

Critical Concerns of Low-Volume-Road Agencies in the 1980s

LYNNE H. IRWIN

From the results of two surveys conducted among highway officials across the United States 11 areas of concern were identified. The principal concern was funding needs. Although inflation and declining public investment in roads are widely recognized as major problems, some data are offered to show that the big retrenchment in capital investment has occurred mainly at the state level. At the local municipal and at the local rural level the amount of money available for capital improvements and for highway maintenance has been steadier. In some cases it has actually increased slightly, when adjustments are made to correct for inflationary effects. In 1980 the state highway systems received 15 times more dollars per mile in capital investment than did the local rural highway systems. The state roads also received 4 times more maintenance dollars per mile. As a consequence of this difference, the local roads agencies put about 50-60 percent of their funds into highway maintenance but the states allocate only about 30 percent to maintenance. Funding problems on the local road systems have existed for a long time, and they may be expected to persist in the future. The real challenge for road officials in the 1980s will be to find and use innovative ways to do better with the limited funds available. Among the other concerns articulated by local roads officials were a need for better communications with the public in order to gain support and understanding of the problems of highway agencies. The most frequently mentioned technical concern was a need for less costly and more durable paving materials and better methods for setting the priorities and scheduling pavement improvements. The remaining concerns included frustration with bureaucracy, a need for better-trained staff, better ways to manage people and funds, design criteria specifically tailored for local roads, frustration with increasing liability and litigation proceedings, a need for ways to deal with increasing volumes and weights of traffic, more cost-effective and efficient maintenance methods, and a need for more fuel-efficient and more durable equipment.

The early 1980s will be remembered as a time when everyone from the local dogcatcher to the President of the United States touted their list of critical issues. The decade is still young enough to squeeze in one more list, this one directed to the special concerns and problems of low-volume-road agencies: counties, cities, villages, townships, and a multitude of differently named by similarly organized agencies. Nearly all of the other lists have 10 items; however, low-volume-road agencies are blessed with more problems than average, and this list resulted in 11 items.

DATA BASE

A list of critical issues, to be authoritative, should represent more than one person's opinion. By that criterion the list that follows is definitely authoritarian because it represents a composite of three different data bases that came from the response to questionnaires circulated among officials directly responsible for local roads and people who provide assistance to local road agencies.

The earliest of the three efforts was put forth by the Committee on Low-Volume Roads of the Transportation Research Board (TRB) in December 1980. The members of the committee were asked to identify one important technical issue and one important administrative issue regarding low-volume roads. A summary of the 17 responses (10 road agency officials, 5 academics, and 2 consultants) is given below. Although the results can hardly be considered a significant data base because the number of respondents was small, they are presented here to illustrate the striking similarity to the list of critical concerns that was developed through two much larger surveys.

Technical issues identified include the following:

1. Realistic geometric design standards,
2. Technology transfer programs,
3. Cost-effective maintenance methods,
4. Environmentally sound road dust control methods,
5. Effective use of computers in design and maintenance,
6. Bridge replacement and selection of structures,
7. Thickness design for aggregate-surfaced roads,
8. Alternative materials for paving and maintenance,
9. Road condition rating for pavement management, and
10. Relation of road performance to maintenance investment.

Administrative issues identified include the following:

1. Obtaining sufficient funding,
2. Optimum use of limited funding,
3. Reduction of paperwork and regulations,
4. Staff training,
5. Optimum standards for road maintenance,
6. Implementation of computerized accounting,
7. Management of labor for maximum productivity, and
8. Impacts of transportation deregulation.

Bayesian statistical theorists would be quick to point out that a small (but well-informed) group can exert a powerful influence toward the correct identification of trends with only very limited a priori data.

