

PROJECTIVE MAINTENANCE

BY H. D. METCALF

*Chief Engineer, Bureau of Maintenance
Ohio Department of Highways*

SYNOPSIS

The term "projective maintenance" is used to describe a type of work that goes beyond the usual maintenance operations and is done with "an eye to the future." The inevitable task of highway reconstruction after the war will be greatly facilitated if current maintenance work is so conducted as to obviate much of the necessity for new construction. The aim should be to make present work dovetail with future plans.

Projective maintenance comprises not only doing those things that will be valuable in future use but in refraining from doing things that will be discarded later. It is, of course, not applicable to roads already sufficient for future needs, or roads that will have to be entirely rebuilt later, but on others many things may be done as maintenance that will contribute to future development.

Some of the items properly to be studied for projective maintenance are: patches, not just good enough but better and made to carry the loads for years ahead; treatment of the chronically "sick" highway; treatment of roads of insufficient surface width; narrow roads and additional right-of-way; inadequate subgrade and surface drainage, weak bases and corrective stabilization, faulty drainage conditions; safety features, and repair of structures.

Highway transportation is vital to the prosecution of the war and highway systems must not be allowed to go backward. While construction projects are being curtailed, maintenance must be adapted to "fill the gap." To the defense must be added that of attack. To sustaining must be added projective maintenance.

Maintenance is the principal phase of current highway operations and the direction it takes today will determine the kind of roads we will have tomorrow. There are numerous war time conditions which require maintenance beyond the normal if disaster to the Highway System is to be prevented and the investment protected.

Much has been said regarding the importance of highway transportation during war time. Almost everything we eat, a large proportion of our mineral production, the material for the clothes we wear, wood pulp for paper manufacture, structural lumber, soy beans for plastics, petroleum products, at some stage between producer, manufacturer and consumer, are transported by truck on highways. In addition, highways are, to a great extent, extensions of the assembly lines in the majority of war plants.

Everyone is familiar with the limitations that the war effort has placed on new construction and reconstruction of highways, thereby imposing an enormous burden on a supersaturated normal maintenance program. In ordinary times, the problems of maintenance

have been considerably lessened by the construction and reconstruction of highways that have become worn out or obsolete. Now, construction efforts are directed to those highways only that are considered of strategic value to the war. However, worn out and partially developed highways not of strategic value, must of necessity be maintained. Only extensive maintenance operations can fill the breach and avoid utter collapse of highway transportation.

CHANGE IN CHARACTER OF TRAFFIC

Throughout the nation, and particularly in the large industrial States, a very small percentage of highways are in a condition or are designed to accommodate traffic of the character now being imposed upon them. The enormous growth of truck traffic as a means of transporting commodities and the increase in the average axle load, has placed on highways loads much heavier than those for which they were originally designed, especially in and near the centers of industry. To say the least, enforcement of load restrictions has been very liberally interpreted in the face of war needs.

In normal times, a large percentage of roads are inadequate for the volume of traffic going over them. Altho there has been a substantial reduction in passenger traffic, it is reasonable to assume that the previous volume of traffic will be resumed.

A different approach to maintenance problems must be made. Past practice has leaned towards the *sustaining* or defensive rather than the vigorous, forward-looking, *attack* type of maintenance. The latter method I am calling projective maintenance. It is that type of maintenance done with "an eye to the future", that type of maintenance that fits into the future development of a highway. It is analogous to stage construction in that the maintenance efforts are not merely to sustain the road in its existing condition, but to go a step further and especially adapt the maintenance to fit into the future development of the road. Someone has said that "disaster for our highway system can be prevented only if maintenance techniques depart from a defense conception to one of attack". The problem resolves itself into finding out whether maintenance operations in general practice today provide, not only a sustaining defense, but an attack against the enemy of deterioration.

AIMS OF PROJECTIVE MAINTENANCE

It is the aim of projective maintenance to eliminate much of the necessity of new construction after the war. If we get into the habit of sustaining maintenance only, we will face a task of highway reconstruction after the war that will be insurmountable. Even with our best efforts there will be many, many roads worn out or disintegrated to such an extent that they will have to be reconstructed; but with a far-sighted maintenance policy aimed at the elimination of superficial repairs, the mileage of roads to be reconstructed from the ground up will be materially reduced. To help improve and strengthen the under-designed pavements or to make them suitable to receive supplementary strengthening is the problem before maintenance organizations. The ultimate aim is to expend our energy so that whatever we do, will dovetail with the future plans.

