



Segregated HV/LV Earthing Assessment

EEA Guide to Power System Earthing Practice Update

HV/LV



VS

HV

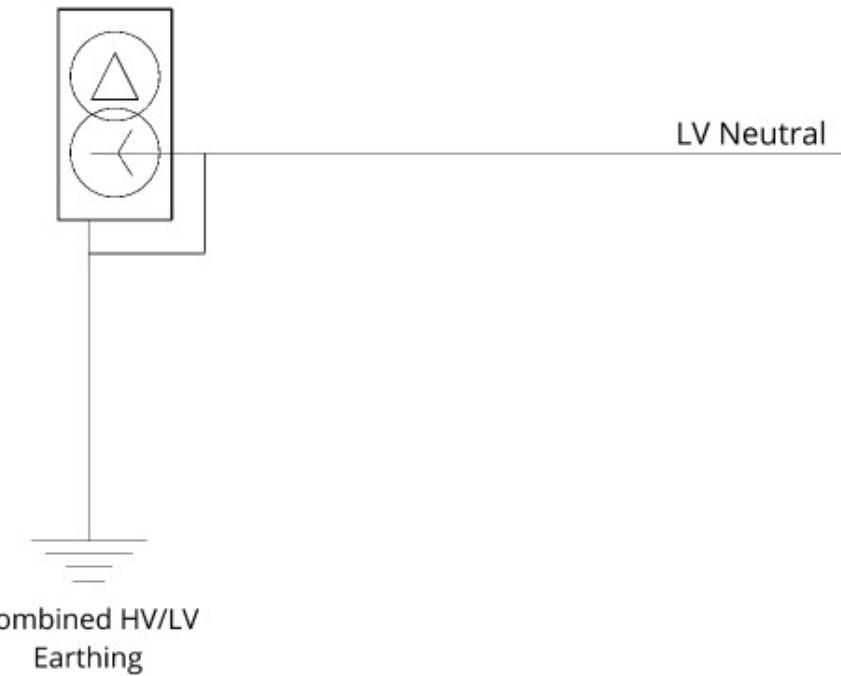


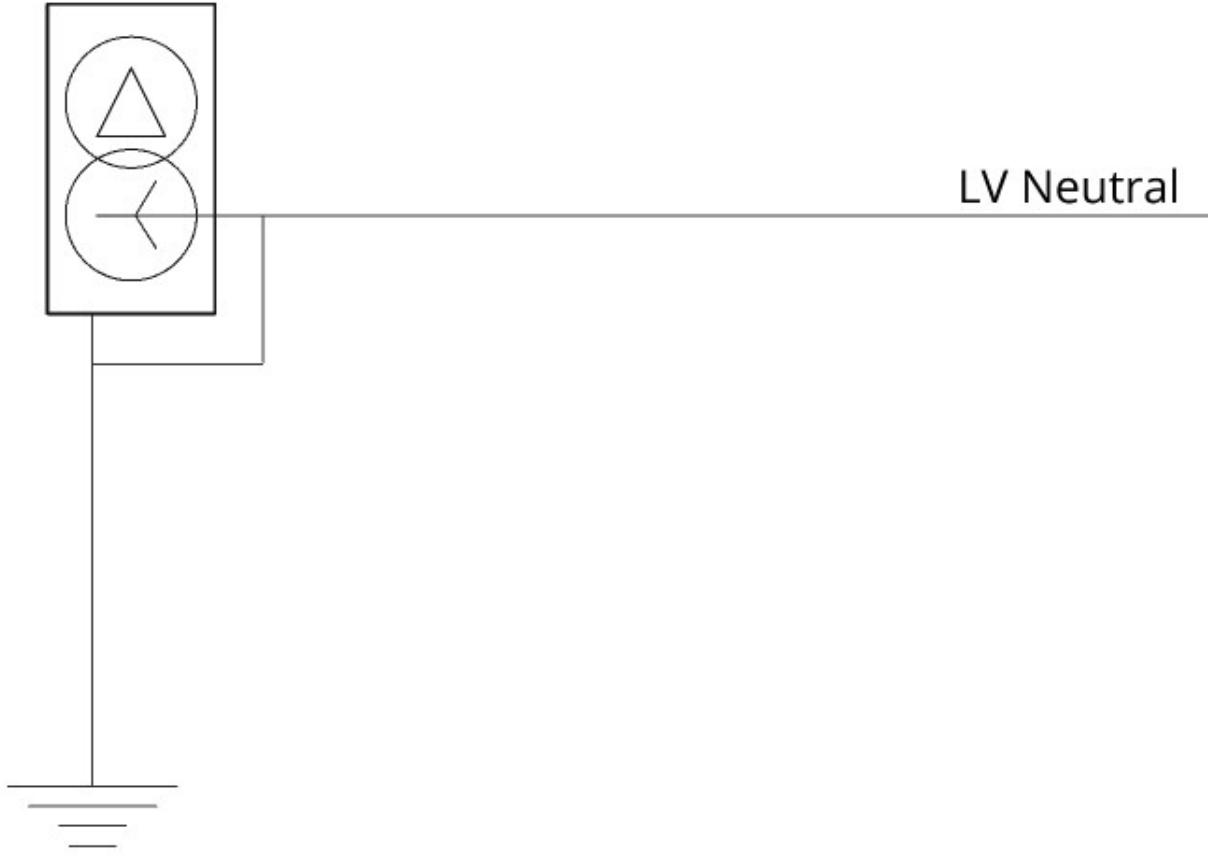
LV



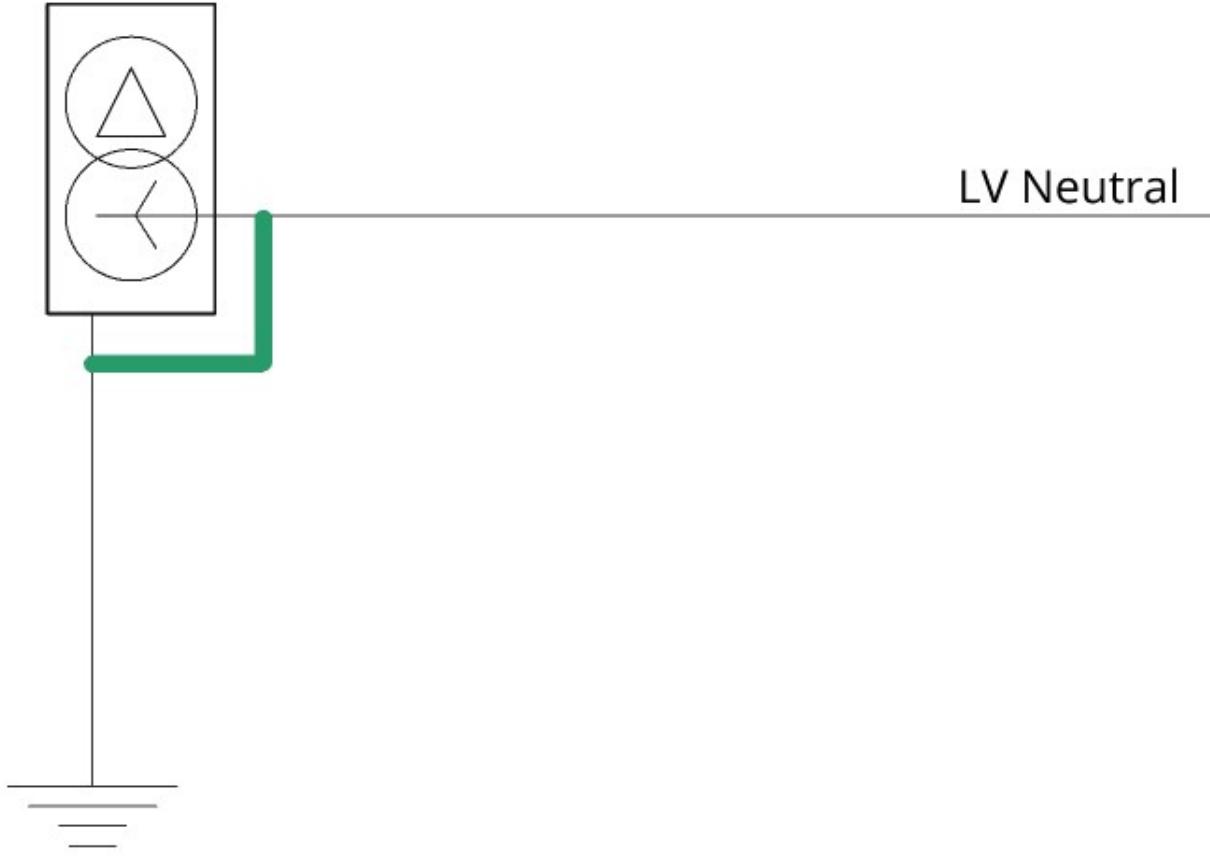


Combined HV/LV Earthing





Combined HV/LV
Earthing



Combined HV/LV
Earthing



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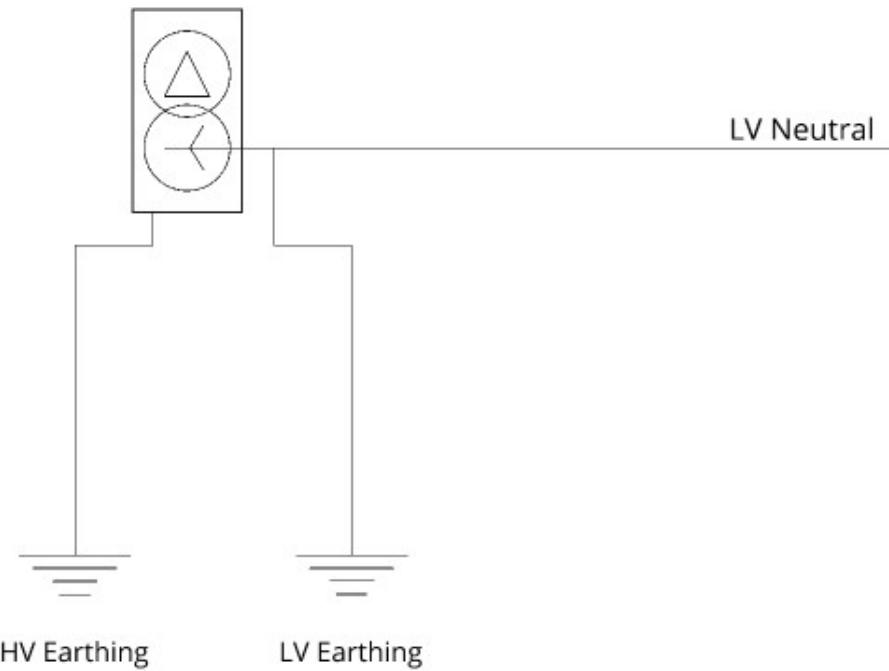


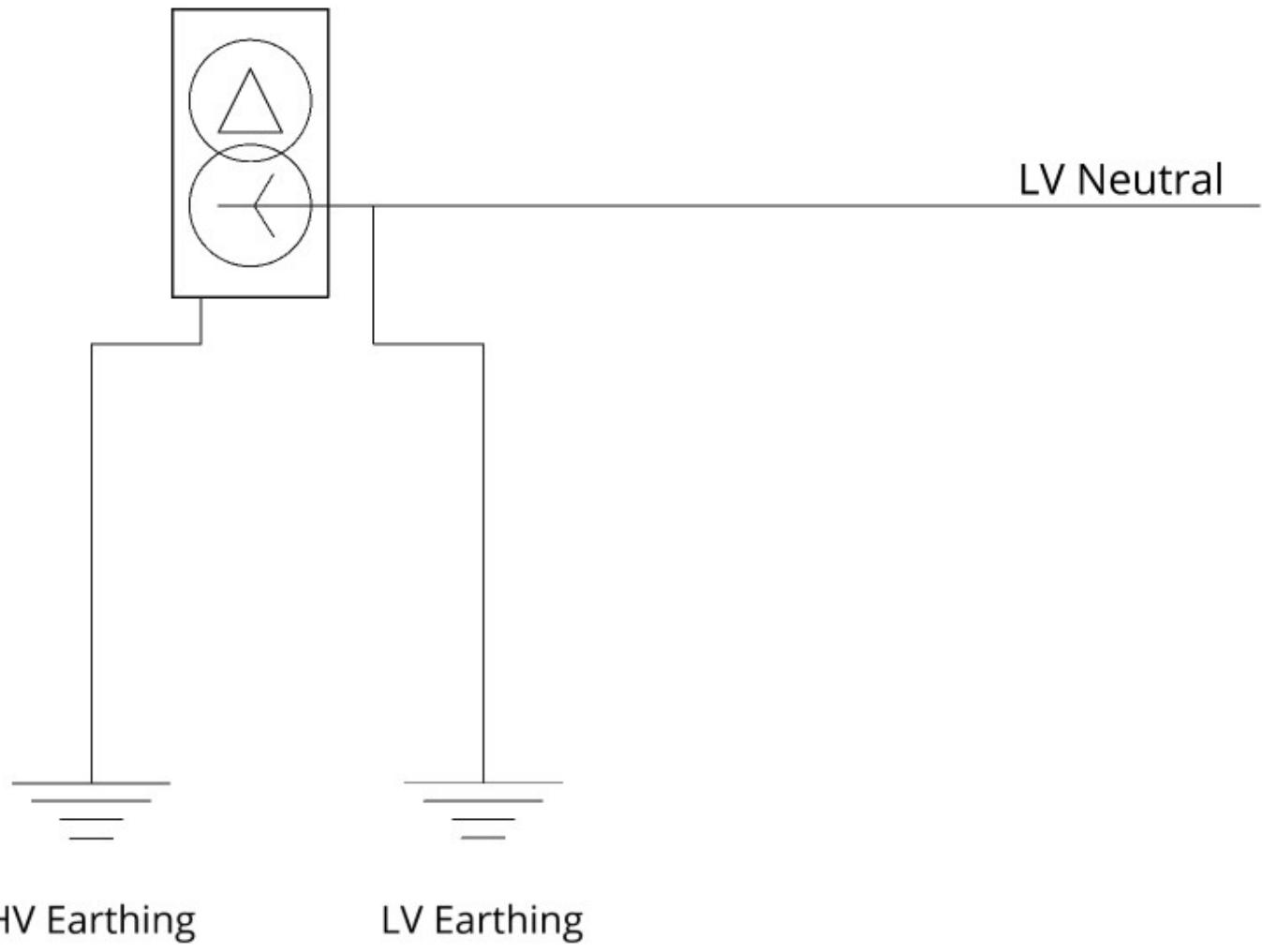
LV





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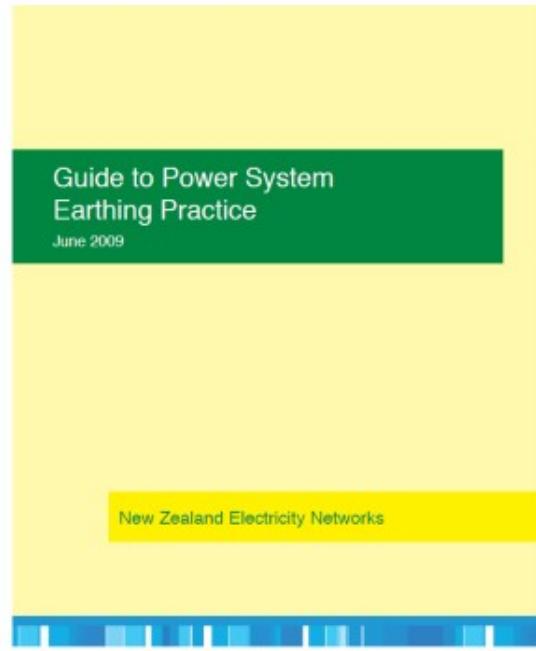


LV





EEA Guide Update



eea

Electricity Engineers'
Association



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vs

