

funding for transportation research. The following is a report on the meeting.

SUMMARY
Ronald F. Kirby
Group 1 Council

Over the past several years, the Group 1 Council has devoted considerable effort to investigating the adequacy of research funding for transportation, with particular emphasis on systems planning and administration. The Council was instrumental in the development of the NCHRP 20-24 research project on research needs of Chief Administrative Officers (CAO's) of state transportation agencies. In September of 1987, the Council held a workshop aimed at identifying significant gaps in research funding, the reasons for those gaps, and possible remedies. At the TRB annual meeting in January of 1988, the Council sponsored a session on research needs which included a progress report on the NCHRP 20-24 project, a review of trends in research funding in the public and private sectors, and a summary of the proceedings of the September 1987 workshop.

This document presents an edited transcript of the January 1988 session sponsored by the Group 1 Council, along with selected charts used at that session, updated information on the NCHRP 20-24 project taken from the final report of October 1988, and the Executive Summary of a Task Force Report on the status of the NCHRP program completed in February 1988. The following sections of the summary attempt to draw together the key points of the presentations and reports contained in this document, and to suggest some next steps in addressing the issue of research funding.

Adequacy of Research Funding

The review by Nan Humphrey of research funding in different public and private sectors of the economy showed that while total R&D spending in the U.S. has increased steadily as a percentage of GNP during the 1980s, civilian R&D has not grown as fast as defense and space R&D, and the growth that has occurred in civilian R&D has come entirely from the private sector. Federal civilian R&D has stayed level in current dollars, and declined in constant dollars. R&D spending in the transportation sector has also declined slightly in real terms during the 1980s.

For the four major transportation modes -- air, highway, rail, and public transit -- Nan Humphrey's

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FOREWORD

In recent years, the Transportation Systems Planning Group Council (Group 1) of the Technical Activities Division has become concerned with the lack of research dealing with transportation management and policy development. When chief administrative officers from state and local highway, transit, rail and aviation agencies have been invited to address the Council regarding their primary topics of concern, they have invariably focused on management, finance and policy issues.

Substantial achievements have been made in funding research directed at reducing the costs of construction and maintenance of transportation facilities. To this end, the Strategic Highway Research Program has been established. The Group 1 Council believes that based upon the responses of the transportation CAO's, a similar program is desirable for management and policy research. The Council has been instrumental in initiating the National Cooperative Research Program project #20-24, "Research Program Design - Administration of Highways and Transportation Agencies." (The project is discussed in this Circular.)

The Group 1 Council invited speakers to their meeting in January 1988 to discuss the problems of

review showed that air transportation accounted for 85 percent of the total research funding followed by highways with eight percent. Over the 1980s R&D spending for air transportation increased, R&D spending for highways increased with the 1982 increase in federal fuel taxes, and rail and transit spending declined.

Comparing R&D spending as a percentage of sales for various industries and as a percentage of revenues for different transportation modes reveals wide variations. The average for all private industries with R&D budgets over one million dollars is 3.5 percent of sales, with a range from 7 percent for high technology industries like computers down to 1.2 percent for many manufacturing industries like steel and textiles. For the transportation modes, air R&D tops the list at 2 percent of revenues in 1986, a drop from 2.6 percent in the mid-seventies despite increases in constant dollar terms. For highways, the increase in federal motor fuel taxes in 1982 raised R&D as a percentage of revenues from only 0.1 percent in 1982 to 0.15 percent in 1987. Rail R&D spending has fallen from 0.28 percent of revenues in the mid-seventies to 0.14 in 1986, and transit R&D spending has fallen sharply from 1.5 percent of revenues in the mid-seventies to between 0.2 and 0.25 percent in 1986.

Nan Humphrey's review concluded that in comparison to private industry, transportation R&D spending as a percentage of revenues is "woefully low", all but the air mode falling well below the one percent level of the lowest spending private sector industries. For highways, this conclusion is supported in the NCHRP Task Force report:

"In a national highway program that spends more than \$60 billion each year, the 0.17 percent allocated to research is not adequate and is far less than even the most stable private industries are devoting to developing new technology."

