

# **Validation of Technical Proposal on the OHE 25kV AC Traction Interference with 750V DC Traction System**

Report submitted to

**Rail Infrastructure Development Company  
(Karnataka) Ltd (K-RIDE)  
Bangalore-560010**

Ref: CP 9269/0403/2021 dated 21 Sept 2021

Technical Consultants

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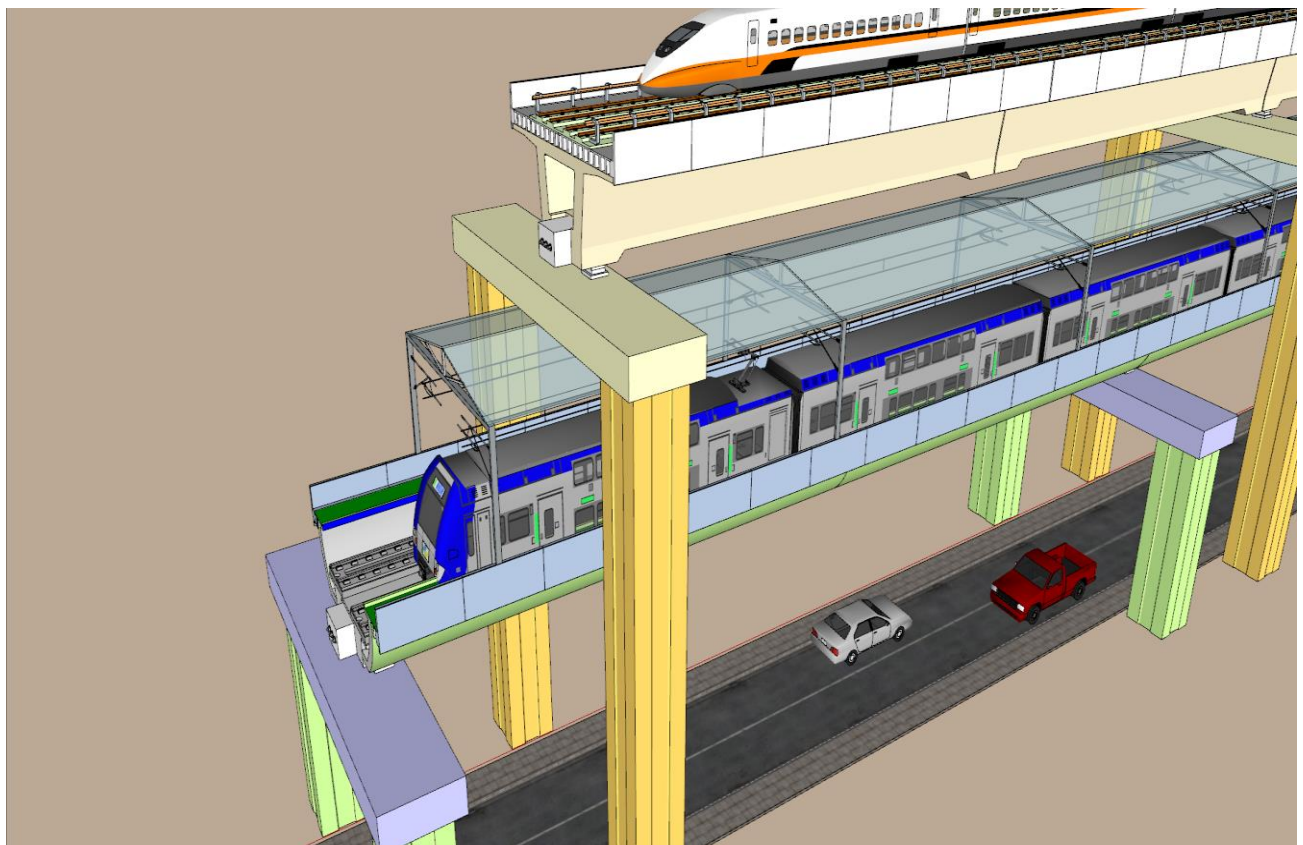
November 2021

## Scope of the Work

Technical Advice and Validation of Proposal on OHE 25kV AC Traction interference with 750V DC traction system which includes evaluation of:

- EMI of 25kV AC OHE on 750V DC traction system of BMRCL
- Minimum static clearance from safety pertaining to various structures as per drawings
- Possible recommendations for mitigations of EMI based on the given drawings

### METRO RAIL and SUB URBAN RAIL NETWORK Crosssection at Benniganahalli and Channasandra, Bangalore

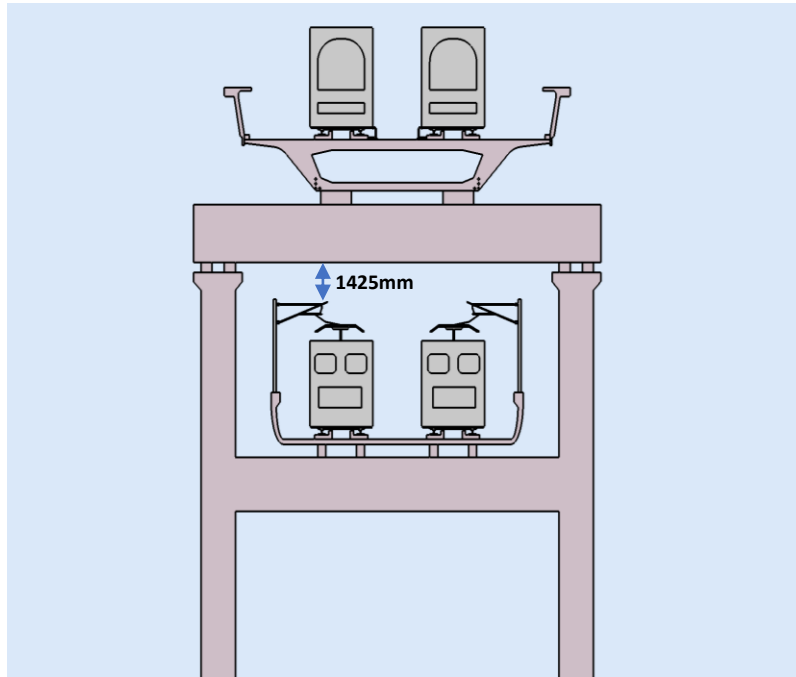


Representative diagram courtesy: KRIDE

## SIMULATION STUDY

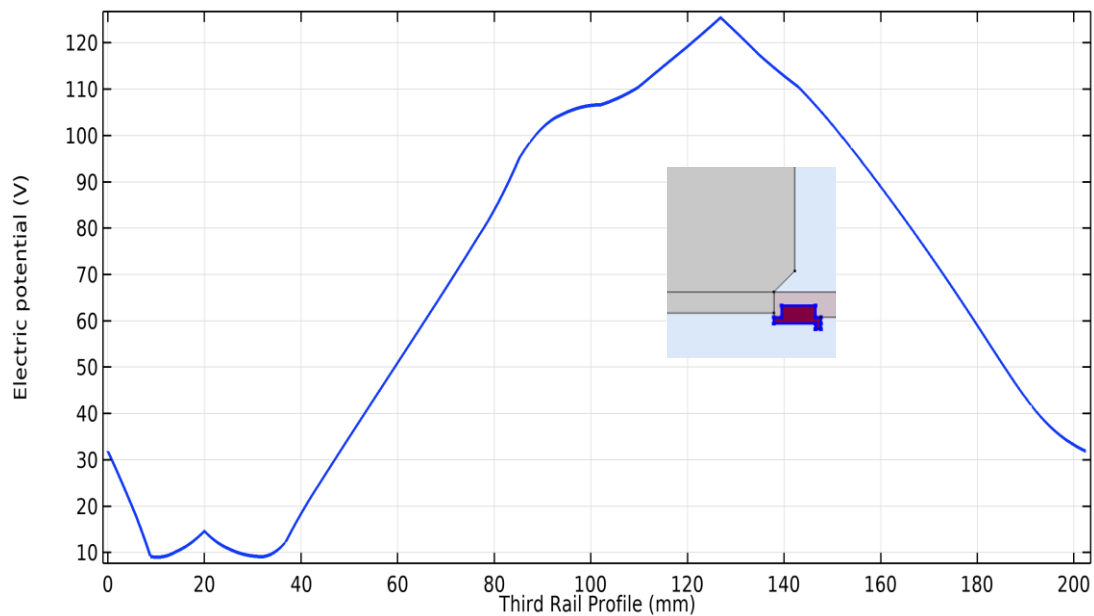
The simulation study was conducted considering the given dimensions with various options of earthing with varying distances. The simulation results for Electrical Potential, Electric field, Magnetic field plots obtained for four different cases are presented below.

