

tem first. Regardless of how accustomed Americans have become to a deficit-based society, the provision of transportation services is ultimately a bottom-line venture.

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Got A Problem? A TRB Staff Field Visit Could Help Solve It

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Potholes, planning, productivity . . . airports, asphalt, administration . . . soils, safety, slopes . . . rail, rights-of way, ridesharing . . . transit, tunneling, taxation . . . law, LRVs, liability . . . design, deicing, data collection . . . the beat (and the list) can go on for pages. The trios of terms noted here represent only a small sampling of the topics that are the "stuff RCS visits by TRB staff to the states are made of."

Each year members of the Transportation Research Board's Division A staff pay a visit to every state highway and transportation department as part of TRB's Research Correlation/Service program. The principal objectives of these visits are to learn of problems that exist and to transfer information related to these problems, as well as to find out

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about research activity either in progress or contemplated. During these field visits, which usually last about two days, TRB staff also discuss TRB activities, identify personnel qualified to serve on TRB committees and task forces, urge researchers to report on their work through the TRB Annual Meeting, and encourage the practical application of useful research findings. In addition to the transportation department, the TRB staff member will also visit universities, along with rail, aviation, transit, safety, and industry organizations, that have ongoing and mutual transportation interests.

What follows is a summary of some of the transportation trends, research activities, and highlights noted on these visits earlier this year.

PLANNING

Transportation planning throughout the states continues to change emphasis. A new framework is emerging for managing state transportation planning that has a technical or substantive side and a management side. The former deals with the design of physical systems and services. In the majority of the states this side of the planning process has been well developed over the past 10-15 years, and no strong trends or new techniques stand out. However, on the management side change and improvement continue. This includes the areas of policy planning with heavy emphasis on financial analysis, communications, allocation of resources/programming, and performance monitoring. The development of performance indicators is occurring in many states to better inform management regarding trends in such areas as travel volumes and characteristics for all modes, condition of transportation facilities and services, financial resources and expenditures, safety and security, energy consumption, and economic trends. As a result, reports are being developed that are informative both to the policymakers and the public at large.

A noticeable trend in many state agencies that cuts across both the substantive and management sides of planning is toward the use of computers by which data can be accessed from terminals throughout the agency. Agencies are switching to computers in which data are stored on disks or disk-packs with massive storage capabilities with instant access. Improved computer capabilities are greatly assisting planning

units to be more responsive to a wide and varied range of transport needs and requirements.

FINANCE AND TAXATION

With state highway programs derived from highway user taxes, most states found themselves with declining revenues and escalating maintenance and 4R expenses. In 1981 and 1982, most states increased highway user charges. In 1983, 21 states raised motor fuel taxes from 1¢ to 5¢ per gallon. There is substantial difference among the states in motor fuel tax rates, ranging from 5¢ per gallon up to 16¢ per gallon at this time.

In 1979 and 1980, many states adopted variable fuel taxes as an attempt to index receipts to rising motor fuel prices. With the constant and now declining fuel costs, those states relying on variable fuel taxes have had to change their laws to put a minimum tax in cents per gallon on the variable fuel tax fluctuations. Some states have also adopted a maximum tax level. Eleven states have levied sales or excise taxes in addition to the fixed cents per gallon tax. Motor vehicle fuel taxes are being used by 20 states to support transit.

MANPOWER AND PRODUCTIVITY

State DOTs continued to reduce staffing levels in 1982-1983 because of lack of funds and state-government-mandated employment freezes and across-the-board staff cuts. Most of the staff reductions were achieved through early retirements, job freezes, and normal employee turnover. Some personnel cuts have been across-the-board with every department being affected; others were specifically targeted to programs. Major activities where staff were reduced were construction supervision and inspection, maintenance, and planning.

With the passage of the 5¢ federal gasoline tax plus additional state user taxes, states are going to be able to expand their construction programs by 25 to 75 percent. Most seem to be planning to do this without significant increases in staff. Where additional staff are needed, they will be specifically approved based on workload. Consultants will be utilized to absorb the increased design activities. The new construction will likely not change the downward trend of maintenance staffing.

Some states are instituting changes to help compensate for reduced personnel complements. Among these are

1. Phased rather than continuous inspections,
2. Shifting more engineering responsibilities to contractors,
3. Augmenting state forces with temporary and consultant inspectors,
4. Expanded use of computer design and drafting,
5. Decentralization by moving central office functions to districts, with a consequent reduction of central office staff, and
6. Reducing maintenance forces by shifting work items to contract maintenance (items include patching, landscaping, delineation, bridge deck repair, seal coating, snow and ice control, shoulder maintenance, and mowing).

