

Maintenance Requirements for the 70's

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I compliment the Highway Research Board and Ohio State University for their vision and foresight in holding this Maintenance Management Workshop. While to most of the public the maintenance of highways may not be as glamorous as planning and building them, there is nothing more important among the responsibilities of the highway engineer and administrator.

Maintenance is important from many aspects, principally of course, in protection of the substantial investment we have made and are making in our highway plant. Even though the Federal Government does not contribute to maintenance costs, it has an investment of 50 to 90 percent of the capital cost of these highways built under the Federal-aid highway program. The Bureau of Public Roads has a statutory responsibility to see that this investment is maintained properly and, therefore, has a significant and continuing interest in the financial and other aspects of highway maintenance.

But there is much more than economics involved, important as that is. We must always keep in mind not only the safety factor but also the return in the form of good or bad public relations which result from the quality of our maintenance efforts. The traveling public is seldom aware of construction features so long as a highway provides a reasonably fast, direct, and safe route. But it is acutely conscious of such things as potholes, ragged shoulders, thriving crops of weeds, litter, illegible signs, and snow and ice on the pavement. And the traveling public is inclined to be quite vocal about its displeasure with such things.

It is an understatement to say that the 1970's will pose tough new challenges for state maintenance forces. The Interstate System will be in use throughout its length sometime around the middle of the decade—the precise time depending on the availability of financing. The Interstate System involves a different set of standards and more complex problems than most maintenance organizations have dealt with historically.

Maintenance must frequently be performed under conditions of never-ceasing heavy traffic, thus entailing much greater difficulties as well as potential hazards to both workmen and the traveling public. Landscaping on a large scale and the need for systematic mowing go hand-in-hand with Interstate routes. Huge signs and rest areas must be maintained and numerous motorist services must be provided. The motoring public demands a bare pavement year-round on high-speed expressways, and it is necessary to try to accommodate this demand if only on the one ground of traffic safety.

All of this adds up to a required raising of the sights in the maintenance field. It means more and better equipment, more and better personnel and more effective utilization of both. It means more and better materials and, wherever possible, materials which are maintenance-free or have long-durability qualities built into them. As one example, we need a simple and inexpensive traffic stripe that will last longer and have greater visibility in rain and fog. Current experimentation with grooving the pavement in the stripe area appears promising in both regards.

Before getting into the specifics of maintenance requirements of the next decade, a few comments on the expenditures involved may be useful, especially in comparison with construction costs. In 1950 the construction cost index was a composite 78.3. In 1967 it was 117.6 or a 39.4 point rise in 17 years. During the same period, the maintenance cost index rose from a composite 70.5 for labor, materials and overhead to 137.4 or a 66.9 point rise. The relatively low rise in construction costs is probably due largely to greater productivity by reason of improvements in both equipment and construction methods. Conversely, the high rise in maintenance costs is perhaps

attributable to a lesser attention to research and development in the maintenance field, combined with the inherent difficulty of improving the maintenance operation.

Most of you are familiar with NCHRP Report 42 on Interstate Highway Maintenance Requirements. This estimates the cost of maintaining the completed Interstate System at \$261 million per year or about \$6,400 per centerline mile. The report concedes that this figure is probably conservative and it is likely that \$10,000 per centerline mile will be a more realistic estimate for the overall mileage. The NCHRP report also calculates that pavement and shoulder presently take 15 percent of the Interstate maintenance expenditures, but that this ratio will rise to 45 percent in 1975 because of the increasing age of the Interstate highways as well as the increase in traffic volumes carried by them.

The Bureau of Public Roads, in a report to Congress, has estimated that an annual average of \$5.8 billion will be spent on maintenance during the years 1973-85. It has also been estimated that maintenance needs will rise about 60 percent during this period. Better maintenance management is one of the ways available to us to offset this rise in maintenance expenditures and that is why I complimented you at the outset on your enterprise in holding this timely workshop.

When we get into maintenance requirements of the 1970's, we have to make a necessary division of labor into two categories. One is physical or general maintenance; the other is traffic services. We also have to start out with the fact that 15 percent of our main state system of roads and streets is still unpaved. Most of such mileage is surfaced with soil, clay, gravel or stone, but not concrete or asphalt. These older roads and streets need widening, resurfacing, additional lanes, frequently complete reconstruction. Everyday maintenance needs are always with us on all roads—such routine activities as striping, mowing, cleaning up litter, patching, signing, ditch cleaning, shoulder work, joint sealing, and upkeep of guardrail.

In the urban areas considerable construction emphasis has been given to freeways, but arterial streets and highways still must carry enormous traffic loads exceeding the freeways. We expect that the TOPICS program will help to relieve some of the congestion in the urban areas. Much can be done by maintenance operations to improve capacity by merely striping left-turn lanes and minor channelization.

Routine maintenance operations on urban roads and streets with heavy volume, high-speed traffic will necessarily have to be done to a great extent during off-peak hours. This may involve night work or hours outside the normal working day. Extra pay will thus be involved but even then there is a problem in getting personnel to work these hours. And sometimes in our larger urban areas there is really no such thing as an off-peak traffic flow. This puts a heavy premium on building facilities that are as maintenance-free as possible.

Trees, shrubs and plantings will require a need for men especially well-trained in pruning techniques, fertilization, watering, weeding, grafting, replacement of materials, thinning, and other technical activities involving special expertise.

Bridge maintenance is probably the most difficult and troublesome problem today and as far as we can see into the future. This activity is of tremendous importance and demands highly qualified personnel. Public Roads has recently issued new bridge inspection guidelines to our field offices and the new Federal-Aid Highway Act of 1968 carries statutory requirements for a special effort in this direction. Bridge deck scaling and sometimes even heavier types of deterioration are causing extra maintenance problems. We need to develop ways of constructing more durable decks and to find more effective ways to maintain them.

