APEX Conference 2014

An Overview of the Outdoor to Indoor 33 kV Conversion of Edgecumbe Substation

By:
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Consulting Electrical Engineers

Overview

* Site Layout
* 33 kV Switchroom
* Cutover Sequence
* Cable Modelling
* Summary
* Questions

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Edgecumbe Substation

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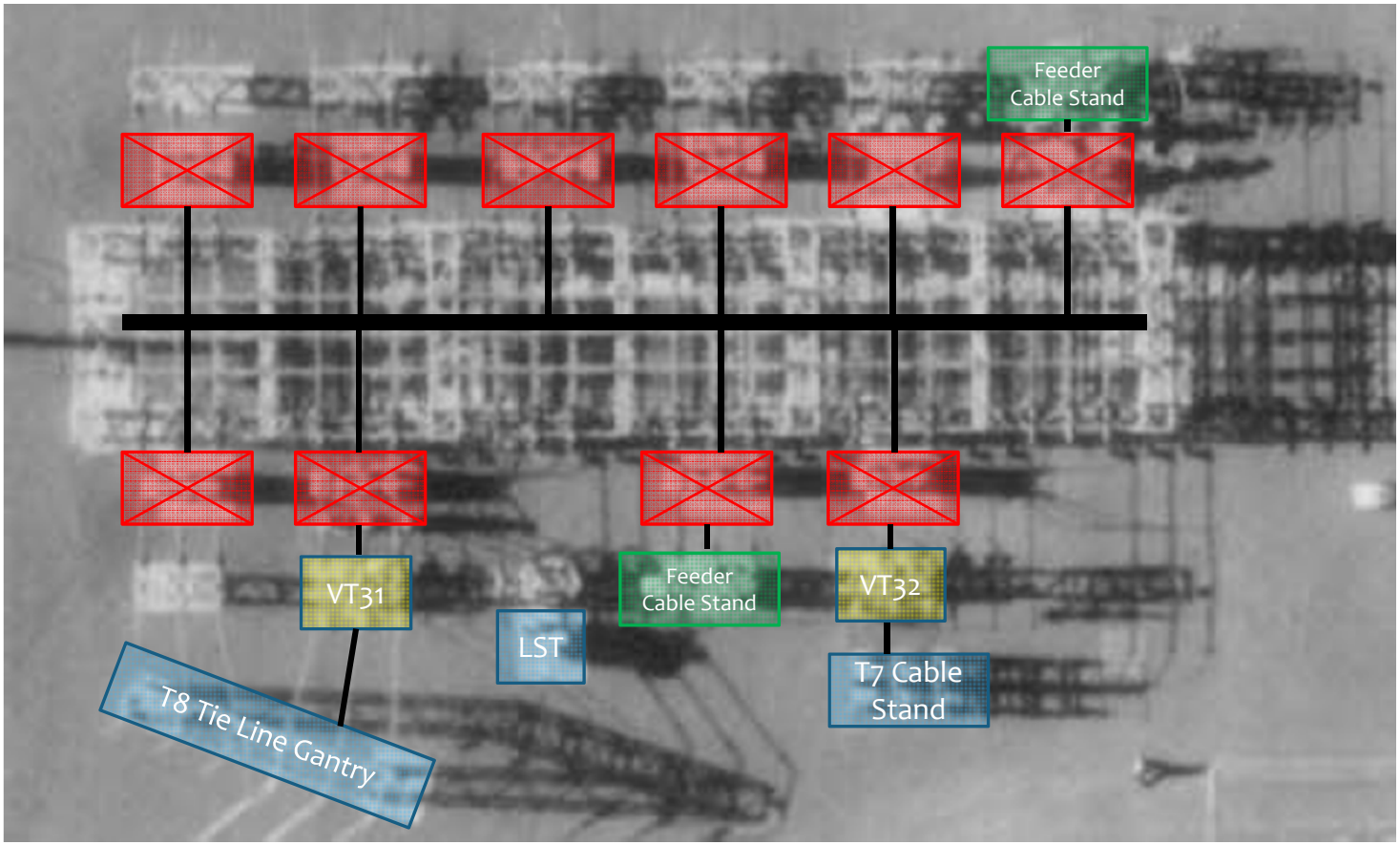
Edgecumbe 33 kV ODS



