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Present Status of Reinforced Concrete Design

New Cement, Aggregate and Steel May Permit Increased Stresses—Structures Manufactured at Site, Hence Need Expert Supervision—Tests by Emergency Fleet Corporation Indicate Defects in Present By-Laws—Paper before Engineering Institute's Toronto Branch

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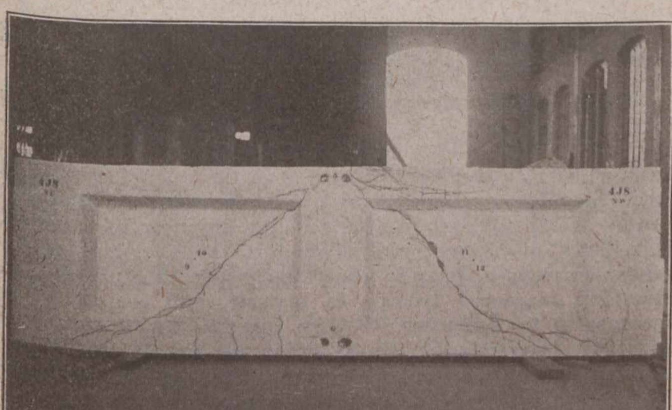
AT one time it was a great achievement to build bridges, dams, high-power engines, etc., and get these works to give service. The cost was a minor consideration; the various works were of such high commercial value that the actual cost of construction bore a small ratio to this value and was therefore a minor consideration. Service was the main consideration.

Conditions have changed. At the present moment the order of the day is service at a price, and a keen price. The commercial competition of the present day is not merely a matter of individual effort; it is now a matter of national importance. A nation that facilitates the quick development of engineering science and then takes advantage of that development is going to be away ahead of a nation that stagnates and provides no machinery by which engineering science can be developed.

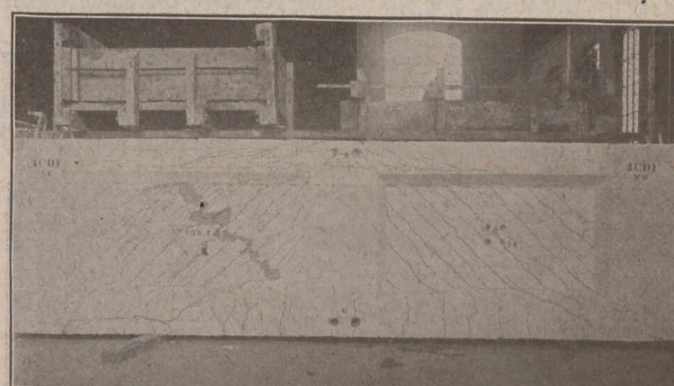
Reinforced concrete as a material of construction offers advantages compared to other materials which in my opinion entitle it to the first place in the consideration of the commercial world of to-day. But Canada stagnates as far as reinforced concrete is concerned. There is no machinery by which engineering science can develop, and we have no reason to be particularly proud of it. We are tied up by a lack of proper understanding, and we are hampered with by-laws in every direction.



TYPICAL FAILURE OF BEAM BY DIAGONAL TENSION

Test by Emergency Fleet Corporation. Steel in this beam not sufficient to take diagonal tension. Note single crack and its width.

Consider for a moment the recent developments in reinforced concrete construction. Firstly, cement: There is a new cement called "Super-Cement," which, I believe, will shortly be put on the market. It is made by mixing a chemical with the clinker before grinding. This new cement shows an increase in strength of upwards of 25% over ordinary cement. Specimens 1 in. in thickness, made one of cement to three of quarry-run sand, have been standing under pressure of gasoline at 115 to 120 lbs. per sq. in. for nine weeks, the variation of pressure from 115 to 120 depending upon the temperature. Specimens four days old, 1-in. thick, using the same mixture, have withstood a water pressure of 30 lbs. per sq. in. Specimens made of one part cement to five parts limestone chippings (crusher run), when seven days old have withstood a water pressure of 28 lbs. per sq. in.



TYPICAL FAILURE OF BEAM BY DIAGONAL COMPRESSION OF THE CONCRETE

Test by Emergency Fleet Corporation. An excess of steel was provided to take diagonal tension and shear. Note large number and even distribution of diagonal tension cracks.

Secondly, aggregate: A new type of aggregate is made by fusing clay under special process. Concrete made from this fused clay, using ordinary cement (one part cement to three parts fused clay aggregate up to ½ in. in size), gave strength of 3,380 lbs. per sq. in. at 7 days, and 4,350 lbs. per sq. in. at 28 days. The weight of concrete made from this aggregate is less than 106 lbs. per cu. ft. Structures made from this concrete show great economy, due to the reduction of deadweight of the structure. The United States government ships were made from this material. In a 3,500-ton ship, the relation of the deadweight carrying capacity and total displacement were 62% for concrete, compared with 65 to 68% for steel and 53% for wooden ships. The fire resistance of fused clay is extremely high.

Thirdly, steel: By physically developing ordinary mild steel, one can increase the stress of the yield point of the material, and also the ultimate stress. This steel is not manufactured in Canada, but is employed extensively in England and elsewhere. In physically developing a square rod (cold-twisting the rod), to get the maximum efficiency of the treatment the corners are always overstressed and