

Enclosure 1 in No. 105.

IMPERIAL ROUTE.—GREAT BRITAIN TO CANADA, AUSTRALIA, NEW ZEALAND, AND HONG KONG.

Report on Proposed Cross-channel Ferry-steamers, by Sir William Henry White, K.C.B., F.R.S. (late Director of Naval Construction, H.M. Royal Navy) to Sir Thomas Troubridge, Bart., 66 Gloucester Gardens, Hyde Park, London, W.

THERE is undoubtedly a popular belief that the transport of railway-trains across the sea in ferry-steamers involves considerable risk. The length, bulk, and weight of a modern railway-train naturally produce an impression that both the operation of placing it on board a ship and its presence on the deck when the vessel is in a seaway must involve serious risk, and must prejudicially affect the stability and behaviour of a ferry-steamer. This popular view has never found favour with naval architects and civil engineers. They have always been prepared to face and solve all the problems involved in the transport oversea of the largest and heaviest railway-trains. Changes that have been made in the propelling machinery and structural materials of modern steamships during the last forty years have all tended to make the work of constructing swift and efficient ferry-steamers more easy, and the introduction of turbine engines has greatly simplified the task.

A first-class passenger *train de luxe* of modern type, providing accommodation for over four hundred passengers, weighs less than 350 tons, exclusive of the engine and tender, which would not be carried across in the ferry-steamer; and has a total length of about 650 ft. To accommodate such a train on the deck of a steamer it would be broken up into two parts during transit; but even then the vessel would necessarily be of considerable length and beam. From the point of view of the naval architect it is a very simple matter to deal with the weight named, seeing that it would be distributed over a length of more than 300 ft. and be carried at a moderate height above water. He is accustomed, especially in warships, to deal with much greater weights carried in a more concentrated form and at much greater heights above water. For example, in a battleship, the armoured stations, the gun-mountings and loading-appliances for a pair of 12 in. guns, the guns themselves, and the armoured shield protecting them, would represent a total weight of over 1,000 tons. This great weight would be concentrated in a length of about 30 ft., and the guns could be carried at a height of 25 ft. to 30 ft. above water. Even after allowance is made for the much greater dimensions of a battleship carrying such an armament, the mere statement of these facts will indicate how much simpler is the problem which has to be faced in carrying the largest and heaviest railway-train in a ferry-steamer.

Special precautions must be taken, of course, in connection with the safe oversea transport of railway-trains. Arrangements must be made by means of which the trains shall be rigidly attached to the vessel, and any motion of the wheels prevented when the vessel is rolling or pitching at sea. This requirement has already been dealt with successfully in many existing ferry-steamers. It is also essential that the vessels themselves shall be constructed to serve as floating railway-stations, with platforms, promenades, and retiring-rooms, into which passengers can pass if they so desire during sea transit.

In regard to appliances for embarking or disembarking trains, careful design is also necessary. Difficulties exist, no doubt, and these vary in different localities; but they can be readily overcome. The use of hydraulic or electrical power insures great rapidity of movement in embarking and disembarking trains and gives absolute control. On the coast of Great Britain and Ireland, where there is a great rise and fall of tide, arrangements are required which are not necessary in non-tidal waters, because of the varying heights of the fixed land approaches above the deck of a ferry-steamer, at different states of the tide. But the engineer readily provides for all such variations. During the operation of embarking or disembarking trains the steamer must, of course, remain in a practically fixed position in relation to the piers and lifts, and must be placed in a sheltered harbour. In practice, the fulfilment of these conditions presents no insuperable difficulty of an engineering nature, although the choice of the ferry-stations at the terminal ports must be greatly influenced by considerations of the points mentioned.

The feasibility and safety of railway-ferry steamers is no longer a matter for debate, the question has been settled by actual experience in various parts of the world. For thirty years past the system has been successfully worked in Denmark, chiefly for the conveyance of goods, but in later years largely for the transport of through passenger-carriages. In 1903 railway ferries were established between Gjedser, in the Island of Zeeland, the steamers making a run of about twenty-seven nautical miles on the open water of the Baltic. This service has been carried out with complete success in all weathers. Two types of ferry-steamers are employed: the first carries an express passenger-train involving a load of about 180 tons; the second is intended chiefly for goods, and has two lines of rails on the deck, the load exceeding 300 tons. The vessels are 285 ft. in length, and average about thirteen to thirteen and a half knots on service. As there is no tidal variation in the Baltic, the operations of embarking and disembarking trains are much simplified and are performed with great rapidity. From six to twelve minutes suffice between the time trains reach the ferry landing-stage and that at which steamers start on the voyage. The longer time is occupied in embarking the heavier trains.

On Lake Michigan, in the United States, railway-ferry boats are also successfully employed on a large scale, making runs of from sixty to a hundred miles across the lake, and facing very severe weather, especially during the winter. Actual observations show that heavier seas are encountered on this service than in cross-channel passages from ports in the United Kingdom. Some of these vessels are 380 ft. in length and about 58 ft. in width. Their machinery is powerful enough to drive them fourteen or fifteen miles an hour; but on service they generally work at lower speeds. These steamers have four railway-tracks on the deck, and can carry thirty railway-cars, each 30 ft. to 40 ft. in length. Experience with these vessels has been quite satisfactory in regard to safe and regular communication and economical transport of goods and passengers.