### Case 1) 1425mm without metallic sheath

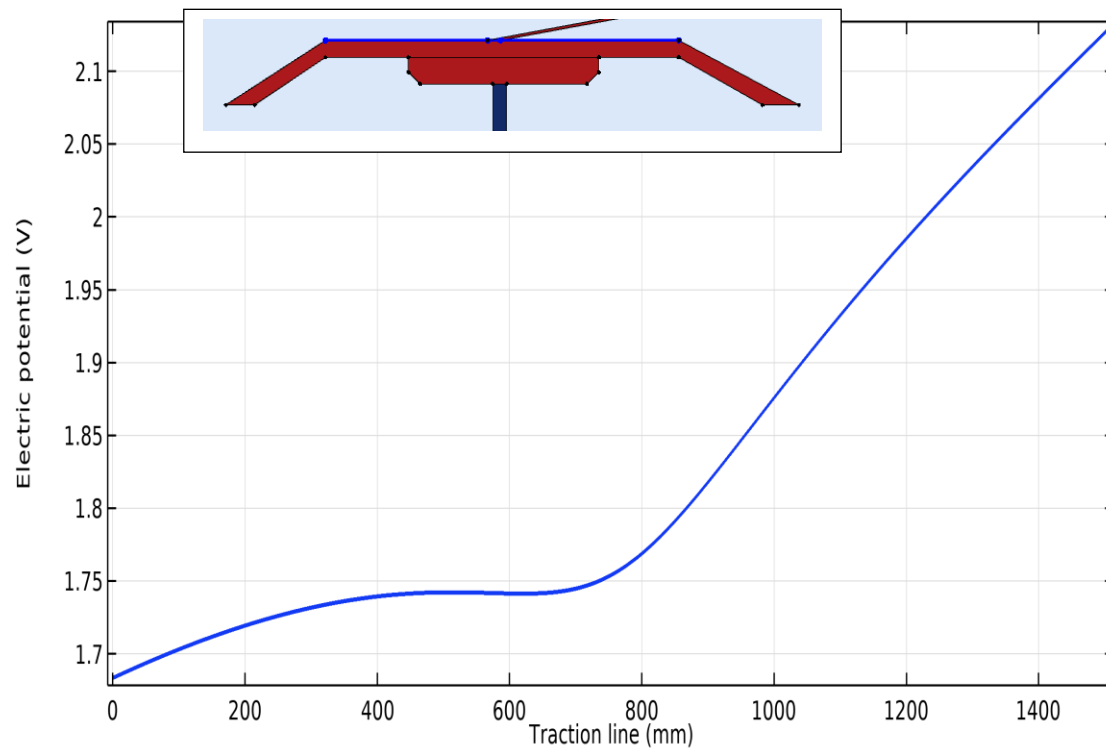


**Model geometry**

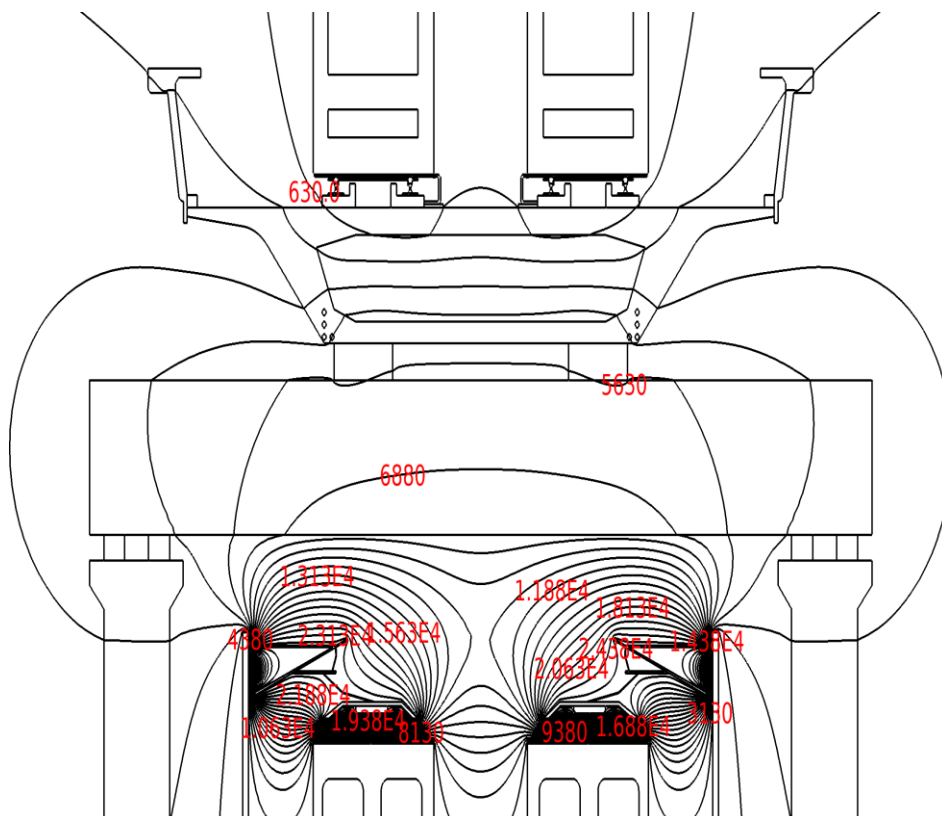
### The induced voltage on the third rail



