TRANSPORTATION RESEARCH NEEDS IDENTIFICATION

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EXECUTIVE SUMMARY

Transportation research and the utilization and development of new technology is an essential cornerstone of effective transportation system management efforts. The Minnesota Department of Transportation has a tradition of commitment toward research and development of transportation technology. A vital aspect of the transportation research and experimentation process, as well as in the development of new technology, is the identification of research needs.

Mn/DOT has recently experimented with and adopted a transportation research needs-identification process that helped Mn/DOT develop approximately 80 top priority research projects for near-term start-up. The functional subject areas were Traffic, Environment, Bridge, Local Roads, Materials, Construction, Freight Movement, People Movement, Transportation & The Economy, and Transportation Finance.

The new process shifted Mn/DOT's direction of research program development from a reactive role conducting research projects that were "researcher-driven", to a more proactive role with the involvement of all elements of the transportation work force.

This process identified the immediate practical research needs in Minnesota using minimal resources and staff. For the purpose of identifying transportation research needs, the new process conducted by Mn/DOT proved to be efficient and effective.

INTRODUCTION

Transportation research, utilization of existing technology, and development of new and applied technology are essential for the improvement of transportation systems in Minnesota and the United States. The Minnesota Department of Transportation (Mn/DOT), with the cooperation of outside partners, is committed to research and development and application of new technologies in terms of resource allocation and support for new innovations. Mn/DOT is also committed to promoting internal risk taking, innovative thinking, education about the importance of research, strategic expansion of resource dedication, and formation of partnerships with the private sector to share resources such as people, facilities, funds, and information.

Mn/DOT's initiative in transportation research is a broad-based, multidisciplinary effort that encompasses a wide range of research programs. Mn/DOT has a strong track record in Materials and Pavement Research. Since 1986 Mn/DOT has been engaged in the planning, design and construction of the Minnesota Road Research Project (Mn/ROAD), a pavement technology research facility. Other major research related ventures at Mn/DOT include: MINNESOTA GUIDESTAR, Minnesota's Intelligent Vehicle Highway Systems partnership, and the Maintenance Operations Research Program that focuses on applied research and development of roadway maintenance activities.

RESEARCH MANAGEMENT

The Office of Research Administration (ORA) is under the direction of the Research Management Council (RMC) of Mn/DOT. In conjunction with the aforementioned research programs, ORA manages and coordinates a diverse program of transportation research and research implementation.

A challenging aspect of transportation research and development is the identification of transportation research needs. There are various means of developing a research program. Mn/DOT has recently shifted the direction of the program development and transportation needs identification process.

In the past Mn/DOT's research program focused primarily on materials and pavement issues. The program tended to be driven primarily by researchers and academia, who often expressed a special interest in research that did not always meet Mn/DOT's immediate need. More recently, Mn/DOT has developed a much broader program through increased resource allocation and commitment to research and experimentation in "non-traditional' subject areas.

A more proactive role was embraced by Mn/DOT through developing 1) A Research Services Section that concentrates on program development and contract administration; and 2) A Technology Transfer and New Technology Development Section with a primary focus on research implementation and technology transfer.

RESEARCH BRAINSTORMING PROCESS

In the Fall of 1992, ORA hosted 6 brainstorming sessions to develop research ideas. Each of the sessions represented a particular element of the transportation business: Local Roads, Materials, Traffic, Bridges, Environmental and Construction. Each session had from 30 to 60 participants representing a cross section of transportation service suppliers including: Mn/DOT, city, county, and federal staff, consultants, contractors, and other agencies. Key to the process was the

involvement of staff from each area in the identification of the list of invitees.

The sessions were run by trained facilitators and ORA staff. After the opening general session and introductions, the group split up into subgroups of 5 to 8 people where the brainstorming actually occurred. After identifying and categorizing the topics, the groups prioritized the subjects into high, medium, and low priority groupings and reported their results back to a general session. There was a total of 1804 ideas developed from these 6 sessions.

