FACTSHEET ON POWER RAIL REPLACEMENT PROGRAMME FOR THE NORTH-SOUTH AND EAST-WEST LINES (NSEWL)

Issued on 12 Sept 2017 along with the Joint Media Release "Replacement of Power Rail Completed on the North-South and East-West Lines"

What is a power rail?

The power rail, also known as the Third Rail, is a special rail that runs parallel to the running rails on which the train wheels travel. Trains are powered by electricity drawn from the power rail through contact with the trains' current collector devices.

Why was the power rail along the NSEWL replaced?

Constant friction between trains' current collector devices and the power rail causes the rail and respective supporting bracket assemblies to become worn, causing power faults. As such, renewal of these ageing infrastructure will help to increase rail lines' reliability, availability, maintainability as well as safety and security (RAMSS). The power rail was replaced to improve RAMSS and prepare the network for higher capacity, i.e. more trains and higher ridership.

Five-stage process for the power rail replacement project:

(i) Pre-construction survey:
Pre-construction surveys allow the team to identify potential challenges to replacement work. This also enables the team to identify new bracket locations, and to mark specific places for the cuts/joints and other third rail components.

(ii) Preparation works:
Prior to delivery of the new components to the work site, the team provisioned for new power rail inserts for sleepers in the tunnels at switch and crossing areas.

(iii) Delivery of new power rail components to site:
As the power rail comes in lengths of 15m, each weighing about 280kg, the team had to use heavy machinery to carry out the advance deliveries. In order to maximise the time available to carry out the replacement, Road Rail Vehicles (RRVs) and locomotives coupled with wagons were used to deliver the materials to the work site.

(iv) Replacement of power rail:
On the actual night of replacement, a team would work on the track during engineering hours to replace approximately 180m of power rail. The team would remove the existing covers, disassemble the power cables and remove the existing power rail. Thereafter, the old supporting brackets would be removed and new supporting brackets installed with new spacing between them. Rail cutting on the old power rail would be carried out to ensure the connection with newly installed power rail for revenue operations later that day. Other power rail components such as mid-point anchors and expansion joints,

protection covers, etc were then installed before an electrical insulation test was carried out on the new rail to ensure it was fit for train operations in the morning.

(v) Commissioning Test:
After the power rail for a sector was installed, a High Potential Test (Hi-Pot test) would be conducted. This involved injecting 5kV of current into the new power rail system for 15 minutes to ensure there was no significant leakage of current.

How long did it take to replace the power rail on the NSEWL?
The power rail replacement project started in September 2015 and was completed in August 2017.

What is the lifespan of power rail?
This is the first time we are replacing the power rail on our network since MRT operations began in 1987.The design life span of the new power rail is typically around 40 years and is mainly dependent on the conditions of the track, the environment, the frequency of usage and maintenance. The new power rail uses an improved method of attaching the stainless steel contact surface to the aluminum body of the power rail, which will eliminate problems related to delamination.

On average, how many power rails were replaced on a nightly basis?
Each installation team achieved about 180 metres (equivalent to 12 rails) of rail replacement each night. There were three to four teams working on the renewal of the power rail at different locations on the NSEWL network each night. The project team gained valuable hours to work on the project with temporary early closure and late opening of selected stations along the NSEWL. For example, with the extra hour to carry out works when train services started an hour later on Sundays between June 2016 and October 2016, a combined team successfully replaced 650 metres of power rail in one night.

What were some of the challenges faced during the project?
Some of the main challenges included the short window of 3 hours available each night, the sharing of engineering hours with other project teams (sleeper replacement, re-signalling, noise barriers installation and regular preventive and corrective maintenance), and accessibility to work site locations that were far away from the stations.

Where does the power rail draw its power supply from, and what is the backup should this source of power go down?
The power rail draws electricity from sub-stations located along the network. If a particular sub-station were to malfunction, the adjacent sub-station will act as the backup power supply for the power rail.

What are the improved components in the new power rail system?
The major components replaced include the conductor rail claws and conductor rail.

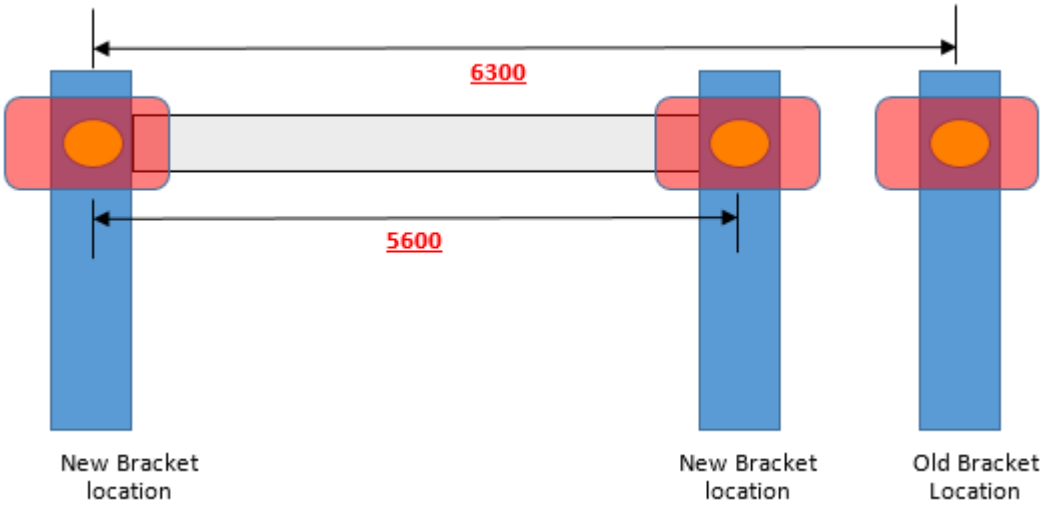
(i) Conductor Rail – The new rails feature a stainless steel conductor strip for improved durability. The new conductor rail also features a curved design to prevent delamination by improving the method of attaching the stainless steel contact surface to the aluminum body of the power rail.

OLD POWER RAIL	NEW POWER RAIL
	

(ii) New Support Assembly (Claws) - The power rails are supported by new rail assembly claws, which feature a positive-lock design for better resistance against vibration. The claws are also made from stainless steel (as compared to galvanized steel previously), which makes them more durable when placed on open viaducts that are exposed to the weather.

OLD POWER RAIL	NEW POWER RAIL
	

(iii) System Design – The new design involves reducing the bracket span by 1 sleeper spacing, from 6.3m (9 sleepers) to 5.6m (8 sleepers). This improved bracket spacing will improve the rigidity of the power rail.



(iv) Insulator Inspection Cover – In the old system design, the insulators were covered by the power rail covers, making inspection of the insulator difficult. In the new system design, an insulator cover has been specially designed with an inspection hole to allow maintenance staff to conduct a quick check on the critical components of the insulator assembly (insulator claw and bolt).

Condition monitoring tools deployed along the NSEWL for better preventive and predictive maintenance of the power rail system

(i) The Linear Variable Differential Transformer (LVDT) helps monitor the alignment of the power rail in real time. It measures the movement of the trains' current collector devices (that come into contact with and draw electricity from the power rail). Through this data, the system can chart the precise height of every inch of the power rail and the maintenance team can quickly zoom in, inspect and rectify any potential power rail faults relating to misalignment.

(ii) In 2017, a new condition monitoring device that detects the lateral displacement of the power rail was added to the LVDT, for even better tracking and monitoring of the power rail's alignment.

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