ENERGY AND ENVIRONMENT

Environmental issues are still being examined by the states and handled to the extent possible. The need for newer, more effective air quality and water quality models continues to be important. Basic policy has not changed at the state level, although the amount of emphasis and visibility has. This shift reflects the integration of environmental processes into routine planning, design, construction, and maintenance activities.

Noise mitigation continues to be a major concern. States are committed to including noise barriers on many projects in urban areas. The use of new noise models has resulted in the cost of barriers being reduced significantly.

In air quality programs, vehicle inspection and maintenance programs are increasing. Cost is still a major concern but the benefits of the program are felt to offset the costs of implementation. Another area of concern for the states is the air quality impacts of hazardous materials spills.

Given the administration's reliance on the free market to act as regulator in the event of an energy supply interruption, states are concerned about fuel supply, the utilization of the strategic petroleum reserve, and the economic impact of a quick, relatively extreme rise in gas prices such a shortage would induce. Even though the current oil glut makes such thinking appear to be overly pessimistic, the volatile situation in many nations that supply the United States makes such thinking necessary.

DESIGN

The development of computer-aided design procedures has become a major topic of interest, particularly in view of the reduction in forces and little likelihood of staff additions. Automated (computer-driven) drafting procedures are an adjunct to the design procedures. Along with the emphasis on computer technology is a desire by individuals to make maximum use of the new generation of microcomputers and remote terminals in order to circumvent delays normally associated with large computer centers. Also a result of reduction in forces is a definite trend toward the use of consultants.

Most states are in some stage of developing pavement management systems. Considerable confusion exists concerning the meaning of pavement management, and many agencies have merely upgraded a pavement rating scheme and are far from a management system.

Pavement rehabilitation and bridge replacement programs command major attention. Many problems are evident in the pavement area, particularly where major maintenance has been deferred too long and where truck traffic has exceeded predictions. These include joints, pumping, loss of subgrade support, cracking, reflection cracking, etc. A number of states are looking for better overlay design procedures.

Several states reported a significant payoff in applying the results of the long-term small watersheds study conducted by the U.S. Geological Survey. Culvert sizes have been reduced by more accurate design procedures and the use of temporary ponding of flood waters.

The use of reinforced earth has now been accepted by many states. Significant savings are generally realized when compared with traditional wall designs.

There is still a need for portable or permanently installed

weight-in-motion scales capable of accurately recording loads without the bias of truckers bypassing the scales. Several states expressed an interest in restricted or exclusive truck lanes.

Control of roadside vegetation by use of herbicides has become a major money saver.

Other areas worthy of note are pavement recycling, bid rigging, potential problems with segmental bridges, downsizing of automobiles versus safety appurtenances, the use of weathering steel, and fatigue cracking in welded bridges.

MATERIALS AND CONSTRUCTION

Problems with asphalt pavements continue to cause concern. The major ones are lack of proper compaction and stripping of asphalt from aggregates.

Recycling asphalt pavements continues to increase with a definite trend toward more states allowing it as an option on all jobs. The contractor retains ownership of the material removed and either recycles it or reduces the bid price accordingly.

A number of state materials and construction engineers noted that past and present cutbacks of personnel, coupled with the trend to more and smaller projects, are resulting in the lack of sufficient personnel to adequately control quality.

States have become increasingly interested in computer programs for detecting possible bid rigging.

SOILS AND GEOLOGY

Personnel continues to be a problem, as geotechnical units have felt the recent cutbacks as strongly as others. As most soils units were small to start with, reductions in force have reduced their effectiveness to marginal levels, particularly at the technician level. Most states simply do not have the lab technicians, drillers, and inspectors needed to cope with current programs, much less ones that will increase in size.

While input of geotechnical engineers into structure design may be improving, involvement in highway design seems to be waning. This is at least partly the result of a poor recognition of the need for geotechnical investigations on 3R and 4R projects. Because of the minor earthwork associated with 3R and 4R work, there is little need for the classic "soils profile" required for the design of major highways, leading to a downplaying of the significance of project soils conditions. Often overlooked is the fact that line and grade adjustments cannot be made simply to avoid adverse geological conditions; they must be recognized and dealt with. At present, many soils engineers find themselves dealing with problems during construction that should have been handled during design.

