



EHS Plan for Under Ground Metro Station E & M Work & Safe Operating System for Panel Erection at Underground Metro Station

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Abstract:

This project phase focuses on the environment, health and safety plan which is prepared for electrical and mechanical works for underground stations in Bangalore Metro Rail-Phase based on one of the critical incidents. It describes the safe operating procedure for such incidents, checklists to be followed, Hazard Identification and Risk analysis, Hazard Control Measures, Personal Protective Equipment to be used for various activities, Machineries to be handled, Communication and Reporting Procedure, Training details, Emergency Response Plan and Documents to be prepared & maintained. This project aims to improve safety in the workplace and environmental protection by means of enhanced risk management in the company.

I. INTRODUCTION

This project proposes step by step procedure to execute the job in a safe manner and EHS plan has been prepared for electrical and mechanical work at underground metro station.

There was a critical incident happened at one of the metro stations during panel shifting to panel room. Based on that incident, SOP has been updated for panel erection work at underground metro station. This project study provides the direct cause, indirect cause, precautions to prevent similar occurrence and panel shifting and handling methods based on this incident.

This journal publishes the updated SOP for panel shifting and panel erection work for underground metro station construction work.

II. PRE OPERATIONAL CHECKS

- Select the Workers and screen for competency and physical fitness to perform the activity
- Ensure EHS induction training provided before engaging on work.
- PEP talk specific to the erection activity shall be conducted explaining hazards associated with the job and the safety measures to be adopted including ERP, First aid.
- All workers at site to wear Safety shoe, helmet, hand gloves.
- For work at height, full body harness with double lanyard, fall arrester and height pass are required.
- A standard signals to use in passing / communicating / controlling erection activities.

- Fully equipped First Aid box should be made available at each erection location.
 - Emergency contact details to be displayed in the workplace.
 - The requirement identified in the Emergency response plan shall be in place
 - Engage skilled workmen for loading and unloading of panels.
 - Approach and access to work area to be ensured.
 - Before erection, check all tools and tackles.
 - Ensure Permit to Work System where ever applicable is in place before starting the job
 - Site / work-front clearances to be obtained.
 - Un-authorized person shall not be allowed to the area of erection
 - Erection work will be carried out under supervision of responsible persons.
 - Unloading arrangements are to be planned before receipt of panels at erection site.
 - Soil condition shall be checked for the load bearing capacity and its level.
- Check the equipment fitness of Crane as per (IM – 15 B Equipment Fitness Report For Vehicle & Earth Moving Equipment)
- Attach the web sling on the hook and pass them under the wooden pallet provided on the bottom of the Panel.

Responsible Person	A person who has sufficient knowledge and training with one year experience in execution, shall be able to recognize obvious defects and is responsible to the section incharge / site engineer the 'in service' inspection and maintenance of equipment
Competent Person	Someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular assignment.(minimum two years of experience in the respective area of work).
Lifting Gear / Lifting Tackle	Any item used to connect a load to a lifting machine or appliance, but which is not in itself capable of providing any movement to lift or lower the load. Lifting gear is in some circumstance known as lifting tackle.
Lifting Appliance	Any machine which is able to raise, lower or suspend a load but excluding machines incorporating a guided load (i.e., lifts) and continuous mechanical handling devices (i.e.,conveyors).
Automatic Safe Load/ Indicator	A device fitted to a Crane, or incorporated in its design, that automatically gives visual indication to the operator when the load being lifted or carried by the crane approaches the Safe Working load, and that also the vicinity, when the load being lifted or carried exceeds the Sate working Load.
Load Radius Indicator	A device fitted on a Crane that shows the radius of the hook and the corresponding safe working load.
Operating Radius	The horizontal distance between the point at which the centre of un of the crane meets the ground and the vertical centerline through the hook.
Capacity Chart (or Plate)	A notice fitted on a Crane specifying the lifting capacities of the Crane at different load-radii and for different operational conditions.
EOT Crane	Electric overhead travelling crane, this is used for erection, handling and moving specified weight of the equipment's called capacity of the crane within a specified area.



