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

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The early 1980's will clearly be remembered in history 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 just young enough that it will be possible 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 but similarly organized agencies.

Nearly all of the lists managed to wind up with 10 items. Low volume road agencies unfortunately are blessed with more problems than average, however, and this list resulted in 11 times.

DATA BASE

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

The earliest of the three efforts was put forth by the Committee on Low-Volume Roads (A0002) in the Transportation Research Board 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, ten road agency officials, five academics, and two consultants) is given in Table 1. Although the results can hardly be considered a significant data base since 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. Subscribers to Bayesian statistical theories 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 \textit{a priori} data.
Table 1. Important Issues Identified by TRB Committee on Low-Volume Roads (A00002), December 1980

TECHNICAL ISSUES
- Realistic geometric design standards
- Technology transfer programs
- Cost-effective maintenance methods
- Environmentally sound road dust control methods
- Effective use of computers in design and maintenance
- Bridge replacement—selection of structures
- Thickness design for aggregate-surfaced roads
- Alternative materials for paving and maintenance
- Road condition rating for pavement management
- Relating road performance to maintenance investment

ADMINISTRATIVE ISSUES
- Obtaining sufficient funding
- Optimizing use of limited funding
- Reduction of paperwork and regulations
- Manpower training
- Optimizing standards for road maintenance
- Implementing computerized accounting
- Managing labor for maximum productivity
- Transportation deregulation impacts

The two major sources of opinion which 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 coming from a total of 42 different states. The eight states not represented include 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 2.
Table 2. Comparison of the Data Bases

<table>
<thead>
<tr>
<th>Date Questionnaire Circulated</th>
<th>ARTBA Survey</th>
<th>CLRPR Survey</th>
<th>Combined Results</th>
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<td>380</td>
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<tr>
<td>Oct. 1982</td>
<td>31</td>
<td>32</td>
<td>42</td>
</tr>
<tr>
<td>Number of Responses</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>States Represented</td>
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<tr>
<td>Affiliation of Respondents (percent)</td>
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<td></td>
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<tr>
<td>State Dept. of Transp.</td>
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<td>9</td>
</tr>
<tr>
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<tr>
<td>Other*</td>
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</tbody>
</table>

*mainly those who did not indicate their affiliation

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 which were mainly money-oriented, directed either at obtaining more funds or attempting to manage limited resources more effectively.

A LIST OF CRITICAL CONCERNS

As interpreted by the author, with appropriate amounts of unavoidable bias typical of humans, 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.

It is interesting to 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 indirectly that the shortage of funding was a critical concern. The need to utilize limited funds more effectively and to increase the availability of funds for manpower, materials, and equipment was stated in a variety of ways. Because it was cited so frequently, the funding problem is at the top of the list as the most critical concern.
Figure 1. Highway Cost Trends for Construction and Maintenance (1977 Base = 100).
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 in *HIGHWAY STATISTICS*. In the decade from 1970 to 1980 the construction cost index increased from 111.8 to 345.1, representing an average growth rate of 10.6 percent per year. During the decade the maintenance cost index increased at a rate of 8.9 percent per 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 rate of between five and six percent per year. 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 have focused 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 in the post "Proposition 13" era 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.
Figure 2. Highway Capital Investment and Maintenance Expenditure in the USA (Adjusted to 1977 Dollar Value).
The figures are adjusted for inflation, they represent the United States as a whole, and they are taken from the FHWA publication *HIGHWAY STATISTICS*. Capital investment for road construction and major repairs rose steadily from 1945 until 1968, peaking at close to 21 billion dollars per year. By 1980 the figure had declined to 12.2 billion dollars.

Maintenance expenditures have trended upward throughout the entire period. Between 1960 and 1970 they increased 20 percent. The trend for the 1970's 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 three percent.

