

FIG. 4.—CULVERT UNDERNEATH EMBANKMENT.

The "substructure" of a railway consists of everything which goes to form the foundation of the rail-system. A leading principle is to have as few bridge openings as possible. Wherever practicable the streams are conveyed beneath the track through covered archways in a continuous embankment. So also, in crossing valleys, embankments are preferred to viaducts, as safer, more enduring, and generally less costly.

Sometimes it is found necessary to divert a river from its channel in order to construct a road-bed for the railway. This is done as shown in cuts 2 and 3.

In the left-hand margin of Fig. 2 is shown the framework of cedar timbers, faced with stone, as a precaution against the wearing action of flood-water on the newly-formed earthwork. To the right hand of the cut is seen the roadbed, encroaching on that of the river.

In Fig. 3 is shown a similar construction, only instead of crib-wharfing the slope of the embankment is faced with large-sized stones.

The culverts or openings under the railway for streams of water are constructed in the most solid manner. The foundations are carried deep below the frost or quicksands, and every

precaution is taken against the undermining effects of currents of water.

Where the road passes at a sufficient height above the bed of the water-course, a culvert is adopted. The heavy mason-work is first built in the most substantial manner, and the earthwork embankment is afterwards filled in on each side of the culvert, the track running transversely across that structure. Cement is now often used for this purpose. (Cut 4).

Where the height of the road above the water will not allow the use of the semi-circular arch—or where a flatter arch will still allow sufficient vent for the water, a segmental arch is often employed. (Cut 5). This arch is thirty feet wide, and springs directly from the sandstone rock. It is built under an embankment sixty feet high, and the tunnel thus formed is consequently nearly two hundred feet long. The cut is from a photograph taken before the heavy embankment was carried over the arch. The comparative size of the standing figure will show the truly Cyclopean character of the stonework.

In these massive structures no attempt whatever at ornament was made. Such pettiness, indeed, would have been conspicuously out of place.

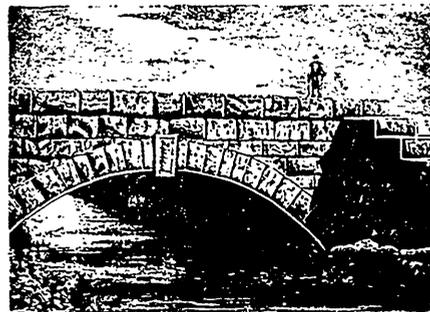


FIG. 5.—SEGMENTAL ARCH CULVERT.