The two major sources of opinion that form the basis of this report were an April 1981 survey of the members of the Transportation Officials Division of the American Road and Transportation Builders Association (ARTBA) and an October 1982 survey of the readers of Nuggets and Nibbles, a technology transfer newsletter published by the Cornell University Local Roads Program (CLRP). The ARTBA survey received 121 responses, and the CLRP survey received 259 responses. The combined results reflect opinions from a total of 42 different states. The eight states not represented were Connecticut, Delaware, Indiana, Kentucky, Rhode Island, Tennessee, West Virginia, and Wyoming.

The responses came mostly from rural road agencies, although about one out of seven responses came from municipalities. The affiliation of the respondents is shown in Table 1.

Both surveys asked the question, "Aside from adequate financing, what are the most critical issues to be faced in the next few years?" The question was phrased as such in an effort to get beyond the obvious problems of insufficient funding, which are widely recognized. Most of the responses, however, tended to cite issues that were mainly money-oriented and directed either at obtaining more funds or attempting to manage limited resources more effectively.

LIST OF CRITICAL CONCERNS

A synthesis of the 380 questionnaire responses follows. The most frequently cited issues are listed first. There was relatively little difference between the popularity of the adjacent items. Note that only one of the top six issues involved technical matters (materials and pavements). Administrative and management-oriented concerns dominate the top of the list. This may reflect the fact that senior administrators in the various highway agencies commonly were the respondents. However, many rural agencies such as counties and townships are small operations, and the senior official frequently has the opportunity to get dirty.

Concern 1: Finance

Nearly every respondent reported directly or indi-

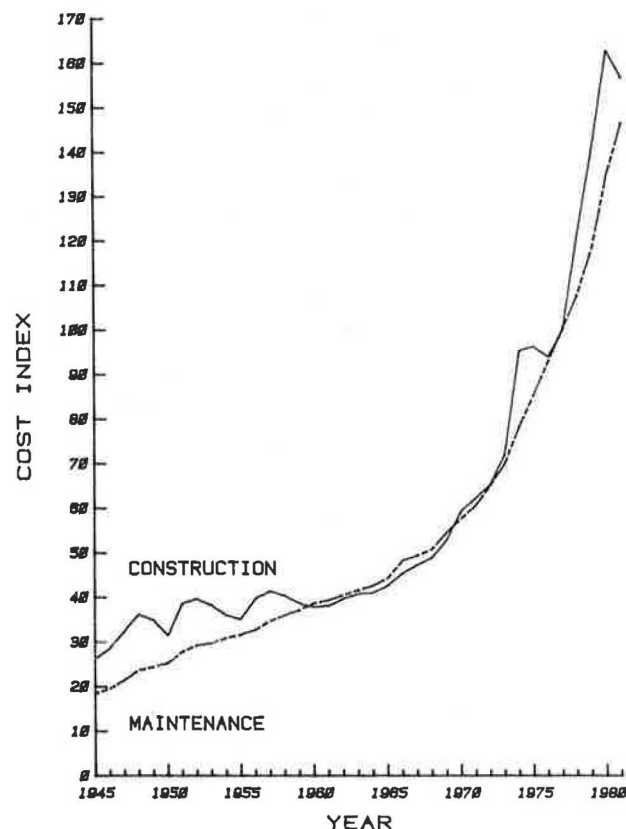
Table 1. Comparison of data bases.

Affiliation of Respondents	1981 ARTBA Survey (n=121) (%)	1982 CLRP Survey (n=259) (%)	Combined Results (n=380) (%)
State department of transportation	14	6	9
Municipal	7	18	14
County	55	19	30
Township	1	26	18
U.S. Forest Service	0	19	13
Other ^a	23	12	16

Note: In ARTBA survey, 31 states were represented; the CLRP survey represented 32 states; and overall, 42 states were represented.

^aMainly those who did not indicate their affiliation.

Figure 1. Highway cost trends for construction and maintenance (1977 base).



rectly that the shortage of funding was a critical concern. The need to use limited funds more effectively and to increase the availability of funds for personnel, materials, and equipment was stated in a variety of ways.

