THE CLOSING OF THE GAPS IN THE WALCHEREN DIKES

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There is a story, well-known all over the world about the brave little boy, saving part of Holland from drowning.

Once upon a day the high sea-waves attacked the dikes of our country and water started to run through a little hole. But there was that little boy, watching the sea and seeing the water pouring through the body of the dike. He was not frightened, of course he was not, because he was a Dutch boy, and so he put his arm in the hole and stopped the seepage. And he stood there the whole day long on his wooden shoes in the mud till the water fell. And that is why Holland is still safe behind its dikes.

Well, gentlemen, I believe this is a good story, even if it is not true. Anyhow it underlines once more the fact, that Holland from old times had to fight the sea. About I/3 of its surface lies below the level of storm-tide,but you must not be afraid, making your trips through our country. Nowadays big and strong dikes, maintained and enlarged from the very beginning of our history up to the present day, form a safe protection against the sea. And that is why we Dutch dikebuilders could hardly believe the news, when in October 1944 the radio told us, that allied bombers had succeeded in breaching the large dikes of the island of Walcheren and that even the famous huge dike of Westkapelle had given way (fig. 1, fig. 2). And all brave little boys in the Netherlands could not prevent the disaster. And to be honest, we did not want to, because we knew quite well, that the island of Walcheren had to be sacrified for the liberation of Europe, being one of the strongest points of the German Atlantic wall in the Sceldt mouth, the entrance to the port of Antwerp.

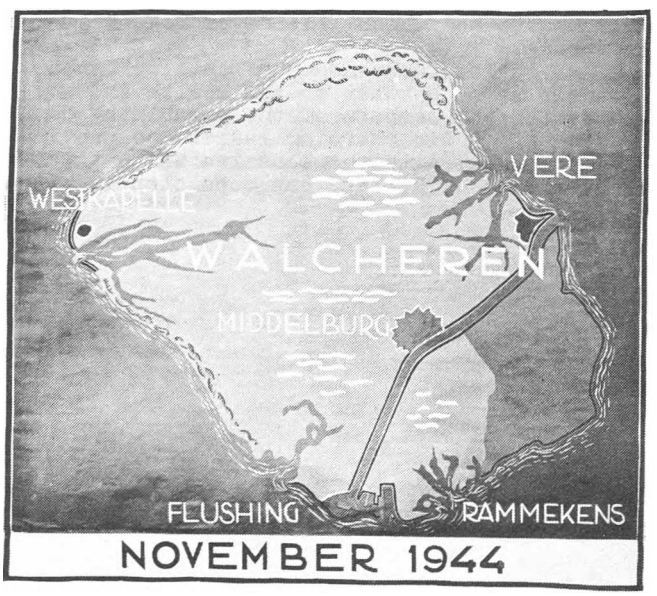


FIG. 1

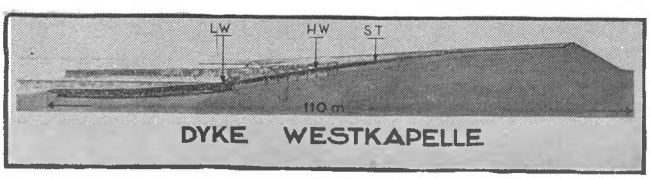
In the very beginning we could not do much. The war went on and there was a total lack of material, of dredging plant, of food, of clothes, of foot-wear, of all things we most needed. And then there were the seamines and thousands of landmines to be lifted before we could start working. So you understand all this together meant a lot of delay and delay meant further scour of the sandy bottom in the four big gaps by the tidal currents, caused by a tidal movement, with a range of four meters, that is 14 feet. I think you can imagine how we felt, standing near such a gap, some hundreds of meters wide, standing in the cold wind that came over the water and hit us and pierced us becauses we were the only upright things in the devastated areas, and seeing the raging currents going in and out, changing their direction four times a day and gnawing at our precious soil.