HV



LV





Assessment Overview

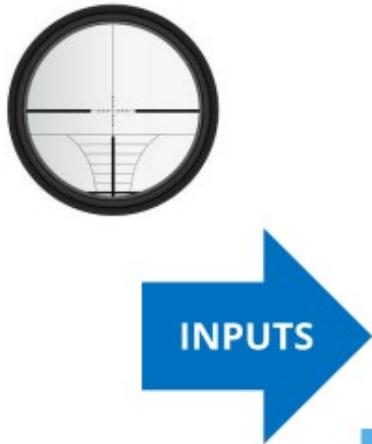
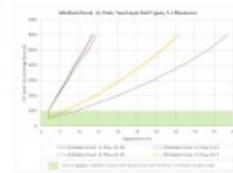


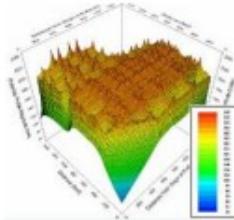
Table 9: Typical Minimum Separation Distances between HV and LV Earths for 11 kV Distribution Transformers

Size of MEN system	Size of HV earth electrode <small>NOTE 1</small>	Minimum separation distance (m)
Medium to large MEN system (> 50 customer earths)	Small	2
	Large	5
Small MEN system (5 to 50 customer earths)	Small	2
	Medium	5
	Large	10 <small>NOTE 2</small>
Very small MEN system (< 5 customer earths)	Small	10
	Medium	30 <small>NOTE 2</small>
	Large	50 <small>NOTE 2</small>





