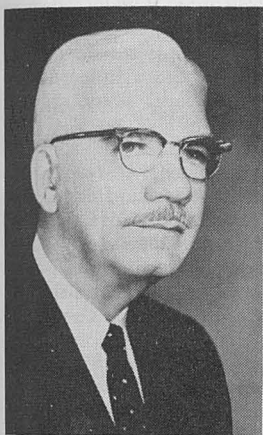


## THE SIGNIFICANCE OF HIGHWAY MAINTENANCE

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Did you ever stop to think about the vastness of our highway systems in the United States? Practically every farm, piece of rural land, parcel of property in all villages and every city lot is connected with each other by some kind of highway or street. Without such connections property not on a railroad or navigable stream would be practically worthless and even in those two cases without highway connections as well, the land value would be a minute part of its present worth.



Of course, such a condition is incredible. Ever since man trained beasts of burden and particularly since the invention of the wheel roads have been the foundation of peoples' livelihood. As roads improved, living improved in proportion. We have but to look at the United States to see that the country with the best highway systems has the highest standard of living and greatest horizons of opportunity.

It is no mean task or responsibility to maintain these street and road systems in good condition so that every person in the United States, every industry, farm, bank, store or hospital can serve the public, employ people, and advance the strength and health of the country. It isn't done by slight of hand or wishful thinking. It is done by the hard work of many specially dedicated highway people. They often risk their lives in blinding blizzards, hurricanes, and treacherous flood waters or removing fallen electric lines to keep the roads open for everyone. We often hear stories about "the mail must go through" or about the doctor who braves the storm to treat a patient. And they, among many others do a heroic service for our benefit, but the highway maintenance man is out there first doing his job so they can do theirs. It is too bad that more writers, newspapermen and television playwrights don't tell the dramatic story of what goes on to keep our roads and streets open. The maintenance men deserve that recognition. Do you ever think of the risk to his life that the paint stripping man takes when he is riding on the little paint machine down the center of an express highway with 2,000 cars an hour whizzing by him some with irresponsible slap-happy drivers?

But, the maintenance of our highways goes a great deal further than just keeping them open. They must be kept safe and the enormous investment in money and labor and sacrifice required to build them must be protected to the maximum amount possible against the ravages of time and use. There are over 3½ million miles of roads and streets in the United States as indicated in the following table.

### Rural Mileage

State .....	658,896	
Local .....	2,345,317	
Federal .....	111,912	
Subtotal .....		3,116,125

*Municipal Mileage*

State .....	50,158	
Local .....	379,410	
Subtotal .....		429,568
Grand Total .....		3,545,693

Of these totals, 2,165,468 miles of highways in rural areas are paved with some type of surfacing varying from gravel to asphalt and portland cement concrete pavements, while 391,502 miles are similarly paved in urban areas.

In other words, 2,556,970 of the total of 3,545,693 miles of highways and streets in the United States have some type of pavement or paved surface.

While I said that the maintenance of these roads could not be done by magic or wishful thinking, sometimes the men in the field must think that is what is expected of them. All too frequently they have too few qualified men strong enough or ambitious enough to work with the zest and enthusiasm required by the job. As a result, the dedicated well qualified men in the maintenance organization have to do far more than their share of the work. Fortunately for everyone, they do it.

Often their equipment is too old and too worn out. It is maintained on a crash basis instead of by a system of preventative maintenance. Just when they need equipment the most, it breaks down. The men stand around waiting for materials, or because the machine work on the job cannot go ahead, until the equipment is repaired or another piece brought in from somewhere else.

Much too often, superintendents and foremen are glued to so much paper work they are not free to see and sufficiently direct actual work in the field. The maintenance of records required to keep track of materials and have them available on time when required, red tape in purchasing, in hiring men, in making reports, and a multiple of other things stick them to their desks. There is no one else available to do the work. Consequently, experienced engineers, maintenance specialists, qualified men in many fields are diverting their talents to clerical work.

It is impossible to do a fine workmanlike job under these circumstances and I have mentioned them because they are badly in need of emphasis and correction in many highway and public works departments.