By far, the most commonly cited research need is the development of standards and test methods for engineering fabrics. Other frequently mentioned needs are automated laboratory data acquisition, alternative retaining wall design, and subgrade drainage. NCHRP's study on reinforcement of earth slopes and embankments is popular. This remains a confusing topic in most states and a definitive study is long overdue. The need for alternative retaining wall designs is becoming critical as rehabilitation of urban freeways commences.

MAINTENANCE

Studies of repair techniques for Portland cement concrete pavement indicate that positive load transfer devices should be installed between major new patches—for example, inserting dowel bars. "Undercutting" of the old pavement, a technique intended to provide load transfer, has not performed as well as expected.

One state's researchers discovered that delaying mowing until after grass seed heads had formed made it possible to reduce the annual right-of-way mowing to a single cut. Investigations of chemical mowing in two other states showed that mowing could be reduced to two or three times at a dollar saving of about \$2 million per year.

A study of hardened steel snow plow blades revealed that they offered two-thirds of the wear of carbide insert blades at one-half the cost. Those findings resulted in a decrease in a bid price for carbide insert blades from \$5 per inch before the study to \$3.69 per inch after the study.

Thirty states have been involved in maintenance-oriented value engineering studies, and the benefits of the studies have been estimated to exceed \$8 million per year.

Use of impact attenuators on maintenance trucks to protect maintenance workers in traffic is increasing.

Linear programming techniques have been successfully applied to selection of maintenance station locations, and queueing theory has been applied to setting optimum equipment shop staffing levels.

National emphasis on development and use of pavement management systems is proving to be useful in establishing maintenance programs.

Numerous joint seal experiments are under way to seal both bituminous and Portland cement concrete cracks. Some materials and processes have performed in a superior manner.

Snow and ice control research is proceeding in several directions. A search for a non-corrosive deicing material has focused the attention of several agencies on calcium magnesium acetate (CMA). And the addition of 3-4 percent by weight of rubber (a Swedish development in the late 1960s) to asphaltic concrete seems to provide a modest reduction in time that snow is retained on a pavement surface. French authorities prepared sodium chloride brine/solid salt mixtures at 80 percent solid to 20 percent brine for preventive and for "curative" treatment; Netherlands spread moistened salt at 60 km/h with a maximum rate of 10 g/m²; Swiss authorities believe careful use of an instrument that measures electrical resistance can considerably reduce chemical usage; and a study of the long-term effect on groundwater of deicing chemical use is continuing. A test of heated abrasives indicated heating was not a cost-effective process.

Although energy concerns are less evident than in previous years, new facilities are subjected to energy analyses, a number of buildings are served by solar panels, and at least one highway office receives some of its electricity from a wind generator.

One authority strongly expressed the view that studies addressed to improving technology would now be more productive than further management studies. The computer's role as data storage for maintenance management data is being expanded for more sophisticated uses; e.g., use of performance indicators as a risk management tool and to compare the productivity of small versus large crews, etc.

A need exists for a focal point for exchange of information about tort liability.

The great increase in use of Jersey median barriers is resulting in some instances in public requests that they be cleaned or painted, and repairs are a growing cost item.

Some maintenance engineers are concerned about how they will repair reinforced earth-type structures, although only one partial failure was noted in this relatively new type of construction in this country.

Expenditures for maintenance of commuter fringe park-and-ride lots are rising dramatically.

SAFETY

The reduction in Federal 402 funds continues to have an impact on staffing levels and new program starts. Over the past two years, many state highway safety units have had a 50 percent reduction in staff. Reorganization and the selection of fewer special emphasis programs, however, appears to have resulted in higher priority being directed to a smaller number of the critical highway safety problems.

Programs to improve traffic accident records systems are a priority in nearly every state. The split responsibility for the collection, analysis, and use of traffic data between two or more state agencies is still a major problem.

A growing concern of many highway safety officials, especially traffic engineers, is the continuing trend of police agencies to investigate only accidents involving a personal injury or fatality. The policy to not investigate property damage accidents appears to be based on efforts to conserve police manpower. The lack of complete accident data seriously limits the ability of traffic engineers to identify, monitor, and evaluate potentially hazardous locations and conditions.

Other priority programs around the country include activities and legislation to combat the drunk driver problem, enforce the 55-mph speed limit, and encourage use of safety belts and child restraints. The most visible achievement has been the enactment of legislation to require use of restraints for infants and small children. To date, such legislation has been passed in 40 states and is pending in another 6 states.

