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Jiangyin Yangtze Highway Bridge: Foundations' Construction

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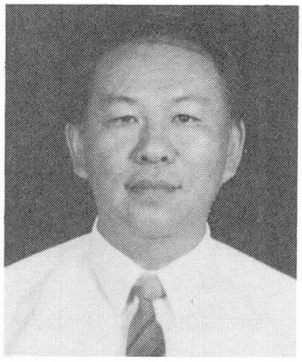

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Summary

Jiangyin Yangtze Highway Bridge will stride over Yangtze River in central part of Jiangsu Province,forming a common crossing for two national trunk lines. Construction commenced in November 1994. Till September of 1997, substructure of the Bridge has been completed mainly. Contractor of superstructure entered work-site in October the same year. We anticipate the Bridge will complete in September 1999 and open to traffic after one month.

1.Brief description

Navigation runs very busy in the lower reaches of Yangtze and the Bridge will cross the narrowest part, considering stability of current and flood, the option of suspension bridge has been selected. Southern tower sets at the bank and northern one at flood land, that avoids hitting of ships. Main span is 1385m, clearance will keep 50m in height for seagoing vessels passing through.

Suspension bridge will be arranged as 336.5m+1385m+309.4m. Main span is a steel box girder with wind noses at both sides. Anchored spands are continuous prestressed concrete box girders. The deck is designed for expressway in dual direction,three lanes each, its width is 29.5m. According to Chinese Standard, designed life load complies with Super-20 and Trailer-300. With regard to the factor of multilane deduction, load means 40KN/m for six-lane deck. Pedestrian load of 3.15KN/m acts on inspection sidewalk, which is formed by wind noses. Wind speed of 40.8m/s and VI degrees intensity of earthquake are designed.

Cable of the Bridge will consist of parallel galvanized steel wires which diameter is 5.35mm each, tensile strength must be over 1600Mpa. Cable in main span will be 864mm in diameter and 1/10.5 of dip/span ratio. Hangers will be made of parallel galvannized steel wires too, arranged at intervals of 16m.

Steel box girder of main span is designed only 3m high, its section looks quite flat.,

however, enough safety of air dynamics will be secured. All surfaces of steel box girder are orthotropic. Top board is 12mm in thickness, web and bottom plate is 10mm. Asphalt concrete in thickness of 48mm will be surfacing of steel deck. These make steel deck lighter and lead decrement of the horizontal tensile force acting at anchoranges. Especially, northern anchorage founded on soil, the designer tries to decrease its burden. Southern tower foundation falls on sandstone layer inclined towards the river, 24 drilling piles diameter 3m each inserted into the rock will transfer force from tower to deeper stratum for security. Southern anchorage situates on the hill. Because of developed rock joint, a gravity reinforced concrete anchorage inlays into rock. Its inclined toothlike footing prevents from sliding and decreased the volume of concreting in construction.

In zone of northern tower and anchorage, thickness of overburden is 80m-120m. Soil there formed in latest period is in low solidity and saturated, as the depth increasing, it changes from loosen sand clay to powder sand then to medium and coarse sand with gravel. Limdstone layer appears deeper than 80m. Northern tower founded on 96 drilling piles, each one is 2m in diameter and longer than 85m. Before piling work commenced, a lot of tests concerning technology had been done. Thus insured the foundation construction successful.

Both northern and southern towers are hollowed double shaft with 3 prestressed concrete portal beams. Each tower finished in 7 monthes and concreted 19000m^3.

2.Construction of caisson foundation

Geological condition of northern anchorage is unfavourable. Rock layer embeds down to 100m from ground surface. The anchorage bears 550MN horizontal force. Final selection is a gravity anchorage with open caisson foundation to satisfy the requitement of stability and less deflecton. Layer of medium and coarse sand with gravel is chosen to be bearing stratum. Dimension of the reinforced concrete caisson is 69m $\times$ 51m, divided into 6 $\times$ 6=36 cells, sinking depth is 58m.

Simple to say,construction method of caisson is concreting the caisson into horizontal sigments and to sink one by one. Lower 30m of caisson was sunk in open air. Under ground water was pumped away through well pipes arranged arround the caisson, descending water table lower than the caisson bottom. Water guns and sand pumps were used to cut and transfer the soil out. When edged footig cut soil down to more than 30m, excavation proceeded under water, soil inside was taken out by air jets. As it fell down to the depth 1m higher than designed elevation, with help of air curtain surrounded outside walls, caisson set into its final position. The final deviation and inclination are much less than that required by Contract Technical Specification. In period of 20 monthes, there were 200 thousand m^3 of soil excavated out of northern anchorage foundation. Because the caisson does not set on rock, to restrict its horizontal and vertical deflection is significant. In consequent construction, surveying for caisson foundation must be continued. When superstructure is being erected, suitable adjustment has to be added to offset the deviation of anchorage foundation.