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## 7. The pier construction

### Location of the construction site

After the decision had been taken in the summer of 1977 to build the piers as monolithic concrete structures, the design of which had then already been conceived in broad outline, there was scarcely any time available for investigating possible alternative construction methods and locations.

Studies which have been carried out before that time had shown, however, that building the piers in a "construction dock" was preferable to other methods. The place where the dock would have to be located was determined fairly quickly because various potentially suitable dock sites were evaluated – at the same time as the above mentioned studies of construction methods – including sites near the Philips Dam locks under construction and near the Schelphoek service harbour.

The final choice consisted of extending and completing the partly constructed "Schaar" dock at the north-eastern extremity of the Geul section of the Eastern Scheldt dam. This dock, together with the Roompot

dock, had been started at the time when it was still intended to build the surge tide barrier with gated caissons, which were to have been constructed in these docks (Fig. 1).

### Planning the pier construction operations

The total space of time, and therefore the organization of the construction of the pier, will ultimately be governed by the following secondary conditions and starting points:

- the longest possible time for constructing the piers in order to keep manning levels as low as possible (manpower recruitment problem);
- a uniform production process (avoiding overstaffing or understaffing);
- earliest possible starting date for construction of piers;
- starting date for installing piers;
- rate of installing piers;
- number of construction docks;
- estimated construction time of the first pier.

### Number of construction docks

Various numbers of dock compartments were considered, each involving a different optimum distribution of the 66 piers over the compartments and a different construction time. For practical reasons dictated by the dock and in order to keep down costs, it was eventually decided to use four compartments. The construction time for the first pier (a determining factor in scheduling the whole project) was estimated on the basis of the working drawings for the piers and detailed job planning, allowing 20 % extra time to compensate for initial "teething troubles".

Many comparative analyses based on different assumptions and starting points were carried out. In the end, an optimum coordination between constructing the piers in the dock and installing them on the site of the barrier was established, based on:

- a pier installing period from 1.8.1981 to 31.12.1983;
- pier construction to start on 1.3.1979;
- construction time for the first pier to be 280 days.

The scheme involves the allocation of 13, 23, 18 and 12 piers at the four dock compartments respectively and the total available construction time for the piers is 4.15 years.

At a later stage, more advanced studies showed that a higher rate of installing the piers would be possible. The resulting gain in time within the overall planning was utilized for the design, preparation and construction of the foundation bed.

More particularly, the starting date for installing the piers was moved back from 1.8.1981 to 1.3.1982 necessitating appropriate adjustments of the programme. At the time of this change, the work of constructing the compartmenting dams in the construction dock was so advanced that it was no longer possible to modify the dock. The planning and organization details