In view of the need to make our highways efficiently serve us for as long a time as humanly possible, one would expect that every governor, every mayor, every town or country executive, every budget director, every legislator and every highway administrator would, as his first order of business, make sure that sufficient funds were available and maintenance organization established to do this job right. But, they don't as a rule. Usually, if anything is cut to the bone and deeper when funds are low, and they usually are, it is the maintenance budget. If poorly qualified men, cheap materials and old equipment are permitted or used anywhere, it is in the maintenance department.

The question is, why do these situations exist when the job to be done is so extremely important? One reason may be the public pressure for new roads. Another may be the romance and glamor that goes along with the building of new facilities. But, I believe it is equally the obvious outcome when two contestants are contesting for a goal and one is well prepared while the other is not. It is as if Notre Dame were to play a high school team in football. There would be no question about the outcome.

It is the same way when contesting for the highway dollar. Most highway departments and department of public works have chief engineers and many similarly trained professional men who know how to present new highway construction needs clearly, factually, and with force. They have mountains of statistics, carefully prepared highway need surveys, project reports, plans and usually a number of influential private organizations backing them up. In addition, besides there is always the federal offer, you put up one dollar and I'll put

up nine or in the case of other federal aid systems, you put up 5 and I'll match it.

Of course, new highway construction is imperative, if our country is to grow and our land values maintained or increased. I would be the last one to say otherwise, but so is properly maintaining the facilities we have already built at such enormous expense. I merely mention these things to illustrate the powerful competition that highway maintenance now has a budget time.

To meet this competition, the maintenance departments must be equally scientific in the analysis of their responsibility and the work programs required to accomplish it. Basic preventative bridge and pavement maintenance must be performed by competent well trained men who have at their disposal modern equipment, good materials, and up-to-date technical knowledge.

Fortunately, there is a rapidly growing awareness of this situation by a number of State Highway Departments and Toll Authorities, the Bureau of Public Roads and some metropolitan governments. This probably flows from the intuitive recognition that the transition from the old type of major highway to rural and urban expressways will require vastly increased maintenance attention and expenditure. The good old days of five thousand dollars a mile annual maintenance cost on major highways is over. It will probably reach ten to twenty thousand dollars a mile and involve an expenditure at least \$400,000,000 a year on the Interstate Highway system alone when completed.

Probably the most encouraging highway research accomplishment in recent years is the completion of the Ottawa, Illinois, American Association of State Highway Officials, Test Road Project conducted by the Highway Research Board, of the National Academy of Sciences. It is the world's most beneficial highway experiment. It can ultimately save its cost a thousand times over directly in improved highway design and through the many new avenues of research which will be constantly developing as a result of the experiment. Already, the States and the Bureau of Public Roads have entered into a National Highway Research Program by pooling their interests and by entering into a cooperative arrangement with the Highway Research Board. At present, 31 new research projects are under way, many of which are directly related to highway maintenance, as well as design. More will surely follow. The Ottawa Test Road is like a nuclear explosion of knowledge, enormously effective in itself and creating a chain reaction of research which will probably even surpass the beneficial effects of the original project.

The important thing at the moment is to bring about an awareness of the immediate value of the AASHO Test Road to maintenance people. It is now possible to plan preventative highway maintenance and ultimate rehabilitation much more effectively than could have been done before that undertaking. It's findings have already been put to use for maintenance programming by the New Jersey Highway Authority on the Garden State Parkway, and by the New York State Thruway Authority.

In effect, the new formulas now available for the design of pavements can be reversed to predict when a pavement will require resurfacing or other major improvement. Through the use of the Present Serviceability Index, the profilometer which was developed for measuring the variations in the pavement surface, and equations relating to these factors to accumulated damage and traffic, it is possible to make these predictions. Similarly, it is possible to measure the effect of maintenance operations and to scientifically adjust future maintenance and expenditure requirements which result from the benefits of current operations.