Well gentlemen, I am not going to tell you the long story of all difficulties we had to overcome. As I told you, our country was almost completely sacked by the Germans, the only thing we had got, was the will to win. We knew that would be an immense task but we did not discuss the chance we had of saving Walcheren. The will of beating the sea is deeply rooted in our tradition. I am sure there was something, that forced us to fight. We fought, and we won,thanks to the help we got from every side.

For us there was only the question how to close the gaps and within half an hour's time I will try to give you an idea of the way we tackled that problem.

This problem was peculiar in so far as a low lying country was flooded, a country protected against the sea by heavy and high dikes. Laymen are often asking how our forefathers could build those dikes with the primitive means at their disposal. I am glad I am among soil experts to day so I can put this shortly.

The answer is of course that at the time of throwing-up the dikes the land was lying at about high water level,which made the construction a simple job. But afterwards the dewatering of the enclosed land caused the ground pressure, the effective ground pressure, to increase and this resulted in a gradual consolidation of the soil layers and more especially of the thick peat layers which occurred at many places Thus the ground surface subsided most where



L.W. - Low Water
H.W. - High Water
S.T. - Storm Tide

FIG. 2

these peat layers were thickest. Moreover this settlement was probably accentuated by a gradual sinking of the whole of the Netherlands with reference to the sea level.

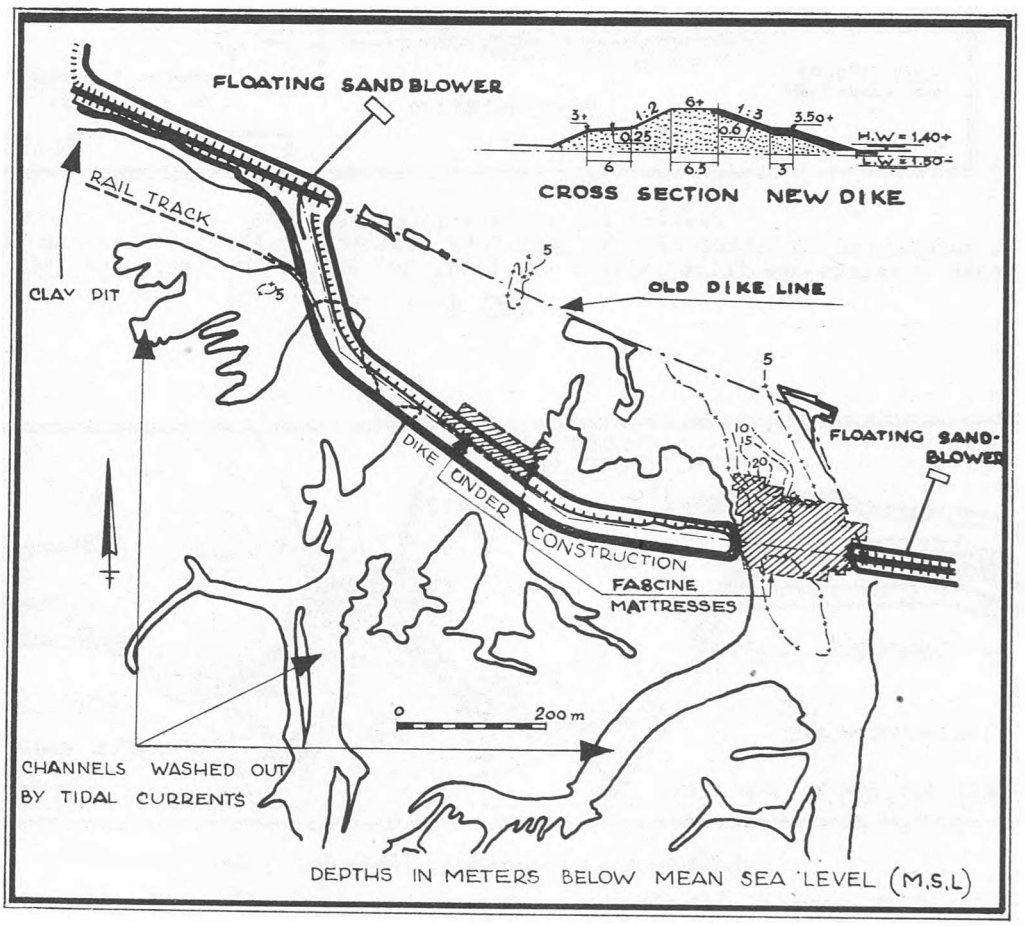
So when the age-old dikes of Walcheren gave in, the sea-water flooded the island at high tide and flowed partly back at ebb-tide. So we had to build dikes across tidal streams of great capacity. For instance through the largest gap, the gap of Rammekens, a total amount of 20 million of cubic-meters of water flowed inwards at flood tide, to rush out again during the next ebb. This is an average rate of discharge of 800 m3 per sec.

