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.
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 $-23.5$m: 1500 mm dia, 16 mm thick, and 27 700 mm long; SKK490
       Below DL $-23.5$m: 1500 mm dia, 16 mm thick, and 11 500 mm long; SKK400
   Pile 2: 1500 mm dia, 16 mm thick, and 39 200 mm long; SKK400
   Pile 3: 1500 mm dia, 16 mm thick, and 39 200 mm long; SKK400
   Pile 4: Above DL $-22.0$m: 1500 mm dia, 16 mm thick, and 26 200 mm long; SKK490
       Below DL $-22.0$m: 1500 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 $\pm0.00$ 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: \( H_{1/3} = 1.0 \text{ m} \)

b) Maximum wave height: \( H_{\text{max}} = 1.8 \text{ m} \)

### 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 any time during the design service life