Such programs correspond to the highway needs surveys previously undertaken by many states to demonstrate highway construction requirements. They were the foundation upon which the presently expanded highway programs were built. Similar predictions based upon the sound engineering approaches developed at the Ottawa Test Road Project will be equally effective in presenting highway maintenance budgets to commissions, governors, legislators and to the public. It will enable them to more correctly understand the total highway re-



quirements during the development of their highway budgets. It will go a long way toward eliminating the imbalance in the presentation of highway construction and maintenance needs. With a better understanding of action requirements, better maintenance organization and financing are certain to result.

Another encouraging factor is the improvement in both the economy of performance and beneficial effect of recent advances made in bridge and pavement repair. New equipment and materials have facilitated the improvement of pavement underdrainage, patching, resurfacing and releveling operations. Similarly, deteriorated bridge decks and members can now be restored more effectively.

It is important for highway maintenance people to study these modern methods and the experiences others have had in carrying them out. It is essential to review the long-range results that have been obtained.

In the past few years, a great deal of experience has been secured in determining the best location, method of construction and material to be used in the installation of transverse weeps and longitudinal pavement drains. Similarly, undersealing of portland cement concrete pavements and the releveling of the slabs are extremely important in extending the life of older pavements. Recently, great advances have been made in the economy and the effectiveness of this type of work. The same thing can be said about overlaying portland cement concrete and asphalt concrete pavements and their shoulders.

Another troublesome and costly maintenance problem deals with bridge decks. Deterioration has resulted from the pernicious gnawing away of concrete quality by the action of repeated freezing and thawing cycles in conjunction with the corrosive action of deicing chemicals. Much experience, however, has been gained in the removal and replacement of this type of concrete and the AASHO-Highway Research Board current research program includes a special study of this critical problem and the current means of coping with it.

The protection of pier caps from water and deicing chemicals is another field of enormous importance to maintenance engineers and again improved methods for eliminating old concrete and patching have been developed, but there is still a long way to go. In this regard, I believe every department should have an active Bureau of Research and Development and that a major portion of their activities should be devoted to maintenance. Science and technology are making such rapid advances now that it is necessary to have machinery with which to evaluate new techniques, material and equipment in the light of the particular maintenance requirements of the state or municipality. It is especially important that such a program include:

1. A review of all important Highway Research Board data and other publications to determine their relevance to the department's highway maintenance.
2. The coordination and programming of pertinent research and experimental work.
3. The determination of responsibility for carrying on specific research and development projects.
4. The evaluation of results so that future policies may be made on a sound basis.
5. The conduct of periodic pavement and bridge condition surveys to ascertain the actual rate of accumulated damage and thus make it possible to adjust projected maintenance programs on a sound basis.
6. The taking of axle load counts to supplement traffic counts as these are extremely important in estimating future accumulated pavement and possibly bridge damage.
7. Periodic surveillance of subbase drainage, particularly small pipe outlets,

french drains, and any evidences of the collection of water beneath the pavement or shoulders.

8. A study of methods to improve the output of heavy maintenance equipment, particularly adaptations of electronic devices to permit instantaneous automatic adjustments and operations.
9. The maintenance of a high coefficient of friction on bituminous surfaces.
10. A study of color additives to pavements, supplementing traffic signs, particularly for accelerating and decelerating lanes and shoulders.

The field for highway research maintenance and development is certainly not limited to these items. They merely illustrate the wide range of research into methods and procedures relating to still further improvement of major highway maintenance work. Such a research and development program could result in substantially reducing future maintenance costs through the development or use of new materials, better techniques and improvement of field practices.

It would appear reasonable, therefore, for every department to reappraise its maintenance divisions and when it is found that reconstruction work or similar maintenance is not performed by wholly qualified men and its operations are performed on an expedient basis, rather than on a scientifically developed long-range plan, that it make such a plan at the earliest possible moment. It can't be done by gazing into a crystal ball or rationalizing on past experiences, but it can be accomplished by following the pattern established by the AASHO-Highway Research Project. Such a long-range highway maintenance program and outline of its full requirements will be the best assurance of success in this field. It will place construction and maintenance competitors on the same plane. It will give with equal force and fact the total highway needs picture to the Administrators. Nothing in the highway field could be more important than that to all.