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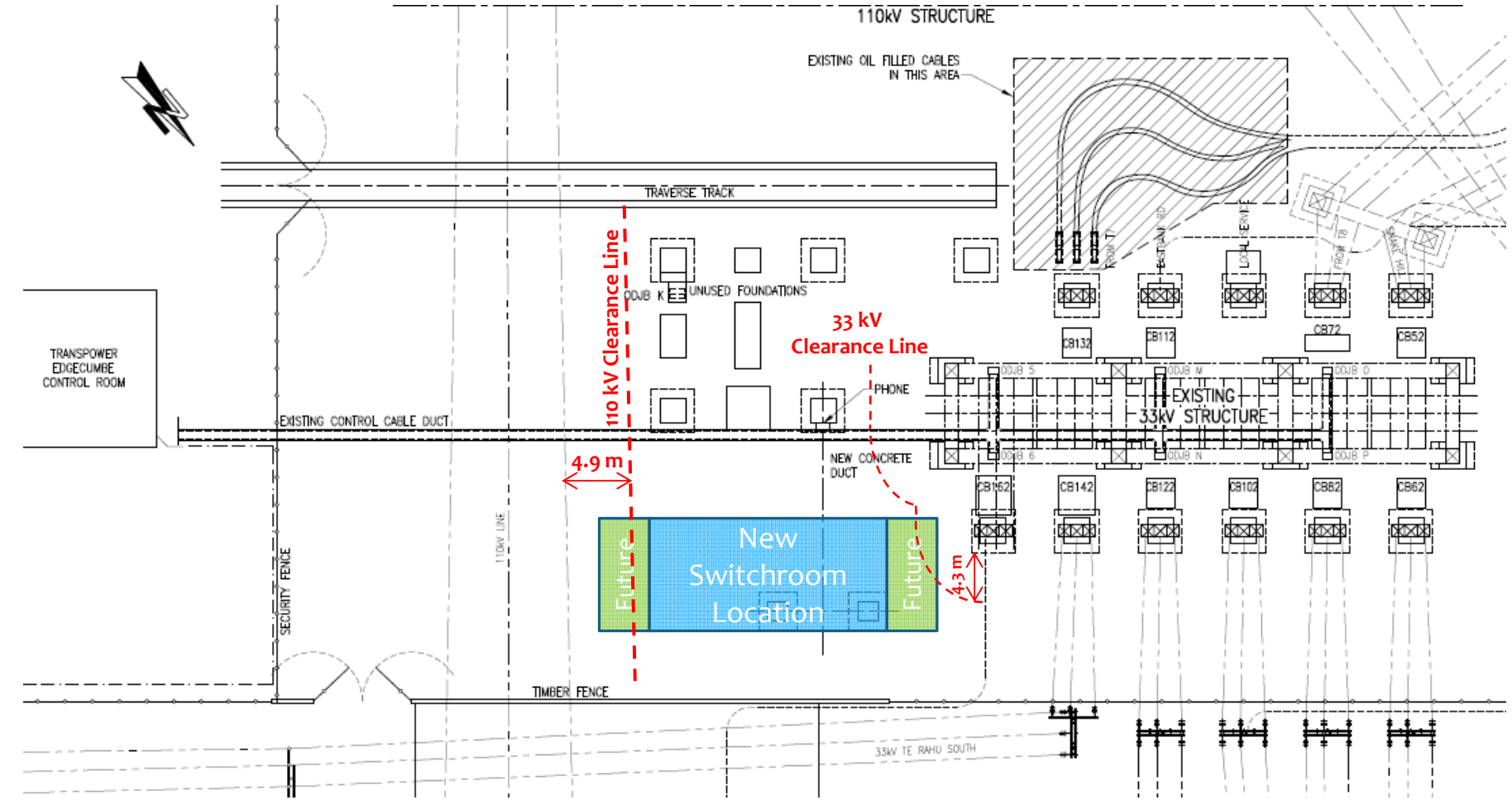
New 33 kV Switchroom Location