Scope



Modelling - Assess a range of scenarios to represent real world uses



Risk Assessment - Calculations for comparison



Recommendations - When to segregate and what to consider



Inputs

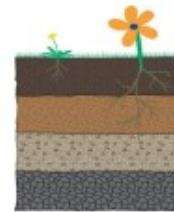


Fault Data

Magnitude - 5 kA and 13 kA

Duration - 0.5 s, 1.0 s and 1.5 s

Fault Frequency - 1 in 30 years



Soil Resistivity - Regional representation

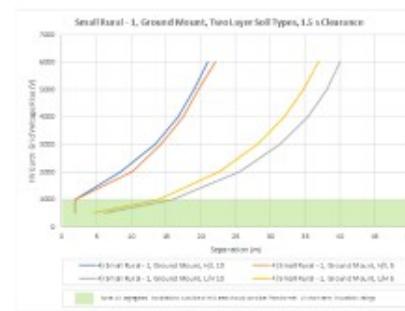
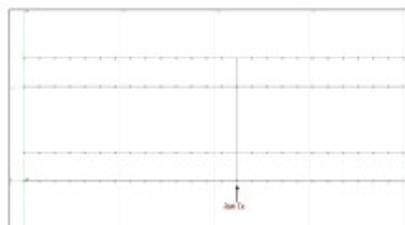
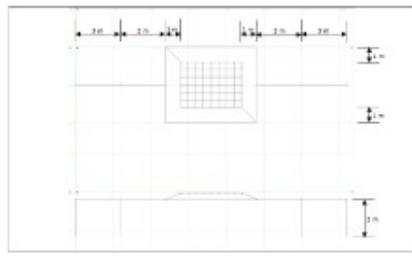
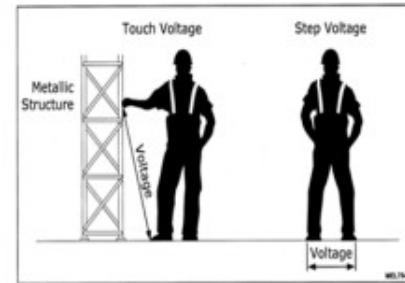
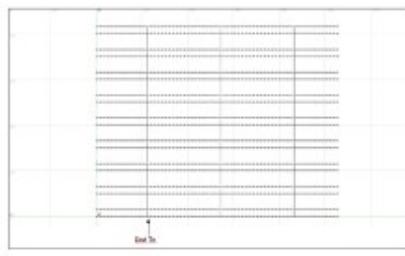
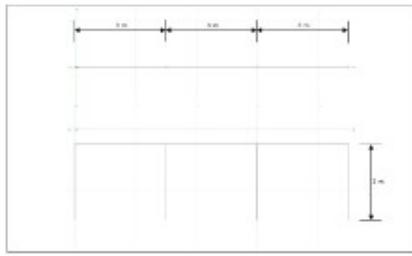


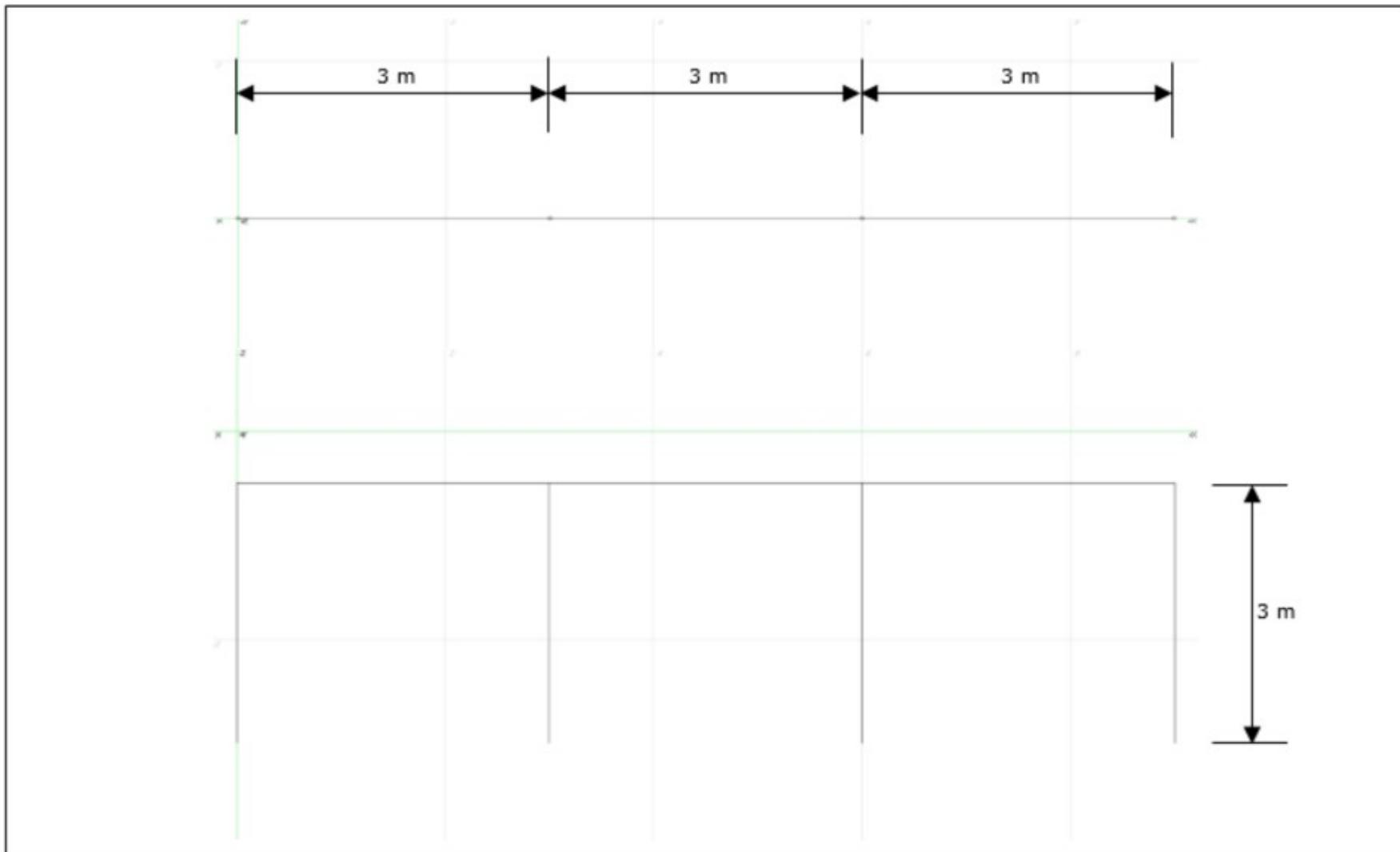
Earthing Systems - Steering Group Guidance





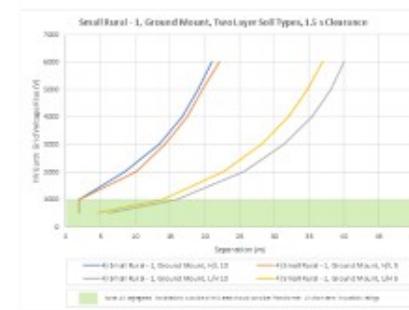
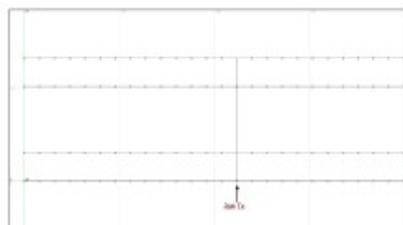
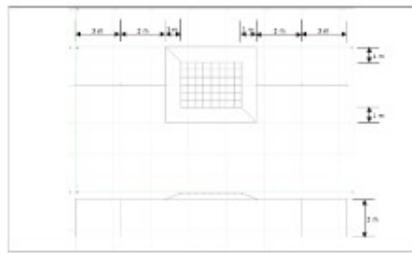
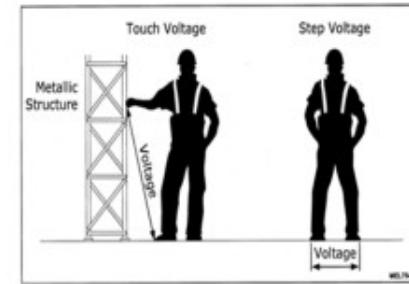
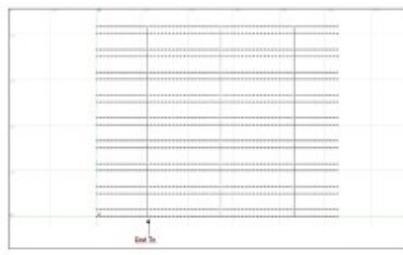
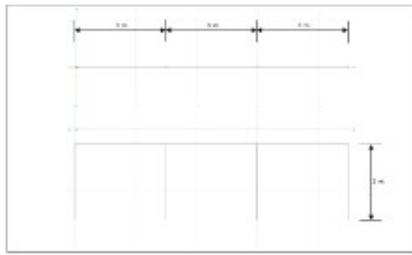
Methodology

