ROAD BUILDING ECONOMICS

SOME NOTES ON BUILDING COSTS — RELATIVE 20-YEAR ECONOMY OF VARIOUS TYPES OF ROADS AND PAVEMENTS.

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THE advent and universal use of high-speed automobiles and heavy motor trucks have made the road problem one of the chief considerations of every municipality, whether it be a sparsely populated rural district, a village, a country town or a great city, and the economics of the subject are of greater general importance to-day than ever before. Various communities may require different classes of road construction but one and all must consider the economic value of the class of road they adopt. Road building being one of the oldest of undertakings there is an immense amount of reliable data on costs of construction, maintenance and deterioration of roads available for analysis, so that the question may readily be reduced to a simple business proposition and the relative economics of various types of road construction accurately recorded. In the following discussion, the various costs apply to average results attainable throughout the eastern section of the United States and though the same figures may not be capable of exact duplication in all sections, the relative economy of the various classes of road construction are proportionally accurate for any section, excepting, of course, for a particularly favored section where purely local facilities of material supply may favor some specific class of road building.

Before taking up a discussion of the various classes of roads, however, a few words on the financing of such undertakings is necessary. With few exceptions, roads are built by the federal government, the state legislature or a municipal board, and it makes no difference to the economics of the question whether the capital employed in building the roads is derived from direct taxation, the sale of bonds or whether the income from other source is employed, the capital invested in the roads must pay or carry a certain rate of interest. This value of the money may govern the economy of road construction in a certain locality—in one locality, one class of road may be relatively cheaper while in another, an entirely different class of road construction would prove the less costly, depending upon the rate of interest that the money employed in road building has to pay. Therefore, in order to make this discussion as comprehensive as possible, the capital charges and the interest charges will be kept separate. The establishment of a sinking fund for retiring bonds issued for road building operations does not materially alter the aspects of the case, retiring bonds before the completion of the road or during the life of the road simply reduces the net amount of interest paid on the capital directly involved in the road building operations by the use of other money that is just as valuable and entitled to the same profit.

Considered from a modern point of view, the available classes of road construction may be taken as macadam, paved and asphalt, and these three classes will be individually considered in that order. To arrive at a true valuation to put on any road the points that must be considered are: 1st, the initial cost of the road; 2nd, the average yearly maintenance charge of the road; 3rd, the life of the road, or the number of years that can be counted upon during which no extensive rebuilding is necessary; and 4th, the periodic rebuilding or renewal charge. The relative importance of these four conditions governing the economic value of the various classes of road construction are tabulated in Table I., for highways of 18-foot roadbed, to which reference will be made when considering the individual types of construction. The measure of economic value of the roads will be arbitrarily based on the total cost of the roads per mile for a period of twenty years as in such period the average road would have been subjected to the complete cycle of expenses to which it is subject and also as that length of time is frequently the period chosen for the life of construction bonds issued for raising the necessary capital.

TABLE I.

Average Road Building Costs Per Mile of 18-ft. Roadbed, etc.

Class of road construction.	Initial cost. $	Maintenance charge. $	Average life. Years.	Renewal charge. $
High-grade macadam	12,000	1,000	10	6,000
Paved roads, no foundations—				
Vitrified brick laid on edge	21,000	50	25	nil
Vitrified brick laid flat	11,000	55	10	11,000
Stone block	22,500	75	40	nil
Hard wood block	30,000	600	15	30,000
Soft wood block	23,000	800	12	23,000
Asphalt paving, no foundations	22,000	1,250	10	22,000

TABLE II.

Average Thickness of Concrete Foundations—Various Classes of Road.

Average cost, $1,100 per mile per inch depth, 18-ft. roadbed.

Class of road.	Thickness of concrete foundation.
Stone block paved	about 9″
Vitrified brick paved	4″ to 6″
Hard wood block paved	about 8″
Soft wood block paved	about 9″
Asphalt paved streets	about 9″

Macadam Roads.—The severity of modern demands on roads is such that in considering roads of macadam construction one type only need be considered. The water-consolidated macadam construction has been almost entirely superseded by the tar macadam or similar construction. Without going into a detailed description of the method of construction of a high grade macadam road of modern development, such discussion being beyond the scope of this necessarily brief article, the average initial cost of construction per mile of 18-foot roadbed is very close to $12,000. The use of such roads is of necessity limited nowadays to comparatively small towns and as connecting highways between various cities or towns, etc., and are the most common class of rural highway construction. Their average maintenance charge should not, if the road is properly constructed, exceed $1,000 per mile per year, and they should not require renewal or reconstruction for a period of 10 years, at the expiration of which period they should be thoroughly overhauled and renewed at an average cost of about $6,000 per mile.

To arrive at the 20-year cost of a road, the measure of its true or net economic value, the various capital charges must all carry a certain rate of interest for the