## The induced voltage on the traction line



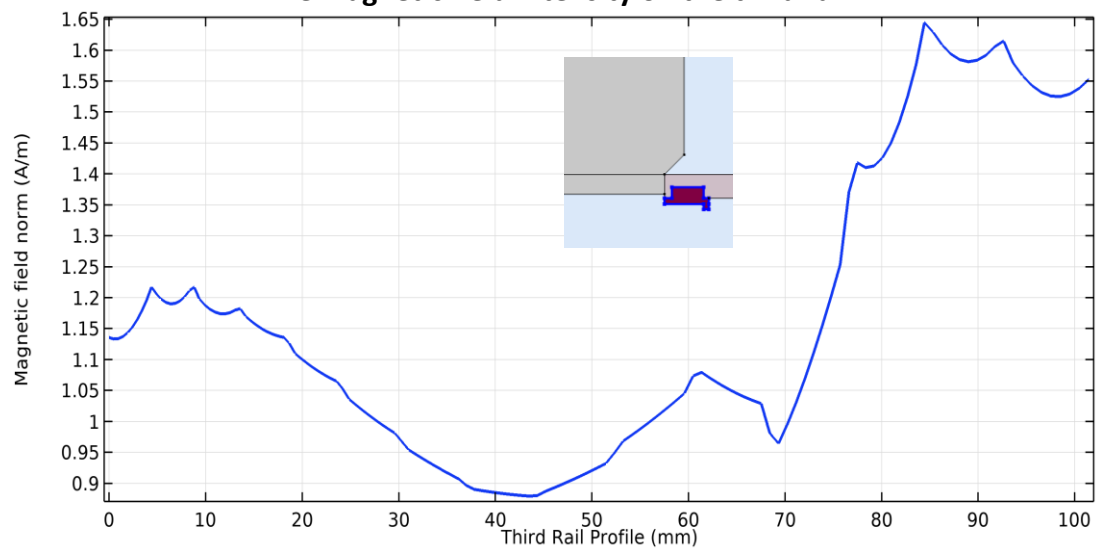
## Equipotential Lines distribution



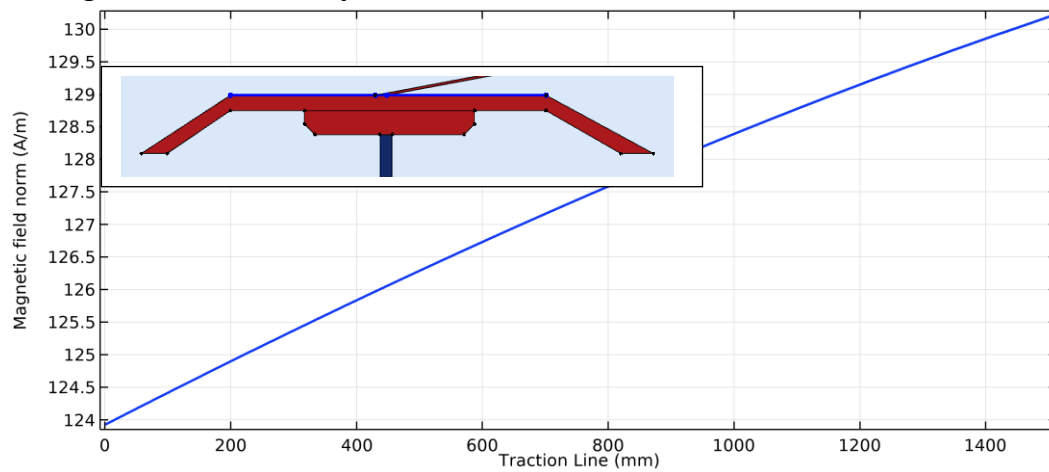
## Electric Field Distribution



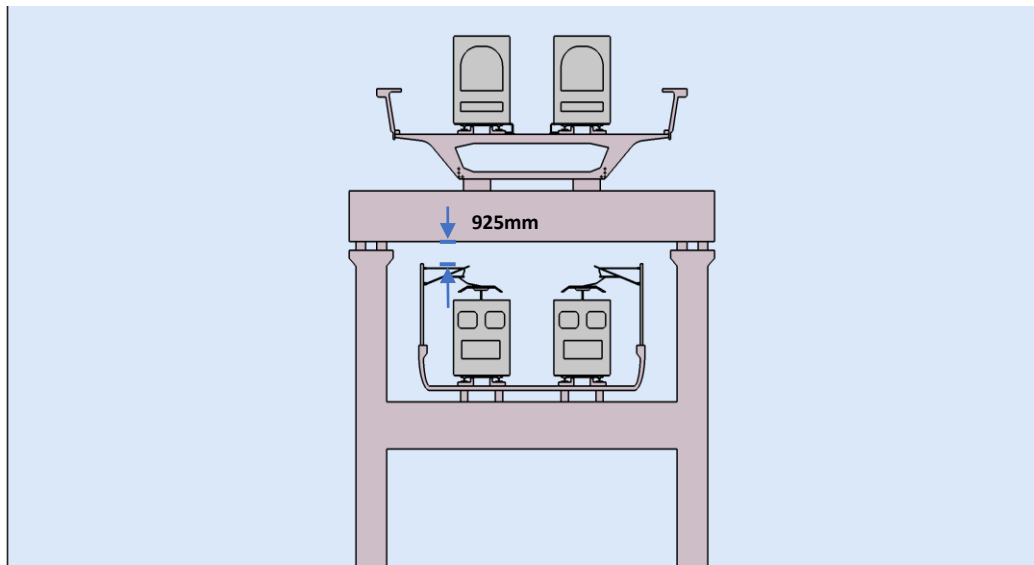
## The magnetic field intensity on the third rail