The erosion of purchasing power due to inflation of highway construction and maintenance costs was often lamented. Figure 1 shows the cost indexes for construction and maintenance reported by the Federal Highway Administration (FHWA) (1). From 1970 to 1980 the construction cost index increased from 111.8 to 345.1, which represents an average growth rate of 10.6 percent/year. During the decade the maintenance cost index increased at a rate of 8.9 percent/year. The index may be interpreted to mean that a given quantity of construction that would have cost, say, \$11 180 in 1970 would have risen to cost \$34 510 in 1980.

Due to the current recession and to declining oil prices, the inflation rate has slowed in the past two years. This trend cannot be expected to last long, however. In the 36-year period following World War II, both the highway construction cost index and the highway maintenance cost index have grown at an average annual rate of between 5 and 6 percent. Inflation can be expected to continue to take a bite out of highway budgets each year well into the future.

The main concern, stated by many respondents, was that highway budgets have not kept pace with inflation. Cover stories in Time and Newsweek magazines in late 1982 focused on national attention to the problems of deteriorating infrastructure. Declining user fees generated by more fuel-efficient automobiles and legislative boards that are reluctant to impose additional taxes are often cited as reasons why adequate funds have not been available for rebuilding and maintaining roads.

Figure 2 shows how capital investment in roads and maintenance expenditures by highway agencies at all levels have changed since 1945. The figures are adjusted for inflation and represent the United States as a whole (1). Capital investment for road construction and major repairs rose steadily from 1945 until 1968 and peaked at close to \$21 billion/year. By 1980 the figure had declined to \$12.2 billion.

Maintenance expenditures have trended upward throughout the entire period. Between 1960 and 1970 they increased by 20 percent. The trend for the 1970s is less clear due to a decrease in the 1979 and 1980 data, but on the average over the decade maintenance expenditures were up about 3 percent.

Note that inflation-adjusted maintenance expenditures did not turn upward sharply during the 1970s, which reflects reductions in capital investment. One might presume that highway agencies would first spend their resources on maintenance and use the remainder for capital improvements. Because traffic volumes and truck weights have been increasing steadily, the expected long-term consequence of declining capital investment would be a dramatic rise in maintenance expenditures. That this has not occurred in the period since 1967 is remarkable.

Maintenance measures cannot, of course, solve all of the problems of an aging road system. With the decreasing availability of funds and with the necessity to put at least a minimum amount of money into capital investment, maintenance expenditures were apparently reduced below the required levels during the 1970s. This dilemma forms the basis for the growing frustrations expressed by local road officials in their response to the questionnaires. But the specific financial situation for local roads is not quite so bad as the general view may make it appear.

Figures 3 and 4 show the inflation-adjusted trends for capital investment and maintenance expenditures, separating the money spent on state highway systems, local municipal (cities and villages) road and street systems, and local rural (counties and townships) road and street systems. It is apparent in Figure 3 that the state highway systems, and not the local road systems, have borne the brunt of declining capital investment. From 1970 to 1980 the state road system capital investment declined by 46 percent, the municipal street system was down 15 percent, and the local rural system was actually up a bit more than 7 percent.

The maintenance trends in Figure 4 show that state maintenance expenditures have generally increased over the past two decades, municipal expenditures trend downward, and local rural maintenance costs are up only slightly. Between 1970 and 1980 local municipal maintenance expenditures actually declined 13 percent, but local rural expenditures increased only 4 percent. The figures, of course, do not represent what should have been spent. They only show what the public was willing to spend on road maintenance and improvement. But they do tend to show that the funding situation at the local level has been more steady than has been the case for the state highway systems.

