MRT Launch Portal @Semantan

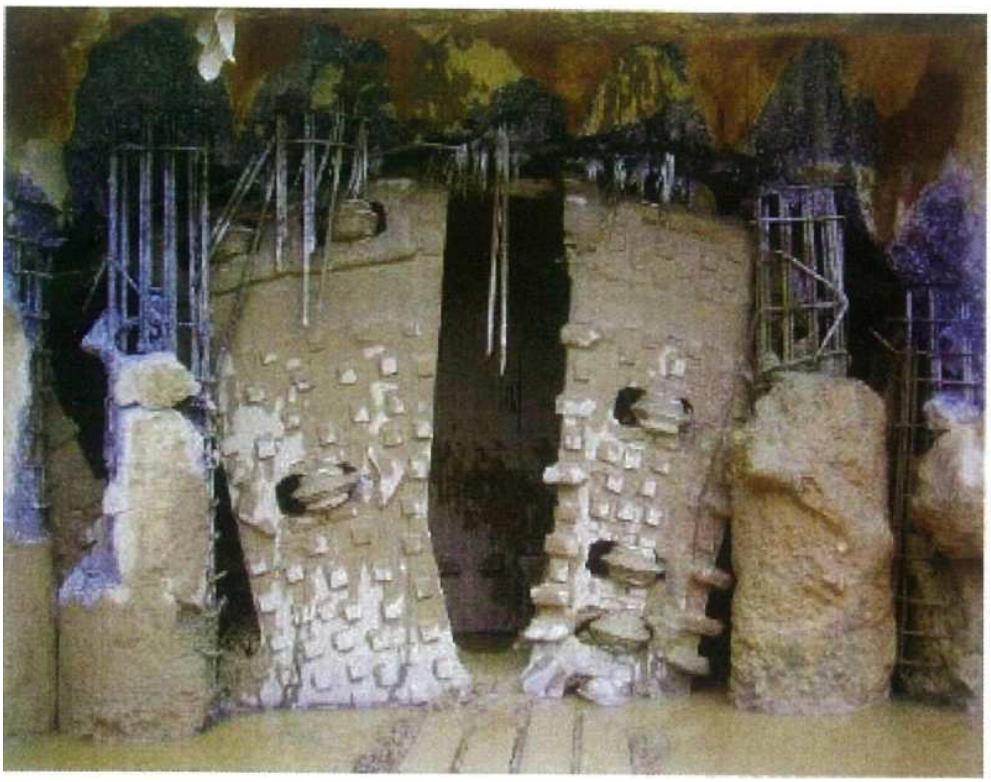
Construction of "Soft Eye Openings"

(by Mr. Perkin Chin, General Manager) (2012 Apr-Jun)

Owner:	MRT Corp, Malaysia
Project Delivery Partner (PDP):	MMC-Gamuda KVMRT (PDP) Sdn. Bhd.
Contractor:	Geohan Sdn. Bhd.

Tunnel excavation will most commonly commence with the TBM (Tunnel Boring Machine) being launched from a reinforced concrete shaft formed either by construction of diaphragm walls or bored pile walls, and likewise will end by the recovery of the TBM at the termination of the tunnel during break out.

In Semantan Launch Shaft, the "Soft Eye Opening" method was adopted. The shaft was formed by construction of 1200mm diameter contiguous Bored Pile Walls. To facilitate the "Soft Eye" openings, 28mm diameter Glass Fibre Reinforced Polymer (GFRP) bars were used to substitute steel bars at the "Soft Eye" region of the reinforcement cages.



Typical View of TBM break out "Soft Eye"

GFRP Reinforcement Cages of 1200mm Diameter, "Soft Eye" piles;
Main Bar: 25mm; Spiral Links: 20mm (fabricated in spiral coils from factory)

<u>This method has the following advantages in construction:</u>

- Shorter construction time especially during launching and breaking through as TBM penetrates directly through the shaft wall at "Soft Eye" openings.
- Reduce wear and tear on the cutter head.
- Reduce safety hazard as no workers are required in the access shaft.
- No grout blocks are required behind the wall therefore cost effective.
- Fabrication of "soft eye" reinforcement are time and labor cost effective (GFRP bars are one quarter the weight of equipment steel bars)
- Reduce cost of machine time. In conventional method, hydraulic breakers/cutting equipment are employed to break out the concrete and steel before the TBM could pass the structure. This demolition works usually take days to complete.
- GFRP bars have high guaranteed tensile strength of 1000MPa (as compared to 500MPa in steel bars)

Even though this method demonstrates great benefits in construction, it has its own limitation with regards to the usage of "soft eye" GFRP reinforcement bars.

- A lead time of at least one and a half (1-1/2) to two (2) months duration must be allowed in the construction program for GFRP procurement and delivery, especially in countries where the project is situated does not produce GFRP bars.
- Even though the weight of GFRP bars are a quarter (1/4) of that of conventional steel bar, its price are at least two and a half (2-1/2) times more than steel bars in Malaysian context.
- Considerable time is required to prepare and fix the lapping joint. Each pair of lapping bars are held together using U bolts as no welding could be performed on GFRPs.