



Report on Trends and Development of Precast Concrete Arch Bridges in Malaysia

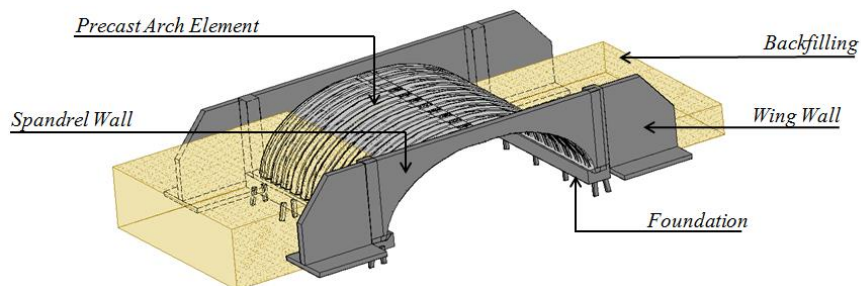
by Ir. Dr Ng Soon Ching

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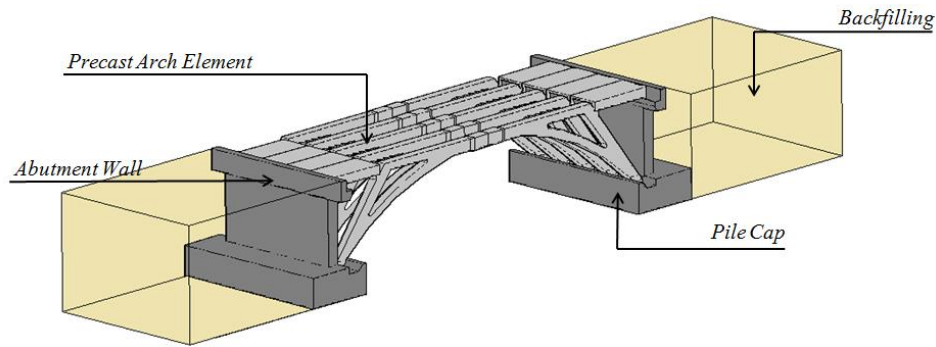
The Civil & Structural Engineering Technical Division (CSETD) has organised an evening talk on the trends and development of precast concrete arch bridges in Malaysia on 9 August 2017 at Wisma IEM. The talk was delivered Ir. Tan Geem Eng, who has vast experience in research, product development, design and construction of precast arch bridge. This talk was chaired by Ir. Dr Ng Soon Ching and was attended by 48 participants.

The talk started with a simple introduction to precast concrete, history of arch bridges and its categories. The history of precast arch bridge can be traced back to the ancient Egyptians in 3000BC. On the hand, the modern precast arch bridge was developed by a Swiss engineer in 1960's which was named as BEBO system. Following that, various precast concrete arch bridge systems were developed mainly in the west such as Matierre (France), TechSpan (Spain), CON/SPAN Series (US), Flexi-Arch (UK) except Rivo Series from Malaysia. During the talk, Ir. Tan also mentioned briefly about the soil structure interaction for precast arch bridge and the importance of the backfilled soil to maintain the stability of the precast arch bridge.

After a general introductory to precast concrete bridges, Ir. Tan focused on the main subjects of the talk: Closed Spandrel Arch bridge and Open Spandrel Arch bridge, (Figure 1). From the involvement of Ir. Tan in precast concrete closed spandrel arch bridge design and construction, he highlighted a few shortcomings in the existing designs or systems of closed spandrel arch bridge namely heavy section, high transportation and handling cost. So, a new closed spandrel arch bridge section was developed and patented by Ir. Tan from the inspiration of the leaves of tropical plants to address the shortcomings of the existing closed spandrel arch bridge system. The new corrugated section is lightweight and stiffer compared to conventional closed spandrel arch bridge section. Therefore, this section is also cost efficient in both transportation and handling (Figure 2).



(a) Closed spandrel arch bridge



(b) Open spandrel arch bridge
Figure 1



(a) Existing



(b) Newly developed and patented corrugated section

Figure 2: Precast concrete closed spandrel arch bridge section

Towards the end of the talk, Ir. Tan shared a few recently completed projects. The most notable project is the replacement of an old 3-span beam bridge across Melaka River. This is a very challenging project with a lot of construction and technical constraints. Generally, the project required the replacement of the existing 3-span bridge as shown in Figure 3 with unique aesthetic appearance. The client insisted an uninterrupted river cruise during construction.



Figure 3: The old 3-span bridge over Melaka River

Another constraint of this project was the high water level which resulted in limited headroom availability. Furthermore, the bridge also requires lower rise/span ratio to ensure that the bridge

deck level is matched with the existing road level. These requirements make the closed spandrel arch bridge unsuitable. Therefore, an open spandrel arch bridge was proposed and constructed as shown in Figure 4. Ir. Tan also shared with the audience in overcoming the construction constraints in terms of poor soil condition and congested site.



Figure 4: Open spandrel arch bridge over Melaka River

At the end of the talk, there were questions raised by the audience which Ir. Tan answered and clarified in more detail. It is indeed a very interesting and rare talk delivered by Ir. Tan, whom is the prime mover in conducting research and development work on a new precast arch bridge system then commercialised the newly developed precast arch bridge system into the market. Ir. Tan also shared some of his challenges faced when he tried to introduce the newly developed precast arch bridge into the market in the initial stage. The talk ended with the presentation of a memento to Ir. Tan by the Advisor of CSETD, Ir. Hooi Wing Chuen.



Figure 5: Presentation of memento by Ir. Hooi Wing Chuen (right) to Ir. Tan (left)