One additional observation can be made from Figures 3 and 4. They show the expenditures per mile of road on the three systems. As such, they depict the widely different costs due to the different standards of construction and maintenance on the state, municipal, and local rural road systems. In 1980 the state highway systems received 15 times more funds per mile for capital investment and about 4 times more funds per mile for maintenance than did the local rural systems. Due to the different stan-

Figure 3. Capital investment per mile of road by system (adjusted to 1977 dollar value).

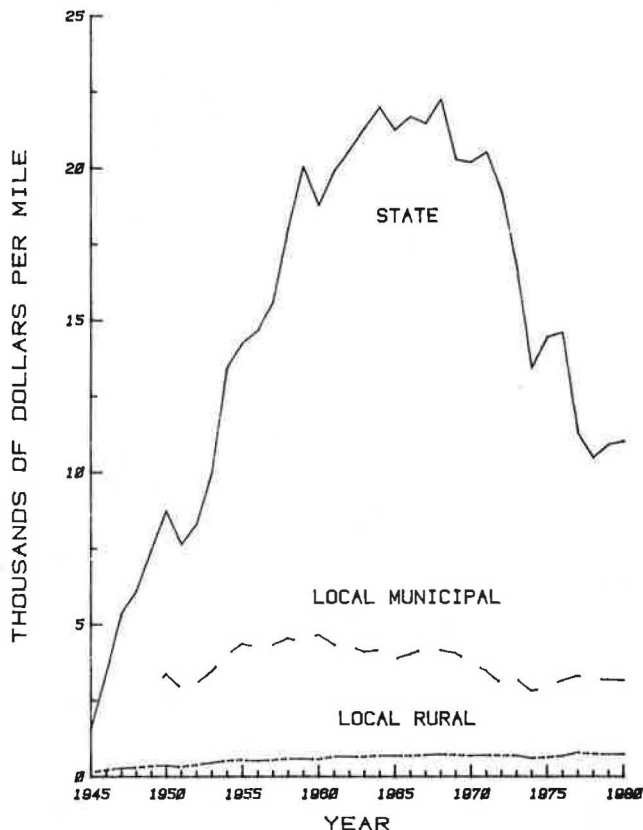


Figure 2. U.S. highway capital investment and maintenance expenditure (adjusted to 1977 dollar value).

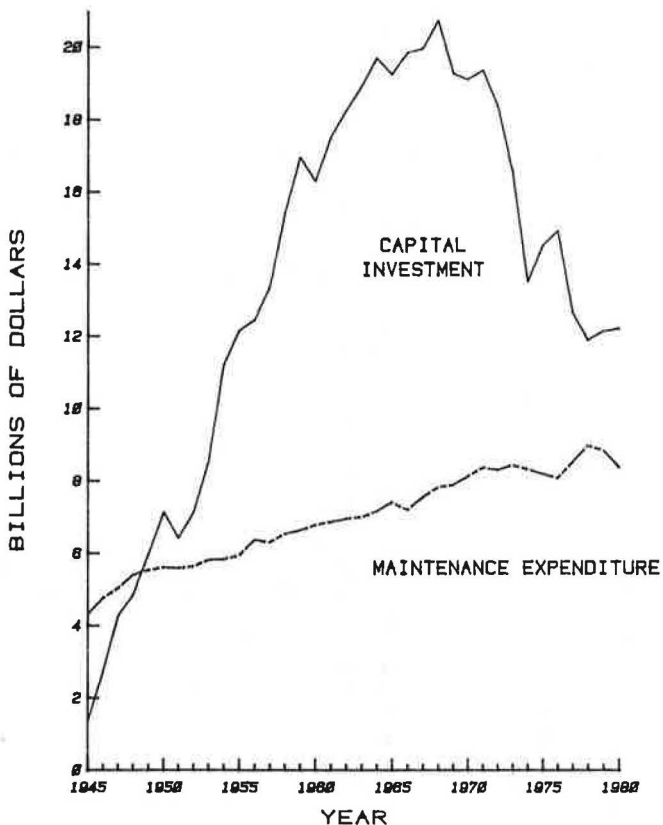
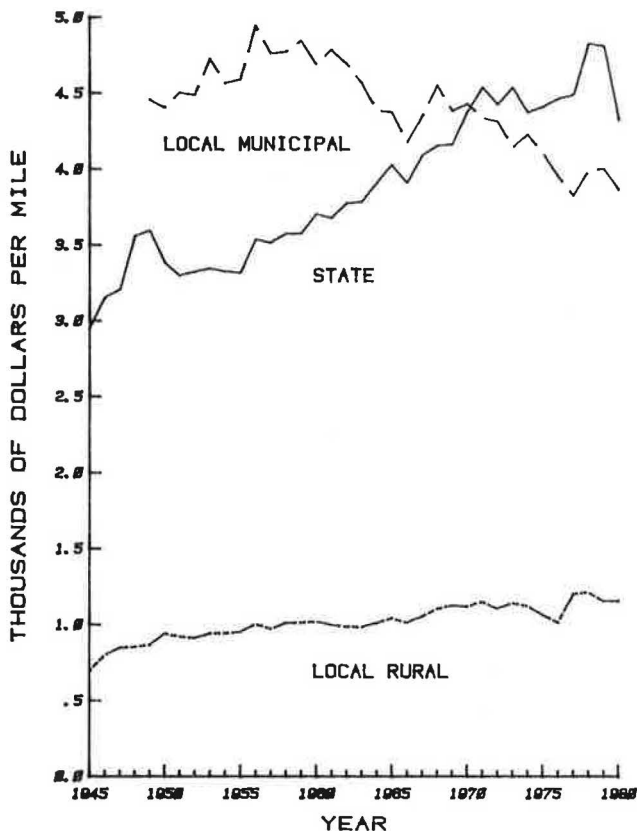


