Technical Visit to Sungai Prai Swing Bridge Project

by Ir. Dr Jumat Ahmad

HIGHWAY AND TRANSPORTATION ENGINEERING TECHNICAL DIVISION

ON 2 July 2011, the Highway and Transportation Engineering Technical Division (HTETD) organised a technical visit to the Swing Bridge project at Sungai Prai, Penang. The technical visit was hosted by MMC-Gamuda Joint Venture Sdn Bhd, the main contractor for the northern Electrified Double Track Project (EDTP) between Ipoh and Padang Besar.

The visit was attended by 15 members of IEM led by AFETD committee member Ir. Dr Jumat Ahmad. The group arrived at the site office at around 11am and was welcomed by the project director for the design and construction team, Dr Khoo Ping Sen who provided the technical briefing.

The technical briefing covered the development status, project general arrangement, swing bridge moving mechanism, and challenges encountered at the construction site. Estimated at more than RM100 million, the swing bridge was designed by Waagner-Biro Stahlbau AG from Vienna, Austria. The electrification, signalling and communications systems are from Balfour Beatty Ansaldo Systems JV Sdn Bhd, United Kingdom. Basic details of the Swing Bridge are indicated in Table 1.0.

Table 1.0: Swing Bridge Details

Item	Wind speed (m/s)
Length	4 x 38.42m + 2 x 45.0m (Swing Bridge) + 1 x 36.5m = 280.18m
Horizontal Alignment	Tangent Track (Except for about 90m at the entry of the Sungai Prai Bridge on a 525m radius curve)
Vertical Gradient	0%
Speed	Design Speed: 60km/h Operating Speed: 50km/h

The 329km long northern EDTP package comprises the design and construction of the infrastructure and systems. The contract involves the laying of two new parallel tracks to replace the existing single track. It also includes the construction of new stations, bridges, as well as the installation of modern electrification, communications and signalling systems. According to Dr Khoo, the new swing bridge, which is part of the EDTP package, is already more than 45% complete. The bridge is scheduled to be ready by 2012.

Photo 1: Completed piling work for pier

Photo 2: IEM showing its appreciation to the host

Photo 3: A group photo of the HTETD delegates

Photo 4: An artist's impression of the new swing bridge

Once completed, the bridge will be an iconic structure on the Butterworth Outer Ring Road (BORR). The bridge that crosses Sungai Prai will have a 90m mid-span section. Through a unique design, the bridge is able to rotate and swing. This was designed to allow unrestricted movement of ships and marine vessels navigating along Sungai Prai. Table 2.0 shows the design characteristics of the bridge.

The new Sungai Prai Swing Bridge will replace the existing 40-year-old single-track railway bridge which was built by Keretapi Tanah Melayu Bhd (KTMB) in the 1960s. Six piers will be constructed to support the overall bridge length of 282m across Sungai Prai. The new swing bridge will be located between Pier No. 4 and Pier No. 6 and will be electro-hydraulic driven. The swing bridge will be monitored continuously from the KTMB control station. It will swing and operate at a 72.3-degree angle rotation with Pier No.5 functioning as the pivot for the moving mechanisms. Table 3.0 indicates the design criteria for the bridge.

Table 2.0: Sungai Prai Design Characteristics

Swing Bridge	• Ballastless Track System • Steel Sleepers Supported On Steel Deck • Sail Structure Formed By Steel Plates • Vessel Protections System Provided
Approach Structure	• Ballasted Track System • Conventional Beam & Slab System

Table 3.0: Sungai Prai Bridge Design Criteria

Total Swing Bridge Length	90m
Total Deck Weight	approx. 1100 tonnes
Operation Angle	approx. 72.3 degree
Drive	Electro-hydraulic operated
Total Operation Time	approx. 5 minutes to fully open and vice versa

The project director admitted that there might be some challenges in completing the project. The main issue relates to the design and installation of the electrical and hydraulic interfacing system with the rail locking mechanisms to ensure reliability of locking during the open or close operation.

The lift and turn mechanism at the centre pivot has to be engaged or repositioned correctly after the rotation or swing. This is to ensure that the track is properly locked. Nevertheless, he was confident that the challenges would be overcome, and not cause any delay in the delivery schedule.

After lunch, the delegates were brought to visit the site. We managed to see the progress of piling works and the completed approach on the Butterworth side. We noticed how well the working area was organised by the experienced contractor. Some piling points for the bridge piers were driven by the stationed piling barge at Sungai Prai. We also witnessed the formwork preparation for the bridge slab deck and substructure platforms at the fabrication yard.

The technical visit ended after a site photography session. Through this visit, the participants were able to gain a better understanding of design techniques, applications and construction of the swing bridge. ■