

2. Structure of Open-Type Wharf and Performance Requirements

2.1 Specifications of Structure

Figure 2.1.1 shows a plan view of the superstructure and Figure 2.1.2 shows a standard cross section of the open-type wharf to be verified its structural performance.

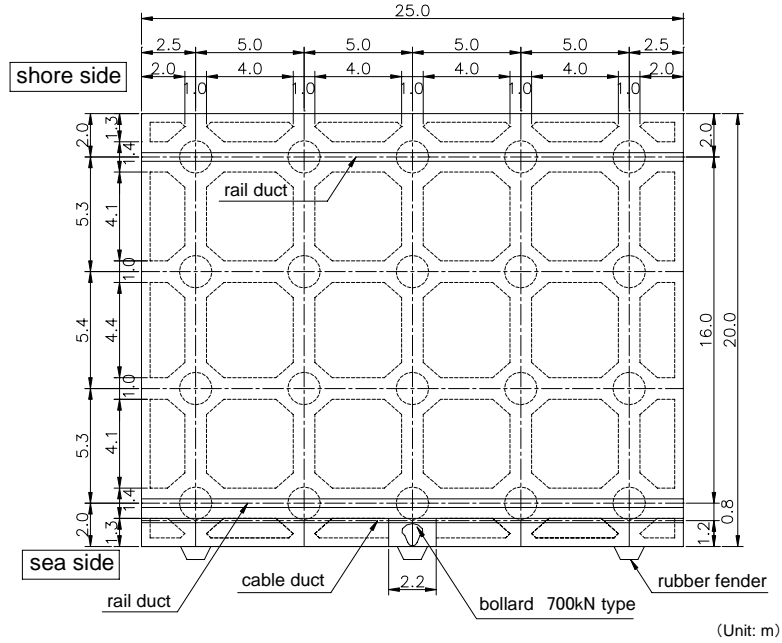


Figure 2.1.1 Plan view of the superstructure

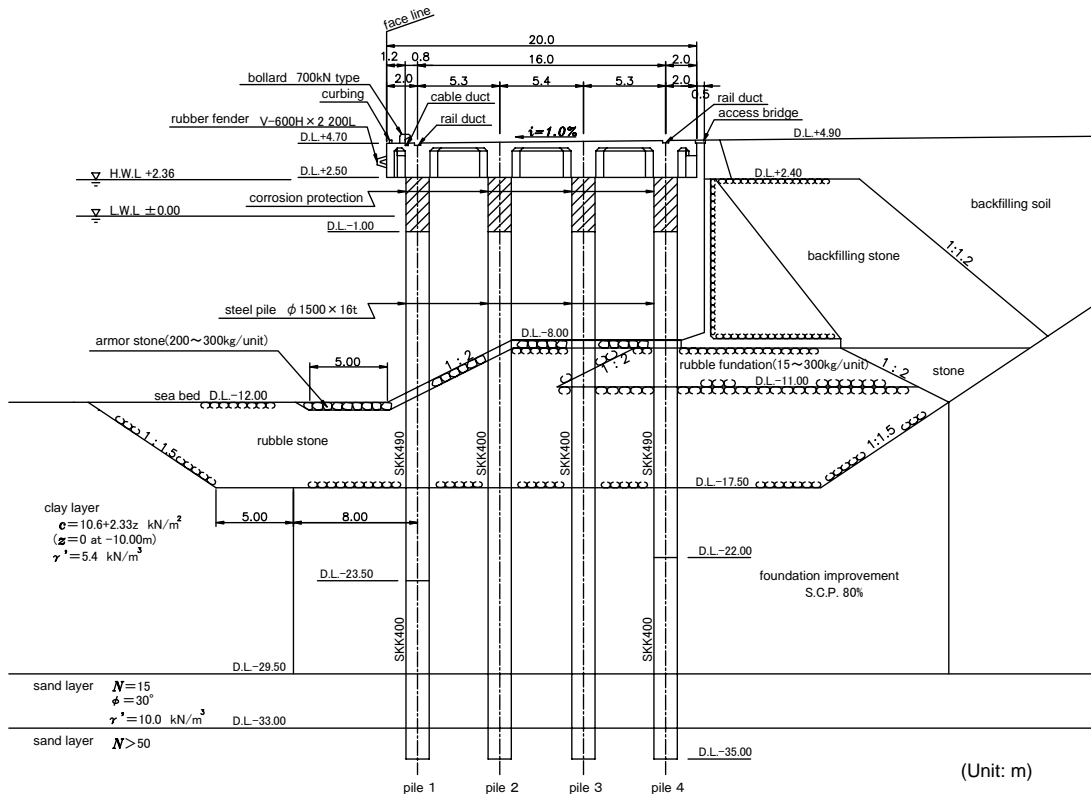


Figure 2.1.2 Standard cross section of the wharf

The superstructure shown in Figure 2.1.1 is based on cross-sectional specifications assumed according to the basic design results (see PORT/Exam). The basic structural requirements and other conditions are as follows:

2.1.1 Structural condition

(1) Basic specifications

- a) Structural type: open-type wharf with vertical steel pipe pile
- b) Design water depth: DL -12.0 m
- c) Level of deck: DL +4.7 m
- d) Length of berth: 240 m (one-block length is 25 m)
- e) Width of apron: 20 m
- f) Slope of apron: 1.0 %
- g) Seismic performance classification: class-S seismically isolated wharf

(2) Superstructure

One block of superstructure of 20.0 m wide by 25.0 m long is picked up for the verification. The superstructure is composed of floor slabs and beams as shown in Figure 2.1.3. The floor slab that is designated as S_1 to S_4 depending on the area, is rectangular shape supported by beams along its four fringes. The beams are classified depending on cross-sectional dimensions into the beam parallel to the face line of the wharf B_1 , the small beams B_2 and B_3 , the beam supporting the crane at sea side G_1 , the beam parallel to the face line G_2 , the beam supporting the crane at shore side G_3 , and the beam perpendicular to the face line G_4 . Here in this example, as the representative members, floor slab S_1 and beam G_3 are focused for the verification. For the other floor slabs and beams, verification can be done by ways similar to these applied for S_1 and G_3 .

