

**Process for deepening and/or reinforcing, consolidating or
renovating a quay wall constructed along a water basin**

This invention relates to a process for deepening
and/or reinforcing, consolidating or renovating a quay wall constructed
5 along a water basin.

Quay walls to which the process according to the
invention may be applied, may belong i.a. to one of the following
categories: sheet pile walls, combi-walls, sludge walls.

10 Quay walls are difficult to deepen without moving
the mooring line. The need to deepen an existing quay wall with the aim
to achieve a greater water depth for the mooring of larger ships, without
appreciably modifying and/or moving the mooring line and without
interfering with the existing merchant shipping traffic, is felt increasingly,
and it is consequently the aim of the invention to prescribe a process
15 allowing the deepening of a quay wall of one of the above mentioned
types, without interrupting or hampering the mooring of ships, while in
addition, the normal activities ashore, such as the operation of cranes
and train traffic, may be continued normally.

20 In order to enable this in accordance with the
invention, on land side behind and below said quay wall, using high
pressure techniques, a network of bores is formed down to the desired
depth, into which a cementing material is introduced under high
pressure to form a network of columns, after which from the water side
and through the original quay wall, at different levels a series of

anchorings is applied, and subsequently the original bottom of the water basin is dredged down to the desired depth.

Still according to the invention, a reinforcement is applied in said bores.

5 According to a possible embodiment, said reinforcement is applied in the still liquid cementing material.

 According to another embodiment, said reinforcement is applied in the already hardened cementing material, whereto desctructive borings are carried out in the hardened cementing material into which cementing material is added.

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Other details and advantages of the invention will appear from the following description of a process for deepening and/or reinforcing, consolidating or renovating an existing quay wall. This description is exclusively given as an example and does not limit the invention. The reference numbers refer to the attached figures.

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The different figures 1-5 schematically illustrate the subsequent steps of the process according to the invention.

Figure 1 shows a customary quay wall in which the reference 1 refers to any type of quay wall such as set forth in the preamble. Reference 2 refers to an anchoring such as those which are customary in different quay wall structures.

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The existing water level, which in many cases is subject to tides, is indicated by reference 3, and the earth body located landward by reference 4.

25 The figures 1-4 also show the existing bottom level 5 of a water basin. With the latter, a river, a dock or the sea is meant, which may or may not be subject to tides. The level 6 which was realised in a later stage, is shown in figures 4 and 5, i.e. after the completion of the deepening works.

30 According to the process in accordance with the

invention, behind the quay wall 1, i.e. on land side, a series of columns 7, depending on local circumstances such as i.a. the soil structure, are formed using high pressure jets. The depth to which the columns will be realised depends on various factors. In figures 4 and 5 the lowest level of a bore is suggested by references 8, 8'. First borings are carried out either vertically or inclined, either or not using high pressure jets. Afterwards, by means of the introduction of a hardening cementation material (grout) under high pressure, columns are formed. With "high pressure" pressures are meant between 250 and 600 bars. After hardening, columns 9, 9' are realised (figures 3 and 4).

Anchoring and/or nailing 10 applied at different levels, ensures the stability of the new quay wall structure that formed by pillars 9, 9' that merge into each other. When the existing quay wall consists of a closed, tight wall (e.g. sheet pile wall), this wall may serve as a permanent formwork.

By realising the different columns in such a way, alongside and behind each other in one or more longitudinal or transverse rows, a network arises of pillars 9, 9' (figures 3, 4, 5) merging into each other, which form the new quay wall. The diameter of the pillars and their "quality" depend on local factors. In this respect, the high pressure techniques allow for great flexibility.

The existing quay wall structure or parts therefrom may also serve as elements of, and be incorporated into the new deepened and/or reinforced, consolidated, renovated quay wall structure. It is indeed possible to anchor this existing structure to the deeper concrete wall to be built yet.

After dredging the bottom, between the original level 5 and the level 6 to be realised, the base of the new quay wall has sufficient hold. The depth of this base will be determined by the geological structure of the soil and by the new loads to which the

deepened quay wall structure will be subject and for which its dimensions have been calculated.

- By applying the process according to the invention, and by using the high pressure techniques, widely varying underground structures may be realised by building a network of columns which will give rise to a massive structure of which the characteristics may be adapted to the local circumstances without any problem.
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CLAIMS

1. Process for deepening and/or reinforcing, consolidating or renovating a quay wall (1) constructed along a water basin, characterised in that, on land side behind and below said quay wall (1), using high pressure techniques, a network of bores is formed down to the desired depth, into which a cementing material is introduced under high pressure to form a network of columns (7), after which from the water side and through the original quay wall (1), at different levels a series of anchorings (2) is applied, and subsequently the original bottom of the water basin is dredged down to the desired depth.
2. Process according to claim 1, characterised in that in said bores a reinforcement is applied.
3. Process according to claim 2, characterised in that said reinforcement is introduced in the still liquid cementing material.
4. Process according to claim 2, characterised in that said reinforcement is introduced in the already hardened cementing material, where to destructive borings are carried out in the hardened cementing material into which cementing material is added.
5. Process according to any one of claims 1-4, characterised in that above said network of columns is constructed such that a monolithic quay wall structure is formed.

