Vitrified Brick.—The constantly increasing use of vitrified brick for paving both urban and rural highways makes the consideration of this class of road construction of particular and important interest at this time. In fact, it is this class of road construction by which its enthusiastic advocates plan a certain upheaval of past road building methods. Unquestionably the construction is economical and possesses many excellent points for both city and country roads, so that its adoption in many instances is good economic practice, even if not so in all cases. In all cases, unless local conditions are extremely favorable to some other kind of road, the vitrified brick highway built of brick on edge and supported by a suitable concrete foundation is the construction possessing the greatest 20-year economic value—i.e., the construction with the lowest 20-year cost. Another method of brick construction is the use of the brick laid flat as paving. The former method requires nearly 50 per cent. more brick for a given area than does the latter and correspondingly the average normal life of the type requiring the greater number of brick is more than twice that of the latter method. The average life, during which only comparatively light yearly maintenance charges are necessary, of the two methods of laying the paving being from 20 to 25 for the one and about 10 years for the less durable construction. The initial cost of the two types of vitrified brick roads, disregarding the cost of foundations or excavation, which is about the same for either, is, for brick on edge, about $21,000 per mile of 18-foot roadbed and, for brick laid flat, about $11,000 per mile. The former construction, having a life of 20 years or more, requires no renewal expenses during a 20-year period, simply a quite nominal maintenance charge of about $50 per mile per year; the latter, having a life of but 10 years, requires complete rebuilding at the expiration of that period at a cost of about $11,000 per mile, and during the years in which simply a maintenance charge is necessary for keeping the road in good repair, this maintenance charge amounts to about $55 per mile per year. For urban service, the thickness of the suitable concrete foundation is about 6 in., while for rural roads a 4-in. concrete foundation is generally all that is required. Formulæ III. and III.-a give the average 20-year cost of vitrified brick roads of

Derivation of Formula III and III-a, 20-year cost of Brick Highways.

Vitrified Brick Highway—18-ft. roadbed.

Note:—I=yearly rate of interest.

	Capital charges.	Interest charges.
Initial cost per mile—		
No foundations—brick on edge..	$21,000	
Flat	11,000	
Concrete foundations	1,100 x t	
Interest on initial costs (20-yr.)—		
No foundations, brick on edge..		21,000 x 20 x I
Flat		11,000 x 20 x I
Foundations		1,100 x t x 20 x I
Maintenance charges per mile		
brick on edge (19 x $50)	950	
Flat (18 x $55)	990	
Interest on 19 increments of $50 each, equivalent to		50 x 190 x I
18 increments of $55 each, equivalent to		55 x 179 x I
Renewal charge (end of 10 years) brick laid flat	11,000	
Interest on renewal charge		11,000 x 10 x I

20-year cost per mile (brick on edge) = 21,000 + 1,100 x t + 420,000 x I + 22,000 x t x I + 950 + 9,500 x I.

20-yr. C = 21,950 + 1,100 x t + (429,500 + 22,000 x t) I.

Formula III.

20-year cost per mile (brick laid flat) = 11,000 + 1,100 x t + 220,000 x I + 22,000 x t x I + 990 + 9,845 x I + 11,000 + 110,000 x I.

20-yr. C = 22,990 + 1,100 x t + (559,845 + 22,000 x t) I.

Formula III-a.

Example 3.

Required:—20-year cost of vitrified brick roads (18-ft. roadbed) per mile, money at 2, 3, 4 and 5 per cent. per annum—concrete foundations, 4″ and 6″ thick.

Brick laid on edge (urban service, foundations 6″ thick).

At 2% = 21,950 + 6,600 + (429,500 + 132,000) 0.02 = $39,780.00
3% = 21,950 + 6,600 + (429,500 + 132,000) 0.03 = 45,395.00
4% = 21,950 + 6,600 + (429,500 + 132,000) 0.04 = 51,010.00
5% = 21,950 + 6,600 + (429,500 + 132,000) 0.05 = 56,625.00

Brick laid on edge (rural service, foundations 4″ thick).

At 2% = 21,950 + 4,400 + (429,500 + 88,000) 0.02 = $36,700.00
3% = 21,950 + 4,400 + (429,500 + 88,000) 0.03 = 41,875.00
4% = 21,950 + 4,400 + (429,500 + 88,000) 0.04 = 47,050.00
5% = 21,950 + 4,400 + (429,500 + 88,000) 0.05 = 52,225.00

Brick laid flat (urban service, foundations 6″ thick).

At 2% = 22,990 + 6,600 + (559,845 + 132,000) 0.02 = $43,426.90
3% = 22,990 + 6,600 + (559,845 + 132,000) 0.03 = 50,345.35
4% = 22,990 + 6,600 + (559,845 + 132,000) 0.04 = 57,263.80
5% = 22,990 + 6,600 + (559,845 + 132,000) 0.05 = 64,182.25

Brick laid flat (rural service, foundations 4″ thick).

At 2% = 22,990 + 4,400 + (559,845 + 88,000) 0.02 = $40,346.90
3% = 22,990 + 4,400 + (559,845 + 88,000) 0.03 = 46,825.35
4% = 22,990 + 4,400 + (559,845 + 88,000) 0.04 = 53,503.80
5% = 22,990 + 4,400 + (559,845 + 88,000) 0.05 = 59,982.25

18-ft. roadbed, the former for roads where the paving is laid on edge and the latter where the brick is laid flat, the derivation of which explains the various charges that such roads must carry. Example 3 gives the average 20-year cost of these roads for both city and country service and a comparison of these costs with similar costs for any other class of road construction indicates that for a 20-year period such roads are apparently the most economical that can be constructed and explains the keen interest that has recently been taken in this class of road by administrative bodies.

Wood Block.—Noiselessness is the main advantage of any wood block paving and, though their slipperiness in wet and wintry weather is a drawback, they find a true economic and satisfactory use in city service. Both hard and soft wood blocks are used, the former usually simply being dipped in a mixture of tar and pitch or creosote oil before being laid, while the impregnating mixture is forced into the latter type of wood block under suitable pressure. Both kinds of blocks are laid upon foundations of concrete, floated in cement and grouted in either cement or pitch. Expansion and contraction, which ordinarily is greater and harder to control with the hard wood block, is taken care of by providing an expansion space along either curb, which space is usually filled with puddled clay. As in the case of all city streets, the width of roadbed is usually more than 18 feet, but, as the cost of any class of road depends directly upon the width of its roadbed, the 20-year cost of such roads will also be considered as 18 feet, so that ready companison of its true economic value can easily be made with the other classes of construction that have been and will be considered. The hard wood block paving is the more costly but it also has a somewhat longer life than the soft wood block paving and the latter carries a heavier maintenance charge per year. The various charges incidental to the two classes of wood block paving are itemized in the derivation of the Formulæ IV. and V., the former of