## The magnetic field intensity on the traction line

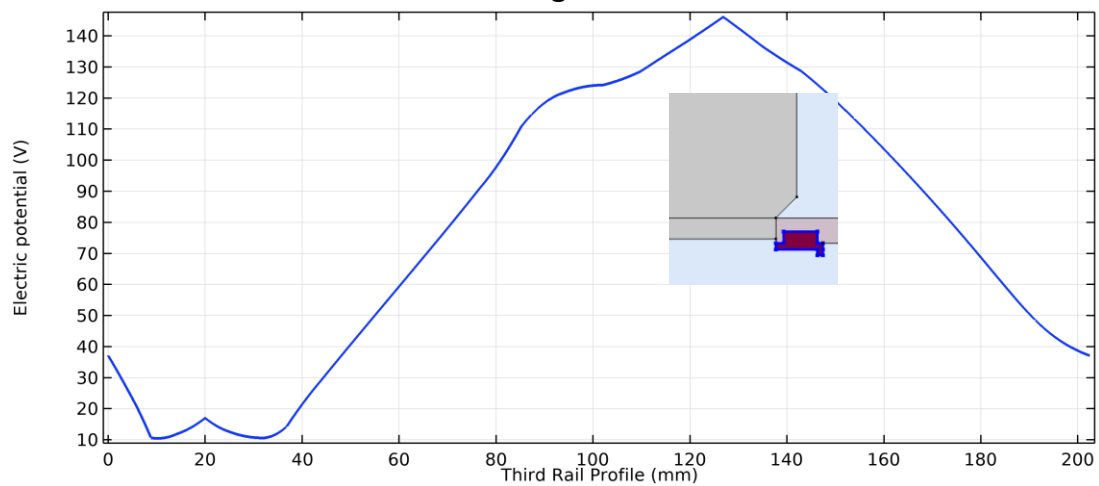


## Case 2) 925mm without metallic sheath

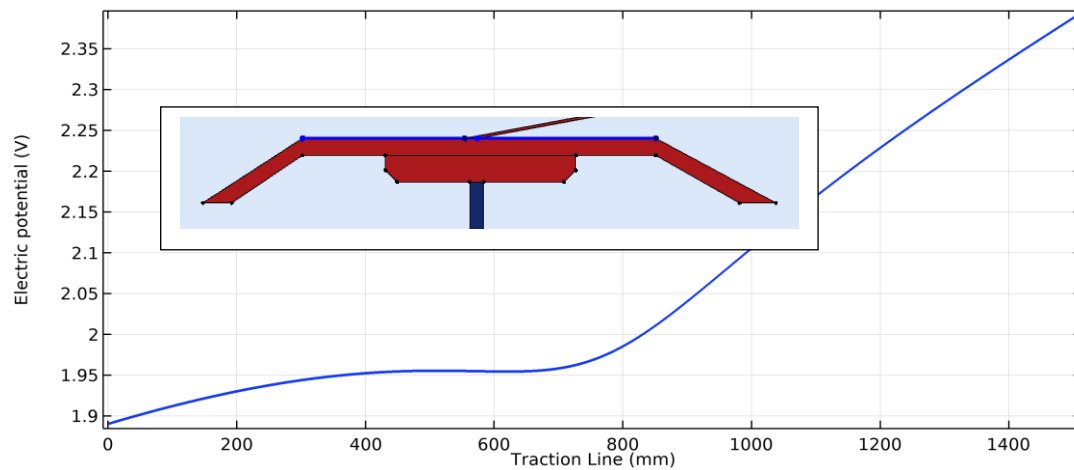


**Model geometry**

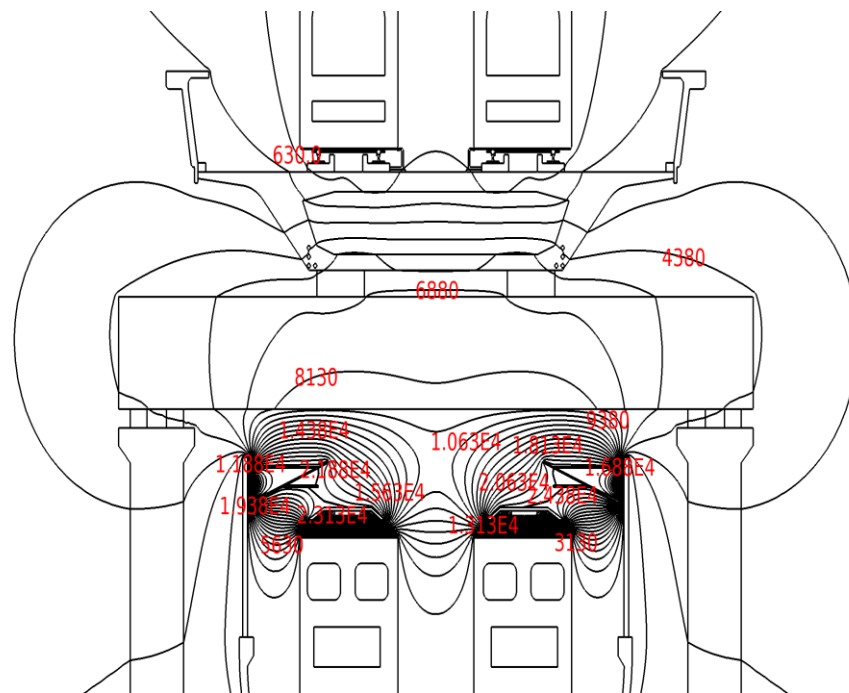
### The induced voltage on the third rail



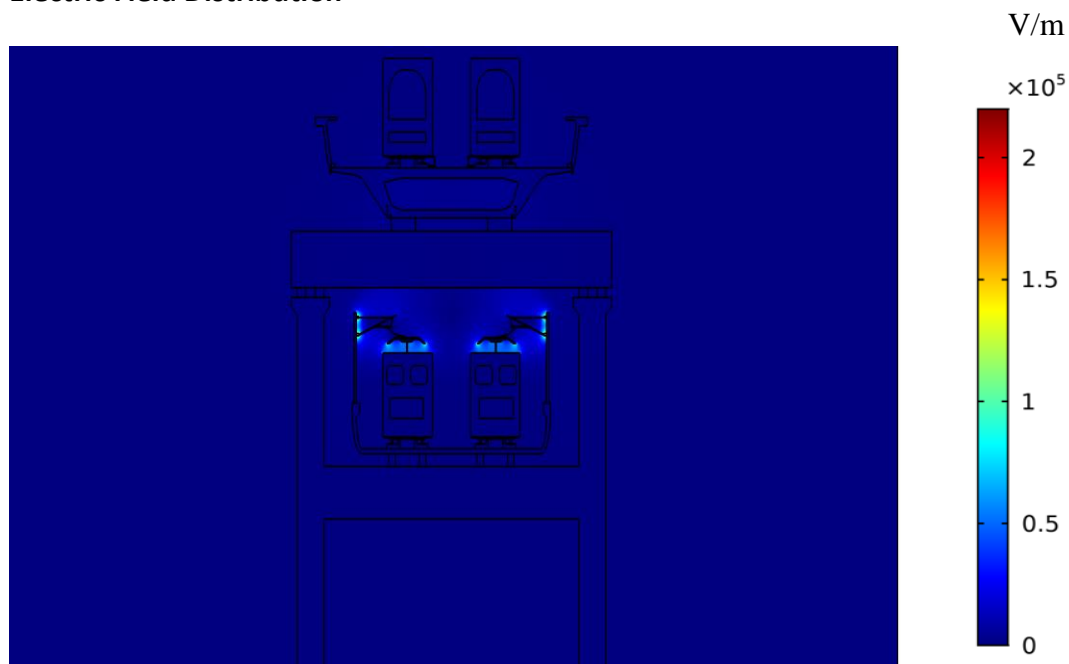
### The induced voltage on the traction line