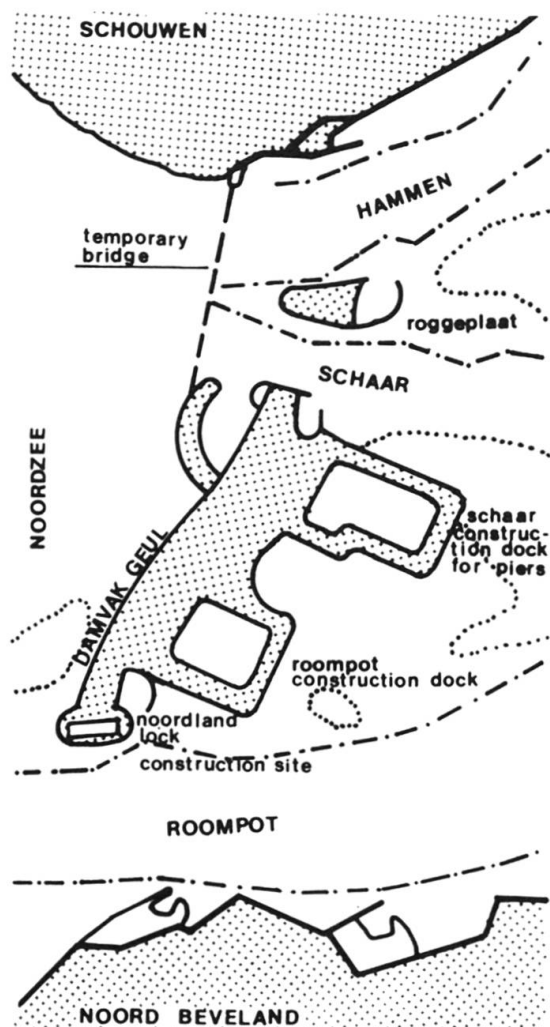


Fig. 1 Mouth of the Eastern Scheldt with working island, construction dock and temporary bridge.

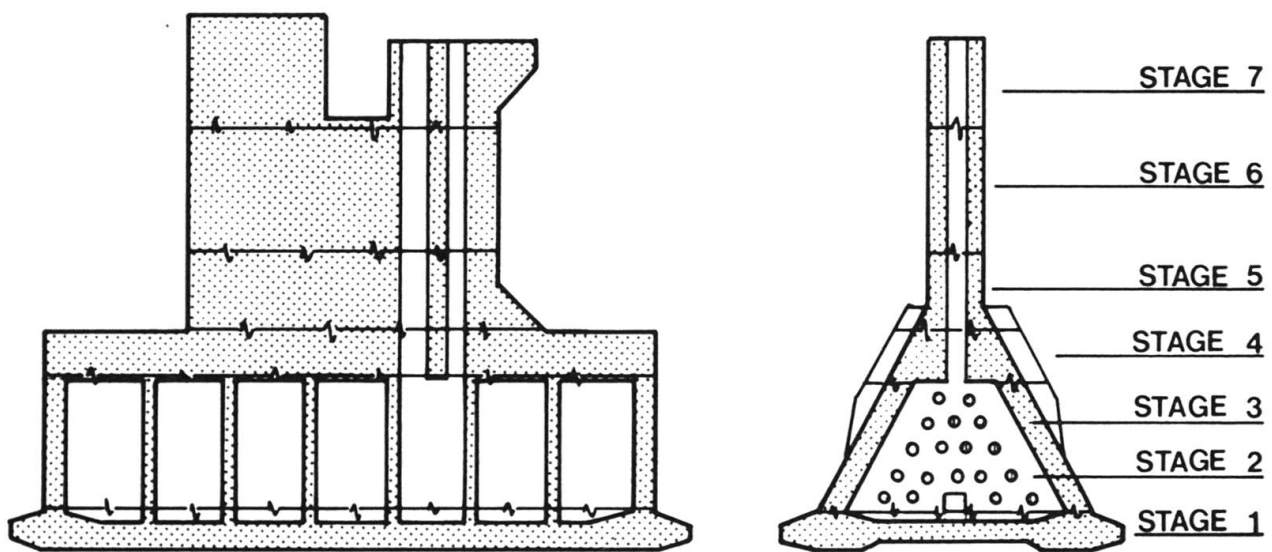
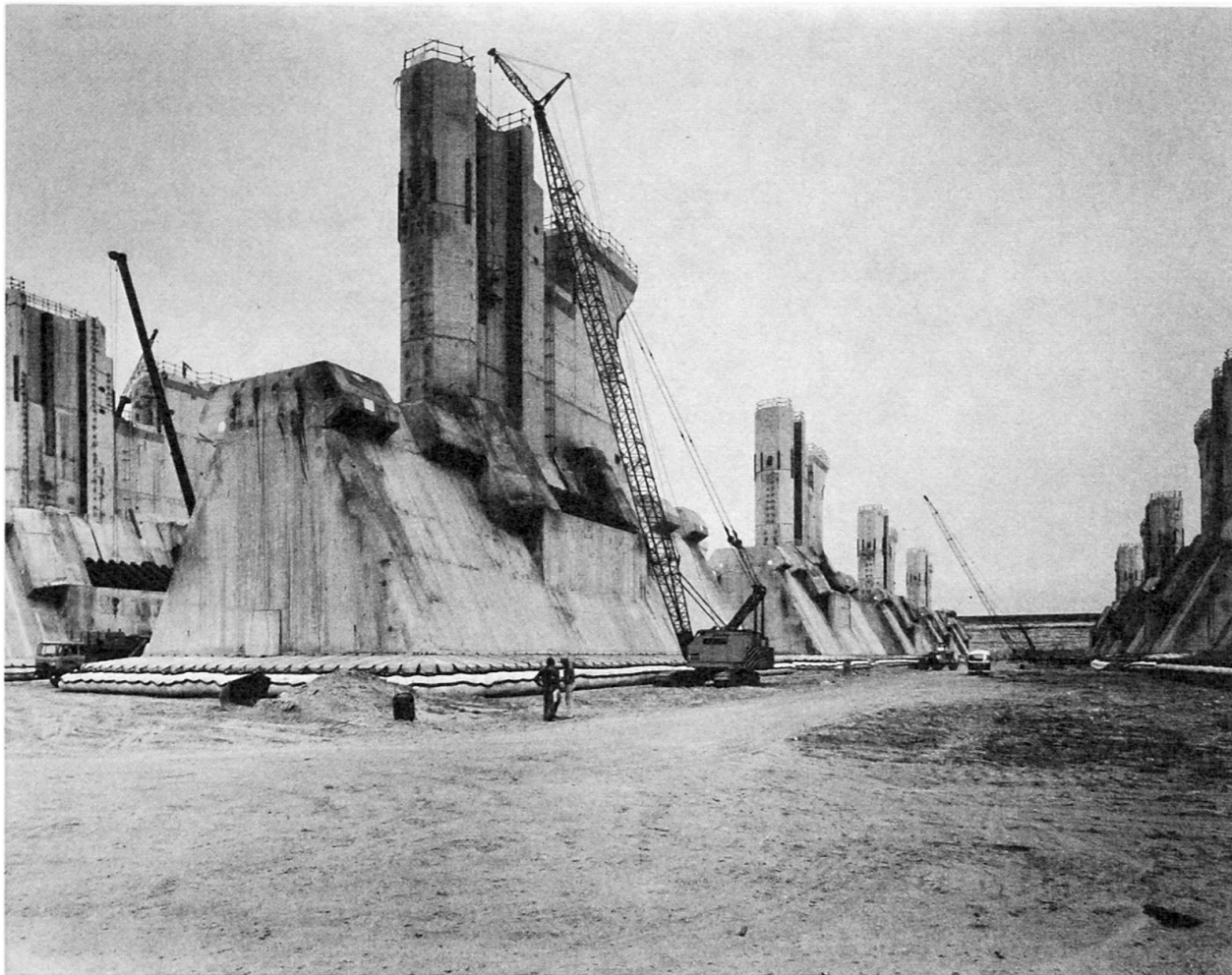


Fig. 2 Construction stages.



for building the piers had also progressed to a point where any change in the total completion time would have constituted a drastic intervention in the overall organization of pier construction. Further job co-ordination studies revealed that three compartments would suffice for building the piers, so that the fourth could be utilized for other purposes (construction of sill beams). Retaining the originally planned total time for completion, the dock is now divided as follows into three compartments: 19, 27 and 20.

#### Number of construction stages per pier

Each pier is concreted in seven "pours", i.e. the concrete is cast in seven successive stages (Fig. 2):

	quantity m <sup>3</sup>	max. working time
1. bottom slab	2200	48 days
2. partitions in bottom compartment	330	38 days
3. external walls of pier foot	2000	46 days
4. top part of pier foot	1100	46 days
5. base of shaft	240/510	31 days
6. shaft up to the head of pier	220/650	29 days
7. head of pier	450	52 days

With the chosen form of organization for co-ordinating and "streaming" the construction gangs working on activities of secondary magnitude, and for working in construction streams, the differences in quantities and working times per stage of building a pier are not of much influence within the overall organization. The working time per activity and the correct "streaming" of the gangs determine the total construction of the piers and thus fix the working time per stage.

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