- Panels shall be tied with web slings to prevent the movement of the panels tied with guy rope from both sides.
- Ensure correct panel is being received from the store as per drawing and it is being taken to its correct destination at the site.
- Check the approach from unloading spot to erection spot for any obstruction.
- Ensure the area is leveled to avoid toppling of panels.
- Ensure identification markings on the panels for their easy traceability in workplace.
- Ensure that the panels are not given any undue jerks.
- No person shall stand below crane or even in the boom radius during lifting, lowering and swinging.
- No person / workmen should travel / sitting on heavy equipment while transportation of materials.
- While travelling by trailer no person should sit on trailer except driver.

- Ensure that a workmen who is going to work on height is competent, having safe climbing arrangement (like scaffold, ladder, staircase, etc.), equipped with required PPEs, having fall arrestor to arrest falling from height.
- Scaffold shall be inspected by the competent trained person and scaff tag to be provided.
- Colour coding system is to be in place to ensure only inspected tools are in use.
- If welding machine is engaged for welding, equipment earthing also to be ensured.
- Direct earthing shall be provided from the machine to parent material to be welded.
- Cables shall free of any damage.
- Before operation, check all tools and tackles to be ensured.
- Lifting tools & tackles are to be stacked in such a manner that they can be taken out easily.
- Audio visual alarm should be in operation while operating the EOT Crane (if the facility is available).
- Emergency switch shall be operating Condition.
- Illumination level of 200 lux shall be maintained at erection site.
- Opening if any in and around the panel unloading or erection area to be guarded / covered with rigid material (6mm chequered plate / 25mm thick wooden planks)
- Before erection complete Panel room levelling shall be taken in 4 or 5 places and take average of the levels to maintain the same level for all panels.

- If any Bus duct are to be connected with panels check the outside transformer levels, distance from switchgear to facilitate the Busducts.
- Clearance between panel's rear side, front side, left & right side should be maintained 1500mm or otherwise specifically mentioned as per O&M manual issued by the manufacturer.
- Control wiring between the compartments to be done as per the drawing.
- Tightness of joints to be done & checked with torque wrench pressure as per recommendation of the manufacture.
- Loose items supplied like relays , meters, draw out type module to be installed on the cutouts. Fixing of panel with Base frame after final alignment or welding with base channel as per the specification

III OPERATIONAL CHECKS

- Provide Rail track with ISMC Channel to roll out the trolley for shifting of panels.
- Crowbars, ISMC channels, wooden blankets are to be used for tracking the panels on the floor.
- Check Panel board gland plate's position to facilitate the cable terminations, it should not come the base channels or floor concrete beams.
- Panel erection should be started after completion of the switchgear panel Room civil work like plastering, window, door installation, internal painting.
- Approach for the vehicle movement to the panel room at least plain road should be there to avoid tilting.
- Leveling of the panels should be made in such a way that bottom of the panel base frame should match with flooring.
- Panel coupling to be done with correct hardware's to avoid gap between panels.
- Main bus bars jointing with spring washers applying petroleum jelly.



IV. PANEL SHIFTING FROM THE PLATFORM LEVEL TO PANEL ROOM.

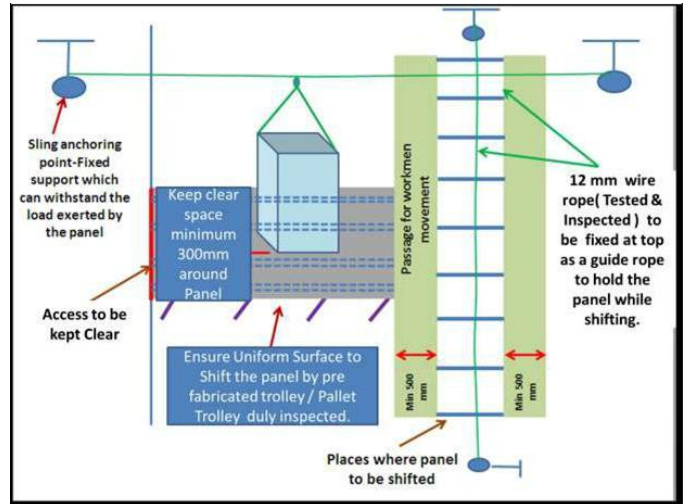
- Daily Inspection of the Forklift, permit system & cross verification of the checklist before shifting the material.
- Competent Supervisor & EHSO or Safety supervisor shall be available while shifting the panel.
- Panel shall be tied by using the Ratchet Belt with the fork frames.
- All the uneven floor surfaces to fill with the sand, else slope arrangement to make to prevent the jerk
- Area shall be barricaded to prevent the unauthorized entry in the movement of the fork lift area.
- PA System (Mega phone) shall be used to aware the forklift operator to guide the step by step operation.