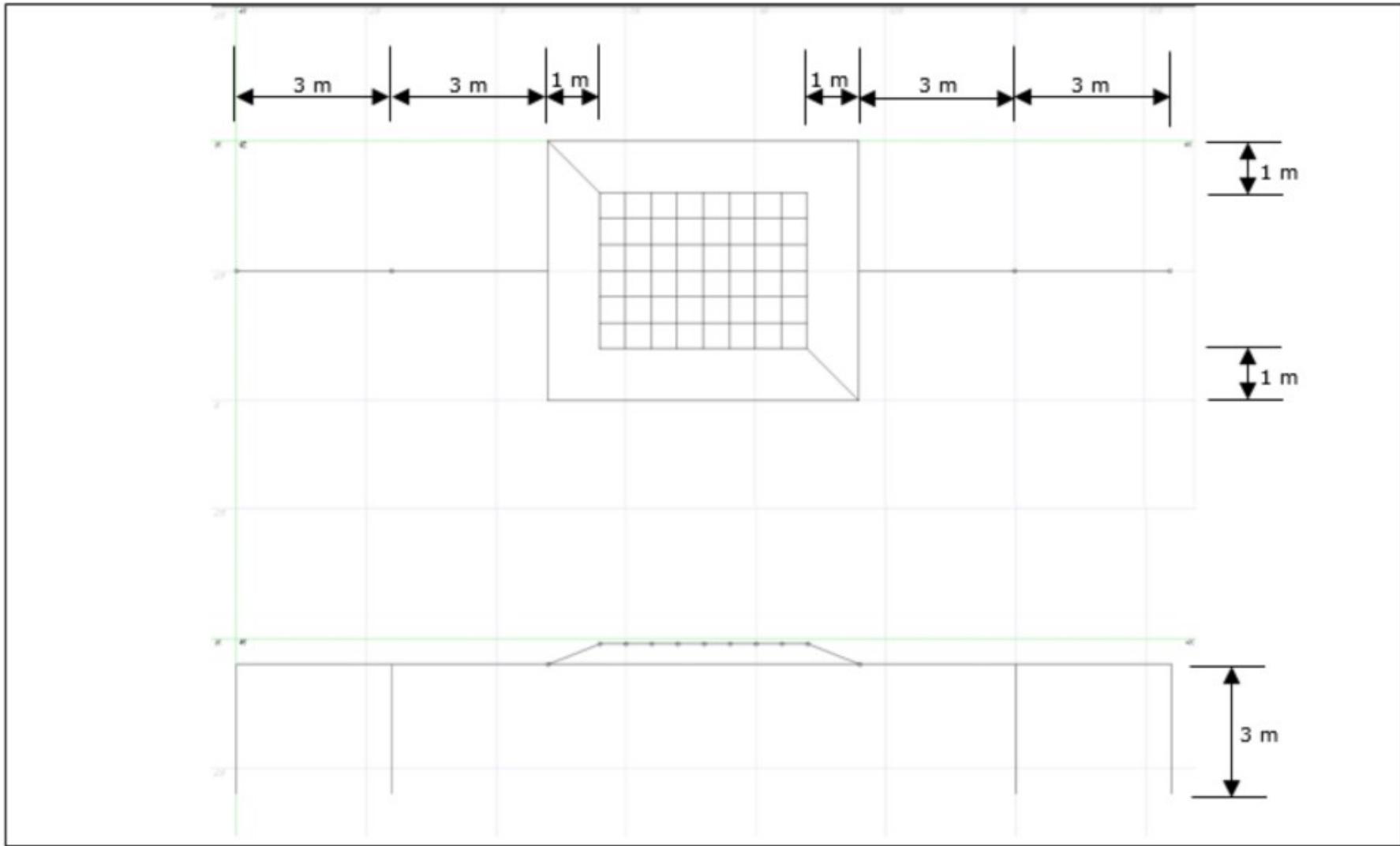






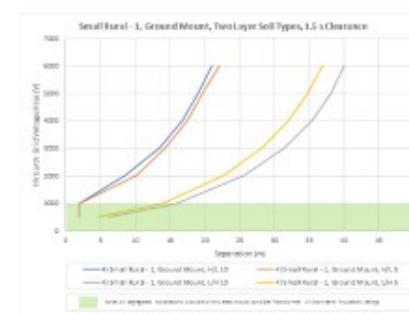
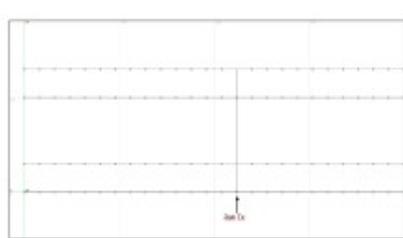
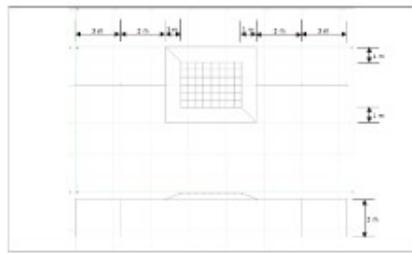
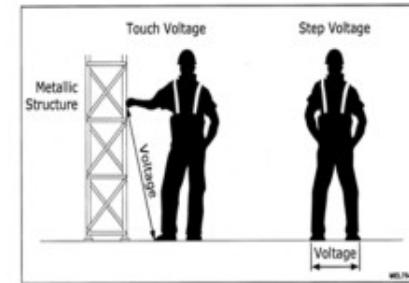
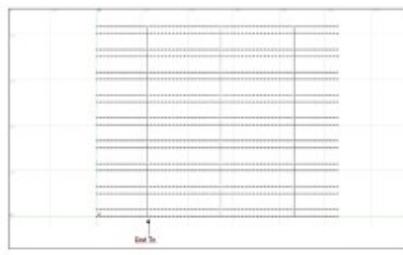
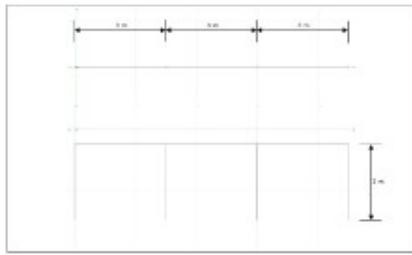
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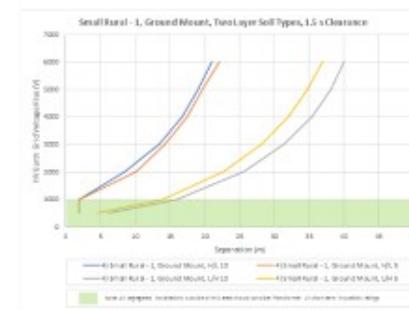
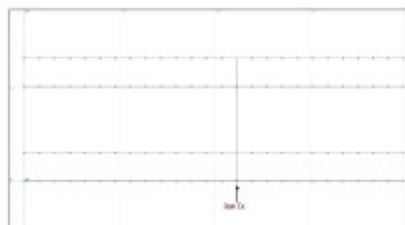
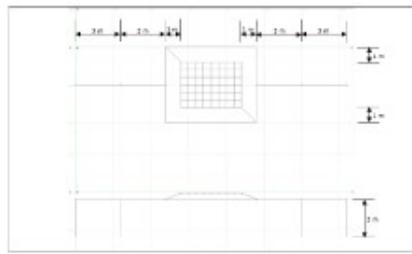
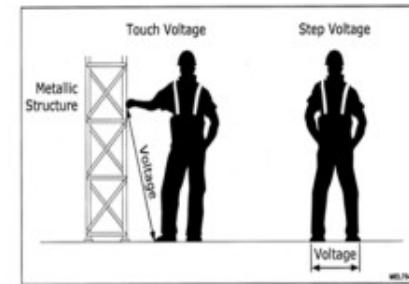
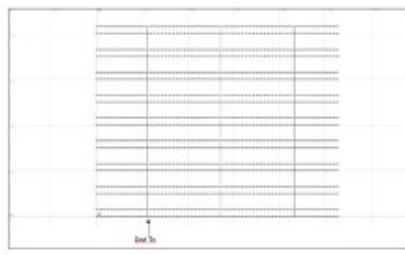
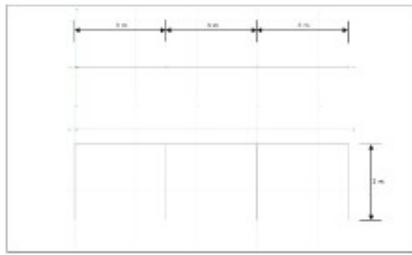
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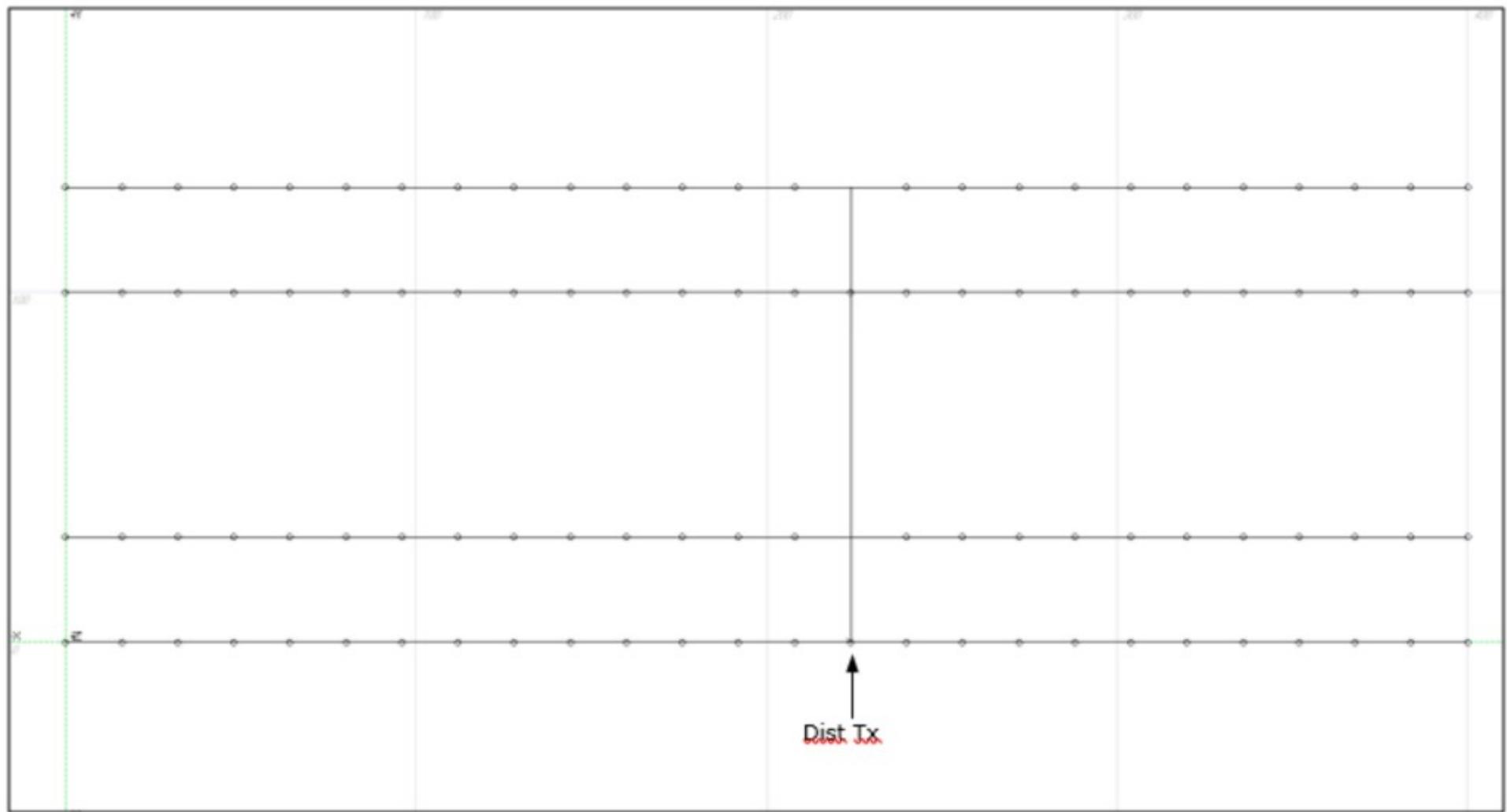






