of handling be freely discussed to promote a more general demand among consuming roads and to offset a well established unjust prejudice against their use.

SAND CUSHION vs. MORTAR BED FOR WOOD BLOCK PAVEMENTS.*

IT has been the custom for many years to lay wood block pavement on a concrete base with a cushion of sand or a bed of mortar between the base and the blocks. At present in European cities the concrete is laid perfectly smooth and the blocks are placed directly thereon, though 15 years ago a mortar bed was used in London. In order that the reasons for the American practice may be discussed with understanding, the specifications as used in the Borough of Richmond, City of New York, follow:

On the surface of the concrete shall be placed a bed of [sand] dry mortar, composed of one (1) part of cement to four (4) parts of sand, one-half (½) inch thick.

On the surface of the mortar bed shall be set strips of wood three (3) inches wide by one-quarter (¼) inch thick, of strips of steel of the same width by not less than one-eighth (⅛) inch thick, and of the greatest length convenient for handling. These strips shall be carefully set parallel and about eight or ten feet apart, running from curb to curb, and be imbedded in mortar throughout their lengths, so that the top surface shall be the required depth below and parallel to the grade of the finished pavement. The space between two strips having been filled with mortar, a true and even top surface shall be struck by using an iron-shod straight-edge on the strips as a guide, and as soon as the bed has been struck, the strips which would interfere with laying the blocks shall be removed and their places carefully filled with mortar.

On this mortar surface, spread and smoothed as above to the proper crown and grade, the blocks are to be laid with the grain up, with close joints, and uniform top surface, in courses at right angles to the line of the street, except in and between car tracks, in intersections and in other special cases, when thy shall be laid diagonally, as shall be directed.

When laid, the blocks shall be covered with clean, fine sand, entirely free from loam or earthy matter, perfectly dry and screened through a sieve having not less than twenty (20) meshes per linear inch. The sand to be swept and brushed into the joints. The pavement shall then be rolled with a four or five-ton roller, and sand spread over the pavement and left on the surface until such time, when, if required by the engineer, the pavement shall be swept clean for final inspection, and any defects then noted shall be remedied.

It would seem from the foregoing that a sand cushion was intended primarily to smooth out the roughness and inequalities in the concrete, so that the blocks might rest evenly thereon. Secondly, the yielding surface of the sand permits the roller to press the blocks into it until they present a smooth surface adjusting the slight inequalities in the depth of the blocks, and thirdly, the sand has a slight resiliency and protects the blocks somewhat from surface wear. The mortar bed performs the same office as the sand as an equalizer of the concrete surface and the surface of the finished pavement, but there the similarity ceases, for, as the mortar gradually sets it forms a hard, unyielding bed for the blocks to rest upon, sacrificing resiliency for immobility.

There are two objections, in the writer's opinion, to the use of a sand cushion. First, when cuts are made for any purpose through the pavement, it frequently happens that weeks and months elapse before repairs are made; during this time, storm water works its way between the blocks and base and disturbs considerable quantities of pavement that will have to be relaid. This is especially noticeable on streets with a considerable grade, and could not occur with a well set mortar bed. Second, it would seem that even the slight resiliency of the sand cushion would mean the unstable condition of each block with respect to its neighbors, and a consequent lack of support on sides and ends which is of the utmost importance.

The one objection to a mortar bed has always been that the mortar has been mixed damp and time must be allowed for it to set hard (three or four days), before traffic could be admitted, whereas wood block pavement on sand cushion can be thrown open for traffic as soon as completed. The writer has overcome this objection by mixing the mortar dry, and allowing it to set as moisture reaches it through the joints, which are always of sand. The roller and immediate traffic work the blocks down to their final beds before the mortar sets. Work of this kind has been examined at plumbing cuts and it has been found that the mortar was set up hard, though traffic had been allowed on the new pavement as soon as completed, and the surface was still uniform.

The fact of the lack of use of sand or mortar cushion in the practice of European countries would appear to indicate their opinion that a firm and unyielding bed for the blocks was the main consideration, relying entirely on the fibre of the wood for resiliency.

Asphalt blocks have for many years been laid on a mortar bed and this method has evidently been adapted for use in laying wood block pavement. Some six years ago the writer used a damp mortar bed for a wood block paving contract. One day the roller broke down at a time when a large yardage of block had been laid and was ready for rolling. Before the roller was repaired the mortar had set and the pavement on this section was never as perfect as on those adjoining. For this reason a sand cushion was substituted for a mortar bed in the specifications until last year, when dry mortar was permanently adopted. In the writer's opinion, mortar is superior to sand for a bed for wood block pavement.

* Read before American Association for the Advancement of Science by Theodore S. Oxholm, Bureau of Engineering, Richmond Borough, New York City.

TRANSVERSE TESTING OF CAST IRON.

In the Journal of the Iron and Steel Institute Mr. G. Hailstone describes a special machine which has been designed for making transverse tests on cast-iron bars of different dimensions. A series of tests has been made on a range of mixtures from weak to strong cast-irons using test-bars 2 x 1 inch in section tested on 36-inch centres and 1 inch square bare tested on 12-inch centres. The results show that the ratio of the strengths is 1.153 for machined bars and 1.146 for bars tested with the skin on, instead of 1.333 as originally allowed for in the standard English specifications. The best standard test-bar, giving the most consistent and comparable results is the one cast to 2⅛ x 1⅛ inches in section and 42 inches in length and machined to 2 x 1 inch and tested on 36-inch centres. The rate of loading should not exceed one hundredweight in 15 seconds, this being a very convenient rate.