Ampang Depot Remodelling Works

Ir. Syed Neguib bin Syed Mohamed

For centuries, railways had played an essential role in the urban, economic and social development of many nations, especially during their early years.

For many decades, the focus of our country's transport landscape was mainly on roads. But with road congestion and the continuing increase in fuel prices, the Government has invested in rail projects with the aim to reduce traffic congestion, increase fuel savings and reduce carbon emission.

The National Key Economic Area (NKEA) for the Greater KL/Klang Valley set an objective to achieve a Top 20 ranking in city economic growth as well as to be among the top 20 most liveable global cities by 2020.

In July 2012, Syarikat Prasarana Negara Berhad (Prasarana) awarded the Ampang Line Extension Project to George Kent-Lion Pacific JV (GKLP). The project was listed as one of the key initiatives under the National Key Result Areas (NKRA). Phase 2 was completed and opened to the public on March 31, 2016. It was expected to have a daily ridership of more than 170,000.

To enhance the existing Ampang Line (which ran from Ampang to Sri Petaling) and to increase the capacity and service performance, a new fleet of 50 trains would be deployed. To facilitate this, a remodelling of the existing Ampang Depot to stable 20 new Light Rail Vehicles (LRV), was of the utmost priority. In operation since 1995, the depot used non-signalise (manual) operations, including hand-operated switch turnouts which presented a unique set of challenges to the constructability of the system.

THE OBJECTIVES

The purpose of remodelling the Ampang Depot was to allow the new LRVs to be operated from the depot which would be installed with the Communication Based Train Control System (CBTC), monitoring and controlling system of the load break switches system for the 750V DC distribution system and the track alignment and turnouts to accommodate the new LRV turning radius which could not navigate the entirety of the depot.

Northern view of Ampang Depot

The last Adtranz LRV to be decommissioned from Ampang Depot

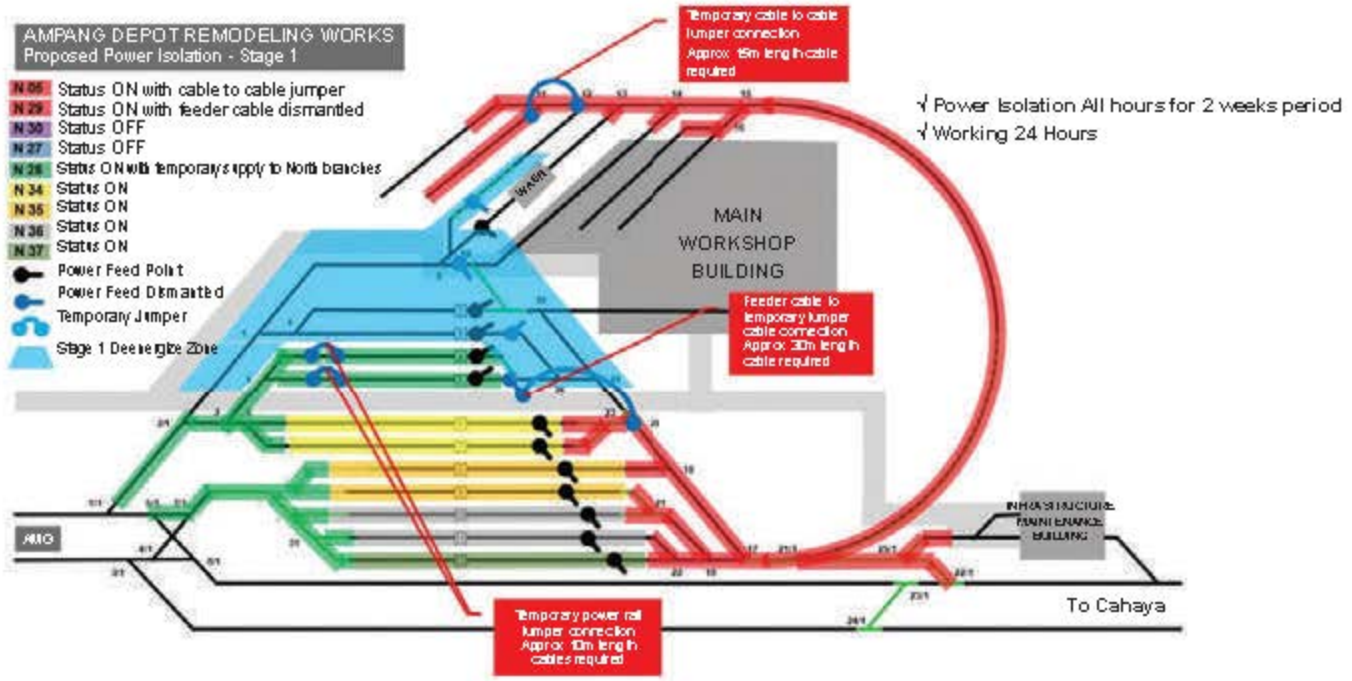
THE CHALLENGES

On a daily basis, Ampang Depot is a beehive of activities, so to reconstruct the track layout and the signalling system means overcoming a plethora of unique challenges.

First, specific track lines had to be closed for work on the trackwork and a staggered power rail isolation plan was required. If track lines were closed, there would be a need to find parking areas (see figure below) for the trains. The challenge here was to juggle between the parking capacity of the existing and new LRVs to ensure the trains would be ready for service every morning, to modify the 750V DC power section to enable works to be done safely within the depot while allowing the LRVs to manoeuver around the depot for operation flexibility. At the same time, the old trains would be decommissioned stage by stage and new trains delivered to the depot.