It must be clear that deep channels were scoured in the sandy bottom, and that the closing became daily more difficult.

It is also clear that the velocity of the currents in the gaps increased as we narrowed the breaches and the waterlevel in the island began to experience difficulties in following the waterlevel of the sea. This in its turn meant an attack of ever increasing ferocity by the currents on the sea bottom. Strong eddy currents aside of the main-stream tried to make deep holes and the newly built portions of the dikes at either side of the gap were in danger of sliding down into these holes. This danger was counteracted as far as possible by a blanket of fascine-work made in the traditional Dutch way into large mattresses, which are weighted by stones and sunk to the bottom in order to protect this against further erosion (fig. 3).

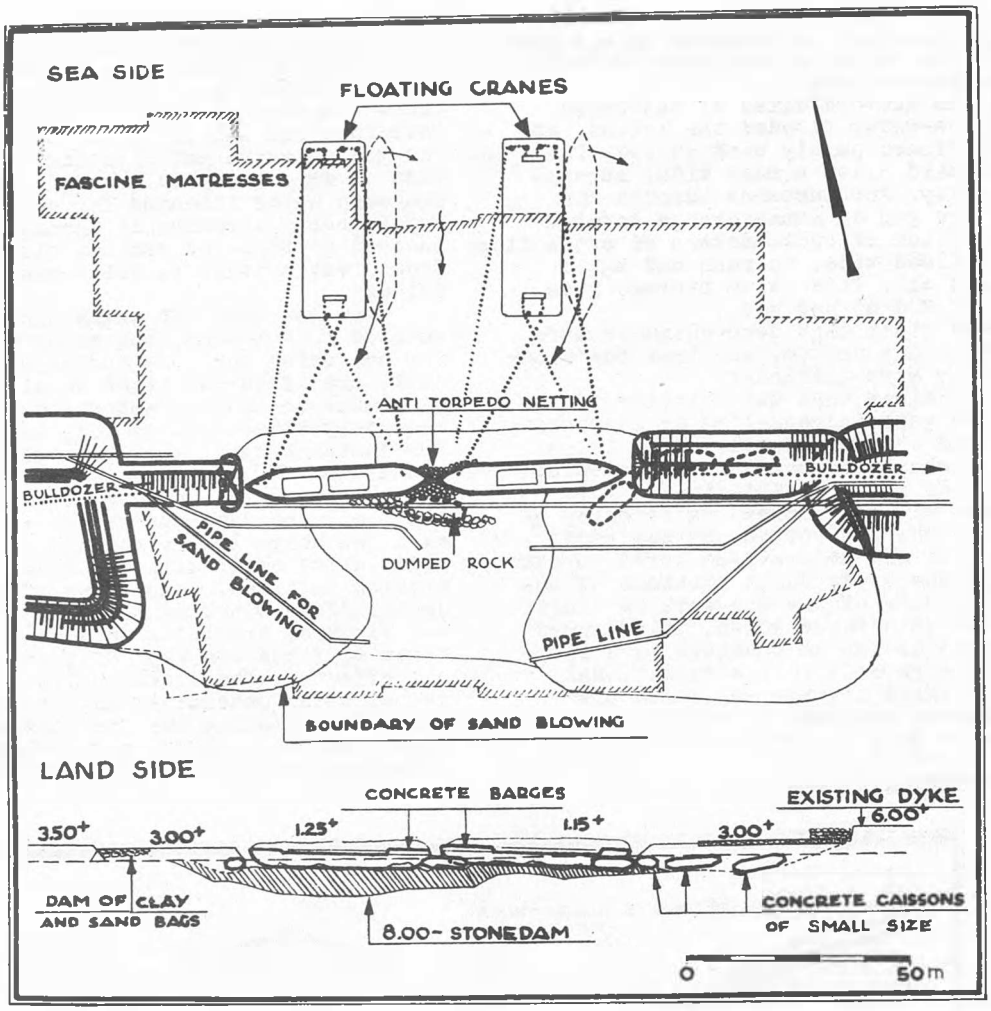
Another difficulty was that the sand used for the construction of the dike was carried away by the currents in increasing amounts, so that progress became slower and slower. Tough clay and stones gave a slightly better performance but even then closure was not feasible. Therefore one had to resort to the sinking in the gap of ships and floating caissons. Just then we were lucky in having at our disposition many units intended for use in the floating Mulberry harbours at Normandy. About a hundred pontoons of various sizes were towed from Great Britain to Walcheren for this peaceful use.

