Saadiyat Bridge Abu Dhabi – One Bridge, Three Construction Methods

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Summary

The 1,450 meter long Saadiyat Bridge, the emerging landmark which will Link Abu Dhabi city with Saadiyat Island is one of the largest infrastructure projects in Abu Dhabi emirate. It will provide swift and smooth access to the signature destination which is being developed into a complete visitor and residential destination. Developed by Tourism Development & Investment Company (TDIC), Saadiyat Island (Fig. 1) is the largest single mixed-use development in the Arabian Gulf. Saadiyat Bridge will carry 2 x 5 lanes of vehicular traffic and two tracks of light rail, plus special architectural features were incorporated such as a variable lighting concept which may be adapted to different occasions. Based on site conditions, the originally envisioned construction method was changed and a combination of incremental launching, span-by-span falsework and balanced cantilever construction was used. These three construction methods are presented in this article. Aside from the considerations that led to choosing these three methods, the advantages and disadvantages of each method are explained underlining specifically the economic aspects governing the choice.

Keywords: Incremental launching, balanced cantilever construction, falsework, segmental construction, cost reduction, corrosion

1. Introduction

The original design for Saadiyat Bridge was signed by Parsons International Limited (PIL) using segmental construction, as well as the balanced cantilever method, and falsework for the distributer section (Unit 3). During tender, the contractor, a joint venture between the German Ed. Züblin AG and the UAE-based Saif Bin Darwish tried to propose an alternative design in order to reduce construction costs. Due to the large navigational

Fig. 1: Saadiyat Island with Saadiyat Bridge on the left hand side

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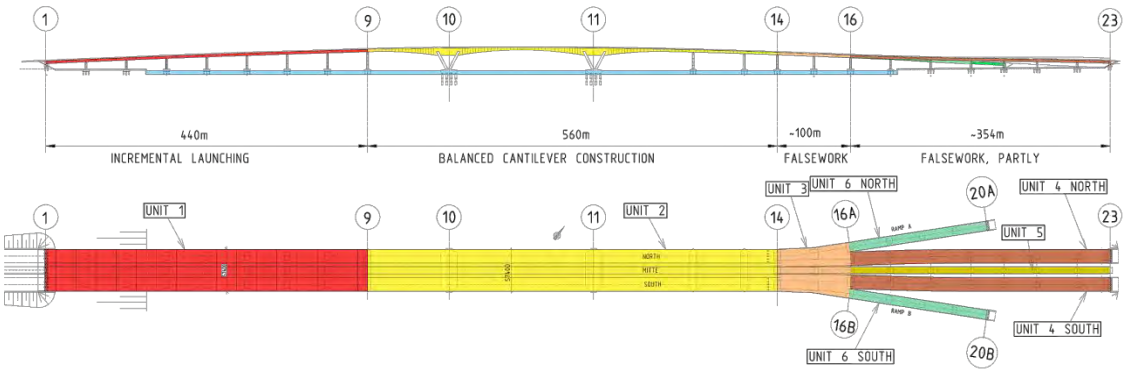

Fig. 2: Saadiyat Bridge – Elevation and Plan View

clearance required, Unit 2 could only be built as balanced cantilevers. Using form travelers with a larger capacity, the segment length was increased and erection time reduced. For Unit 1 – originally to be erected using precast segments – the incremental launching method was proposed instead. This method is widely used in Germany, Austria and Switzerland and the contractor has had longstanding experience with the method and highly capable personnel as well as the necessary equipment were already available. Choosing this method did no longer make it economical to use precast segments for Units 4 through 6, but the low height of the terrain made it possible to use span-by-span construction on falsework instead as was used for Unit 3.

2. Construction Method

The standard span length of 55 meters and the overall length of 440 meters are ideal parameters for the incremental launching of Unit 1. No auxiliary piers are necessary and with a girder depth of 3.50 m the parameter $c=l^2/h$ is within the range of 500 through 950 where incremental launching is economical. As the deck is made up of three independent box girders (Fig. 3) made continuous laterally only at the end of the construction process, the launching port for all three cross sections was re-used by repositioning it transversely.

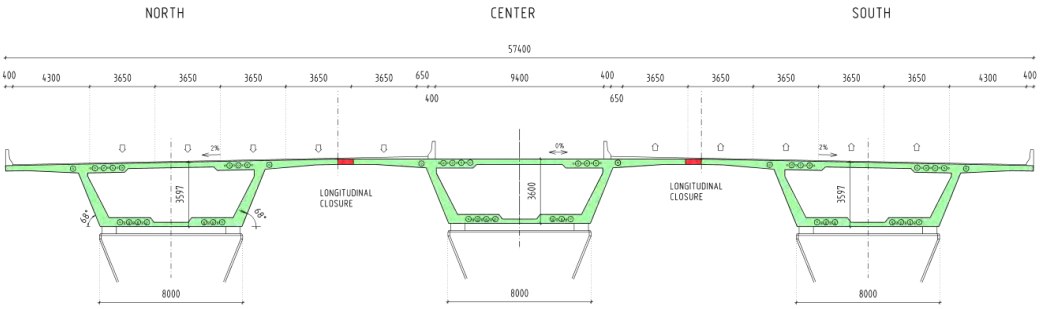

Fig. 3: Standard cross section Unit 1 – Incremental launching with transverse prestressing

The construction time necessary for Unit 2 was significantly shortened by using 16 form travelers in parallel and at full capacity. This reduced the total number of segments to be cast by 72 with a corresponding reduction of the necessary number of man hours and erection time.

For the distributer structure (Unit 3), a temporary landfill off the Saadiyat Island side made it possible to erect the falsework as if on dry land. In order to save on scaffolding costs here as well, the unit was divided into three longitudinal sections which each were cast in three stages – bottom slab, webs and deck slab.

Units 4 through 6 were erected on standard falsework span by span in two stages as well – bottom slab and webs cast first followed by the deck slab.

3. Outlook

When designing an object, a construction method must be used that is practicable for a great number of contractors. Each company must then decide for themselves which method is most cost effective. It may thus be advantageous for the owner to allow alternative construction methods during the tender process. Even if the structural analysis and detailed design needs to be completely reworked, an alternative erection method may still be more economical.