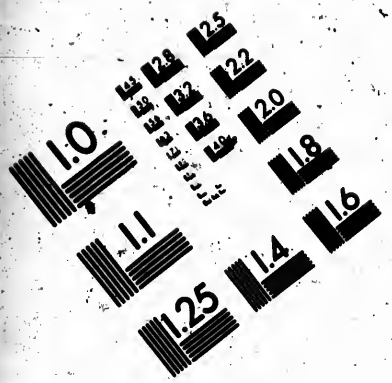

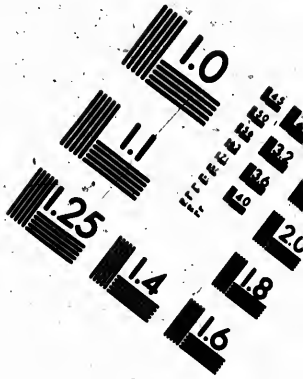

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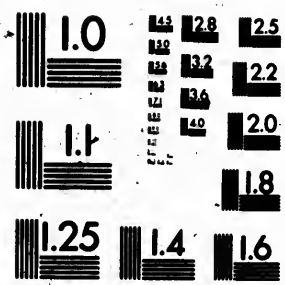
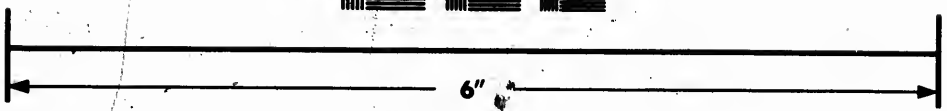
TEST TARGET (MT-3)





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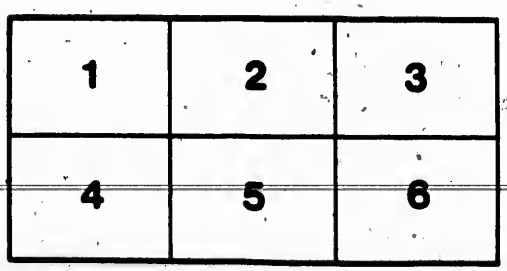

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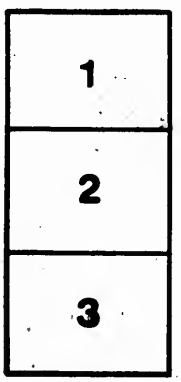

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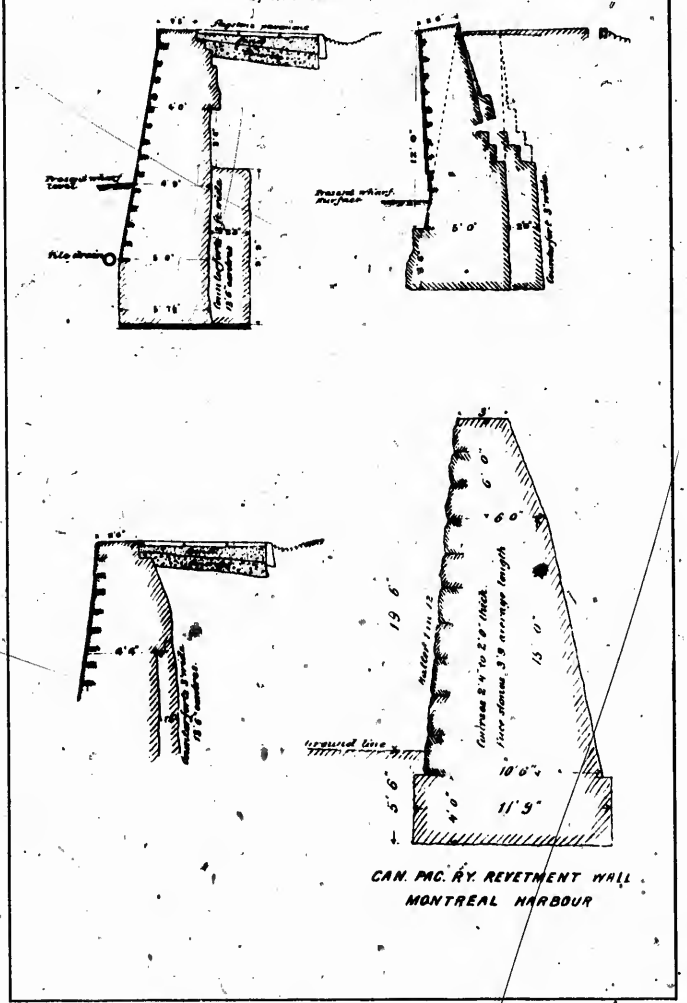
AN OLD REVETMENT WALL.