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New 33 kV Switchroom

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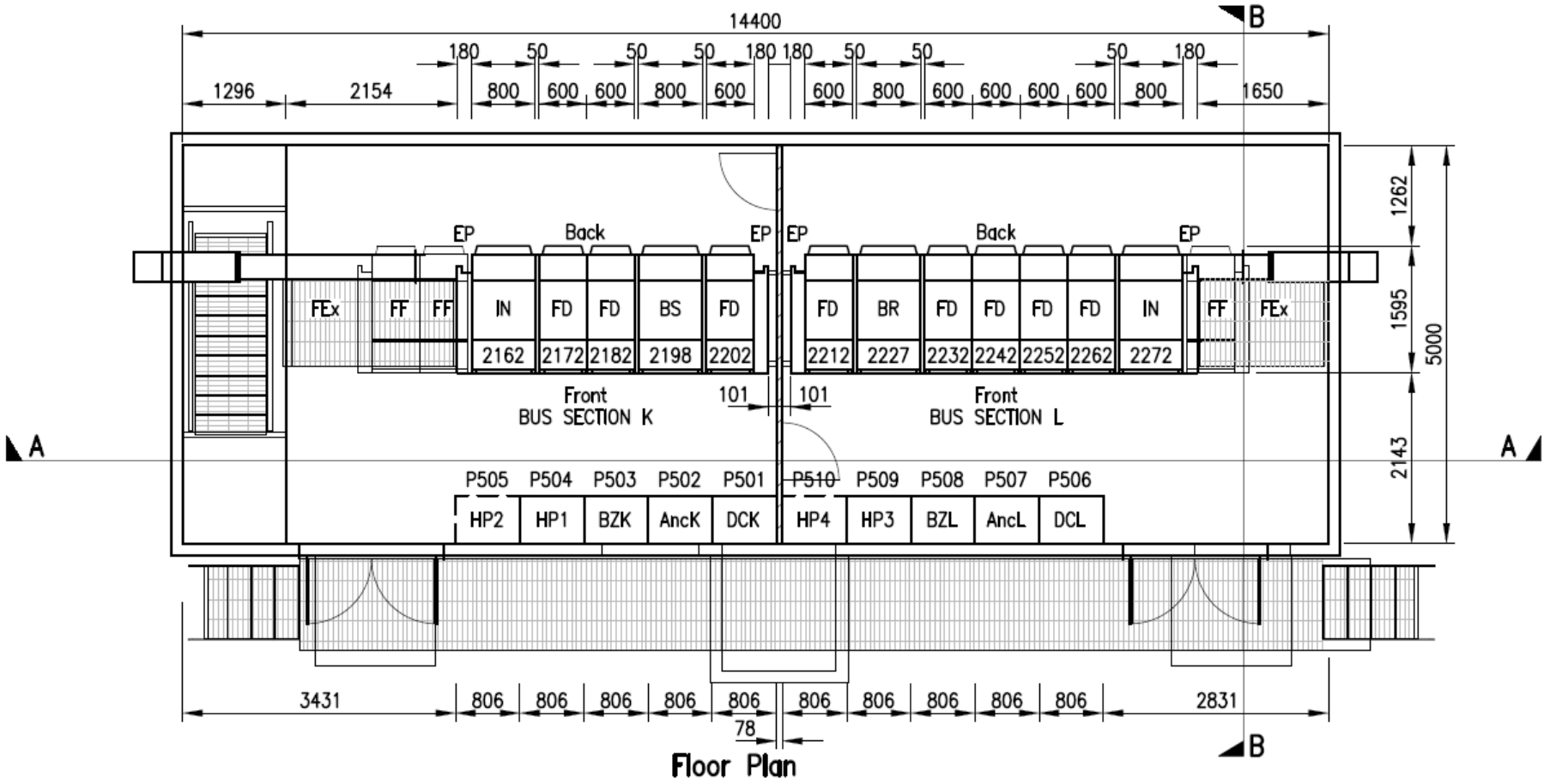
New 33 kV Switchroom Plan