Figure 4. Maintenance expenditure per mile of road by system (adjusted to 1977 dollar value).



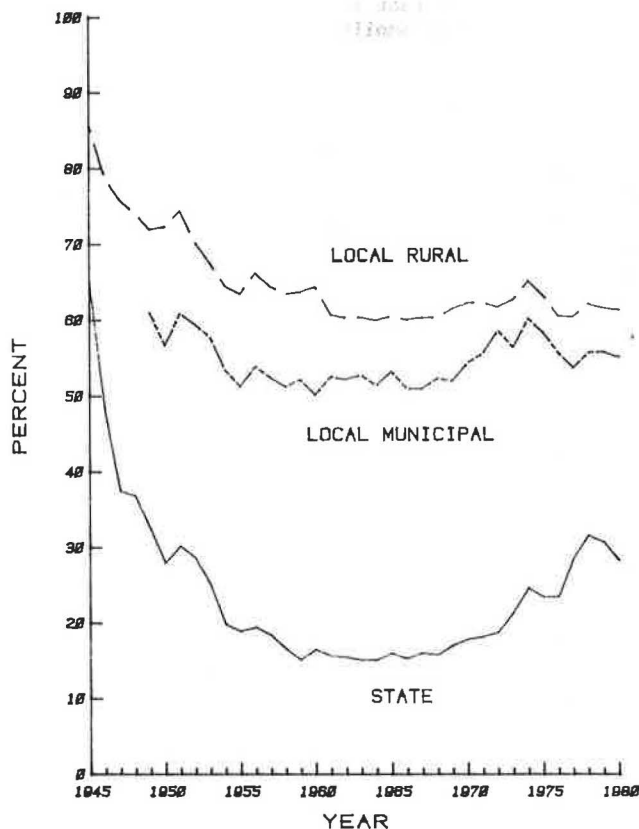
dards of construction, a higher proportion of funds goes into maintenance on the local road systems (Figure 5). One can see that at the state level in the past decade there has been a big increase of the proportion of funds going to maintenance. In 1980 the states put 28 percent of their road expenditures into maintenance (up from 18 percent in 1970), the local municipalities used 55 percent, and the local rural systems used 61 percent for maintenance.

