

WHAT CONSTITUTES A LOW COST ROAD

C L McKesson,

Materials and Research Engineer, Division of Highways, Department of Public Works of California

In the past the designation "low cost roads" has been applied quite generally on the basis of first cost only. Mr. Connor renders a distinct service in pointing out that "low cost" should mean low cost including first cost, maintenance and decreased vehicular operating costs in so far as such costs are affected by the type of roadway surface. Wearing surfaces which cannot qualify as low cost roads under this rigid specification are economically doomed and will fall into disuse as they are supplanted by really low cost types.

Crushed rock and gravel surfaces have been commonly classed as "low cost" types. A recent study of such surfaces in Oregon and California has indicated that under traffic of 600 to 800 vehicles the maintenance cost has usually ranged from \$1000 to \$1500 per mile per year including metal for replacement. The original average cost of surfacing ranged from \$5000 to \$6000 per mile and an interest charge should be added in the amount of \$250 to \$300 per mile. Recent research studies by the Washington State College indicate that tire wear is four to five times as great on these surfaces as on bituminized or concrete surfaces. In making comparisons for economic purposes the total annual cost of such surfaces should include such added extra cost of tire wear due to the abrasive properties of the surfacing, and with the traffic as indicated this cost might easily amount to \$500 per mile per year. Iowa State College studies show gasoline consumption to be 25 per cent higher on graveled roads and another \$500 might therefore be added for extra gasoline cost. Summing up these annual charges it appears that the total annual cost of the so-called low type roads including maintenance, replacement, interest on capital investment, increased cost of operating due to tire wear and extra gasoline is, therefore, probably considerably more than \$2000 per mile per year. Under such an analysis it is quite obvious that this type of road is not entitled to the designation of "low cost" surfacing. The figures used are not believed to be precisely correct but are symbolic of costs which are incurred and which can never be accurately determined.

The writer believes that untreated rock, gravel or macadam surfaces cannot usually pass muster as "low cost roads" when costs are analyzed in the manner indicated above using the figures which are

found justified in each particular community. Such construction may be entirely justified as a part of stage construction which includes prompt treatment with some bituminous binder material. Surface treatment with asphaltic oil or tar or mixed-in-place treatments with the same binder materials appear to cut the annual cost of such roads to one-half or less of the original amount. The initial cost of such bituminous treatment, based on experience in California and Oregon, ranges from \$600 to \$1300 per mile. In addition to the savings which can be more or less definitely estimated such as prevention of loss of road metal, reduced cost of maintenance, and reduced operating expenses other benefits are secured, such as elimination of dust and increased smoothness which cannot be reduced to dollars and cents but which are none the less appreciated by the traveling public. A large number of states apparently recognize the uneconomical features of untreated roads; and it is believed that economies are effected by treatment in most sections where treatments are intelligently used.

The writer believes that these types of surfaces when properly treated may be found to qualify as "low cost roads" within the definition set forth in this discussion and also believes that untreated roads will usually fail to so qualify. In other words, it appears that any road which justifies development by a state highway department will probably justify some type which can be more economically maintained than the untreated metaled roads, even if the initial cost is somewhat higher

Instead of surface treated traffic bound gravel or stone surfaces or mixed-in-place treatments an alternate is presented in surface treated and penetration bituminous macadams. The initial cost of bituminous macadam is sometimes greater but maintenance cost where bituminous macadam is properly constructed may be expected to be somewhat less and the life somewhat longer. The intensive maintenance required for the less expensive types is not so indispensable or burdensome. No preference is here expressed and the selection of types, it is believed, should rest on the study of local conditions and costs.

The possible use of the natural road as material for mixed-in-place oil or tar treatment should be carefully considered. Sandy or gravelly soil is frequently well adapted to this use and a really "low cost road" surface may result where it is found that additional metal is not required prior to oil treatment

European highway engineers in general appear to agree that untreated metal is no longer economical. The writer recently had the pleasure and privilege of inspecting several hundred miles of roads in England, France and Germany. In England the writer encountered no untreated roads. Except where paved, the surfaces have usually been treated with tar or emulsified asphalt. Repeated treatments over a period of 12 or 15 years have in many places resulted in a surface which has the usual characteristics of pavement. In France many hundreds of miles of macadam have been surface treated with tar or emulsified asphalt since the war and the work is being carried on as rapidly as funds will permit. Much penetration macadam has also been laid. The results on the whole are very satisfactory and this frugal expenditure of limited funds by the French engineers is giving them a large mileage of smooth, dustless road which can be maintained at a low cost.

The extensive use of emulsified asphalt is a development in these countries. The emulsified asphalt, of which there are several kinds, is used in both penetration and surface treatment. It can be used in wet or dry weather and with simple inexpensive equipment, as heating is not required. These features make it attractive to European road builders and its adaptability to use here should receive consideration.