Now you must not think that, once you have adopted this method, the going will be easy. For one thing pontoons and ships, once they are sunk, are often too light to withstand a considerable horizontal waterpressure, so that immediately after placing they must be loaded, for instance by filling them with sand, clay or stone. This filling must be done quickly because the closing units, placed at the turning of the tide, will be subjected to severe waterpressures a few hours later. Another snag is that those rigid units never will fit closely to the anti-erosion mattress, which lies often at very great depth. After blocking the mainstream, many holes and fissures are left, through which the water tries to force its way. If a rapid sealing is not effected, the sunken units will be in danger of being undermined and stability might be lost. This sealing must be done with stone and clay, smaller caissons and generally with everything that may break the current (fig. 4).



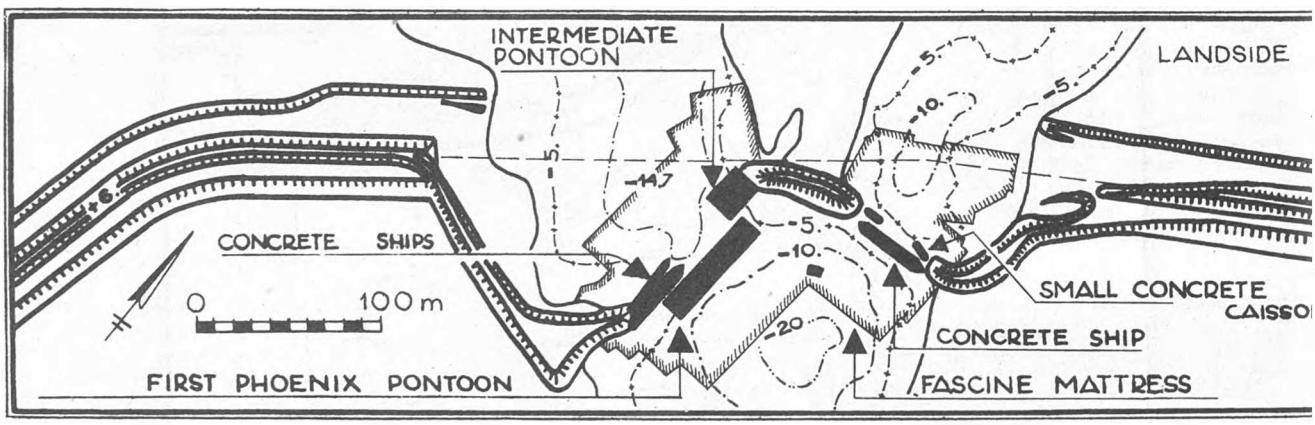
Situation at Veere, September 1945.