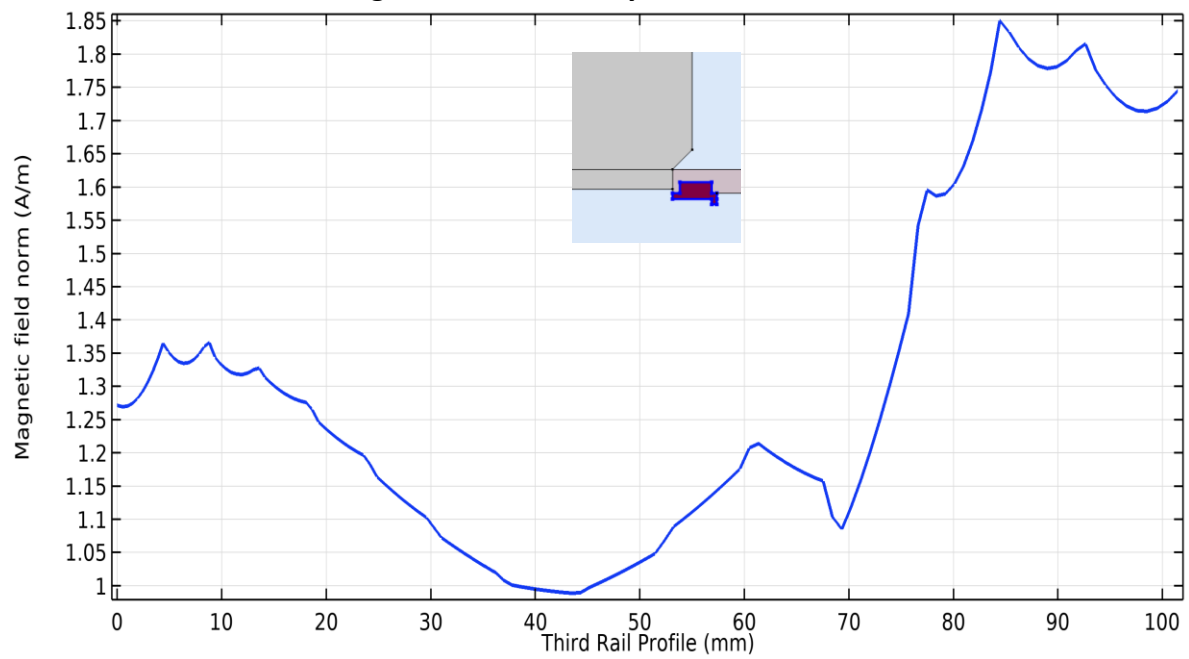
### Equipotential Lines distribution



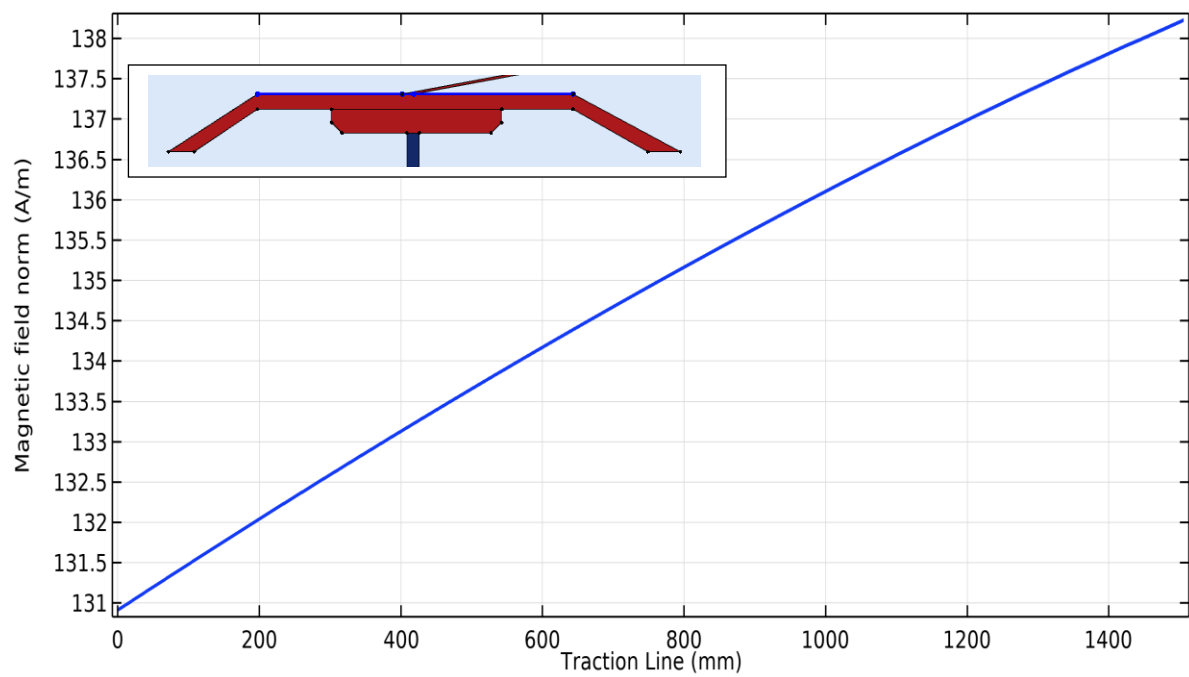
### Electric Field Distribution



**The magnetic field intensity on the third rail**

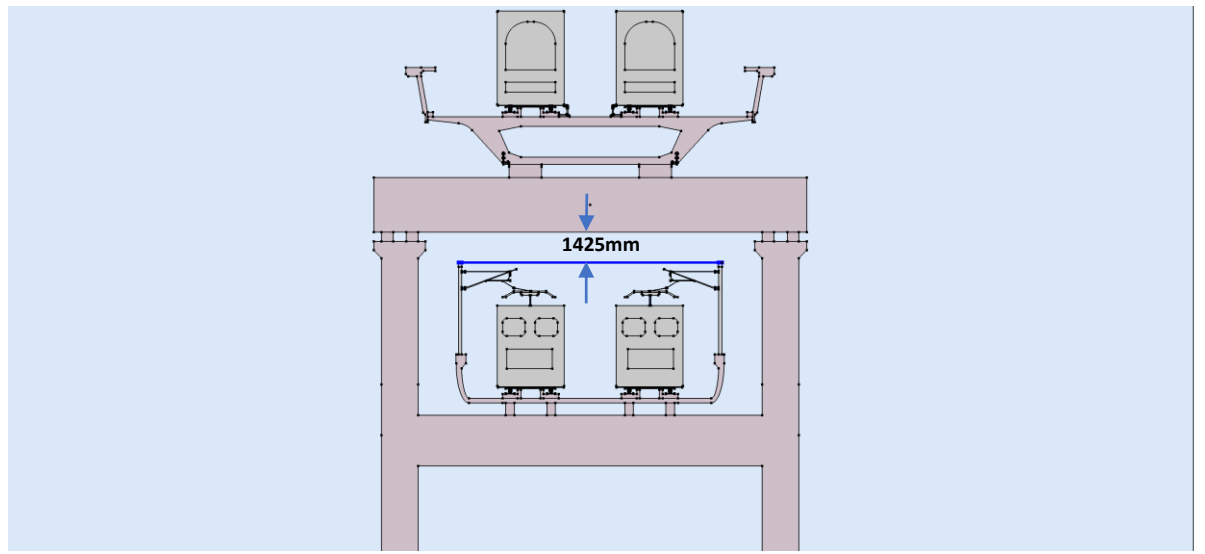


**The magnetic field intensity on the traction line**



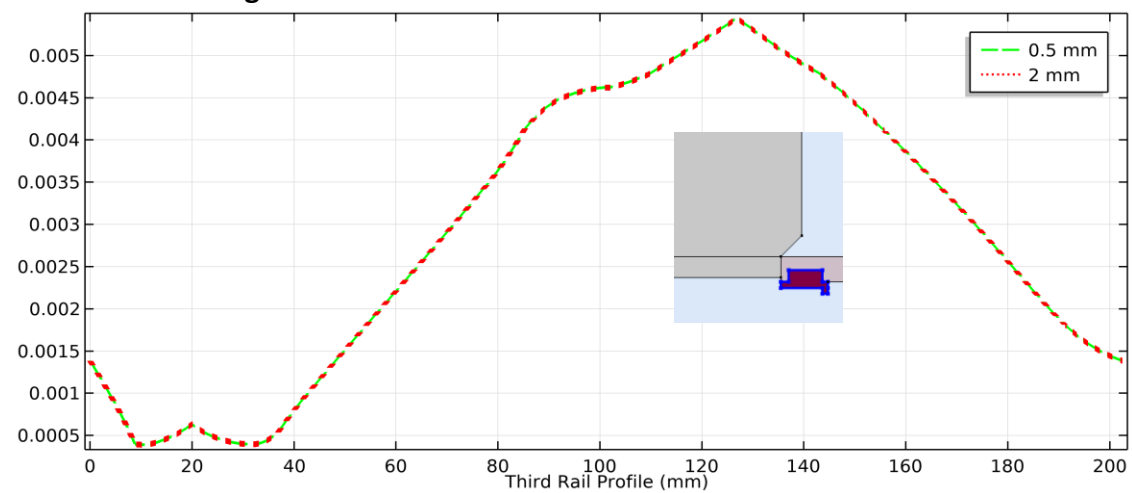