It is obvious that cars are getting smaller, whereas trucks are not. Speeds are increasing, whereas the use of safety belts is not. Although these factors have negative influences on highway safety, 1982 U.S. fatalities decreased by a whopping 10 percent; the rate of 2.95 fatalities per 100 mvm is at an all-time low. Thus some of the things most of us are doing most of the time must be right.

TRAFFIC AND OPERATIONS

Considerable traffic control device experimentation exists, particularly in the pavement marking field, with some states reporting successes with materials that other states find wanting. For example, one state is happy with an epoxy-based paint, another has one that dries in 8 seconds, and others are looking for a good water-based paint to minimize the solvent pollution problem.

Raised pavement markers are reported a success in a snowbelt state, while other states claim success for them only when they are placed in recessed slots. There is still a

need for good marking removal practices to avoid scarring or incomplete removal and to minimize costs. This area will continue to be significant because 3R and 4R activities will generate the need for more temporary markings. A medium for rapid exchange of information on successes and failures could be helpful.

Heavy expenditures continue in many states on grade-crossing protection, though clearly this very successful program is reaching the diminishing return stage. Emphasis is shifting from warning device enhancements to crossing surface improvements. As states consider the need to replace deficient grade separation structures, cost considerations are requiring them to look at use of grade crossings in competition with new grade-separation bridges.

Maintenance and construction work-zone traffic control obviously continue as major concerns. There is little doubt that worker and public safety considerations are now getting a much better level of attention and more financial support in construction funds than they used to. Flashing arrowboards are deemed a success.

TRANSIT

Commitments to public transit services at the state level have remained substantially unchanged. For the most part, most states have not changed their transit funding in any significant way. It is important to note, however, that the states are now providing nearly \$2 billion in funding for public transportation.

There appears to be a much greater awareness of transit research among employees of transit agencies. Even though the National Cooperative Transit Research and Development Program is only in its second year of existence, many individuals visited were familiar with the program. They expressed hope that the program will grow in size and importance.

Microcomputers are being used widely in transit planning, management, and operations. The uniqueness of transit operations may be responsible for their quick acceptance in many transit agencies.

AVIATION

Use of helicopters has been increasing rapidly, particularly in business roof-top landings and in medical emergencies to and from hospitals. The public perceives the helicopter as a hazardous piece of equipment. Thus there is a need to inform the public concerning the value of the helicopter as a transport vehicle. In one state, they are now licensing roof-top helicopter landing areas; in another, two out of every three hospitals have heliports for which a state permit is required.

In one state, proposed school sites within two miles of an airport are inspected for noise impact, aircraft accident potential, and other possible aircraft hazards. If the site does not meet the criteria, the school does not receive state aid.

A need is perceived for an airport pavement management system similar to those in the highway field. Many airports are now 30 years old and older and little has been done to keep the pavement in shape. The FAA airport program is for new construction and does not provide money for maintenance.

States continue to be concerned about the impact of FAA standards on the costs of general aviation airports. They feel that adherence to these standards makes airports unnecessarily expensive. Furthermore, general aviation flying is down nationwide. Many states are concerned about the need for establishing an economic rationale that the public can understand for spending public money on general aviation airports.

RAIL

The change in the formula to allocate federal funds for the improvement of grade crossing protection has caused some states to lose significant amounts of money. Generally, the improvement programs are being continued as planned with state monies making up the difference.

Problems still exist with the accuracy of the national grade crossing inventory. The selection of highest-priority grade crossings for improvement is being done with various formulas; the New Hampshire formula is used by several other states. There is a need for guidelines to determine the degree of protection needed.

Many states continue to install prefabricated grade crossing surfacing on an experimental basis.

Railroads continue branch line abandonments at an accelerated pace. In grain-producing areas the railroads are moving toward regional terminals to permit hauling grain in unit trains. This forces heavy grain trucks to use feeder roads not designed for such traffic and is causing concern for the expected increase in deterioration.

More states are purchasing lines that are candidates for abandonments. The prospective loss of federal money for rehabilitation and operating subsidies will cause the closing of some of the lines already purchased and the purchase of fewer lines by states in the future. Generally, the states are requiring shippers to contribute where operating subsidies are required, with some states setting the shippers' share at 10 percent.

Also, several states are studying the need to assist weaker railroads in the rehabilitation of lines. Studies of high-speed passenger service continue in at least eight states. At least two states have imposed new railroad taxes, one a train-mile tax and the other a fuel tax to help replace the lost federal money. One state has developed a program for moving hazardous materials over the safest routes by avoiding unsafe grade crossings.