(3) Steel pipe pile

a) Specifications

Pile 1: Above DL-23.5m: 1 500 mm dia, 16 mm thick, and 27 700 mm long; SKK490

Below DL-23.5m: 1 500 mm dia, 16 mm thick, and 11 500 mm long; SKK400

Pile 2: 1 500 mm dia, 16 mm thick, and 39 200 mm long; SKK400

Pile 3: 1 500 mm dia, 16 mm thick, and 39 200 mm long; SKK400

Pile 4: Above DL-22.0m: 1 500 mm dia, 16 mm thick, and 26 200 mm long; SKK490

Below DL-22.0m: 1 500 mm dia, 16 mm thick, and 13 000 mm long; SKK400

b) Corrosion protection measure

From the bottom of beam (DL+2.5 m) to DL-1.0 m: protective lining (design efficiency is 100 %)

Below DL-1.0 m: cathodic protection (design efficiency is 90 %)

2.1.2 Tide

- a) Mean monthly-highest water level (H.W.L) is DL +2.36 m
- b) Mean sea level is DL +1.30 m
- c) Mean monthly-lowest water level (L.W.L) is DL \pm 0.00 m

2.1.3 Design wave

The following design waves acting on the wharf are determined by taking into account the diffraction waves from breakwater.

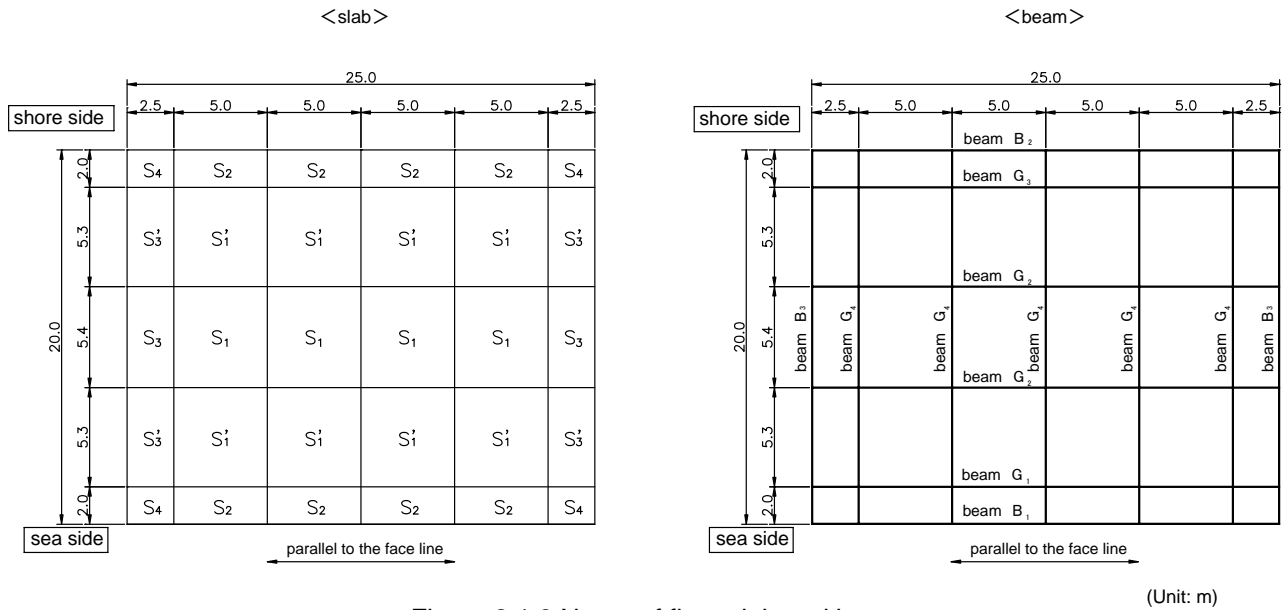


Figure 2.1.3 Name of floor slab and beam

- a) Significant wave height: $H_{1/3} = 1.0$ m
 b) Maximum wave height: $H_{max} = 1.8$ m

2.2 Performance Requirements

The following performance requirements are considered for the verification:

Performance 1: Safety under self-weight and overburden loads during the design service life

Performance 2: Safety under loads imposed by cargo handling vehicles and equipment

Performance 3: Safety under loads imposed by berthing and mooring of vessels

Performance 4: Safety under uplift pressure due to design wave height

Performance 5: Serviceability without the necessity of repair under Level 1 ground motion and safety under Level 2 ground motion

Performance 6: Serviceability under overburden loads

Performance 7: Serviceability ensuring smooth traveling of cargo handling vehicles and equipment

Performance 8: Serviceability ensuring smooth berthing and mooring of frequent vessels

Performance 9: Safety against fatigue failure due to repeatedly traveling cargo handling vehicles and equipment

Performance 10: Performance 1 to 9 shall not be lost at the any time during the design service life