?

Ratings are translated into priority rankings. Based on expected federal-aid apportionment, the committee determines which projects will receive funding at a March meeting.
Program Approval

Final authorization comes from balloting state highway and transportation departments. The program consists of those new and continuing problems that receive a favorable vote from 2/3 or more of the state DOT's.

Analysis

The study suggests several questions for NJDOT consideration:

a. Does the research bureau want to give greater strategic direction to the solicitation and prioritization process?

b. Does the bureau want to promote greater outsider participation at the solicitation stage?

c. Would the process benefit from putting explicit criteria in the manual and using them to guide prioritization?

Setting a Research Agenda

Transportation agencies have to combine a bottom-up process of generating ideas with some strategic direction. The trade-off is between stifling certain areas of inquiry
through too much direction and not having a coherent program because of too little direction.

The trend today is for programs to put more effort into setting a coherent research agenda. This allows them to focus resources on the areas they deem most important and to learn from one year's projects in setting themes for subsequent fiscal periods. New York intends to use emphasis areas to impose strategic direction. Virginia is considering developing a top-level strategic committee for this purpose. A 1995 analysis of NCHRP urges it to have a more targeted approach. New Jersey should consider how its research program can benefit from a greater concern for strategic direction and priority setting.

Having strategic direction does not mean that a bureau can not respond to short-term problems that come to light between solicitation cycles. The New York and Virginia manuals explain why budgeting time allocations for such exceptions is important both for the research bureau and the agency. NJDOT should consider putting into its manual a
budgeting policy for mid-cycle exceptions at the same time that greater attention is given to strategic direction.

**Encouraging Wide Participation**

Gathering ideas is an essential element in developing a research program. New Jersey's research bureau knows that new ways of thinking and increased support for the research function emerge when problem statements come from diverse sources. For that reason it solicits ideas from all NJDOT divisions. But the manual does not mention soliciting ideas from people outside NJDOT. This tactic may preclude some knowledgeable outsiders from offering useful ideas to the research bureau. If asked, agency contractors might identify concerns that the department has overlooked. University personnel might use their expertise
to define problems in materials or structures. Thomas Larson, a former Federal Highway Administrator, and David Albright, president of the Alliance for Transportation Research, argue for private-sector involvement in setting transportation research agendas as well as in carrying out research work. ("A Framework for Developing a Future Transportation Research and Development Agenda").

Tapping all groups with relevant experience generates the greatest number of usable problem statements. The breadth of the research agenda is almost certain to benefit from casting a wide initial net even if up-front solicitation costs are somewhat higher. A solicitation's audience determines the breadth of problems DOT's receive. Getting outsiders involved may also raise the visibility of research endeavors. This is important because few agency executives come from a research background and the advantages of research may not be plain to them. Heightened visibility can lead to greater interest and support on the part of
top management. At the same time it can increase the operating unit's interests in and support for research.

Involving outsiders is not easy. New York solicits problem statements from people in industry and academe through newsletters and mailings. While these written communications generate some statements, they have not sparked outsider interest every year. More than written notice of a solicitation is necessary to propel a wider group of participants. The bureau must show that its research can help a broad range of individuals and interests if it wants them to offer ideas for research projects.

New Jersey already uses the perspectives of outsiders at the review stage. Research bureau staff can contact people at various institutions who have relevant information to share. NJDOT wants to tap into the best minds for review regardless of their institutional affiliation. Now the bureau has to consider the extent to which it wants to solicit problem statements from outsiders and the vehicles that are most useful for doing this.

Providing Prioritization Criteria
Prioritizing and selecting projects necessitates difficult decisions. Putting explicit criteria in the manual gives all process participants an indication of how problem statements are evaluated. It reminds those people who prioritize the statements which factors to keep in mind in making judgments. New York and NCHRP have explicit criteria. Both programs highlight a) urgency of the research, b) lack of duplication of efforts and c) probability of completing the project in the time stated as important prioritization issues. Virginia does not believe that experienced researchers need criteria. It would be interesting to know whether New Jersey's research staff and RUC members think explicit criteria would be useful. If they do, such criteria should appear in the manual.

Recommendations

This section gives recommendations for enhancing NJDOT's solicitation and prioritization process to make it even more useful.
Recommendation I: NJDOT should increase attention to strategic direction and priority setting by developing emphasis areas for problem-statement solicitation. Emphasis areas should be broad enough to encompass a variety of interests. The process used to generate them should include discussion on the departments goals, the state's transportation climate and problems, the state's economy and the departments major areas of concern. The development of emphasis areas will enable NJDOT to practice proactive management. Each research effort will reinforce others under the umbrella of inclusive themes.

Recommendation II: The manual should contain explicit channels for involving outsiders in problem-statement solicitation. A quarterly research bureau newsletter is a first step in giving outsiders notice of NJDOT needs; such a newsletter would also serve the purpose of a publicity vehicle, highlighting research bureau activities for DOT executives. By itself, however, a newsletter may be insufficient to generate a large outsider response. Workshops are an additional mechanism for getting a wide audience to contribute problem statements. The research bureau could sponsor brainstorming sessions that include representatives from
industry, trade associations and universities as well as DOT's own staff. These face-to-face sessions would stimulate academic and industrial interest in contributing ideas to NJDOT's program and facilitate a broad exchange of problem statements. An effective bureau seeks information from a wide variety of publics.

Recommendation III: The research bureau should poll relevant staff to see if they want to put explicit prioritization criteria in the manual. If a majority of staff members believe it would be useful to develop and publicize such criteria, the bureau should set up a committee to do this. While this recommendation requires additional administrative work, it could lead to greater uniformity of understanding at the prioritization stage.