### Case 3) 1425mm with a metallic sheet (0.5mm & 2mm)

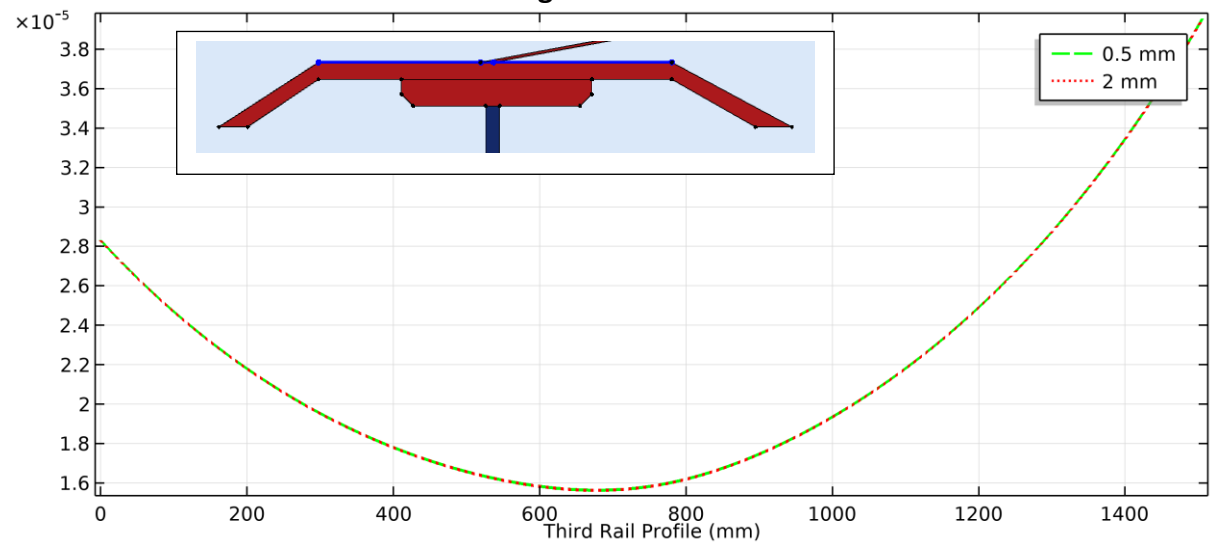


Model geometry

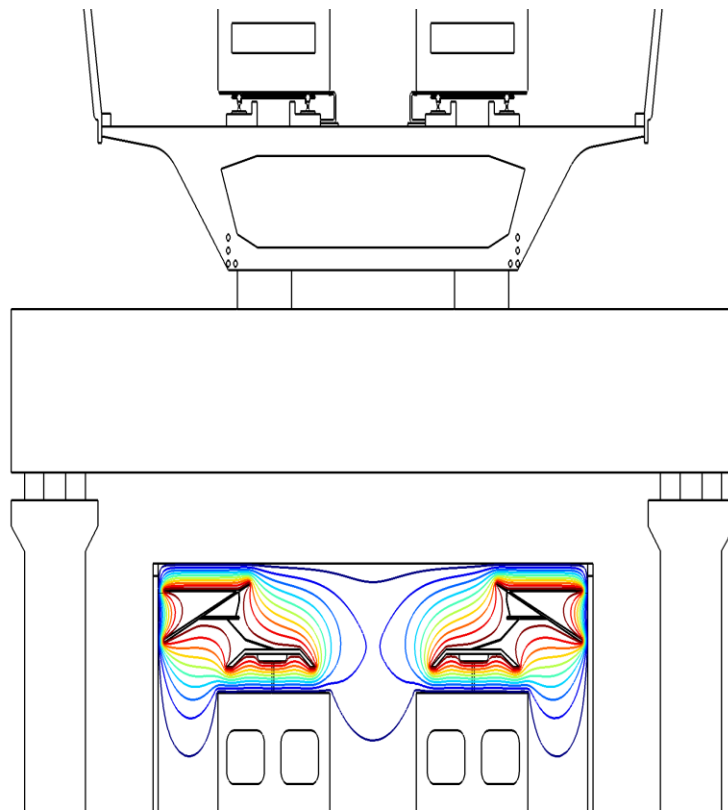
### The induced voltage on the third rail



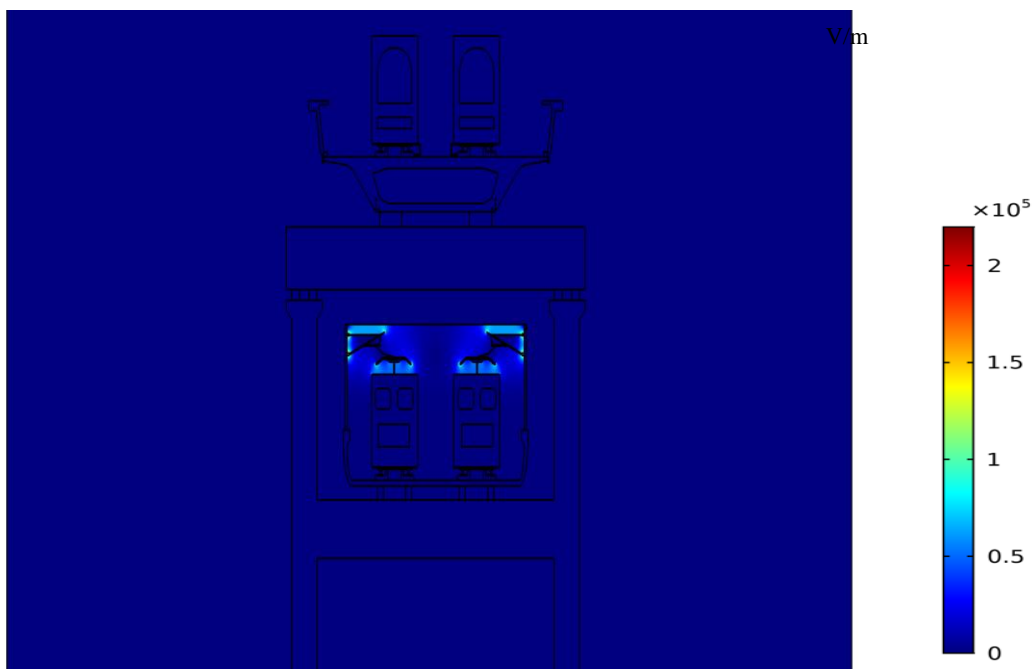
### The induced voltage on the traction line