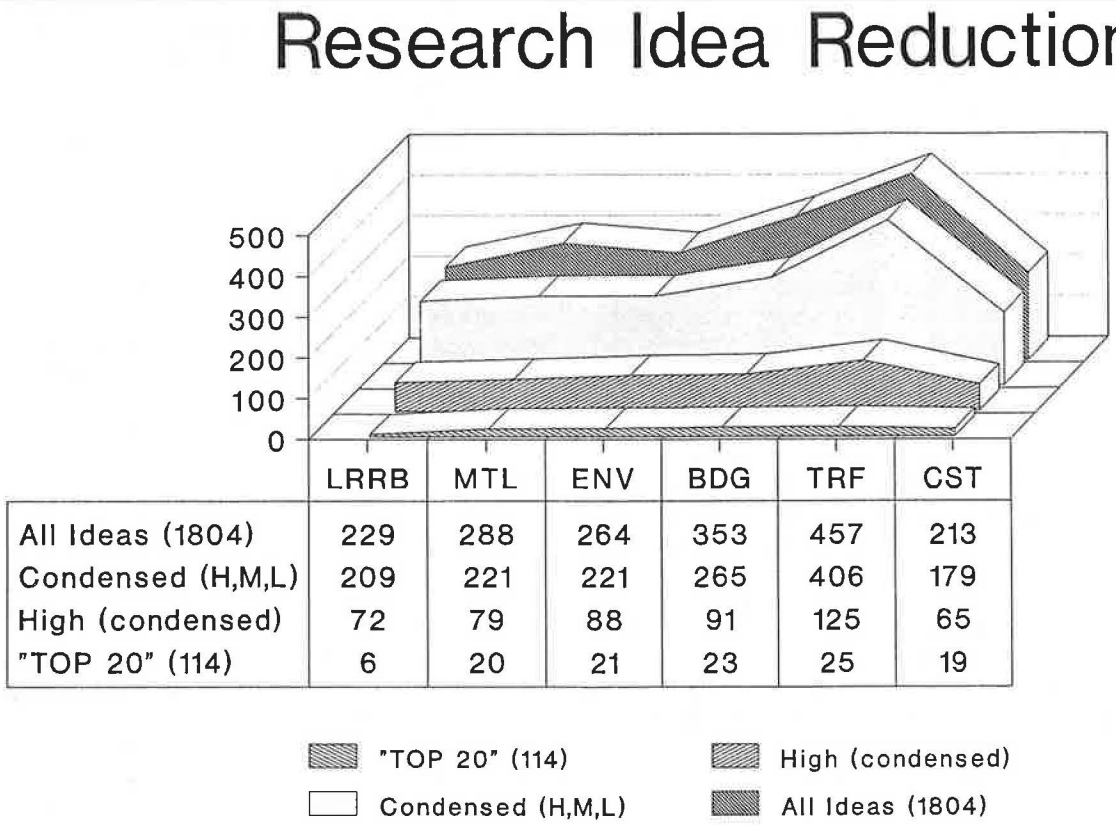
Following the brainstorming sessions, ORA staff began the processing task. The ideas generated at each session were consolidated to eliminate any duplication of ideas. After the consolidation of the individual group ideas, they were merged to develop a master list of high, medium, and low priority topics. Once again, the ideas were consolidated and duplications were eliminated. The master list was then sorted by category, high priority, and origin of idea so that the research ideas could be evaluated by a team of about ten technical experts from each original group.

The experts were then asked to select their "top 20" from the resulting list of about 100. The results of this polling method were then provided to the experts for use in a half-day session where they debated the merits or shortcomings of the "top 20" and developed a "final top 20" list. They also identified a contact person for each idea. Figure 1 illustrates the reduction process.

A subjective evaluation of the selected high priority ideas ("Top 20") was performed by the technical experts. Each research idea was given a high or low rating based on its risk and ultimate payoff. Risk was defined as exposure to failure and probability of success in obtaining some form of a conclusion. Payoff was defined in terms of economics, safety and social benefit of the research project. Figure 2 illustrates the results. Approximately half of the ideas had the ideal rating of high payoff with low risk. Approximately a quarter of the high priority ideas were rated as high risk/high payoff. The remainder were judged to be less productive, i.e., low payoff and/or high risk without adequate payoff.