Inflation and competition for public funds are factors that will continue to frustrate highway officials long into the future. Recent increases in road user fees at the federal level will enhance the funding for the federal-aid highway system, but local roads will not benefit greatly. Funding increases at the local level (necessary to keep pace with inflation and to enhance capital improvement expenditures) will continue to require justification of the need. Like death and taxes, highway funding problems cannot be expected to go away, and they will probably continue to be a principal item on future lists of critical concerns. The major challenge for highway officials at all levels in the 1980s will be to find innovative ways to do better with the limited funds available.

Concern 2: Public Relations and Communications

Many local roads officials noted the need to do a more effective job of communicating their problems as well as their accomplishments to the public. Some expressed concern that all highway agencies suffer from an image problem with the general public. One respondent suggested that "the public perceives highway officials as robber barons who want to steal their hard-earned and overtaxed income to fill potholes".

Figure 5. Proportion of highway funds going to maintenance by system.



Today the media are giving attention to the problems of deteriorating public works, and this provides an opportunity for highway officials to communicate with the public. But it will be only a matter of time before infrastructure problems drop from view in the newspapers and magazines. Inflation will continue to erode the value of highway budgets, and both the public and the legislative bodies will need to be told repeatedly about highway department problems and needs.

Some respondents expressed frustration with the apparent inability of legislators to understand the long-range financial consequences of deferred investment in roads. When pavements are permitted to deteriorate beyond a certain critical point, relatively low-cost rehabilitation measures, such as overlaying, cease to be effective, and the road needs to be completely reconstructed. Under these circumstances, with only a few years of delayed investment, project costs can escalate by a factor of 10.

Local road officials need to communicate an understanding of these matters. If they are to serve the public effectively, it would be irresponsible not to speak out. Some highway officials seem to feel it is their duty to make do with the funds they receive, but there is also a duty to protect the taxpayers from needless expense that arises from a failure to make repairs when they can be done most inexpensively.

Some questionnaire respondents stressed the importance of communicating financial needs in order to obtain public support for highway programs. Others noted the need to communicate internally with employees and legislative board members. A third set called for improved methods to permit the public to register their complaints and to advise of problems with the road system. An effective public relations program should contain all three of these components.

Concern 3: Materials and Pavements

Materials and pavements was the most frequently expressed category of technical concern. Numerous respondents to both the ARFBA and the Cornell surveys cited a need to find low-cost substitutes for petroleum-based materials. Great interest was expressed in having more information on sulfur-extended asphalt and on recycled asphalt concrete. Many of the comments simply called for the development of new, alternative materials.

The need for more durable materials was also mentioned frequently. Some respondents described instances where overlays seemed to not last as long as they used to. Changing traffic, both in terms of weight and number of vehicles, could cause this. In some areas, as roads get older, silty fines intrude into formerly clean base course materials and change the frost-susceptibility and strength of the base. This will greatly reduce overlay life. The effectiveness of overlaying in such cases is reduced, and alternative methods of road rehabilitation need to be considered.

In recognition of the need to consider a broader range of road improvement alternatives, many respondents suggested that pavement management techniques need to be developed for use at the local level. Some indicated that such methods should not be computer-based, and others called for improved, simple computer programs for pavement management that could be used on low-cost microcomputers. Better communication and cooperation between local roads officials and engineering consulting firms might lead to significant advances in pavement management methods.

Better tools for setting priorities and scheduling pavement improvement projects were requested. Road inventory methods, data base management procedures, and prioritization schemes suitable for use at the local level are needed. The large mileage of aggregate and earth-surfaced roads on the local systems poses a problem because essentially all road condition rating schemes are formulated for paved roads. A significant reduction in measurable road roughness can be achieved by simply blading an aggregate road. Although this would improve the condition rating index of the road, it should have little effect on the priority rating for reconstruction if the road surface is inadequate for the traffic it must serve. A total of 57 percent of the nearly 4 million miles of road in the United States is unpaved, and management procedures suitable for use with these roads are needed if money is to be spent on them as wisely as possible.

