

## **DC Stray Currents in Bangalore Metro Project & Corrosion**

### **Concept of dc Stray Current Corrosion**

The traction system in Bangalore Metro Rail Project is 750 V DC third rail system. In dc traction system, bulk of return current finds its path back to the traction sub-station via the return circuit i.e. running rails. The running rails are normally insulated to minimize leakage of currents to the track bed and then to the structure. However, due to insulation deterioration (dirt, premature ageing and wear, insufficient maintenance) some leakage from the return current takes place, which is known as 'stray current'. The current follows the path of least resistance back to the sub-station. Return current may deviate from its intended path if the resistance of the unintended path is lower than that of intended path. The stray current may flow through the unintended path of metallic reinforcements of the structure or other metallic utilities located parallel to the railway back to the sub-station. It is also possible that part of the stray current may also flow into the ground, where it may be picked up by metallic utilities and discharged back to the ground and then to the sub-station. Minor corrosion effects of stray current are noticed over a long period say 10 – 15 years to the metallic structures if protection measures are not taken.

World over, dc traction systems are in use on most of the Metro Rail Systems and it has been seen that there have been no case of damage wherever stray current corrosion protection measures are adopted. Accordingly, modern remedial measures are adopted in Bangalore Metro Project at par with latest technologies prevalent around the world to eliminate the effect of stray current and corrosion.

Adequate measures for protection against Stray Current Corrosion are built into the design and implemented. The major measures are as under:-

- i) The running rails have been insulated and the conductance per unit length for single track sections are ensured as under as per internationally acclaimed limits:-

Elevated section: - 0.5 Siemens/Km

- ii) Reduced resistance of rail-return circuit e.g. using continuously welded rail and rail/track bonding.
- iii) Stray Current Collector Cables [commonly known as structural earth (SE) cable] (2 x 200 mm<sup>2</sup> copper or equivalent) have been provided along the viaduct and all the metallic parts of equipment, cable sheath, viaduct reinforcement, signal post etc. has been connected to SE cable.

- iv) The continuity of the reinforcement bars of the piers/viaduct as well as track slabs have been ensured along with a tapping point for connection with SE cable in order to drain back the stray current.
- v) A provision has been made to automatically earth the running rail (i.e. negative bus) in case of rail (running rail) potential being higher than limits prescribed (120V) in order to ensure touch voltage safety of personnel. This has been achieved by providing track Short Circuiting Device (SCD) at all stations in TSSs / ASSs.
- vi) Station platforms are also provided with anti touch voltage membranes within the platform structures. This prevents touch voltage between passengers standing on the platform to a stopped train.
- vii) Increased insulation between running rail and track bed by using insulated track fastening system.

Any leakage current is effectively drained into a low resistance cable running [structure earth cable SE] alongside the track and thus prevented from escaping into the other structures.

#### Stray Current Monitoring Mechanism:

A system of measurement of running rail to earth voltage is already in place through the Supervisory remote Control and Data Acquisition (SCADA) System. The values of the running rail to earth voltage will be recorded once in a month. Incidentally, the Short Circuit Device, which also utilizes the same voltage measurement and earths the system in the event of the build-up of the voltage beyond permissible level, is already in place to ensure human safety. Depending on the Voltage level, a decision would be taken to have a revamp of related track and earthing installations.

In addition, a full-fledged Stray Current Monitoring System (SCMS) (Design under finalization) will be installed within next four to six months on par with a world class Metro Rail Systems.