At the September 1987 Group 1 Council workshop, attendees noted that the Corps of Engineers has been able to commit about one percent of its total revenues to research, and that the gas industry routinely devotes a portion of its revenues to a central institute which does research for the industry. The concept of earmarking a portion of all transportation revenues -- say one percent -- for research had considerable appeal.

There was a concern expressed at the Council workshop, however, about the danger in earmarking

only certain sources of transportation revenue such as the federal programs, which may be declining in real terms. In this context, the NCHRP Task Force decided to recommend an increase in the percentage of state HP&R allocations allocated voluntarily to the NCHRP by the states from 4.5 percent to 5.5 percent, to combat the effects of "gradual erosion from inflation, coupled with the reduction in HP&R apportionments under 1987 legislation," which would otherwise "result in a 1988 program that represents only 59 percent in equivalent dollars of the program of 20 years ago." Concerns were expressed that the transit STRS proposal, which proposes to earmark one-half percent of the federal Section 9 and Section 18 funds, might suffer from uncertain federal funding levels.

Subject Area Gaps

In addition to inadequacies of overall funding levels for research, a number of concerns have arisen concerning subject area gaps. The distinction between "soft-side" and "hard-side" research was of considerable interest to the Group 1 Council, but numbers on the allocation of dollars between these categories were hard to obtain. Nan Humphrey's review noted that there was a decline in soft-side projects funded by NCHRP in the early 1980s, but some increase in 1987 and 1988. The new Strategic Highway Research Program (SHRP) has provided an increase in hard-side projects for highways. For transit, much of the funding decline was in "hard-side" projects, so that the proportion of funding for "soft-side" projects has actually increased as overall funding levels for transit R&D have fallen.

Project NCHRP 20-24 noted serious inadequacies in research oriented to the needs of the CAOs, and identified seven major research areas in order of priority:

- long term policy development;
- finance and resource development;
- organizational forms for implementation;
- financial management;
- decision support;
- understanding of the transportation industry; and
- public and political interactions.

The project panel concluded that subsequent phases of the project should concentrate on three of these topics:

- resource development;

- decision support; and
- financial management.

Continuing research is being recommended in these areas.

Gaps were also noted in long-term basic research, in multi-modal research and in funding for innovative research ideas stimulated by the researchers themselves. It was noted that NCHRP tends to be oriented to implementation issues, applied research, and the interests of the state transportation agencies. There seemed to be little or no prospect of an explicit program of transportation research at the National Science Foundation (NSF). The federal highway and transit agencies seem to have been directing most of their research funding to short-term policy oriented research. The new University Centers program promises to provide \$20 million per year of research in the highway and transit areas, although all projects under this program must be approved by the Secretary of Transportation. There was some questioning of the extent to which this latter program will be able to close the gaps in basic long-term research areas given the approval process for projects.

Reasons for Inadequacies

This discussion at the Group 1 Council workshop in September of 1987 identified in order of priority seven major factors that were considered primarily responsible for the current inadequacies in transportation research:

- Agencies administering research funds currently are not oriented to long-term, basic research issues;
- Federal research funding has been reoriented to immediate policy priorities over the past six or seven years;
- The interests of the research community and government agencies do not match very well, and have been diverging over recent years;
- There is a lack of top management support for basic research in federal, state, and local transportation agencies;
- Overall funding levels for research have been declining for most transportation modes, as part of the overall decline in real terms of federal funding for civilian research;
- Research funding is very compartmentalized by mode, with little funding available for multi-modal research;
- There has been no politically potent constituency advocating research funds for "soft-side" projects. Potential Remedies. The Council workshop identified the following potential remedies for these problems:
 - Researchers need to devote more effort to educating or reeducating funding agencies on the value of research, particularly long-term research;
 - Efforts should be made to extend the concept of earmarking a portion of sales or revenues perhaps one percent to a broader range of transportation revenue sources, including state and local funds, and perhaps tolls and fare revenues;
 - Communications between researchers and funding agencies need to be improved through internships and staff exchanges between research agencies and the transportation industry;
 - Resources should be provided for innovative research stimulated by the researcher, through funding of unsolicited proposals and student fellowships at universities;
 - Funds need to be earmarked for multi-modal research, either as a small portion of the total for the modes or through some formal pooling of modal funds; and
 - The paucity of soft-side research funded by NCHRP seems to be due to a lack of good research proposals. Researchers need to devote more effort to developing and advocating soft-side projects for NCHRP.