POSITIVE AND NEGATIVE APPROACH

There is both a positive and negative approach to projective maintenance, i.e. doing

those things which will fit in with and assist in carrying out of future plans and not doing those things which will be thrown out and discarded later on.

To illustrate: supposing the abutments of a bridge fail and have to be rebuilt and it is known that this bridge is on the line, grade and location of a future improvement which would call for a wider roadway and increased loading. The positive approach would be to rebuild the abutments to fit a wider and stronger superstructure and use the existing superstructure until the road improvement is made. An illustration of the negative approach would be the failure of a deck on a bridge that is in the wrong location to fit the future highway. Here the obvious thing would be to repair the deck with a minimum repair job. Certainly, it would not be correct to build a completely new superstructure knowing that a new bridge will have to be built in a few years on a new location.

It is obvious that if a road has grade and alignment not suited to the expected volume and character of traffic, or is in an undesirable location and may be abandoned, it should receive sustaining maintenance only. It is not economical to do expensive work that will last far beyond the expected use or life of the road in its present location. Those roads should be patched so that the patch is comparable to the surrounding pavement in durability, certainly not in such a way that it is far better than the rest of the highway. Widening shoulders, reducing curves and other improvements should be done elsewhere.

Roads that are adequate in design for normal future needs may be eliminated from consideration as they require sustaining maintenance only. Unfortunately we have very few of this type. In general, projective maintenance is not applicable to roads that have a grade and alignment unsuitable for future development, to roads that have a decreasing traffic trend or to roads that fulfil requirements of present and future traffic. What should we, as a maintenance organization, do about the remainder?

POSITIVE PROJECTIVE MAINTENANCE

To approach the maintenance problem positively, to depart from a defense conception to one of attack requires that the maintenance organization maintain close liaison at all times

with the bureau that makes designs and plans. The maintenance organization, from the chief engineer down to the county superintendent at least, should become well acquainted with the plans for the development of the roads under its jurisdiction. They should become well acquainted with the order in which these roads are to be improved. Only by intimate acquaintance with these future plans can the maintenance engineers be kept from expending much needed maintenance money for work that may be thrown away later.

Projective maintenance may be simply doing day to day patch work, by making patches that are not just good enough to get by today, but by making patches that are better, patches that will not only carry today's loads, but that will carry the loads that will be traveled over them years ahead. Then again, projective maintenance may take on a more substantial character. This can be illustrated best by the type of road that is chronically failing, the road on which repair work is always being done. Such roads may call for a major operation. Under such conditions it is advisable to allocate a certain portion of the maintenance funds to take care of these major operations of a maintenance character. Such operations, when completed might appear similar to the road before it got bad, but actually would be far more substantial. In many cases resurfacing at some future date, would be all that is required. The funds set up for this type of work should be carefully administered with special controls, if necessary. Such funds should be allocated to the field forces by special projects, after adequate investigation has been made, the course or procedure determined, and a definite plan adopted. In extreme cases complete soil profiles or drainage studies should be made before anything is done. This type of work may be tackled as a job to be pushed or done piecemeal, as it fits in with other operations.

Now consider some actual conditions and see what can be done along positive lines in carrying out a program of projective maintenance. Assuming that the grade and alignment are suitable for future development, a road may still be inadequate in many ways. The width may be insufficient for present traffic, the pavement may be too weak, there may be lack of traffic safety or the subgrade

and drainage features may be inadequate. Each of these calls for a different approach.

Narrow Roads

There are roads that are too narrow for present or future traffic but are satisfactory in grade and alignment. The road bed may be too narrow or just the pavement. An alert maintenance engineer may often materially assist such a future development by utilizing waste soil obtained from stripping or gravel pits, channel relocations or other incidental operations to widen the berm and roadway. Purchase of additional right-of-way may be justified. Shoulders may be stabilized, but to fit in with a program of projective maintenance such stabilization should be deep enough to serve as a base for the future pavement widening. More substantial base widening, such as with waterbound or penetration macadam may be justified. Extension of culverts may be considered, particularly if repairs are contemplated.