By W. J. SPROULE, M. E.



for a long period in winter one to three feet up on the face of the wall, fluctuating one to two feet with variations in the temperature of the weather. Part of the wall in this way is often exposed to temperatures 15° to 20° below zero after being immersed in water for days or weeks. But this does not seem to be the determining cause of failure, for the best and worst parts of the wall have been equally exposed to these conditions. The masonry on the inclined surface of the ramps, however, at about one to three feet above wharf level is much displaced. The wall is built of limestone from quarries in the vicinity of Montreal. A few stones are cracked and somewhat weathered, but sufficient disintegration has not taken place in the stones

Canadian Society of Civil Engineers.

INCORPORATED 1887.

TRANSACTIONS.

AN OLD REVETMENT WALL.

By W. J. Sproule, Ma. E., M. Can. Soc. C.E.

To be read Thursday, 28th January, 1892.

The old Revetment Wall along the city front in Montreal Harbor is a very instructive example for Civil Engineers—more instructive than modern examples of massive masonry which show no signs of failure and in which there may be much surplus strength, and hence much unnecessary capital buried. It is an example of a wall so nearly equal to the requirements that part of it remains in good condition, while part has failed. The accompanying cross sections show that the wall is much lighter than the practice of the present day warrants for similar situations, as is seen by comparing its cross section with that of the Canadian Pacific Railway revetment wall recently built, and yet after fifty years' duty a considerable part of the wall is but little disturbed and with a similar rate of degeneration would not be in bad condition fifty years hence, while part has failed so badly that it became unsafe, and timber props were resorted to several years ago. Part of the wall was built in 1831 and part in 1840-41. The failure during recent years has been very gradual and the displacement probably nearly equal from year to year. Parts of both the older and newer portions of the wall have failed. Their cross sections differ but little. This seems to indicate that the wall of 1831 had not shown signs of failure in 1841, otherwise the newer wall would likely have been built heavier. The wall is an ordinary retaining wall to support a city street. In the rear the ground rises rapidly in part, and in part is level for a considerable distance back. The wall is about one mile long, and on the harbor side is bare for a height of about ten feet from the wharf level to the coping.

In the beginning of winter, but always after a considerable interval of severe frost, in which the thermometer usually goes below zero, the river rises until the wall is partly immersed, the average height reached by the river at the "taking" of the ice being, for the last forty years, a level within five feet of the coping of the wall, varying, however, much from this level, often being lower and frequently nearly up to the coping. After the ice becomes stationary on the river the water falls gradually and usually recedes from the foot of the wall, but at times remains for a long period in winter one to three feet up on the face of the wall, fluctuating one to two feet with variations in the temperature of the weather. Part of the wall in this way is often exposed to temperatures 15° to 20° below zero after being immersed in water for days or weeks. But this does not seem to be the determining cause of failure, for the best and worst parts of the wall have been equally exposed to these conditions. The masonry on the inclined surface of the ramps, however, at about one to three feet above wharf level is much displaced. The wall is built of limestone from quarries in the vicinity of Montreal. A few stones are cracked and somewhat weathered, but sufficient disintegration has not taken place in the stones

themselves to perceptibly affect the general stability of the structure. The face is Bush Hammered Ashlar backed with rubble masonry. The face courses vary from ten inches to thirteen inches in thickness, but are in general eleven or twelve inches thick, and the stones in certain parts average three feet in length; in other parts, three feet five inches. The bed joints average 0·22 inches in thickness. The coping stones average five feet two inches in length, twelve inches in thickness and two feet six inches in width. The wall has failed by sliding on the joints especially at eight to ten feet down from the coping or one to two above the wharf, and by revolving on the joints, but as no systematic observations are available, it is uncertain whether these two motions have taken place simultaneously, or that the revolving began after the sliding movement had seriously affected the equillibrium of the wall. The sliding movement amounts to five inches in a single course in certain places, and a very slight displacement on joints seems to have taken place even in the best portions of the wall, but are here so slight as to make it uncertain whether the irregularities observable are due to imperfections in the setting or to subsequent movement. The mortar seems to have lost all its bonding strength and as picked from the joints appears as a granulated mixture of earthy materials and lime. No openings or "weepers" appear on the face of the wall to drain water from behind. Where excavations have been made near the best parts of the wall the foundation is a coarse sand, apparently the old river beach, and this porous material no doubt has served a useful purpose in draining the wall, but the examinations have not yet been extensive enough to warrant the conclusion that the superior condition of the wall here is wholly due to this cause. Fortunately the wall has served its purpose, and must be taken down and entirely obliterated in carrying out the general harbour improvement project lately adopted, and this would be necessary even if the wall were in the best condition. When this is done, something more may be learned of weak points of the wall and of the causes that preserved or destroyed it.