Overall, the Group 1 Council's inquiry into the adequacy of transportation research has concluded that there are serious shortfalls in funding levels and significant gaps in coverage of the spectrum of needed research. Now that funding levels are down, a major effort will be required to get research funding to levels approaching the one percent of revenues that are at the low end of the range found in the private sector. Funding levels for the highway, rail, and transit modes are particularly low at present -- in the 0.14 to 0.25 range as a percent of revenues.

Establishing adequate funding levels and

coverage of transportation research topics is likely to require new mechanisms to earmark research funds from a broader range of transportation revenue sources, and the design of a comprehensive array of research programs that includes all of the different types of research that are needed. The current efforts to formulate post-interstate federal transportation programs provide an immediate opportunity for researchers to advance some new proposals for funding and managing transportation research in the highway and transit areas. This and other avenues for increasing research funding and topic coverage would appear to be worthy of continued attention.

INTRODUCTORY REMARKS

Richard P. Braun
University of Minnesota

I think most of you here today would expect that a Department of Transportation (DOT) head, which I was for eight years, or someone who is on a top administrative level within the DOT, would have a different perspective on research than some of his or her staff might have. A key issue for some DOT heads is timing. You might look at that almost as impatience. But what it really involves is the fact that the person on top, the administrator of a specific unit, feels that something has to occur fairly rapidly.

In the case of the chief administrative officer of a DOT, just think about the longevity issue right now. Very few heads of DOT's last more than four years. I think there has been a turnover of more than thirty state DOT heads in the last 15 or 16 months.

Those in these top positions feel that they need fast answers; they need answers to respond to some political questions, some constituency questions or something a legislator might ask them. It is difficult to say "you're going to run that sort of request through a whole long process," such as the NCHRP process. That was one of the reasons why the synthesis projects were developed. This is a process in NCHRP where you could get a fairly exact answer in a relatively short period of time on a specific issue.

Actually, if you go back to, let's say, the late seventies, that was one of the reasons why the Commissioners of State DOT's (COSDOT) was created. COSDOT was a group of impatient young DOT heads who felt that AASHTO wasn't moving

fast enough, and they started to organize entirely on their own. Over a period of years, for a variety of reasons, COSDOT went out of existence. Perhaps most of you don't even recall that there was such a group just a few years back.

The subject of research needs in administration next arose at a meeting that was held in 1986 to take a look at what the research needs are of administrators in general and more specifically the chief administrative officers. This meeting resulted in the research project NCHRP 20-24, which will be reported on by the first speaker.

The second speaker will discuss the trends in research funding in the public and private sectors. This is a critical topic for all of us, particularly in the current period of cutbacks in federal funding resulting from a large federal deficit and uncertainty as to the future of federal funding. Our third speaker will discuss gaps in research funding, the reasons for those gaps, and the possible remedies. This is a summary of the Group One Council meeting that occurred last summer.

I don't think there is much need for me to talk about the minute percentages of funds that are actually allocated to transportation research. I recall that Bill Agnew who is the technical director for environmental and human sciences at General Motors, did a really super job presenting this subject a year ago in an article in Transportation Quarterly. It was in that same issue that Tom Deen, the Executive Director of TRB, pointed out that less than three percent of the non-defense research goes to transportation. If you added in the defense research, less than one percent of the total money allocated to research nationally went into transportation.

TRENDS IN RESEARCH FUNDING IN THE PUBLIC AND PRIVATE SECTORS

Nancy Humphrey
Transportation Research Board

I was asked to provide some background information on research spending trends in both the public and private sectors to provide a context for your more specific concern about the adequacy of research funding in the area of transportation planning and administration. Basically I've organized my talk around four central topics:

1. an examination of overall R&D spending trends;