Another evaluation process that was conducted considered the long-term/short-term payback. Payback is defined as the time it takes from the commencement of the project to the implementation process (acceptance of the results). It is ideal to have a mixture of both short-term and long-term projects to achieve a balanced program. Approximately two-thirds of the high priority ideas should have a short term payback (short term is defined as less than five [5] years).

Upon completion of this process, a literature search using the TRIS data base was performed on the top priority ideas. The contact persons and research originators then reviewed the literature searches and recommended either further research or identified the idea as a technology transfer project indicating that



	LRRB	MTL	ENV	BDG	TRF	CST
All Ideas (1804)	229	288	264	353	457	213
Condensed (H,M,L)	209	221	221	265	406	179
High (condensed)	72	79	88	91	125	65
"TOP 20" (114)	6	20	21	23	25	19

Figure 1

RISK VS PAYOFF

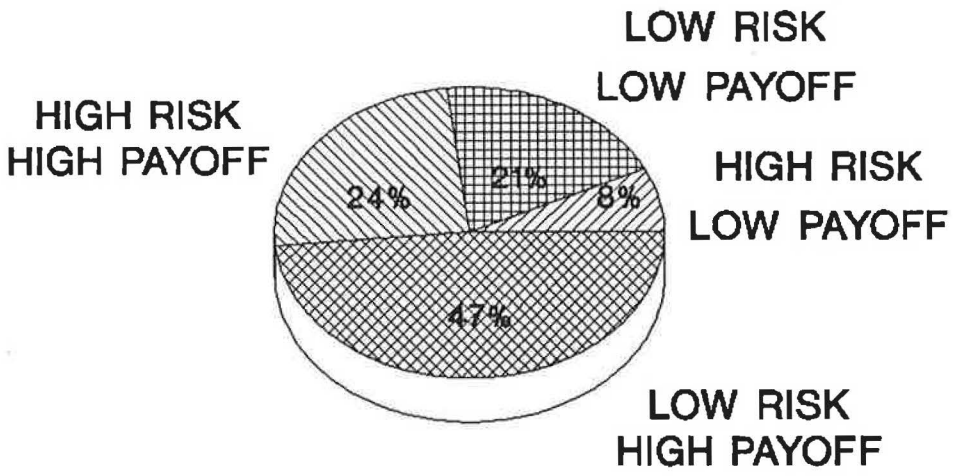


Figure 2

TABLE 1 BRAINSTORMING RESULTS

	LR	MAT"L	ENV	BDG	TRF	CNST	TOTAL
SELECTED HIGHS	7	20	21	23	25	10	106
CONTINUE RESEARCH	6	15	13	18	16	6	74
TECH. TRANS	1	5	8	5	9	4	32
POLICY HIGHS	27	7	21	25	13	17	110
# SUBGROUPS	5	7	4	5	8	4	33
IDEAS/SUBGRP	46	41	66	70	57	54	55
IDEAS/PERSON	6.0	5.2	8.5	7.7	7.6	6.5	6.9
HGH P/PERSON	2.0	1.8	3.4	2.3	2.4	2.4	2.3

LR = Local Road
MAT'L = Materials
ENV = Environmental
DG = Bridge
TRF = Traffic
CNST = Construction

sufficient research has been done or is on-going on that specific topic. (Table 1 shows these data). Of the 106 top priority projects, 74 were recommended for further research and 32 were recommended for the technology transfer process. Also in Table 1, the non-research (policy) ideas are shown. There were a total of approximately 110 high priority policy ideas that were forwarded to the appropriate agency(s) for their information and action. Other pertinent brainstorming session information shown in Table 1 is the number of subgroups per session, ideas per subgroup, ideas per person, and high priority ideas per participant. There were between 2-3 high priority ideas per person that had an influence on the design of the revised research needs-identification process.