The hazard of bridge deterioration was brought forcefully and tragically to the attention of the public and Congress by the collapse of the Silver Bridge at Point Pleasant on the Ohio River last December. Fortunately, very few bridge failures are so disastrous but still about 150 of them fail for various reasons every year. We do not have complete centralized information files on all of the highway bridges in the United States, but we are now working toward a nationwide inventory to determine both their number and their condition. It has been estimated, meanwhile, that of the approximately 1 million highway bridges in the country, a very large percentage of them are more than 30 years old and deficient in load capacity for much of today's traffic.

Much deterioration of older bridges is undoubtedly due to overloading and this is essentially a police problem rather than a maintenance problem. However, adequate and regular inspections of bridges are maintenance activities, and if done properly will detect conditions which may signal a possible collapse. Bridge inspection techniques must be vastly improved and new maintenance practices developed which do not in themselves contribute to deterioration of the structures. For example, deicing techniques are needed which do not corrode the floor system of the bridge or its supports.

In the field of traffic services we are being forced into new and additional activities. Rest area maintenance, for instance, is requiring a full-time maintenance man 24 hours a day in the larger rest areas that have all the facilities. Constant manning of this scope actually requires 5 employees. Personnel chosen for these duties must be more than cleanup men. They will be required to furnish information on routes, roadway conditions, historical features and answer other questions from the traveling public. Emergency aid to the stranded motorist is a new field requiring a great deal of attention today. Public Roads has issued an Instructional Memorandum (IM 60-1-66, dated October 18, 1966) on this subject and Federal aid is participating in experimentation with this activity in a number of states.

One of the growing problems of safety in the maintenance field is the disabled vehicle in the high-speed lane or middle lane of an 8-lane facility. Some type of arrangement will have to be developed to remove it from the traffic flow. Some far-out proposals have suggested that possibly a heavy crane traveling on tracks located in the center median can reach out to the disabled vehicle and lift it out or that helicopters might also be used as a possible means of coping with this problem.

Sign replacement and maintenance of large directional units will require a great deal of planning. The average life of the facing material in some cases has been estimated to be from 7 to 10 years after which fading and deterioration will occur, requiring major replacements. Signals require specially trained personnel to maintain electrical circuits, clean fixtures, replace bulbs and perform other similar operations in increasing amounts.

Snow and ice removal is a very expensive maintenance item but a necessary one. Possibly it need not be so expensive if we combine research and development with imagination. Snow removal methods are essentially the same today as they were 30 years ago. But this does not mean that progress is at an end. Whole new varieties of equipment and tools or perhaps materials also, may be required eventually—designed to meet the special requirements of the Interstate and other high-speed roadways carrying heavy traffic volumes.

In the field of highway safety, maintenance personnel must be trained in procedures for summoning aid, protecting others from hazards at accident sites, and removing debris quickly and efficiently. Programs must be developed for preventive maintenance, repair, and daytime and nighttime inspection of traffic control devices. Safety equipment on maintenance vehicles is of increasing importance. Roll-over bars, for example, on tractors and mowers are being used today in some states. Seat belts and effective warning signs and lights on vehicles are also items of importance. Proper control of the movement of traffic through maintenance worksites is a field in which considerable improvement is necessary.

Litter is not only costly and time-consuming to the state and local highway departments, but is repugnant to the great majority of conscientious, law-abiding motor travelers. We do not have any very good answers on this problem yet except manpower and more manpower. New types of equipment are needed to mechanize portions of the trash pickup problem. Or, possibly, some genius will develop self-destruct beer cans and pop bottles. But in the meantime we must continue to rely largely on pulling maintenance forces away from the more constructive work they should be doing to cope with the problem of litter.

I mentioned earlier the need for research, development and imagination in planning and carrying out maintenance programs for the future. Let me add to that cost accounting. As the maintenance operation becomes more complex, so does the need for strict control of the highway dollar. As in the past, there will in the future be just so much

money available for highway purposes and any dollar wasted on inefficient maintenance practices is a dollar deducted from the funds available for new facilities.

In other words, I am talking about maintenance management—the very timely subject of your meeting. Even though most maintenance operations do not lend themselves to computerization, your brains are doing a pretty good job in perfecting such practices as properly scheduling maintenance operations and installing maintenance management reporting techniques.

During your brainstorming sessions here you are covering many matters of vital importance to meeting the maintenance requirements of the 1970's.

Many of you are invited to participate because of your knowledge in the systems analysis and management fields, while others are maintenance operators with direct responsibility at the firing line for the results. I do not happen to be one of those individuals who believe blindly in the worship of the systems analysis approach as the beginning and end of all knowledge and that its application to every one of our problems will insure an automated, push-button, easy and infallible answer. But there are variations of the organized approach to a problem which are characteristic of the engineer training which many of us have had, through which we may substantially contribute to the solution of many of these problems which face the highway maintainer both now and in the future. Many of these problems are answerable through the application of improved management practices covering our resources of manpower, equipment, materials, and dollars; while others are in the realm of research into improved materials through chemistry and physics.

We have traditionally given less attention in both the management and research fields to maintenance of our road system than we have to its initial construction, although we are now expending amounts for maintenance which rapidly are approaching the level of capital expenditures. It is time that we gave substantial attention to this area of our responsibilities. I feel strongly that on a relative scale, there is opportunity for much greater payoff, and greater cost-effectiveness application here than in the construction side of our responsibility. I therefore commend this thought to you in the sessions which you hold during this workshop.