

tional work are the tops of copings which are fine pointed (but not bush hammered), and the faces of the parapet walls which are rough pointed to facilitate erection of iron work.

The copings were clamped, as shown in plan of abutments, with flat <sup>10"</sup> clamps of 1½" x ½" section sunk in level and then flushed over with a thick grouting.

The sandstone used was from the coal measures of the carboniferous, and underlies the 9-foot Connellsville coking vein about 100 feet. It is very easily quarried and rifts easy and true to bed, and is so full of quarry snags as to make it very easy cutting. But, on exposure, it hardens rapidly, and in that climate stands weathering well.

The cement used was the Louisville Black Diamond, a very good Rosendale, if used when fresh, but deteriorating rapidly with age. It is of a dark slate color, very uniformly ground, has no free lime to notice, and will stand 45 to 60 lbs. in 24 hours. It was shipped in paper bags, which saves about 20 cts. per bbl., and costs \$1.10 per bbl. delivered in Morgantown, W. Va., on cars. Ordinary mortar was mixed 1 cement, 2 sand, and kept continually and thoroughly tempered on the wall until a box was used up. As this is a quick setting cement, this was very necessary, and experiments lately made in Ohio show that cement so tempered does not lose much strength for one or two hours, but if tempered for a long time, say eight hours, will reduce its strength about 50 per cent. at end of one week, and 40 per cent. at the end of seven weeks.

The concrete in abutments was mixed 1 cement, 2 sand, filled with stone, broken for a 2" ring. The mortar being made as usual, by mixing cement and sand thoroughly before adding water, and then being thoroughly mixed again before adding the stone. This is particularly mentioned, because most contractors (because it is cheaper) and some engineers even make concrete by putting down alternate layers of sand, cement and stone dry, and then add water, and mix by repeated turnings over. This the writer does not consider will blend the sand and cement so thoroughly as in the first method, or give as good results. The concrete was then put down in 9" layers, and rammed with a 2-man rammer, until water stood on the surface.

In pointing the masonry, all joints were raked out for one inch in

depth and pointed thus  $\frac{\text{Stone}}{\text{Mortar}} \frac{\text{Stone}}{\text{Mortar}}$  with mortar mixed 1 sand, 1

cement, which seems in practice to give better results than neat cement mortar, as the latter cracks badly if applied in hot weather.

The timber work was commenced August 23th; masonry work commenced September 24th, 1892; suspended January 10th to March 1st, 1893, owing to river being frozen, and completed April 30th, 1893, or a total of 167 working days, in which time was built:—

367	cubic yards of timber,
250	" " concrete,
3,710	" " masonry.
4,327	" " Total,

of which all but the concrete was laid by one gang, or at an average of 25 cubic yards per day, including all stoppages from rain and other incidents.

On one occasion in Pier I, 200 cubic yards were laid in 48 hours, working relays every 12 hours.

The cost of the structure is as follows:—

4,327 c. yds. Masonry, timber and concrete at \$11.00	\$47,597.00
2,085 " Rip-rap..... at 2.50	4,652.50
2,085 " Dry Earth Exc. .... at .50	1,042.50
179 " Dry Rock Exc. .... at 1.00	179.00
1,776 " Wet Exc. .... at 2.00	3,552.00
Superstructure, estimated to cost \$33,000.....	33,000.00
Total.....	\$90,023.00