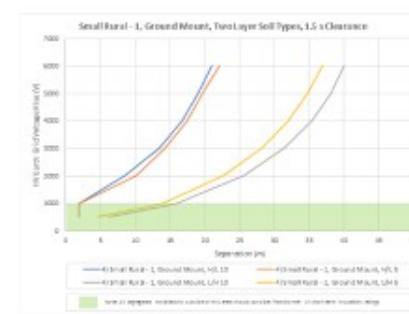
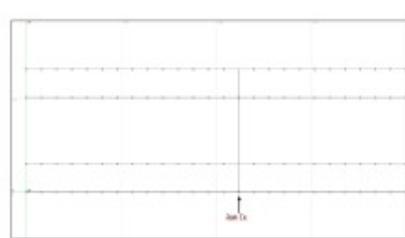
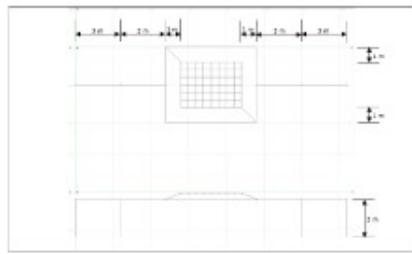
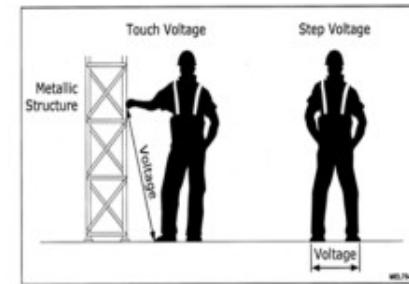
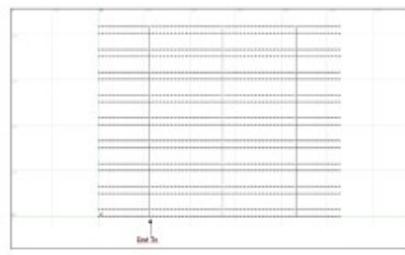
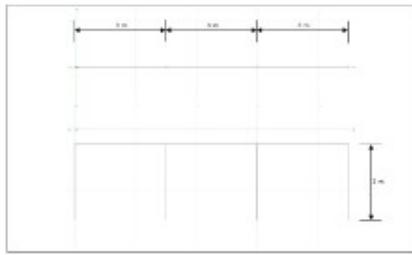
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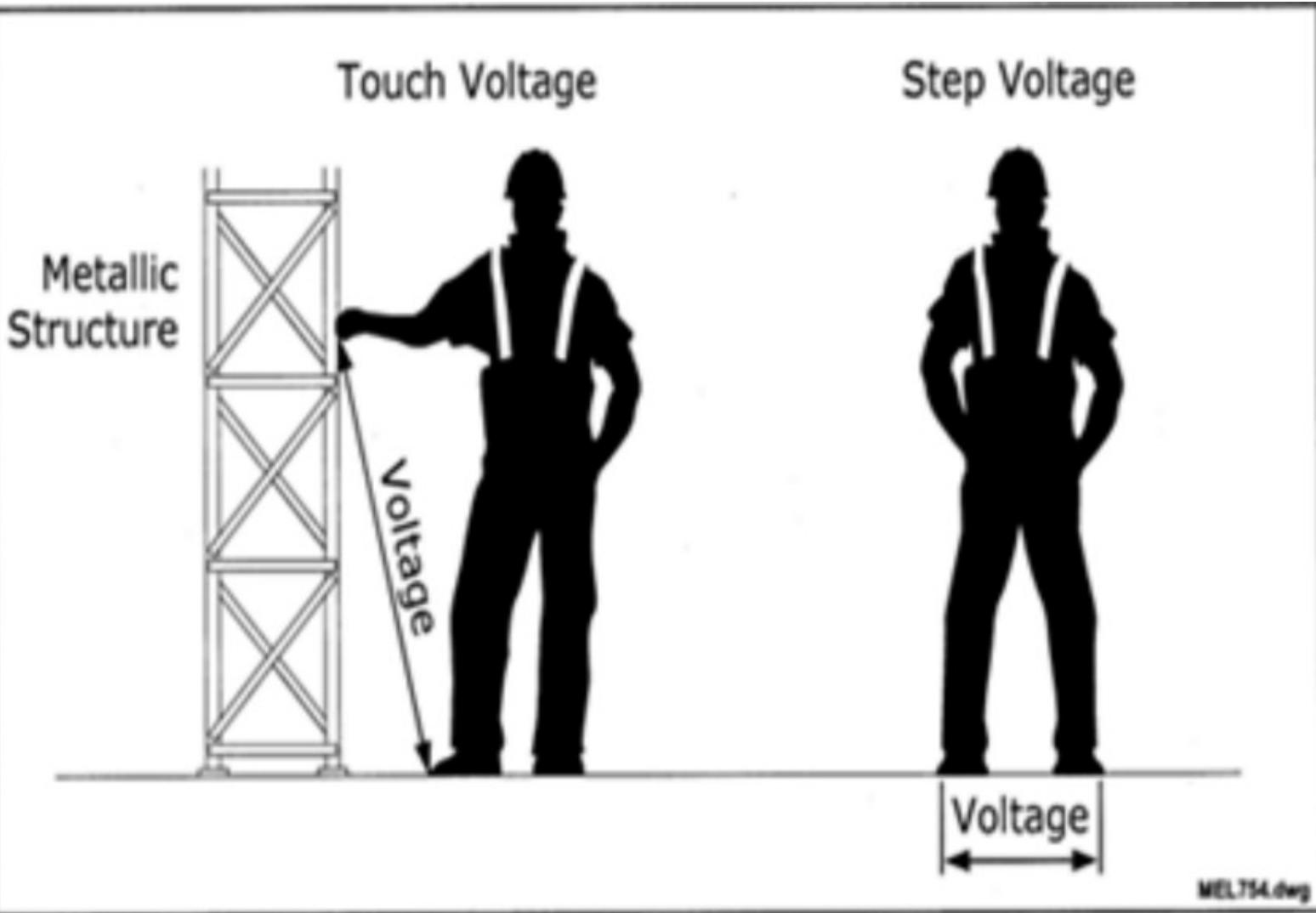