FIG. 3



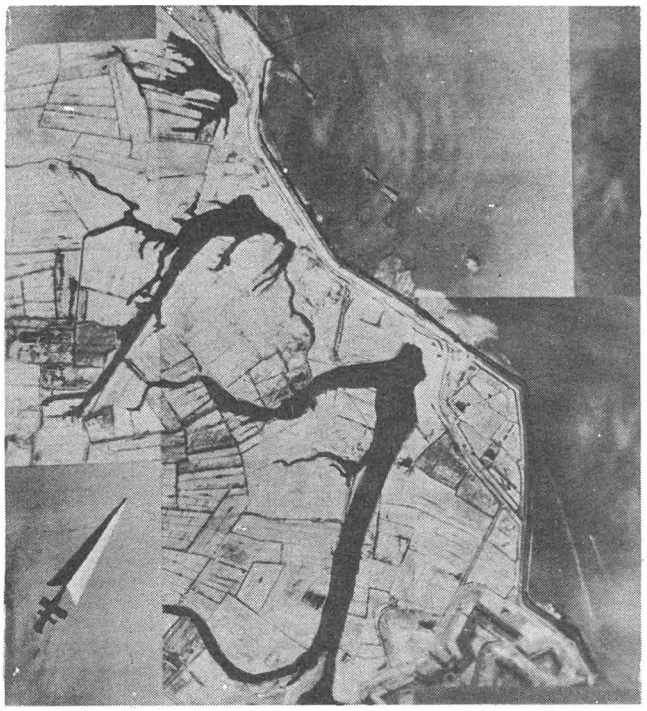
Sealing gap at Veere; October 1945
Both barges are simultaneously brought into position by the two floating cranes.
Remaining openings are filled with rock, clay, antitorpedonetting, sand bags. a.s.o.

