apportionment commission. This can ordinarily be done if both sides are reasonable.

(d) It is doubtful if the railroad company should ordinarily be charged for additional convenience due to the reconstructed bridge. This, however, is a matter the settlement of which hardly comes into the province of the engineer.

## DIFFERENT SECTIONS OF SHEET PILING FOR VARIOUS CONDITIONS.

HE views shown herewith illustrate the use of sheet steel piling on several Canadian construction jobs. The first shows the cofferdams for the pier foundations of the Winnipeg-St. Boniface traffic bridge. The piling used in this work was in 35-foot lengths and

penetrated about 25 feet of clay and 7 feet of hardpan. The other illustration relates to the north wall of the Don River diversion in connection with the Toronto harbor

were then driven to final position.' These cofferdams were thoroughly watertight, and the contractors, Messrs. Macdonald and McCougan, state that the driving costs were very reasonable. After completion of the picr foundations the piling in these cofferdams was pulled by four and five-sheave wire rope blocks and found to be in good condition. It is the intention to use all of the steel sheet piling three or four times before completion of this work.

The Lackawanna Steel Company have furnished us with the following descriptive notes concerning the piling used on jobs such as those referred to above.

The section is of the double interlock type with similar hooks and guards on each edge. The hooks of adjacent sections engage to offer the greatest resistance to longitudinal displacement while the guards overlap and engage the outer surfaces of the hooks on the adjacent sections, thus preventing lateral displacement and cooperating to prevent longitudinal displacement. The contact surface in the joint is increased to three points (or

lines) so that there is a positive, double, firm and close interlock, yet a minimum of friction in driving or withdrawing and ample opportunity for material to work into the joint and render it watertight.

The section, being entirely integral, without riveting or other assemblage at the interlock, is without excessive weight or weakness and drives with little difficulty. A pile that drives easily pulls easily, so this type of section has considerable

duce a flexible joint between adjacent piles. A change of direction of from 16° to either side of the piling line with the smallest, to 20° to either side with the other sections is quite practicable. For example, a right angle may be turned with

Fig. 1.-Cofferdam Work on the Winnipeg-St. Boniface Bridge.

and waterfront development, described in The Canadian Engineer for June 10th, 1915. The use to which the sheet steel piling has been put in this instance is adequately explained by the photograph.

In both of these instances the sheet piling used is of Lackawanna make. In the Winnipeg-St. Boniface job, although sunken logs were encountered, an Arnott No. 2 hammer drove the piling without having to deflect the piling line. Where the logs were encountered, driving was temporarily stopped until, after partial excavation, the logs were removed. The retarded piling sections six 7-inch and with five of any other Lackawanna sections. The advantages of this flexible interlock in turning angles to pass obstructions, are clearly shown in Fig. 3. Small sumps, pits for pumps, circular caissons for foundations and the like can be made from this steel piling without bending the webs and without fabrication.

Clearance in the interlocked joint admits of great latitude in correcting the plumbness of each pile without distorting the interlock, should carelessness in driving or inequalities of the bottom throw the pile seriously ahead or behind.