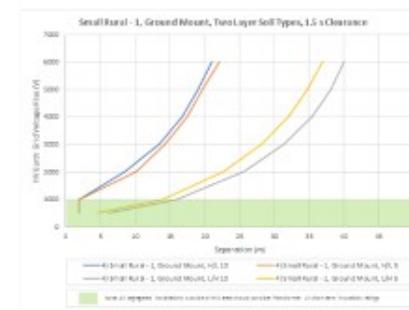
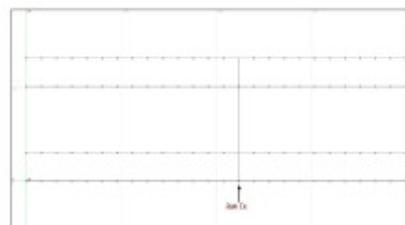
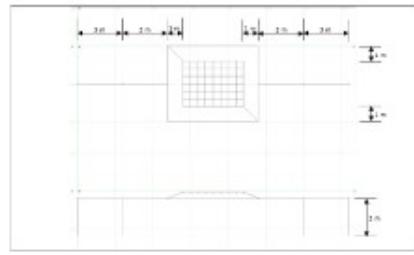
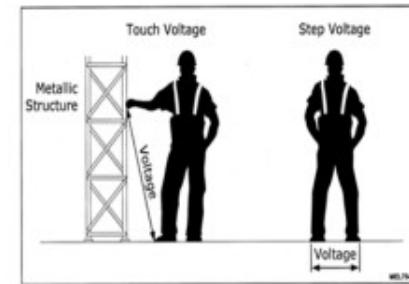
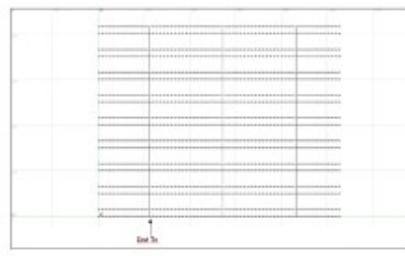
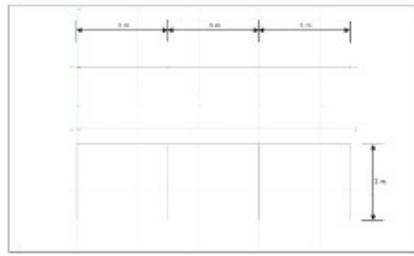
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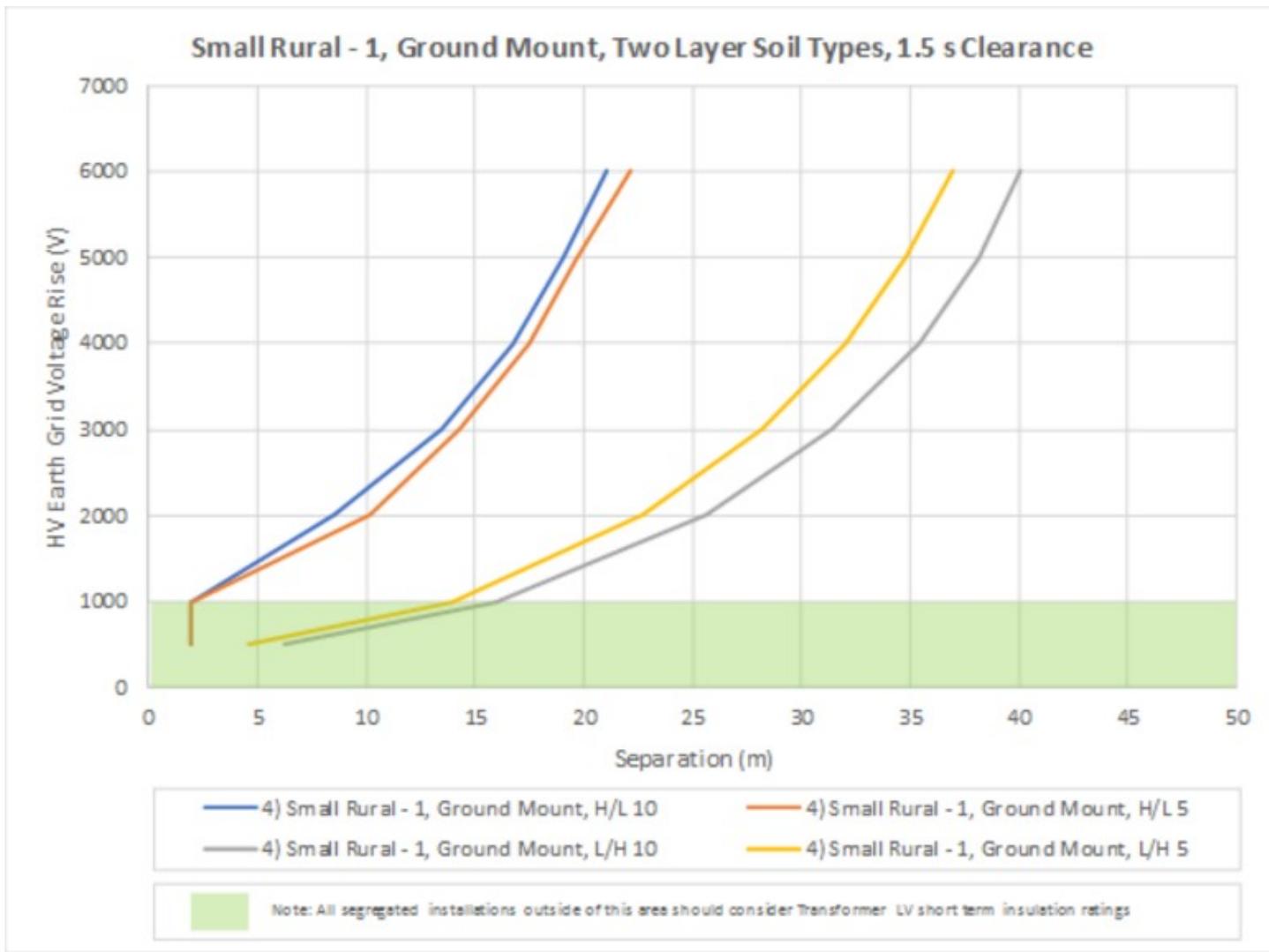






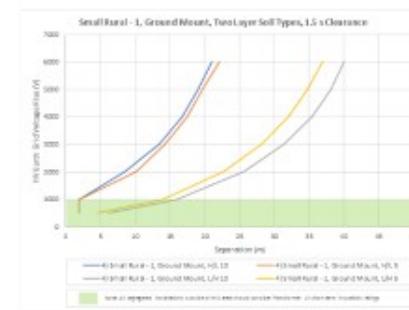
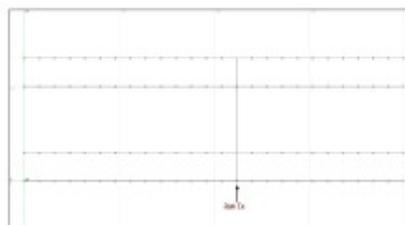
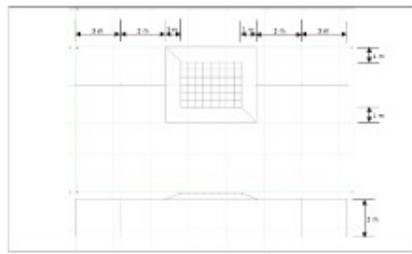
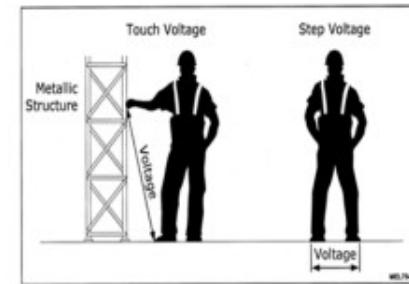
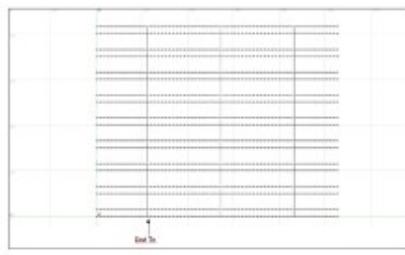
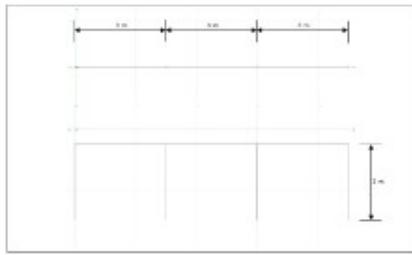
Methodology