The need for better and inexpensive materials for controlling road dust was often noted. Prohibitions on the use of petroleum products for dust abatement have been advanced in many areas in recent years in order to reduce air and water pollution. In some regions, housing developments have resulted in increased traffic at a time when funds are not sufficient to permit paving of aggregate roads. Some local road agencies have found it necessary to return weakly paved roads to aggregate surfaces as a cost-saving measure. Due to traffic, roadside residents are subjected to high dust levels, and the cost of dust palliatives to control the problem is offset by reduced costs for road blading and watering. Effective substitutes for petroleum-based materials need to be identified.

Concern 4: Bureaucracy and Red Tape

A frequently cited concern was a deep-seated frustration with the bureaucratic aspects of managing a highway department. Curiously, this was the only issue on which the ARTBA data base and the Cornell data base differed significantly. Approximately three-fourths of the ARTBA respondents singled out red tape as a major problem. Only a small number of respondents mentioned it on the CLRP questionnaire. In synthesizing the two data sets, the concerns about bureaucracy became a top issue.

Highway people are builders and doers, and the increasing responsibility for paperwork is apparently seen as being nonproductive. Excessive involvement of state and federal agencies in the operations of the local highway department was a common complaint. State mandates and regulations, permit requirements, minority business enterprise requirements, Davis-Bacon wage requirements, and environmental impediments were specifically cited as problems. More commonly, however, the questionnaire respondents simply indicated red tape as a categorical source of grief.

Some respondents observed that the large national agencies such as the American Association of State Highway and Transportation Officials (AASHTO) and FHWA are promulgating design standards for local roads. The extent of the understanding of problems at the local level by such agencies was questioned, along with the appropriateness of the design standards. Similar concerns were expressed about local road maintenance standards developed by state highway agencies.

Local road departments, which use less costly standards than those developed and sometimes mandated by other agencies, noted their concern that a dual-standard road system was resulting. Externally aided roads are being built to one set of standards, and locally funded roads are built to the less-

costly standards. Potentially complicated litigation problems that might arise together with the fact that many more miles of road could be improved with the state and federal aid if locally acceptable design standards were used jointly formed the basis for concern about the dual-standard approach.

Some respondents advocated that standards for design and maintenance appropriate to local road function and traffic levels need to be developed. Such standards would probably have to be written as guidelines to permit local adaptation to prevailing practice.

A desire for more local determination in the expenditure of aid funds was also expressed. Finally, the need to modify procedures for public input on route location and highway planning, developed for major state-level projects, was cited. In most cases local opposition to projects is negligible and access of citizens to the responsible officials at the local level provides adequately for communication. Procedural requirements designed to permit public input to faceless state agencies add needless delay to local-level projects, thereby lengthening project development time and frustrating local officials.

Concern 5: Personnel

Respondents expressed concern about the shortage of qualified people, the difficulty of retaining good people, and the need for training programs to improve employee qualifications. Some complained of the high cost of labor, and others said that low salaries had made public employment unattractive.

A great deal of interest was shown for technology transfer programs. Such programs would contribute to the improved productivity of the labor force aspects of the work. Ten regional technology transfer demonstration programs were begun this year in various state universities under the sponsorship of FHWA. The hope is that this program will be justified through its accomplishments and perhaps can be expanded to additional states in the future.

Concern 6: Management

Several specific management needs were cited. Greater use of value engineering at the local level to assist in decisionmaking was advocated. A need to define an appropriate optimum balance between capital investment and maintenance expenditures was also expressed.