It is interesting to note that the inflation-adjusted maintenance expenditures did not turn upward sharply during the 1970's, reflecting reductions in capital investment. One might presume that highway agencies would first spend their resources on maintenance, using the remainder for capital improvements. Because traffic volumes and truck weights have been steadily increasing, it would be expected that the long term consequence of declining capital investment would be a dramatic rise in maintenance expenditures. The fact that this did not occur 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, apparently maintenance expenditures were reduced below the required levels during the 1970's. 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 as 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 monies spent on the
Figure 3. Capital Investment per Mile of Road, by System (Adjusted to 1977 Dollar Value).
Figure 4. Maintenance Expenditure per Mile of Road, by System (Adjusted to 1977 Dollar Value).
state highway systems, and the local municipal (cities and villages) and local rural (counties, townships, etc.) road and street systems. It is apparent in Figure 3 that it is the state highway systems, and not the local road systems, that have borne the brunt of declining capital investment. Over the decade from 1970 to 1980 the state road system capital investment declined by 46 percent, while 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, while 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 while 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 Figure 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 four times more funds per mile for maintenance than did the local rural systems. Due to the different standards of construction, a higher proportion of funds go 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), while the local municipalities used 55 percent and the local rural systems used 61 percent for maintenance.

Inflation and competition for public funds are factors which 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 con-
Figure 5. Proportion of Highway Funds Going to Maintenance, by System.
continue to be a principal item on future lists of critical concerns. The major challenge for highway officials at all levels in the 1980's 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".

Today the media is 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, again and again, 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 it becomes necessary to completely reconstruct the road. Under these circumstances, with only a few years of delayed investment, project costs can escalate by a factor of ten.

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

It is interesting to note that some questionnaire respondents stressed an 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

This was the most frequently expressed category of technical concern. Numerous respondents to both the ARTBA and the Cornell surveys cited a need to find low-cost substitutes for petroleum-based materials. There was great interest 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 frequently mentioned. Some respondents described instances where overlays seemed not to last as long as they used to. It is possible that changing traffic, both in terms of weight and number of vehicles, could cause this effect. In some areas, as roads get older, silty fines intrude into formerly clean base course materials, changing the frost-susceptibility and the 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, while others called for improved, simple computer programs for pavement management which 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 prioritizing 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 system poses a problem since 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. While 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 are 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 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 are 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 questionnaire respondents singled out "red tape" as a major problem, while 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 local highway department operations 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 it is generally the large national agencies, such as the American Association of State Highway and Transportation Officials (AASHTO) and the Federal Highway Administration (FHWA), that 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 about local road maintenance standards developed by state highway agencies were expressed.

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, while locally funded roads are built to the less costly standards. Potentially complicated litigation problems which 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 the 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. It was indicated that in most cases local opposition to projects is negligible and that access of citizens to the responsible officials at the local level provides adequately for communication. Pro-
cedural 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: Manpower**

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. While some complained of the high cost of labor, others felt that low salaries had made public employment unattractive.

A great deal of interest was shown for technology transfer programs. It was noted that such programs would contribute to the improved productivity of the labor force through a better understanding of the technical aspects of the work. Ten regional technology transfer demonstration programs were begun this year in various state universities, under the sponsorship of the FHWA. Hopefully this program will be justified through its accomplishments, and perhaps it can be expanded to additional states in the future.

**Concern 6: Management**

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

Dealing with labor relations, motivating the work force to higher levels of productivity, accomplishing the required work with personnel ceilings, and managing union negotiations were all mentioned as problem areas. One respondent wrote that his problem was “trying to maintain a balanced, realistic, viable, 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 due to the fact that 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 lead to more frequent suits was 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 volumes of traffic, 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, noting 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 optimize 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 very big problems were included by numerous respondents.

It will be interesting to see how many of the critical concerns of the 1980’s will still be around in the 1990’s. 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 which we use today.

Thomas Carlyle once wrote:

“Adversity is sometimes hard upon a man; but for one man who can stand prosperity there are a hundred that will stand adversity.”

It does give 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 roads officials, to have a clear view of your problems so that we can set our priorities accordingly.