PROCESS OF RESEARCH NEEDS IDENTIFICATION

After approximately 6 months of processing and filtering the 1804 research ideas developed using the original brainstorming process, the ORA revised the process for identifying Minnesota's transportation research needs. The reasons for this shift are as follow:

1. The original process resulted in a large and difficult-to-manage number of research ideas that required an enormous amount of effort to prioritize, consolidate, and define. It also resulted in many non-research (policy) ideas, which was not the immediate goal of the research needs-identification process.
2. The ideas in the final list were in the form of a single statement and, in some cases, were too general and vague. A better defined and expanded problem statement was later needed for the researcher to develop a research proposal and cost.

The revised focus group process was implemented for the Intermodal Programs brainstorming session. The following concepts were used in the new process:

1. Each selected participant was given the opportunity to think about, develop, and submit 2-3 ideas prior to the meeting.
2. The Intermodal Division subjects were divided into four functional groups: freight movement, people movement, transportation finance, and transportation and the economy. Each group reviewed and discussed their related research ideas and selected the top five ideas from each functional group creating approximately 20 intermodal research ideas.
3. The participants then developed the problem statements describing the specific goal of the research for those 20 ideas and suggested potential researchers and research project reviewers.

Upon completion of this process, both the original and the revised process were evaluated and the advantages and disadvantages were summarized as follows:

Advantages of new process:

1. Group discussion and consensus of each idea.
2. Participants were better prepared and more informed at the session.
3. Chance to build on ideas and develop more topics at the session.
4. Much less work for ORA staff due to the condensed process.
5. Elimination of non-research (Policy) ideas.
6. Identification of interested parties for review of the research project.
7. Identification of potential researchers.
8. Literature search is responsibility of researchers and not the ORA.

Disadvantages of new process:

1. Takes away from a true brainstorming process
2. Does not identify as many technology transfer research topics (research that has already been completed but users are unaware of the results).

While the brainstorming and focus group processes appear to be effective means of identifying critical research needs, Mn/DOT staff retain some discomfort in subject areas where they have minimal experience and expertise. The first specific example addressed was the subject of transportation, land use, and economic development interrelationships. To address this issue, Mn/DOT has contracted with the H.H. Humphrey Institute at the University of Minnesota for the preparation of a strategic plan for research in this topic. The plan will be developed following an assessment of current research, evolving public policy, and current funding scenarios (e.g. ISTEA). A panel of experts from public agencies, academia, and the private sector has been recruited to assist in this task. Hopefully, a report will be available by the '95 TRB meeting to share results of this additional means of identifying strategic research needs.

PROGRAMMING & FUNDING PROCESS FOLLOW-UP

A total of 82 Problem Statements (Similar to Stage-1 NCHRP) from the original brainstorming process and the revised needs-identification process were submitted to the Center for Transportation Studies (CTS) at the University of Minnesota (UM). The center distributed the problem statements to potential interested researchers who in-turn will develop a project proposal with a defined work plan and cost estimates. Mn/DOT's technical experts, contact persons, and research originators will then review and evaluate the

proposals. ORA will then select the highest rated projects and match the available and appropriate funding to these projects for the following fiscal year.

Other universities and research consultants will be asked to respond to proposals in areas where the University of Minnesota faculty are not available. In addition, some of the research ideas have been included in the NCHRP process.

CONCLUSIONS/RECOMMENDATIONS

Based on our experience with the true brainstorming process and the focus group process used most recently, Mn/DOT will rely primarily on the revised focus group approach. Since each session is designed in partnership with key technical staff, we will be encouraging and supporting the use of "pre-focus group" brainstorming opportunities that provide for "grass roots' organizational involvement without the extensive reliance on ORA staff time. In addition, we will continue our use of general solicitations to catch ideas not included in the focus process as well as the consideration of needs identified by the Department's managers, the Legislature and other partners.

A research needs-identification process can assist states or other agencies to determine their top priority research needs. The process can be successful with minimal resource allocation and staff requirements. Repeating this process for each functional area every 2-3 years is recommended.

ACKNOWLEDGMENTS

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