# The Canadian Engineer

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# Reinforced Concrete in Harbor Works

**Causes of Disintegration or Disruption and Means of Preventing Same—Description of Pier No. 2 and of Furness Withy Pier at Halifax—Practice Adopted in Various Ports of the World—Paper Read This Month at Engineering Institute's Halifax Meeting**

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MASS CONCRETE has been used in the development of harbors for practically as long a time as it has been used on land, but the use of comparatively light concrete structures, reinforced with steel embedded in them, only commenced with the present century, and there are few, if any, reinforced concrete marine structures of a greater age than fifteen years. In that short time, however, it has been used extensively in every continent and in every harbor and port of importance.

At first harbor engineers went ahead and used this new form of construction with apparently little or no fears for the future, but of late years their eyes have been somewhat rudely opened, and now it is being realized more and more every year that successful use of reinforced concrete in marine works depends not only on very careful designing and the first-class quality of the workmanship, which means a most rigid inspection

**Fig. No. 1—Furness Withy Pier at Halifax, N.S.**

of the materials and work, but also on the means taken to protect the structure against the elements and other harmful agents.

R. J. Wig, of the U.S. Bureau of Standards, and L. R. Ferguson, of the Portland Cement Association, have recently made a very extensive examination into the condition of nearly every important marine concrete structure in the United States and Canada. In their report they state that "the majority of all reinforced concrete marine structures on the American coasts, subjected to sea water action, are now showing evidences of deterioration or failure, due to the corrosion of the embedded reinforcement above the water line."

That is a very serious and important statement. The structures reported on were in practically all cases less

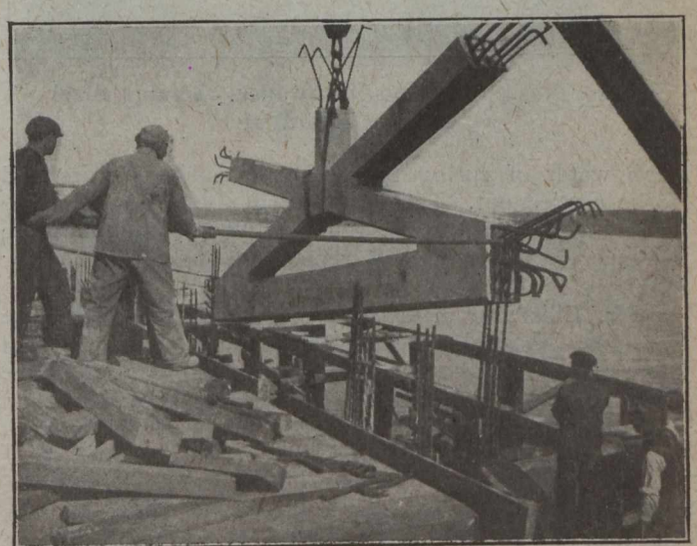

**Fig. No. 2—Furness Withy Pier—Reinforced Concrete Brace Member**

than ten years old at the time of their examination. Many of them had been but recently completed. It means that in the majority of cases in America the use of reinforced concrete in marine structures has not been an unqualified success up to the present time.

These gentlemen further state that their investigations led them to believe that reinforced concrete of excellent quality, designed according to recommendations of engineering societies and present-day practice, is subject to relatively rapid deterioration in most localities. They found, however, that below low water level, reinforced concrete appeared to be safe.

Other investigators have found similar conditions in other parts of the world. S. H. Ellis, in a paper published in Vol. 199 of the "Minutes of Proceedings of the Institution of Civil Engineers," describes finding much corrosion taking place in a steel and concrete wharf in Hong Kong harbor. The wharf was a structural steel