FIG. 4



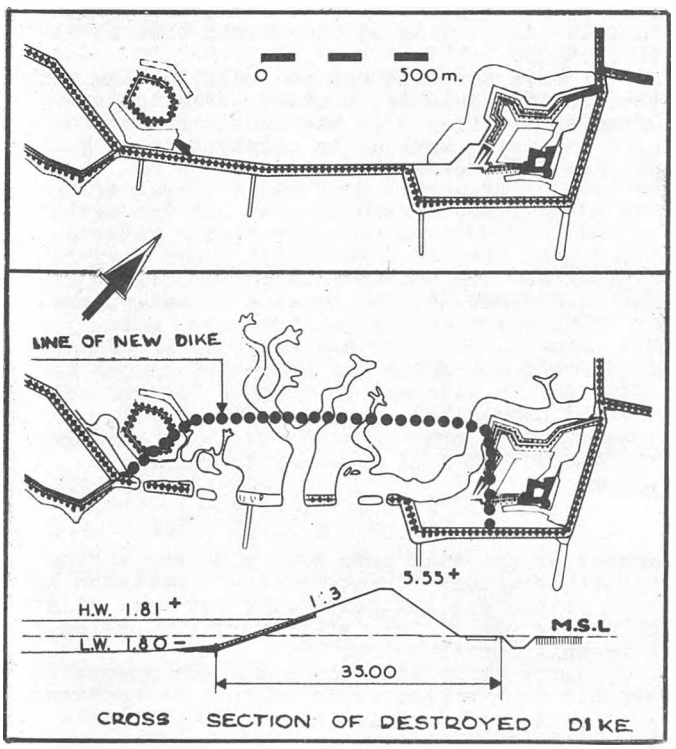
Situation at Rammekens, 1December 1945

FIG. 7



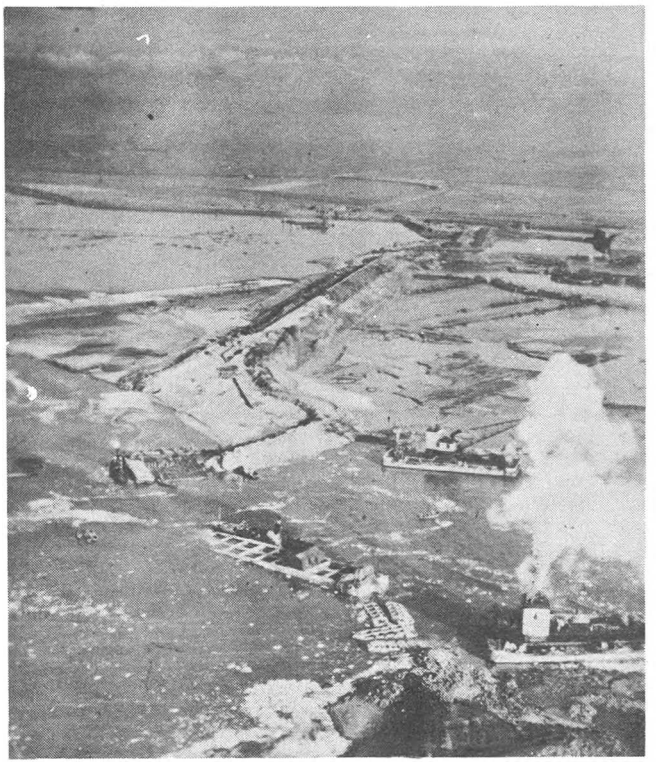
R.A.F. Photograph showing new dike near Veere at 5 December 1945. Remark the channels washed out by tidal current.

FIG. 5



Situation at Rammekens.
Above: before 7 th. October 1944.
Below: in February 1945.

FIG. 6



General view of closing gap at Rammekens, 6 December 1945. In the background the flooded country is visible.

FIG. 8

All in all this is a construction method containing many problems and when on top of all that you consider the fact that the closure had to be effected during the autumn and winter of 1945, that is during the season of storm and cold, then you will understand that we took a great deal of risk in our efforts to reclaim Walcheren (fig. 5)

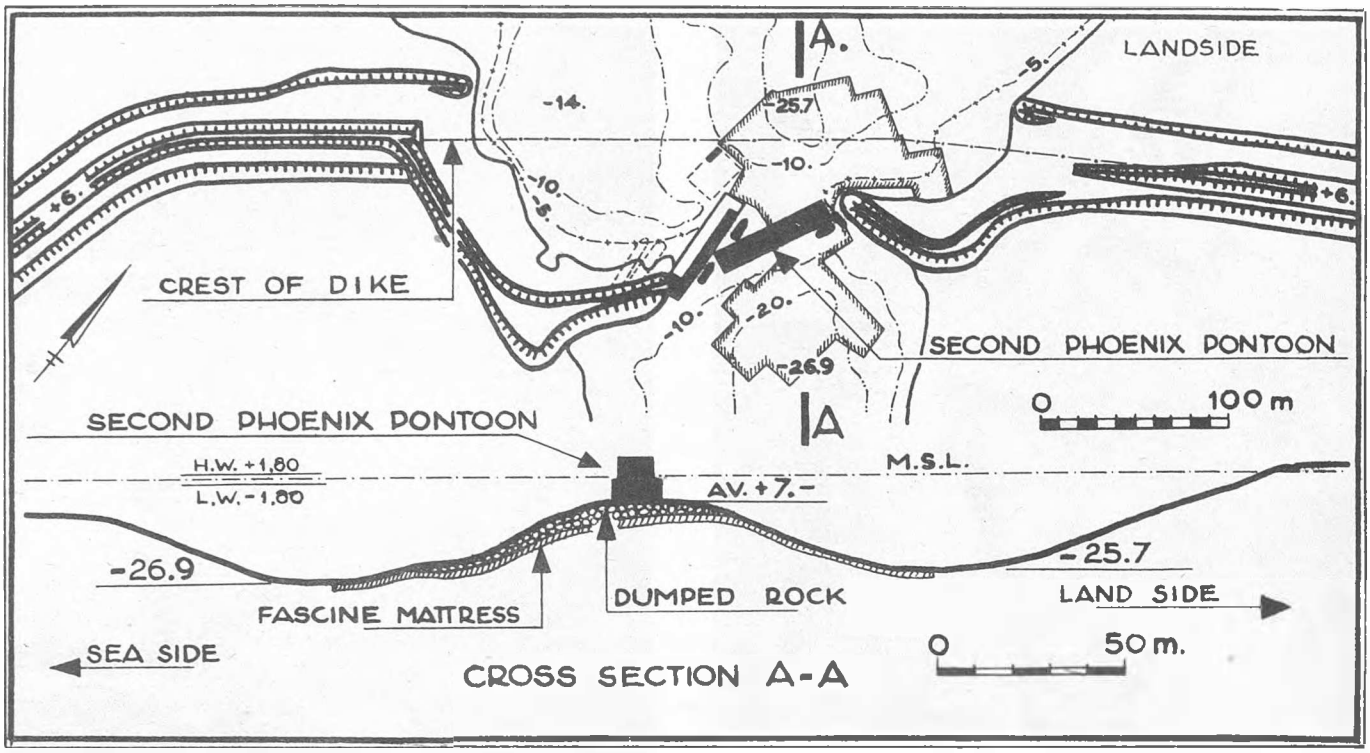
The worst set-back we experienced at the closing of the last gap, the gap of Rammekens (fig. 6), where the waterdepth on both sides of the line of the new dike increased gradually to more than 20 meters.