- Other material shall be kept at the platform level shall be kept away in the vicinity of the marching area. The bay shall be kept clear while shifting the panel.
- Cross Inspection shall be done to identify the deviation if any



- Panel shall be tied by using the Ratchet Belt with the fork frames.
 - Access is kept clean to avoid undo jerk while shifting.
 - Other Moment are kept clear in the fork lift area.
 - Cordoned by using the barrication tape & signal man.
 - Competent Supervisor & EHSO or Safety supervisor shall be available while shifting the panel.
 - Top anchoring arrangement made of 12 mm steel wire rope shall be provided at top support in order to restrict toppling of panel
 - In case of narrow base, the panel is shall lift the case at either end, to insert pallet truck but never lift too much
 - Workers handling panels should be CAUTIOUS IN ORDER to avoid injuries to toe & fingers getting caught under roller
 - Workers should always be behind the panels while pushing. To avoid tilting sideways tag line ropes can be provided
 - Embedded parts (EP's) provided for panel erection shall be checked for level.
 - After the panels have reached the erection spot wooden packing shall be removed from the panel.
 - Use step ladder for unpacking
 - Dispose the wood packing material to its allocated area. Removal of protruded nails from the wooden planks is to be done
 - Ensure that the communication between the signal man are the concerned fitter gang is correct
 - Skilled rigger shall be engaged to control hoisting & de-hoisting of crane.
- 3 Meter of long Tag line should be used from both the ends to minimize oscillation of equipment
- Chain pulley block should never be used for horizontal / oblique pulling
 - Only "tirfor" is to be used for such pulling
 - When lifting the panel, area must be protected and no unauthorized person should be permitted to enter the area

- Do not load beyond the rated capacity of the crane
- While lifting of panel, sharp edge protection such as gunny bags, cotton pads should be provided



- Embedded parts (EP's) provided for panel erection shall be checked for leveling
- After the panels have reached the erection spot wooden packing shall be removed from the panel.
- Place panels with hydra / EOT Crane with their own base frame over EP's as per sequence indicated in drawing.



V. POST OPERATIONAL CHECKS

- All the tools & tackles used for such activity are to be taken back by the group of workmen after completion of day work.
- Opening if any in and around the panel erection area shall be closed.
- Work permits shall be returned after completion of the activity.(if obtained)
- Remove the unwanted material from workplace.
- Dispose the wood to its allocated area. (Packing material if any)

- Supervisor should ensure all workers have left the building before leaving the workplace himself.
- Handed over the lock & Key to the identified security incharge / section incharge.

VI RELATED DOCUMENTS & CHECKLIST

1. Erection schedule / Approved Drawing
2. Safety Induction card to all workmen
3. EHS Risk Assessment
4. Training Records
5. Pep Talk Report
6. Equipment Fitness Report
7. Vehicle & Earth Moving Equipment
8. Crane Inspection Checklist
9. Erection Safety Checklist
10. General EHS Inspection Checklist
11. Working at Height Checklist
12. Project Emergency response plan

VII CONCLUSION

This project proposes an EHS plan for underground metro station work. Several objectives of this study, including methods for operating procedures, provide information and quick solutions in a structured manner. Safe operating procedure has been prepared in this project work based on one of the critical activities at underground metro station and provides solution to avoid such incidents in the future.

IX. REFERENCE

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