Methodology





Outcomes

No definitive result

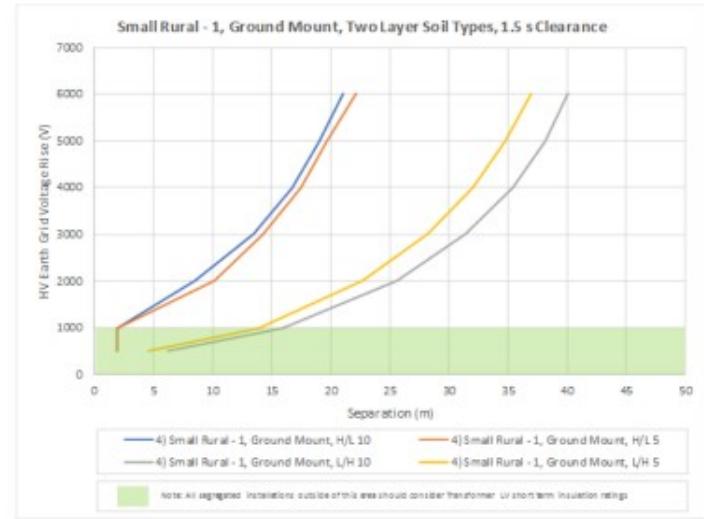
Scenario specific decisions

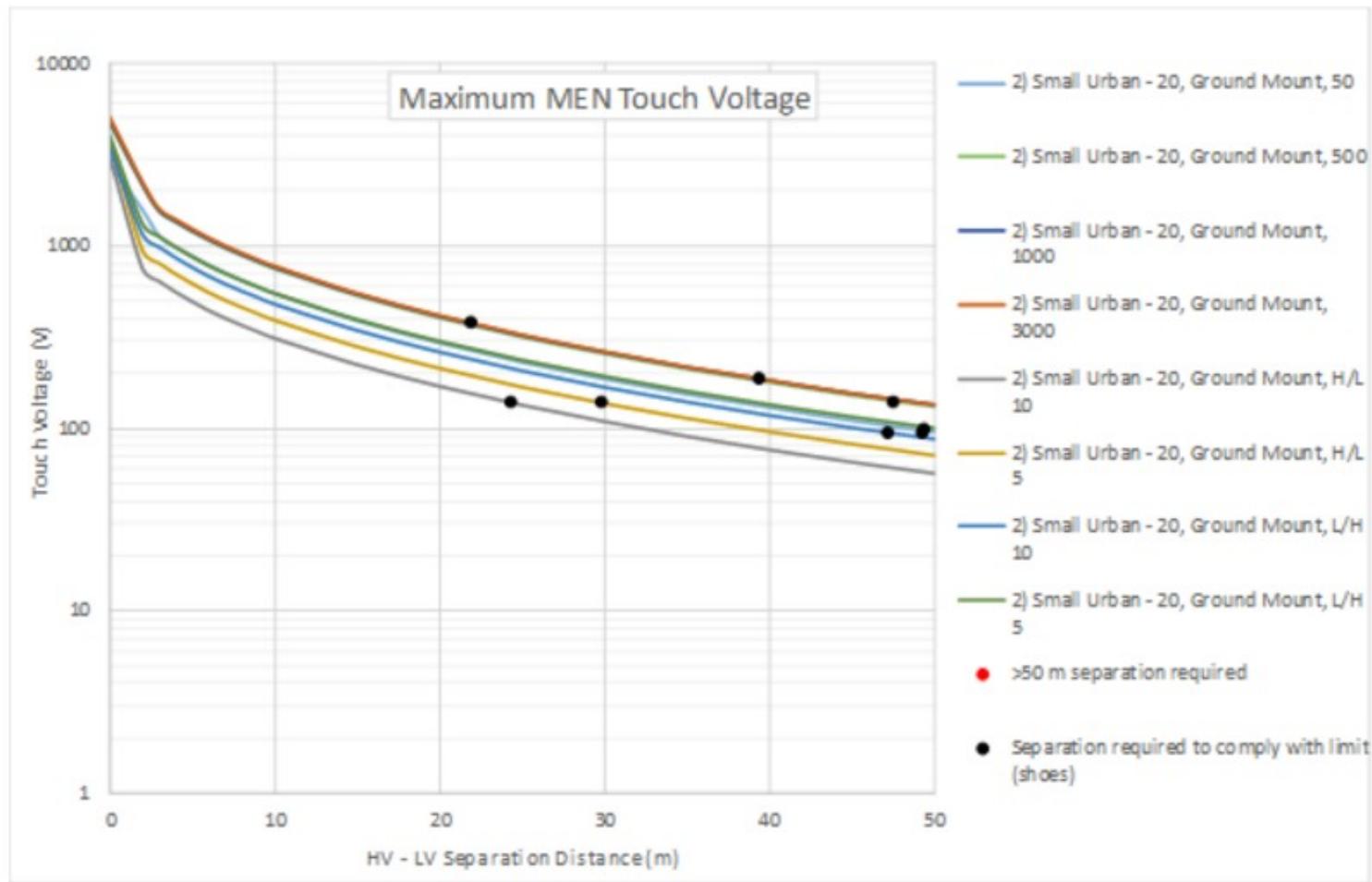
In General:

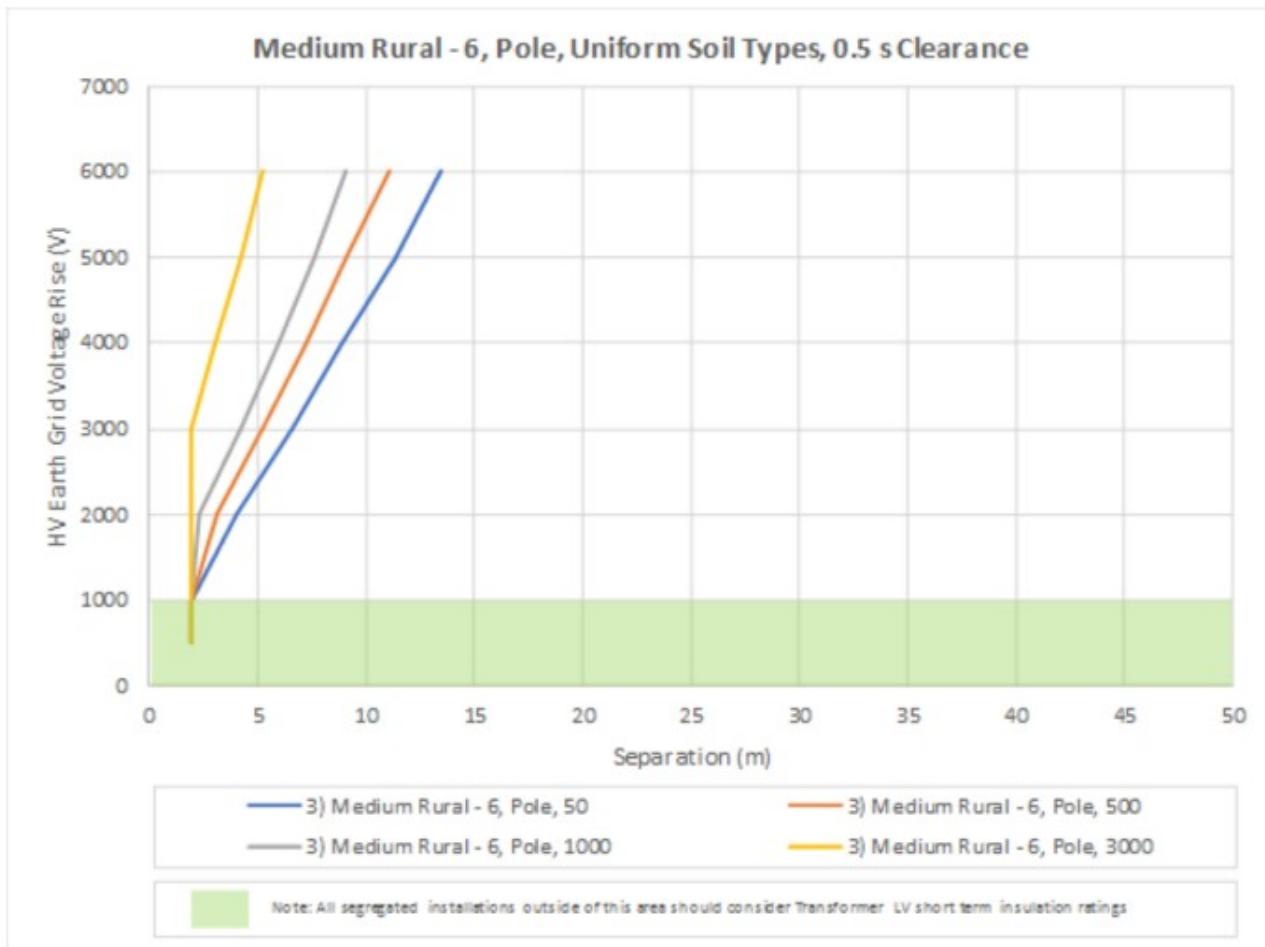
- Small Rural MEN - Segregated
- Urban - Combined