On the first of December 1945 the closing unit, a 60 meters long Phoenix-pontoon was placed on a layer of fascine mattresses (fig. 7), but shortly afterwards it started to subside and slide away, and a new gap was formed (fig. 8).

This new gap became very deep in a short time and only by immediately bringing many fascine-mattresses to the spot, weighted with another 30.000 ton handstone, the danger could be warded off.

A second Phoenix was placed on a heap of stone. When one sees the cross section (fig.9) it will be appreciated that we hesitated a moment in view of the profile of the dam, thinking of the forces that would arise after closure at very low tide. But the advice of the Laboratory of Soil Mechanics at Delft on this point helped us to take the decision, mainly on the consideration that in the protruding sections of the dike every now and then flow slides, caused by the currents, occurred and thus dangerous settlements were to be feared.

The placing of the second caisson gave no trouble so that on the 24th of January 1946



Situation and cross section at Rammekens, 24 Jan. 1946

FIG. 9

the gap was blocked. At first there was still an average leakage of 100 m3 per sec. through the remaining holes, but with the aid of fascine-mattresses, stone, torpedo-netting, sand and clay, a complete seal was effected in roughly 2 weeks time.

And now again Walcheren is safe behind its dikes. Why did I tell you all this? Believe me gentlemen it is not because we are so very proud of the job we have done. As I told you before we only could finish it with the help of our allied friends.

I told you the story of Walcheren because it is symptomatic for reconstruction work in Holland, because it means that we Dutch are fighting for a prosperous future even in this foolish world where we just heard the news that the developing of the atomic bomb is satisfactory.

I hope you will see yourself, making trips through the Lowlands, how the Netherlands are effacing the traces of the last war, working hard and being anxious to cooperate with you all for a better world economy.

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THE CONSTRUCTION OF THE ROTTERDAM HARBOUR

Ir. D.H. de HERDER

I consider it a privilege to address you and tell you something about the demolitions and the reconstruction of the quays for seagoing vessels in the port of Rotterdam.

There cannot be any question of treating the subject in the little time allowed me, generally, comprehensively and in all its details.

I shall only sketch how the Dutch have tried to solve the problem of quaywall-construction upon loose soil, though this has not always been in a equally satisfactory manner.

In a constructional experience ranging over a century, during which more than 30 kilometres of quaywall have been erected, a considerable amount of interesting experience has been gained and engineers have not been slow in making use of this with every succeeding quay-wall construction.

Hence it is that the Rotterdam quaywalls exhibit such a remarkable variety of profiles. As a matter of fact the higher requirements made from time to time by shipping with respect to the depth of water at the quays, the loading of the wharves with merchandise and of the walls with cranes, the application of new building materials, new working methods, altered economic conditions etc. from time to