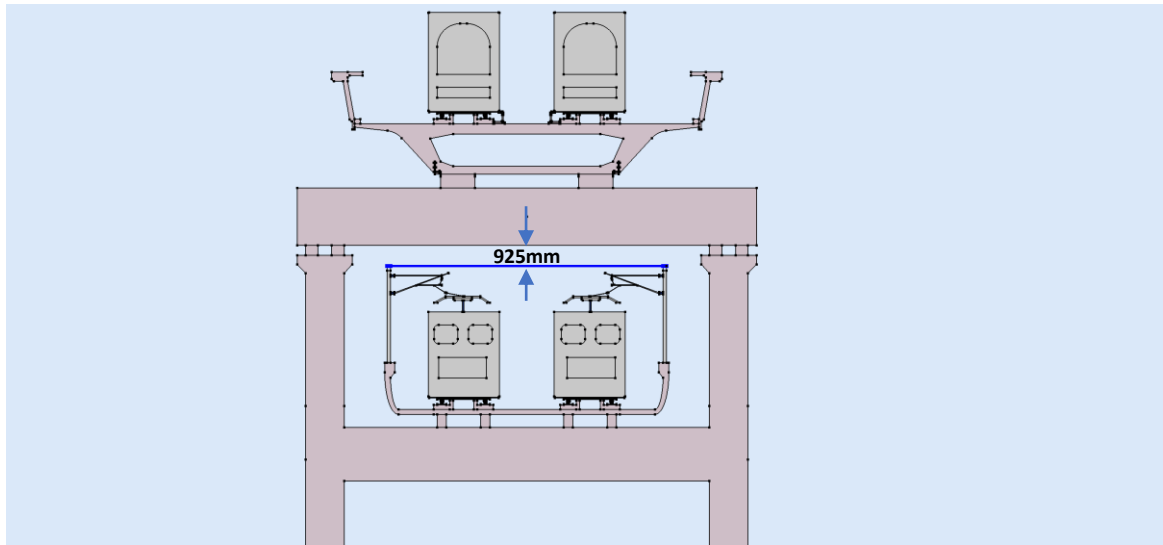
## Equipotential Lines Distribution



## Electric Field Distribution

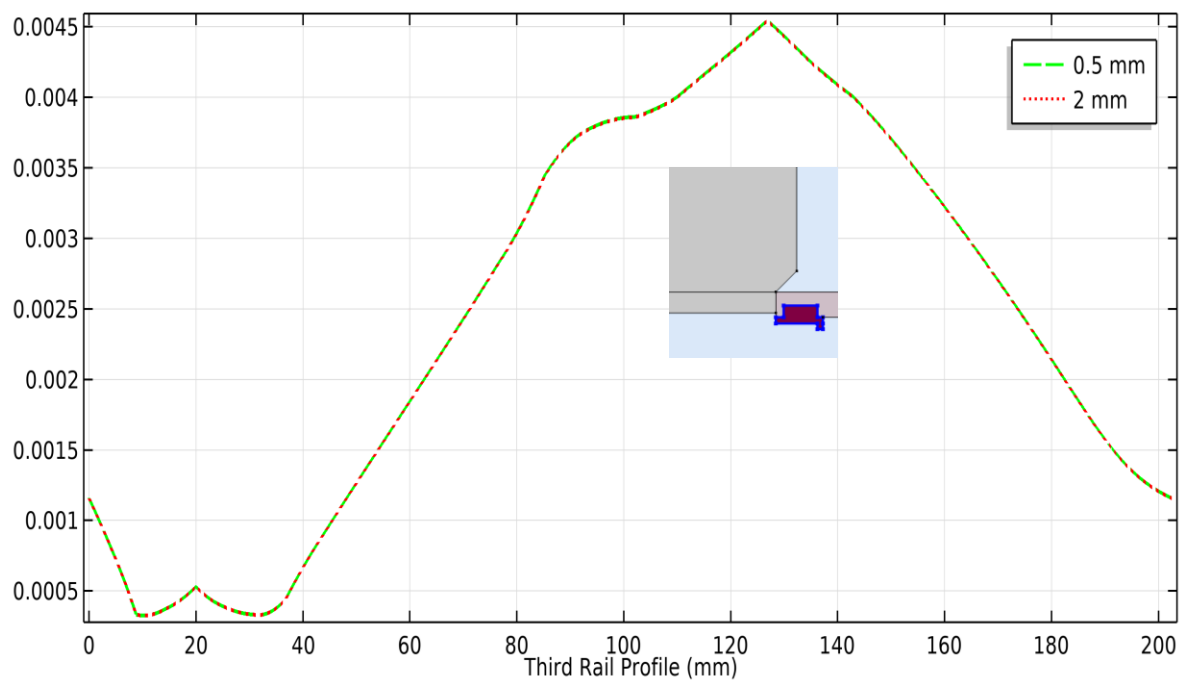


**Case 4) 925 mm with a metallic sheet (0.5mm & 2mm)**

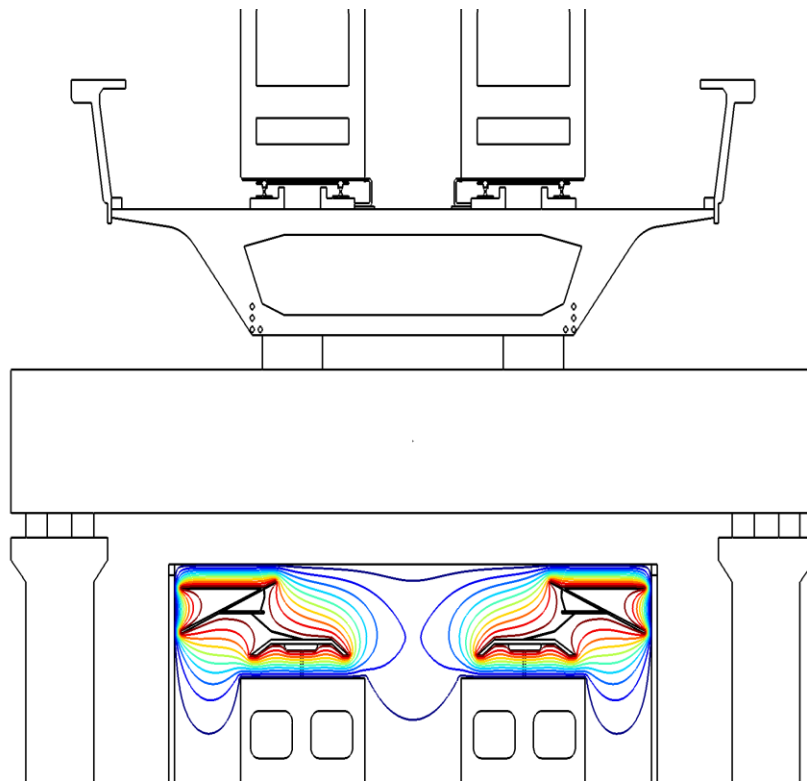


**Model geometry**

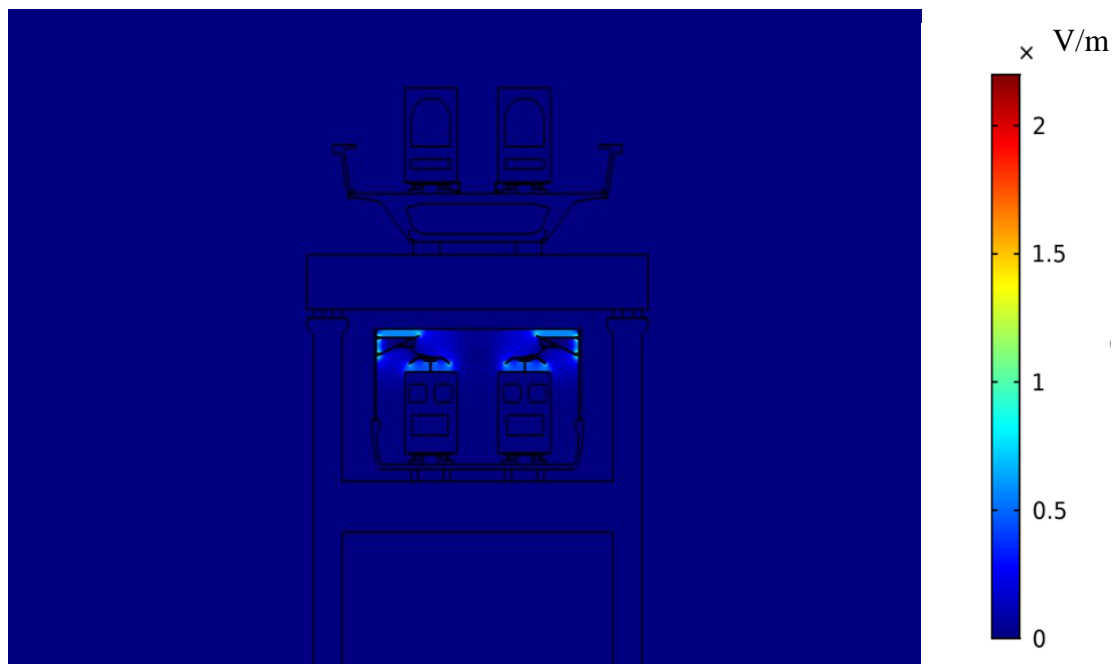
**The induced voltage on the third rail**