Subgrade or Surface Drainage Inadequate

Lack of adequate drainage is one of the major causes for unstable subgrades and the fundamental cause of many pavement failures. This drainage problem must be attacked projectively. It is not sufficient simply to patch pavements if the fundamental cause of failure is some deep seated drainage trouble. Subdrainage in the form of French drains or better still tile drains may be advisable. In some cases special studies involving boring exploratory holes to determine the origin of water or geological investigations may be required. This may seem to be a lot of trouble but it will pay dividends in the future.

Strength Insufficient

One of the greatest opportunities for projective maintenance lies in base strengthening. The higher type pavements may be strengthened by piecemeal replacement of the weaker or broken up portions in conjunction with supplementary drainage or insulation courses. Pumping joints may be tightened up by mud jacking or asphalt subsealing, or under slab drainage may be required. Macadam bases can be strengthened by reconstructing the weaker areas to greater thickness combined with corrective drainage or subgrade im-

provement. In some cases an overlay with a supplementary course of macadam may be the answer. It is on the traffic bound roads that one of the greatest opportunities exists for projective maintenance. These roads generally are at an intermediate stage of development. Ultimately in nearly all cases it is the plan to surface them with a bituminous top of the intermediate or high type. It is well known that the success of bituminous topping depends on having a substantial base. Under a program of projective maintenance corrective stabilization of traffic bound roads may be done by tearing up and re-working the existing road adding the quantity and type of aggregate required to make up for the deficiencies that exist, and adding chemicals, cement, or bituminous materials. An alternate method is to overlay the surface with a stabilized course of the necessary thickness. The choice of the type of corrective stabilization depends upon the condition of the existing road and on the next steps to be taken. If it is not planned to treat the road immediately with bitumen the use of calcium chloride is recommended. This treatment not only provides a compact surface but insures against loss of aggregate and protection against the dust nuisance. If, however, the road is a bituminous treated road that chronically fails, bituminous stabilization or a combination of bituminous and chemical stabilization is the recommended plan. In all cases an effort should be made to correct faulty drainage conditions. This type of work requires careful investigation of the existing road and subgrade to diagnose the faulty conditions and determine the deficiencies that exist. Such a program if carefully planned and executed provides an admirable base for a higher type of pavement, but the roads under consideration must have grade and alignment fitting in with future plans if much of the work is not to be wasted.

Safety Features Insufficient

Another direction that projective maintenance may take is toward providing adequate safety features. The first thought along these

lines is guardrail. The critical materials situation makes it almost impossible to build guardrail now; nevertheless, posts may be obtained and set at the proper spacing ready for installation of the road guard as soon as the materials are available after the war. Deep ditches close to the road and in hazardous locations, may be relocated or enclosed drainage provided. Other items along these lines may suggest themselves.

Structural Maintenance

Maintenance and repair of structures can be handled to fit in with a program of projective maintenance, even though new structures are not being built except on access roads or to replace structures that have collapsed. Deteriorated abutments may be rebuilt to accommodate superstructures of adequate strength and width for future needs. Shortage of critical materials may dictate the use of a temporary superstructure. Culverts that need repairing on the outlet or inlet ends may be extended to fit future road widths. Floor replacement may be done with an improved and strengthened floor for very little added cost. On other features decision on whether projective or sustaining maintenance should be the approach would be governed by the future plans.

Over zealotness, lack of judgment, or failure to keep close contact with the location and design bureaus may nullify the beneficial effects of any of the foregoing mentioned operations. In fact, it is better to go along on a plan of sustaining maintenance if the work done is subsequently wasted because of failure to fit in with future plans.

Construction projects are being curtailed. The character of traffic has changed. Highway Systems must go forward—not backward. An added approach to maintenance of highways is required. Maintenance operations must be adapted to "Fill the gap". To defense must be added attack. To sustaining must be added projective maintenance, and together they spell—planned maintenance—both now and hereafter.