materials, and it is the same when using slag, and it is there that the trouble of the varying composition of the slag comes in. Still, with reasonable care and a competent chemist, this difficulty need not be insurmountable. There is, however, in addition, the mechanical difficulty that slag cement clinker is particularly hard to grind satisfactorily, and failure to appreciate that fact has been the cause of much trouble. Still, with adequate grinding plant the grinding can be effectively carried out. Then, again, slag Portland cement, owing possibly, remarks Mr. Day, to its high alumina content, is naturally very quick in setting. This, however, can be readily adjusted by known means, so that any specified setting time can be obtained.

The following table shows in what way slag Portland cement is not in accordance with the British Standard Specification, and how it compares in its properties with cement produced from limestone and clay.

| | British Standard Specification for Portland cement. | Aberthaw "Druid" brand Portland cement | Slag Portland cement. |
|---|---|---|---|
| Neat (a) 7 days ... | 450 lb. | 644 lb. sq. in. | 623 lb. sq. in. |
| Tensile (b) 28 days... | $a + \frac{40,000}{a}$ or, say, 539 | 783 ,, | 729 ,, |
| Sand (c) 7 days .... | 250 | 283 ,, | 207 ,, |
| Sand (d) 28 days.... | $c + \frac{10,000}{c}$ or 290 | 382 ,, | 280 ,, |
| Specific gravity .... | Not less than 3.1 | 3.203 | 2.96 |
| Expansion ..... | Not to exceed 10 mm. | .66 mm. | 1.5 mm. |

It will be seen that whereas the slag cement has a plentiful margin in excess of the standard requirements as regards neat briquette tests, both at 7 and 28 days, the strength of the sand briquettes is not equal to standard requirements. The 28-day test, however, is not greatly below the standard figure and the rise in strength between 7 and 28 days is greater than is expressed by the formula $c + \frac{10,000}{c}$. It will be noticed, too, that the specific gravity is low.

Slag Portland cement is usually manufactured on the dry or semi-dry system, but Mr. Day, in conjunction with some clients, is carrying out some experiments with a view to manufacturing on the wet system. So far, we gather, these experiments give promise of success. Mr. Day strongly recommends blast-furnace owners to consider seriously the question of turning their slag into cement.

In the discussion following the paper it was pointed out by a speaker that the sulphur in blast-furnace slag would disintegrate the cement and therefore it would be necessary to take very great pains in removing the free sulphur from the slag. For reinforced work the use of slag cement would be very dangerous. Other speakers mentioned cases in which slag cement had been successfully used. It appears that with very efficient inspection and proper tests of each shipment, and the storage of the cement until the laboratory results are known, that slag cement for certain uses is economical and efficient, employing as it does a product which otherwise is more or less wasted.

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In proceedings by one railroad company in United States to condemn for railroad purposes the land of another, the Pennsylvania Supreme Court holds that the fact that the latter had ceased to operate did not limit the damages to the value of the ground for agricultural purposes, but permitted recovery on the basis of its value by reason of its availability for the location of a railroad.

## STANDARD FORM FOR CONCRETE ROADS.*

THIS form is for the concrete pavement only. Cost of other items, such as grading, drainage, bridges, culverts, railings, etc., should be kept separately. In consideration of the items mentioned, a division should be made indicating those portions of the highway improvement which can be considered as permanent as differentiated from portions which will need renewal in the course of time. Such a distinction is necessary in order to work out any reasonable system of highway financing.

Name and Location of Road.....
Length .....Width .....Thickness .....
Proportions of Mix.....Number of Cubic Yards.....

| | | Per Cu. Yd. |
|---|---|---|
| 1. *Labor: | | |
| On subgrade | $..... | |
| On forms | ..... | |
| Material to mixer | ..... | |
| Mixer to place | ..... | |
| Covering and cleaning | ..... | |
| Total labor | $..... | |
| 2. Concrete Materials: | | |
| Cement, f.o.b. | $..... | |
| Hauling | ..... | |
| Storage | ..... | |
| Lost sacks and waste | ..... | |
| Sand, f.o.b. | ..... | |
| Unloading | ..... | |
| Hauling | ..... | |
| Stone, f.o.b. or in bins | ..... | |
| Unloading | ..... | |
| Hauling | ..... | |
| Total concrete materials | $..... | |
| 3. Water: | | |
| Charge for | $..... | |
| Piping | ..... | |
| Pump | ..... | |
| Labor, etc. | ..... | |
| Total water | $..... | |
| 5. Plant for forms (interest and depreciation) | ..... | |
| 6. Reinforcement | ..... | |
| 7. Joints | ..... | |
| Total cost concrete pavement | $..... | |

WAGE SCALE.

Superintendent .....Teams .....Common labor.....
Assistant superintendent.....Auto trucks.....
Skilled labor.....Length of working day.....

(Remarks on features of plant and materials which have special bearing on costs.)

* Includes supervision.

It will be noted that the form calls for reporting the cost on a cubic yard and not on a square-yard basis. The latter has been a popular method of reporting city paving costs, but the former is probably now the prevailing practice on concrete road work. The cubic yard system has the disadvantage of preventing ready comparison with the costs of other types, but possesses other advantages which, in the committee's judgment, more than counterbalance the disadvantage. The square-yard basis, on the other hand, is not definite, for it neglects the thickness of pavement, making comparison between two concrete slabs of different thicknesses difficult. The cubic-yard basis is not open to this objection. The cubic-yard method of reporting gives repeated checks on the amount of stone and aggregate used and on the thickness of pavement itself.

*From report of Committee to National Conference on Concrete Road Building.