In dealing with labor relations, motivation of the work force to higher levels of productivity, accomplishment of the required work with personnel ceilings, and management of union negotiations were all mentioned as problem areas. One respondent wrote that his problem was "trying to maintain a balanced, realistic, viable, and economically feasible program that will not rape the landscape, will meet the needs of industry and the public, and yet not violate the hordes of environmental constraints placed on us by legislative acts and mandates".

Concern 7: Safety

Despite the recent attention given to road and bridge deficiencies, safety was not a frequently stated concern. This may be because many of the other critical issues implicitly involve public safety as an underlying factor.

The question of public safety due to the shift to smaller cars and larger trucks was cited by several respondents. They saw a need for information on how standards for local roads might need to be modified

in order to be responsive to the changes in vehicle sizes and weights.

Some respondents expressed concern about the need to improve horizontal and vertical alignment on roads. Others were concerned about narrow and inadequate bridges. Several noted the need to have better criteria to decide which deficient bridges should be replaced.

Concern 8: Liability and Litigation

Closely ranked with safety were concerns about liability associated with road system hazards. Great frustration was expressed by some about the profusion of litigation that has affected highway departments in recent years. The changing public attitudes that have led to more-frequent suits were tied to the need for better public communications by some respondents. Others noted that changing interpretations by the courts and new laws have affected sovereign immunity, possibly leading to greater personal liability for some public officials.

Concern 9: Traffic

Increasing traffic volumes, increasing vehicle weights and sizes, and changes in legal load limits were often noted as important problems. Several officials complained of a need for better enforcement of load limits and noted that rural roads are used to bypass state-operated weighing stations.

Problems with heavy trucks were mentioned by many respondents. The increasing size of trucks used for transporting agricultural products is a concern. The shift from rail transport to highway trucks is damaging roads in some impacted areas.

Concern 10: Maintenance

Maintenance problems were not frequently cited as critical concerns. The need to identify and communicate cost-effective, efficient maintenance methods was noted. Perhaps the new technology transfer programs can contribute in this regard. How to identify the proper level of maintenance expenditure necessary to protect the investment in roads was seen as a problem. Better snow and ice control methods and materials and concern about the damage caused by road salt were mentioned.

Concern 11: Equipment

Better fuel efficiency and a need for more durable equipment were cited as problems. The need to replace aging equipment and the unavailability of replacement parts for older equipment were also mentioned as important concerns.

CONCLUSIONS

The 380 returns from the two surveys have provided a

broadly based inventory of the current concerns of low-volume-road officials. Many of the problems are representative of the concerns at all levels of highway agencies. A few problems, such as controlling dust on aggregate roads, are unique to low-volume roads.

Some critical concerns were conspicuous by their absence from the responses. I learned as an undergraduate that the three most important aspects of highway engineering are drainage, drainage, and drainage. Surprisingly, only one respondent cited drainage as a critical concern. The large question of how responsibility for the financing of local roads should be shared between federal, state, and local levels was not raised. The need to make optimum use of the density of our public road system, abandoning road segments where possible in order to save on costs, also was not mentioned. Perhaps these issues are too big, but some big problems were included by numerous respondents.

An interesting exercise will be to see how many of the critical concerns of the 1980s will still be around in the 1990s. Certainly some issues such as funding problems, bureaucracy, and the need for public relations can be predicted to appear. New technical issues can be expected to replace many of the current concerns. The need for training of personnel will still be present, although we may invent a new buzz word to replace the phrase "technology transfer" that we use today.

It gives courage to those who are faced with adversity to know that they do not stand alone. It is to that end that developing an inventory of critical concerns in the low-volume-road field serves a purpose. Perhaps it will help you to know that your greatest problems are shared by many others. Certainly it helps those of us who are charged, as I am, with providing assistance to local road officials to have a clear view of your problems so that we can set our priorities accordingly.

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REFERENCE

1. Highway Statistics. FHWA, Repts. FHWA-HP-HS-45 through 82, 1945-1982.