The nation's highway system is deteriorating at an accelerating rate. After years of neglect national attention is being directed to the need to maintain, repair, and preserve this system. Congress recognized the need for a revitalized highway program by enacting legislation in 1982 that provides $58 billion in federal aid for highways over the next 4 years.

If we are to meet the challenges of this new building program without the problems of the past, now is the time to develop the needed technology. If current technological needs are to be met through a research program, this is the time to put that program into place. The Strategic Transportation Research Study (STRS) focuses exclusively on the six high-payoff research areas set out in Table 17. These major gaps in our technological progress require an immediate large-scale research effort that cannot be met within existing institutions and resources. Such an effort requires a new research program because a clear mission must be maintained to ensure that the resources necessary to make significant breakthroughs are available.

At the same time, the commitment within STRS to these efforts must not distract from the necessary and continuous progress being made under other programs in other areas such as planning, finance, and human factors. Ongoing national research programs, including Federally Coordinated Program for Highway Research and Development and Na-
<table>
<thead>
<tr>
<th>Research Area</th>
<th>Objective</th>
<th>Projected 5-Year Costs ($ million)</th>
<th>Potential Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphaltic materials</td>
<td>Define Chemical and physical characteristics of asphalt and their relationship to performance in pavement systems.</td>
<td>50</td>
<td>Better quality control and better materials; and improved design capability and performance predictions. Potential saving of $100 million per year.</td>
</tr>
<tr>
<td>Pavement performance</td>
<td>Assess long-term performance of various pavements under various loading and environmental conditions. (Studies would continue for three additional 5-year terms of data collection and analysis.)</td>
<td>50</td>
<td>New capability to assess and select alternative pavement maintenance and rehabilitation strategies; and improved design and construction techniques. Potential saving of $10 billion.</td>
</tr>
<tr>
<td>Maintenance cost-effectiveness</td>
<td>Develop improved procedures for administering and controlling maintenance programs; develop new processes, equipment, and materials; and improve productivity of maintenance program.</td>
<td>20</td>
<td>New management systems and increased maintenance productivity. Potential saving of $150 million per year.</td>
</tr>
<tr>
<td>Concrete bridge component protection systems</td>
<td>Develop new methods to stop further deterioration of existing chloride-contaminated bridge decks and other components.</td>
<td>10</td>
<td>More effective techniques for removing chloride from concrete or protecting concrete from chloride contamination? Potential saving of $400 million per year.</td>
</tr>
<tr>
<td>Cement and concrete</td>
<td>Understand chemical and physical phenomenon of hydration; evaluate new options such as recycled concrete and energy saving components; and develop nondestructive testing methods.</td>
<td>12</td>
<td>Ability to produce a better quality and more durable concrete. Potential saving of $50 million per year.</td>
</tr>
<tr>
<td>Chemical control of snow and ice</td>
<td>Reduce the use of salt through management techniques and optimum use of mechanical or thermal removal plus alternative chemicals.</td>
<td>8</td>
<td>Reduction in corrosion and environmental problems without a reduction in the level of service of snow and ice control programs. For example, potential savings from a decrease in automobile corrosion could be $45 million per year.</td>
</tr>
</tbody>
</table>
Conclusions and Recommendations

The National Cooperative Highway Research Program, have made and must continue to make vital contributions to highway technology. A new special research program will have to be structured in careful coordination with and protection for the continuity and health of existing national research programs.

The strategic highway research program discussed in this report is a unique, highly focused program concentrating major efforts and funds on six specific areas of highway technology. The areas are inherently interrelated with many opportunities for synergism if the problems are approached as part of a common program. The program includes areas of national importance that have not received a concentrated effort under previous research programs. A concentrated research effort in these areas promises significant returns in cost savings and system improvements.

Funding in the range of $30 million per year is required; and a long-term commitment of these funds to assure the continuity and completion of the program is essential. This major funding requirement can be met by permitting about 0.25 percent of federal-aid highway funds to be used for this purpose. Under the authorizations contained in the Surface Transportation Assistance Act of 1982, the 0.25 percent set aside would be about $35 million per year. This amount closely matches the funding requirements for STRS and administrative costs.

The 5-year strategic highway research program summarized in Table 17 outlines a pragmatic approach to tangible problems that are related to materials and processes used to build, maintain, and manage the physical structures of the highway system. Research in two critical areas, asphaltic materials and pavement performance, will address the need to understand, improve, and control the quality of the most commonly used materials in highway pavements and the relationships of the measurable characteristics of these materials to pavement performance.

The pavement performance study differs from the others proposed in the program in that it will entail continuous data collection and analysis beyond the 5-year term of the program because very little happens to a pavement in the first few years of its life. Additional funds and an additional 15 years will be required for the long-range pavement performance study. Four study areas, maintenance, concrete bridge components, cement and concrete, and ice-melting chemicals, also represent major challenges for research and provide opportunities for payoffs.

A special institutional arrangement is required to carry out this strategic research effort. That organization, whether it is carved out of an existing institution or created separately, must have independence to concentrate on the new mission, insulation from special interests, con-
tinuity throughout the program term, an adequate full-term financial commitment, constituent involvement, effective central control, competent management, and adherence to the clear mission that has been established.

Using conservative projections and eliminating those areas where double counting might occur, the potential payoffs from this program could exceed $600 million per year. Further, most of the saving to taxpayers will continue to accrue each year—long after the 5-year research program has been completed.
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