Required separation - 2 m to >50 m

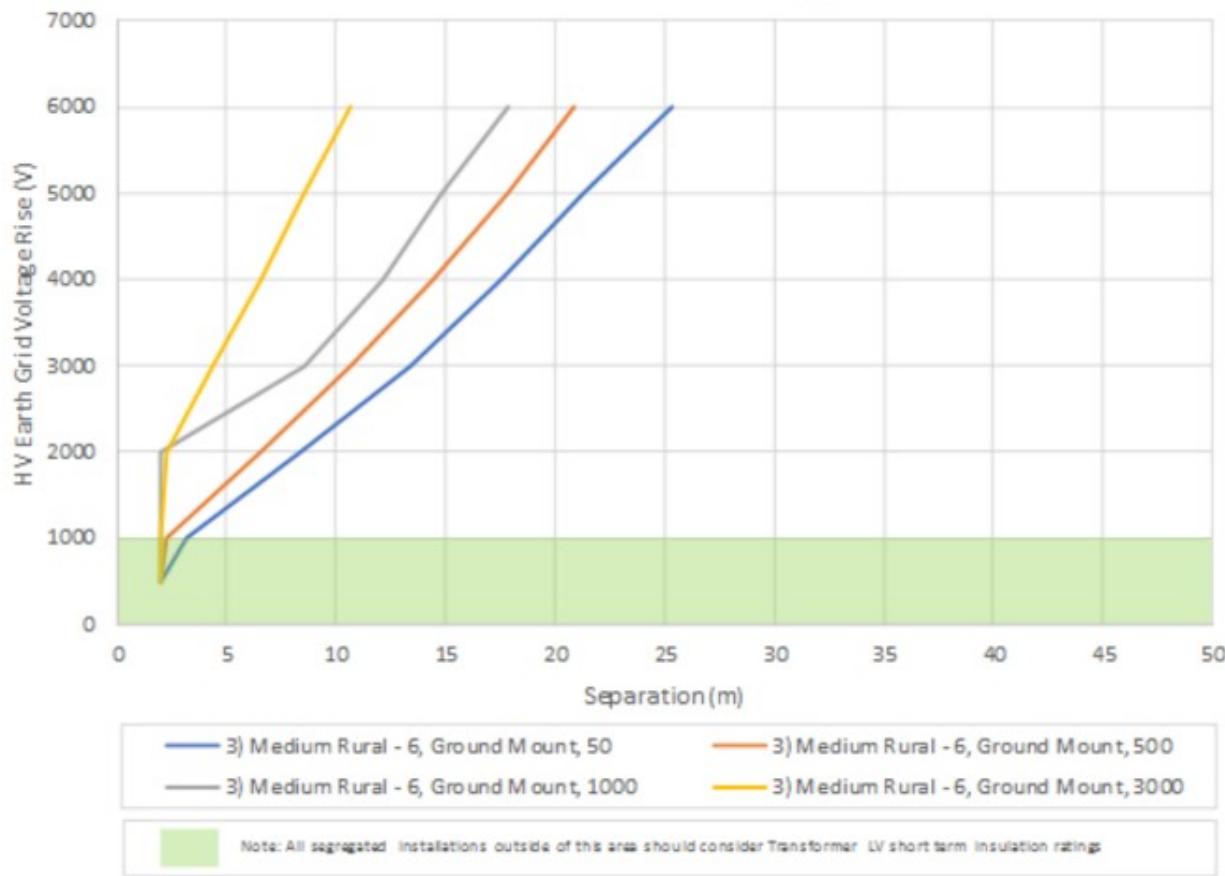
HV Earth - High EGVR



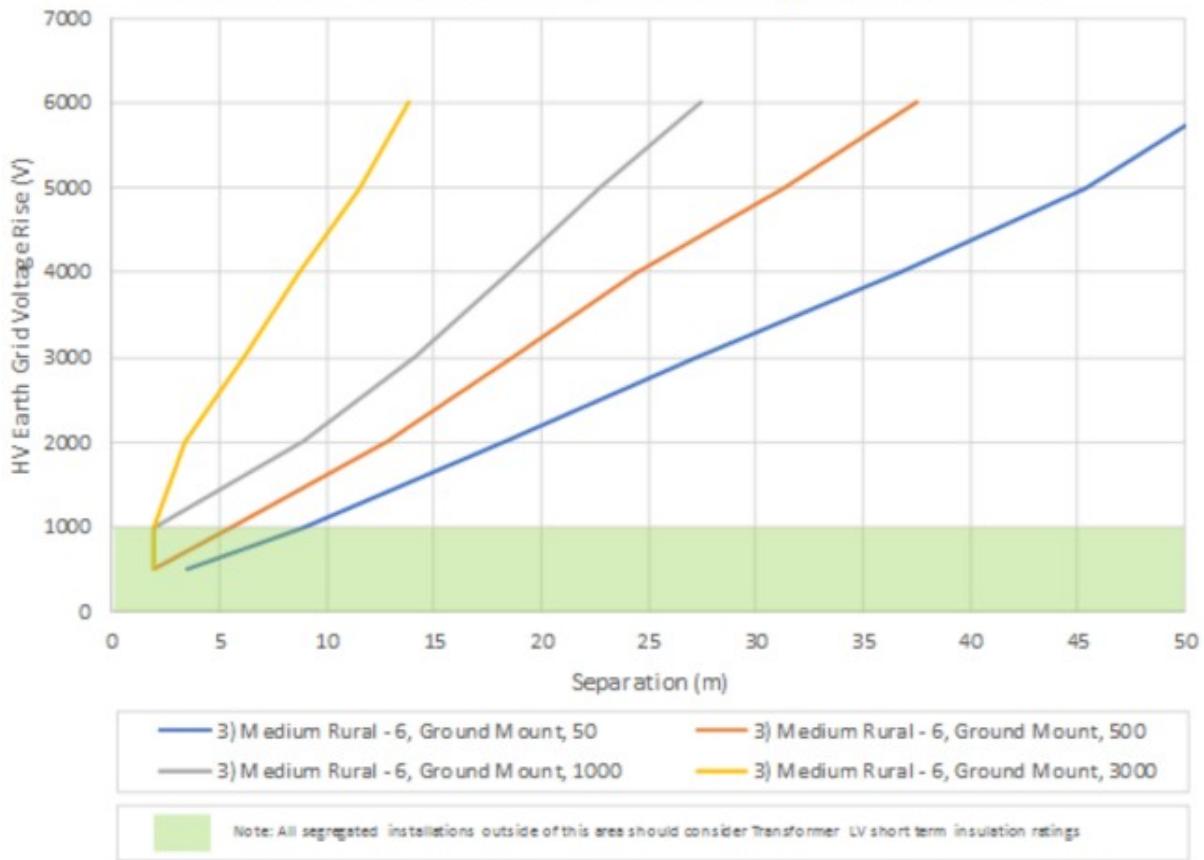




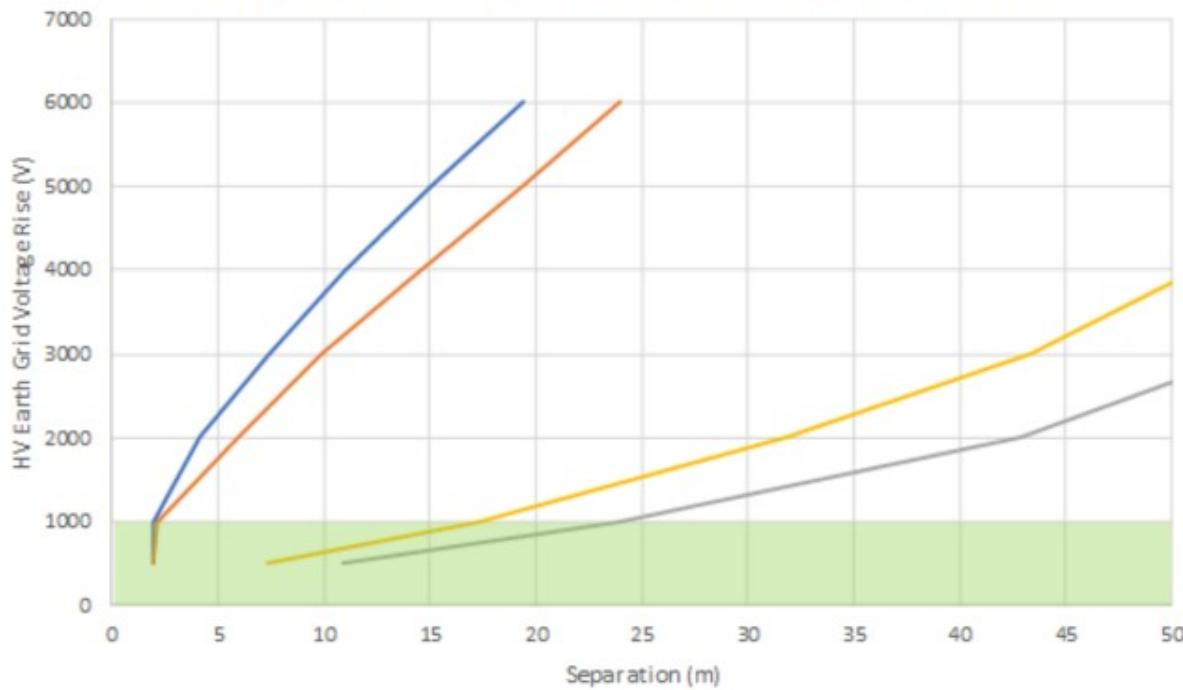
Medium Rural - 6, Ground Mount, Uniform Soil Types, 0.5 s Clearance



Medium Rural - 6, Ground Mount, Uniform Soil Types, 1.5 s Clearance



Medium Rural - 6, Ground Mount, Two Layer Soil Types, 1.5 s Clearance



— 3) Medium Rural - 6, Ground Mount, H/L 10 — 3) Medium Rural - 6, Ground Mount, H/L 5
— 3) Medium Rural - 6, Ground Mount, L/H 10 — 3) Medium Rural - 6, Ground Mount, L/H 5

Note: All segregated installations outside of this area should consider Transformer LV short term insulation ratings



Recommendations and Considerations

Segregate when:

- 1. MEN touch voltages exceed the deterministic limits**
- 2. Probability of exposure, $P_e > 10^{-6}$**
- 3. Practicable to install at the location**

Considering the following,



Recommendations and Considerations

1. Extent of HV/LV earthing
2. Transformer LV winding insulation ratings
3. Fault duration
4. Soil resistivity structure
5. HV earthing connections
6. Transformer location
7. Separate conductive items
8. Overhead considerations
9. HV to LV clash
10. Lightning strikes
11. LV Faults on tank
12. Maintenance of separation



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