

rough granite or whin block, its use is limited to such physical conditions on account of its noise and its roughness to automobiles and pleasure vehicles, and its destructive effects on horses' hoofs. Asphaltic mixture pavements, on the other hand, are noiseless, practically dustless, and afford easy and pleasant locomotion, but in wet and frosty weather many types of this pavement are slippery, particularly on average grades, and are therefore unsuitable for heavy teaming traffic.

Such instances emphasize the need for care and discretion in the selection of a class of pavement to be adopted in any city street—conditions which at best only require the exercise of commonsense judgment.

Width of Pavements.—This is an important feature of pavements, which is frequently lost sight of in designing city streets. Neglect of fundamental principles in the adjusting of the width of the pavement often gives rise to subsequent widening and reconstruction at heavy expense. Purely residential streets and business streets should be treated on their own merits and semi-residential streets destined to become business streets should have special consideration. Traffic conditions present and prospective should always be duly considered, as not infrequently an important street will subsequently be selected because of its preferable grades or location for a car line and unfrequented thoroughfares may become business streets owing to the location of works or factories, or railway and dock terminals. An excessively wide pavement on a residential street is an unnecessary and extravagant expense inasmuch as it is expensive to maintain and clean, while a narrow pavement on, say, a car line street is a source of danger and tends ultimately to congestion of traffic, and resultant financial loss to the travelling and business public. In residential streets primary attention should be paid to aesthetics; in business streets the study of traffic conditions should have first consideration.

Construction of Pavement.—Next in importance to the selection of type of pavement is its construction. The permanent value of any pavement, be it of the poorest type, depends to a very great extent on the discriminating selection of the materials which form the component parts of the pavement, and the care, efficiency and thoroughness used in the grading or mixing of materials, and in the actual laying down of the pavement. In paving, as in any other class of construction, the greatest stress should be laid on the studied and systematic attention to the all-important details, and the necessity for taking pains, as close, careful and scrutinizing inspection is necessary right from the drainage and preparation of the subgrade to the finishing touches on the wearing surface. Instances are known to us all of the best types of pavement turning out poor and unsatisfactory just because of carelessness in construction, or laxness and indifference in inspection, while many comparatively poor types of pavement often stand the test of time and traffic because materials and workmanship employed thereon were of the best procurable. For instance, bituminous pavements which appear to be best adapted for this climate have been laid under similar conditions, but have produced dissimilar results, chiefly due to defective materials and more defective construction. Again, wood block pavement, which has been so much condemned in this neighborhood, is one of the best pavements to be seen in most European cities and in Australia, because the blocks used and the methods of construction are entirely different to those in vogue in most American cities.

Brick, concrete, dolarway and the various asphaltic mixtures are the chief pavements upon which the atten-

tion of engineers has been concentrated of late. The adoption of the various types for highway construction obviously depends on the varying conditions and circumstances—the location and grades on which they are to be built, and the particular use to which they are likely to be put. A brief reference to each type of pavement may suffice to demonstrate their demerits and merits and their usefulness or otherwise, particularly as applied to main rural highways.

Brick.—The adoption of a brick pavement necessitates the use of an unyielding concrete foundation upon which their stability and durability so greatly depend. The high cost of a concrete foundation, particularly in districts where transportation facilities are not good, and the excessive cost of the bricks, renders this class of pavement heavy in first cost. The objects aimed at in their adoption are the furnishing of a double wearing surface, which will have the minimum of traction resistance and the maximum of wearing resistance. The cheaper ordinary brick, which figured so much in earlier construction, has now been supplanted by the more expensive vitrified brick. The principal advantages of brick pavement are:—

- (1) The sure foothold they afford for horses.
- (2) Their special adaptability to heavy grades.
- (3) The comparatively little dust and mud which they yield.
- (4) The ease and expedition with which they can be repaired.

Their durability under moderate traffic.

The principal disadvantages are:—

- (1) Their excessive first cost.
- (2) The lack of uniformity in the quality of the bricks, some bricks being softer and more porous than others.
- (3) The lack of evenness and regularity in the wearing surface.
- (4) Their disagreeable noise under team traffic.

Finally, as laid on a rural highway, they appear to be out of all harmony with the remainder of the road and are, therefore, of little or no aesthetic value. However, with the perfecting of a more uniform and properly vitrified brick and the improvement in the modes of construction, there is little doubt that this form of pavement will shortly be more in general adoption on arterial highways.

Concrete.—Until quite recently the use of concrete in the construction of pavements was wholly confined to the foundation, but pavements entirely composed of concrete are now being more generally adopted, not only in city streets but also on rural highways. As in every type of composite pavement, their success depends upon the proper grading of the best procurable materials, and on the workmanship being of the highest order. The advantages claimed for such roadways are:—

- (1) The low first cost. It is contended that they cost little more than the bare cost of the foundation used for other composite pavements.

(2) The pavement is a monolith, and therefore the wearing surface cannot separate from the foundation as in other composite pavements.

(3) The surface can be made rough or smooth as desired to meet different conditions.

(4) They require no subsequent coating of material to protect them from the wear and tear of traffic.

(5) They are impervious to injurious oils and gases which affect bituminous pavements in particular.

(6) They strengthen with age.