INTRODUCTION

This paper describes the possible concepts for access ways of floating type structure in the calm basin between reclaimed islands for an airport. It is well known that a new bridge named the Yume Mai Ohashi has been constructed which connect Yumeshima Island and Maishima Island in Osaka city. It is a steel made bridge of 410m in length and 60m in width. The author will show some alternatives of floating type structure which may be in use for air ports and others.

In this study, two reclaimed islands with 200m water ways between will be considered. As those two islands are constructed in rather offshore and deep sea over the thick alluvium deposit of soft clay, settlement and displacement of those islands may affect the structural stability and strength of access ways. Two instances will be shown that one is access way for air craft use and the other for car use. Several alternative concepts are proposed and discussed.

TAXI WAY BRIDGE FOR AIR CRAFT USE

In this section, alternative concepts for a taxi way bridge for air craft use between two islands. The taxi way may be planned either longitudinal end of reclaimed island where wave height is rather high than the middle of the water way. Conditions of use and prime design conditions are as follows.

Conditions of Use

1) Service of period: 50 years
2) Main dimension of taxi way bridge:
   Length: 200m
   Width: 150m
3) Longitudinal slope:
   Maximum 1.5%, where visible the access surface at the height of 3m and 300m distance.

Prime Design Conditions

1) Tide level:
   HHWL: DL+3.2m
   HWL: DL+1.6m
   MSL: DL+0.0m
   LWL: DL+0.1m
   CDL: DL+0.0m
   LLWL: DL-0.41m

2) Water depth:
   17~18m

3) Oceanographic and meteorological conditions:
   Waves(100-year wave):
   \[ H_{1/3} = 2.0m \]
   \[ T_{1/3} = 5~6 \text{ s} \]
   Tidal current speed:
   less than 1.0m/s
   Wind speed(100-year wind speed):
   50m/s

4) Design seismic coefficient:
   0.2 (horizontal)

5) Live load:
   Air craft:
   LA-0 680tf
   Vehicle load:
   B live load
   (Road bridge specifications)

6) Others:
   Navigation of passenger vessels
Structural Concept

Five alternatives listed below and illustrated in Figure 1 to 5 are considered.

1) Alternative A: Floater Truss Supported as Both end

2) Alternative B: Full-surface Bottom Contact

3) Alternative C1: Continuous Girder + Bottoming Piers (1): hinge pier support

4) Alternative C2: Continuous Girder + Bottoming Piers (2): rigid pier support

5) Alternative D: Floater Truss + Bottoming Piers

Prime Standpoints of Qualification

Followings are seemed the prime standpoints of qualification.

1) Utilization of buoyancy
2) Effect against settlement
3) Affect to settlement
4) Countermeasures against bottoming settlement
5) Re-floating and removing

Navigation of passenger Vessels

It is convenience for passengers that passenger ships from and toward several sea terminal around the airport may directly access the terminal if it were constructed in the calm sea basin. Some feasibility study was made on vessel type available, and the results would be reflected to structures of taxi way bridge.

The classification of vessel type currently in service and height allowances are illustrated in Figure 6.
ACCESS WAY FOR CAR TRANSPORTATION (Floating bridge)

This access way may be constructed at the middle of water way where it is rather calm than the previous case study.

Conditions of Use
1) Service period 50 years
2) Main dimension of floating bridge
   Length 200m
   Width 20m
3) Longitudinal slope
   Maximum 5%
   Gradually reduced to 2.5% at the intersection with main road.
4) Design speed 60km/h

Design Conditions
1) Tide level
   HHWL : DL+3.2m
   HWL  : DL+1.6m
   MSL  : DL+0.95m
   LWL  : DL+0.1m
   CDL  : DL+0.00m
   LLWL : DL-0.41m
2) Water depth 17m~18m
3) Oceanographic and meteorological conditions
   Waves (100-year wave) $H_{1/3} = 1.8m$
   $T_{1/3} = 5~6s$
   Tidal current speed less than 1.0m/s
   Wind speed (100-year wind speed) 42m/s
4) Design seismic coefficient 0.2(horizontal)
5) Vehicle load
   B : live load
   (Road bridge specifications)

Structural Concepts

Five alternatives listed below and illustrated in Figure 7 to 11 are considered

Alternative 1
Consists of a central girder and adjusting girders on either side. As the structure is statically determinate in the vertical direction, ground deformation may be readily accommodated.

Alternative 2
Two pontoons receive the dead load of the superstructure. The superstructure consist of three continuous span box girders, thus eliminating knuckles and providing for unhindered vehicle use.

Alternative 3
The same concept as Alternative 2, with greater rigidity in superstructure.

Alternative 4
Waterline area is reduced to minimize the effects of tidal changes. Simple beams suspended at either end provide for ready accommodation of ground deformation.
Alternative 5

The connection of undersea cables and fenders in a serial arrangement improves response to ground subsidence and seismic resistance. The space between the central and adjusting girders corporate rubber shoes which restrict displacement perpendicular to the axis of the bridge, and improve its utility.

CONCLUSION

The bridge which are examined in this paper will be symbolic of offshore airport by introducing the new technology of “Soft-bottoming Structure” by fully use of the structure’s buoyancy.

Further, the project may be the first attempt to adopt this technology, which is expected to spread to other facilities in the future.

REFERENCES