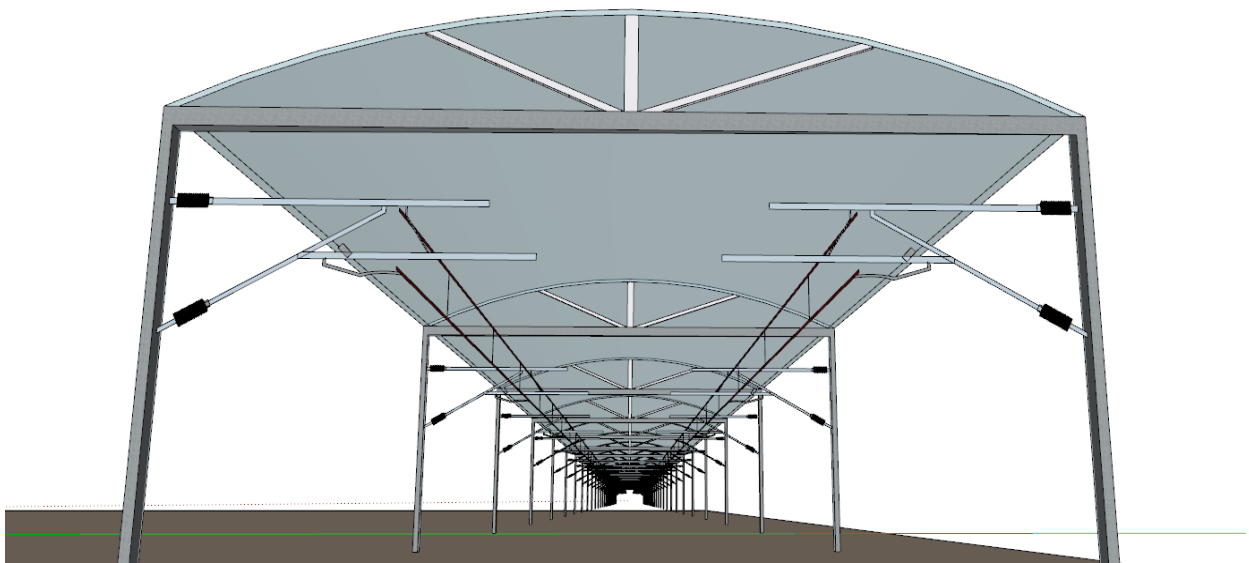
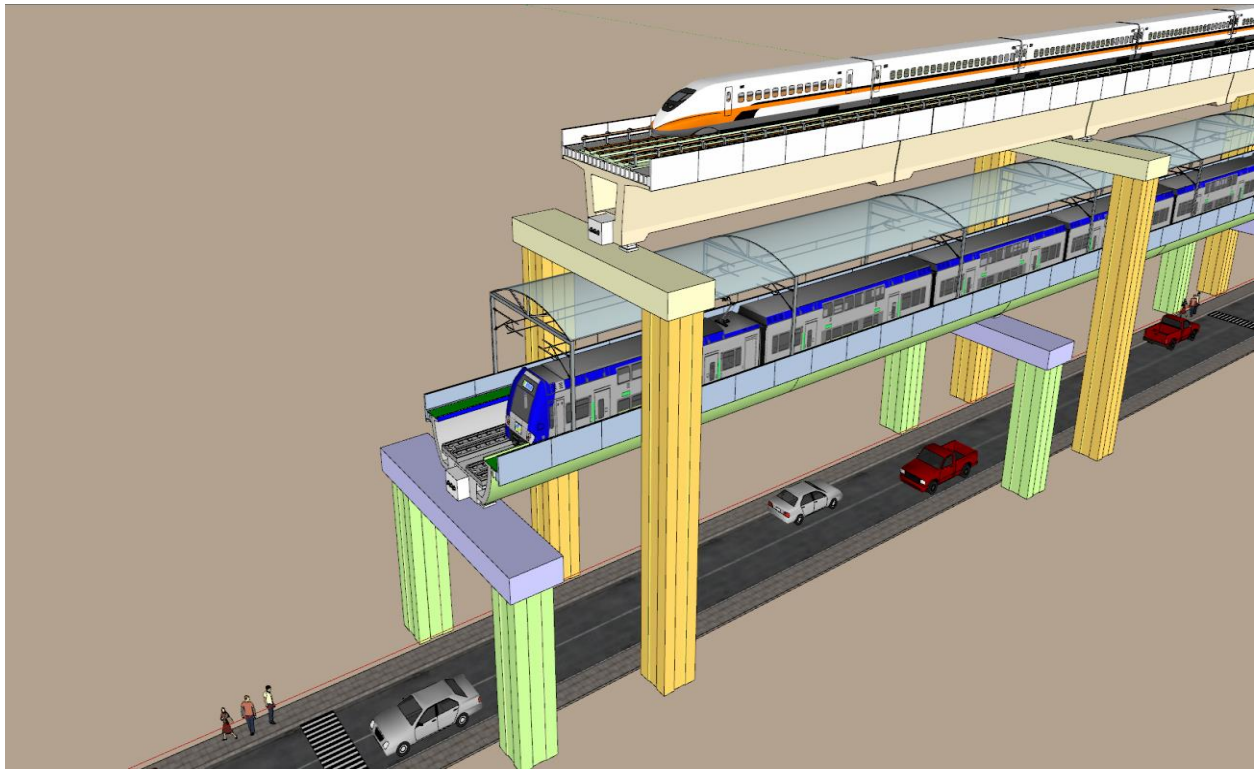
## Equipotential Lines Distribution



## Electric Field Distribution



## Proposed /Recommended Enclosure for Shielding & Earthing



**Representative diagram for Shielding & Earthing**



**Representative diagram for Shielding & Earthing**

### **Conclusions:**

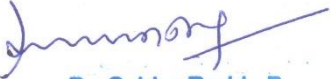
- An exhaustive simulation study was conducted to understand the effect of electric potential, field and magnetic fields with the given dimensions with varying distances considering the possibilities with and without metallic sheet for earthing.
- From the study (Refer case 3 and case 4) considering metallic sheet (both for 0.5mm & 2mm thickness) earthing the induced potential (is less than a volt), electric field and magnetic fields are very minimal on the third rail system.

### **Mitigation Techniques suggested:**


Based on the study and experience, to counter the effects of electric potential, electric field and electromagnetic induction due to induced effects of 25kV AC OHE line on 750V DC third rail system, it is advised

1. to provide a solid metal sheet shielding (flat, curved/ other configuration of 0.5mm thickness or higher maintaining the clearance) parallelly along the length of 0.4Kms between 25kV AC and 750kV DC traction system.
2. The earthing/shielding arrangement to be provided for 0.4kMs below the top deck of the metro line to avoid induced potential/fields/stray currents etc generating from 25kV AC OHE.

3. It is advised to ensure the metallic sheets used for earthing be seamlessly connected to earth with metallic strips at regular earth points ensuring continuity, (ensure proper bonding in case of joints/welding to the sheet/strip etc). Avoid using cable for earthing this could provide inductance.
4. It is recommended to use bimetallic connectors to join different materials, to maintain low earth resistance.
5. The maintenance staff/Electricians/supervisors are to be informed about basics and importance of earthing and regular maintenance aspects.
6. Regular physical inspections and maintenance should be a part of an established preventive maintenance program, earth resistance measurements, log entries to be maintained.
7. During earthing in case of high resistance soils or poor moisture content or absence of salts or freezing temperatures are present, treatment of soils with carbon, Coke Breeze, conductive cements, bentonite, chemical ground rods, natural salts or other low-resistance additives may be employed.



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## References

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2. IEC-60913, Electric traction overhead lines, 1988
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