Before embarking on the project, there was a need to identify each feeder and jumper cable for each power section within the depot. The work was done during "engineering hours" (1.00 - 4.30 a.m.) by opening the breakers at the Traction Power Sub Station to check the power feeds at ground level. When each cable feed to the conductor rail was determined, an as-built single line diagram was drawn and power isolation concept (see diagram below) was designed to facilitate the work sequence of the project and to provide a safe working area for the crew.

The project was divided into 4 sections at different locations, with the ultimate objective to realign the



Stage 1: Power Isolation Diagram

trackwork, modify existing infrastructures and install the CBTC signalling system to accommodate the new trains.

TRACKWORK

The new trains have a continuous gangway concept design. A gangway connection is a flexible corridor that connects two coaches. The track geometry at certain sections of the depot would have to be realigned to accommodate this new design.

Turnouts are geometrically precise track components and high risk areas which can cause train derailment as the basic function is to guide a train moving from one track to another. Through the principle of leverage, the switch road switches the moveable rails and guides the trains into the designated route.

The existing 1:5 turnouts at Ampang Depot were to be replaced with new 1:6 turnouts which had a smaller crossing angle. To accommodate the existing alignment of the depot, a custom-made equilateral turnout and crossover were installed as well. A crossover is a pair of switches that connects to parallel tracks and an equilateral turnout is a Y-Shaped turnout. A total of 14 turnouts were affected, including 3 on the mainline. Due to site constraints, the existing turnouts had to be dismantled piece by piece, and transported out of the locations, before the new turnouts were transported in pieces and installed at the final locations.

Modification of Existing Diamond Crossing

Each rail joint was connected using alumino thermic welding. The preparation works included cleaning the joints of rust, dust or other contaminants to avoid these fusing with the weld material.

The rails were then aligned using straight edge along the running edge of the rail head with a gap of minimum 25mm between rail joints to get a satisfactory result when the thermic portion is poured into the weld mould. Alumino thermic welding is fundamentally a process that causes a fusion of metals by heating them with superheated molten metal from the alumino thermic reaction between aluminium and metal oxide. For the Ampang remodelling works, approximately 500 thermit joints were performed.

INFRASTRUCTURE MODIFICATION

Ampang Depot is the oldest metro depot in Malaysia. One of the major challenges of the project was to modify the existing infrastructure to accommodate the new track layout and LRV Structure gauge.

A structure gauge is the minimum body clearance outline of the train to clear structures around the railway such as tunnels, bridges and station platform. One modification was to remove the existing stabling platforms to allow the LRV to pass through while retaining the mechanical and electrical services at the platform. Where required, 750V cables, SCADA communication cables, were also relocated to protect against damage during the remodelling works. After the project was completed, an interface test was done to ensure the new infrastructure cleared the structure gauge of the LRV.

Crossover Crossing Assembly

MAIN LINE WORKS

On 11 December, 2016, work shifted from the depot to the main line to remove and replace the existing crossover. This was extensive and, engineering and project management wise, required surgical precision to execute. The uniqueness of the work required making a special application to Suruhanjaya Pengangkutan Awam Darat (SPAD) to extend the engineering hours from 4.30 a.m. to 9.00 a.m., which meant the LRT operating hours would be delayed by 3 hours. With the consent of SPAD, an announcement was made via mainstream media and notices were put up to inform the public.

Failure to execute the work satisfactorily and hand over the line possession back to Rapid Rail, would result in a hefty fine of up to RM300,000 an hour.

A comprehensive plan was drafted, detailing every step in 30-minute blocks, including each worker's responsibilities and targets for the night. Risk analysis was done and mitigation plans were proposed with sufficient redundancies provided to ensure the risks were as low as possible.

A week before the date, intensive preparation works started, including the preassembly of the crossover. At 1.05 a.m. on 11 December, with more than 100 workers and engineers on site, the crossover that was first commissioned almost 20 years ago as Malaysia's first LRT system, was lifted out with a 300-tonne crane.

The work was completed at 8.20 a.m. The engineers did the final checks and waited for the first train from Ampang Station to navigate the crossover at 9.00 a.m., completing the crown jewel of the Ampang Remodelling works.

LESSONS LEARNT

Even with all the designs and work planning, it required tremendous coordination and cooperation between all parties concerned throughout the construction period, to put all the pieces together. The engineers worked untiringly, no matter the hour, to ensure the project was a success.

From the reconstruction of the track layout and the modification of the existing infrastructure, to the staggered power isolation and juggling the LRV parking plan and re-signalling the depot, we are reminded of how important the human element is to the success of a project.

The success of the LRT Extension Project and the recent launching of the KVMRT Line 1, including the ongoing works for KVMRT Line 2, LRT 3, East Cost Rail Link (ECRL) and South Double Track, demonstrates the government's commitment in railing the nation forward. ■

Author's Biodata

Ir. Syed Neguib bin Syed Mohamed, *is the Managing Director of Interfleet Rail Engineering & Consulting. He is also in the General Committee in Corporate Affairs, Membership Drive & Promotions, Mechanical Engineering Technical Division and Logbook Training Scheme.*