Floor Plan

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33 kV Switchgear

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33 kV Switchroom Basement

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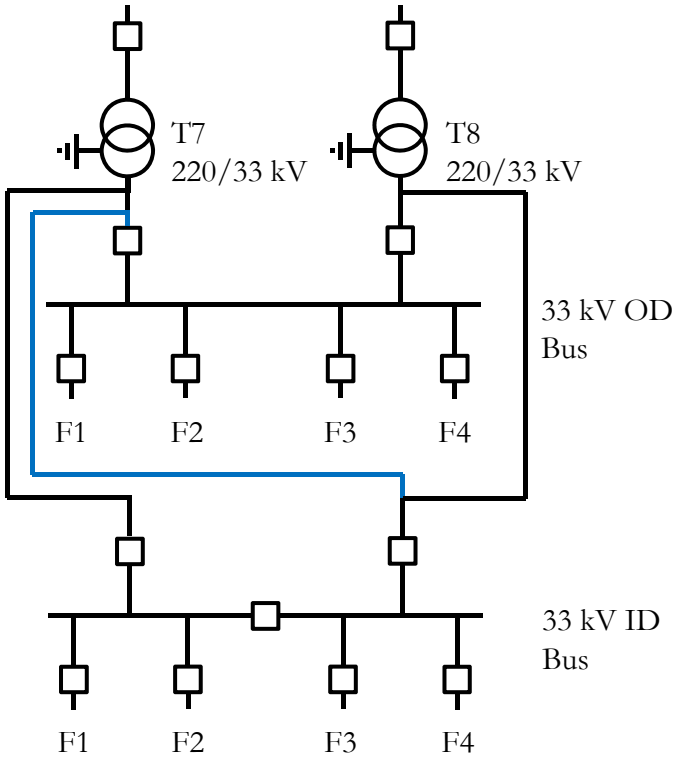
Cutover Sequence

* Two Options:
  - Temporary tie cable between the outdoor and indoor switchboards.
  - Connect the two switchboards in parallel.
* Maintain N-1 contingency.

Temporary Tie Cable



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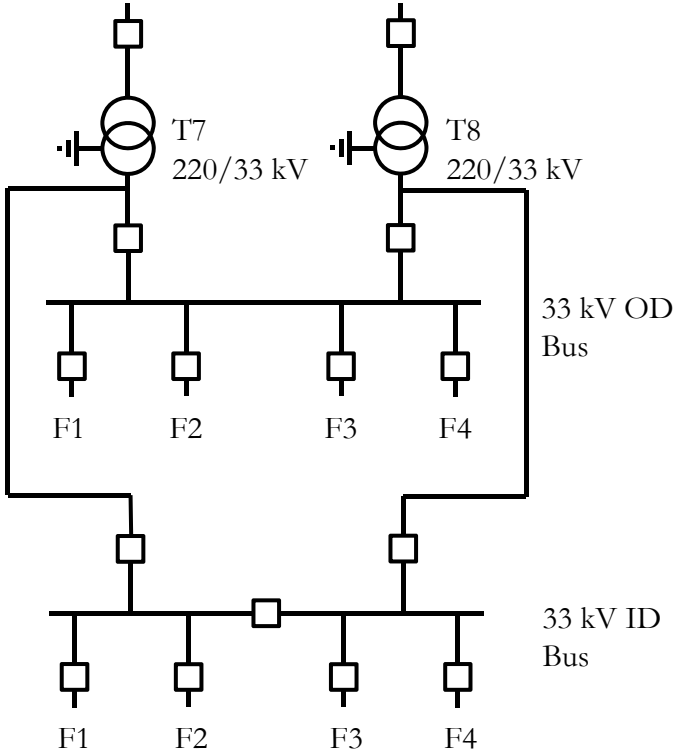
Temporary Paralleling



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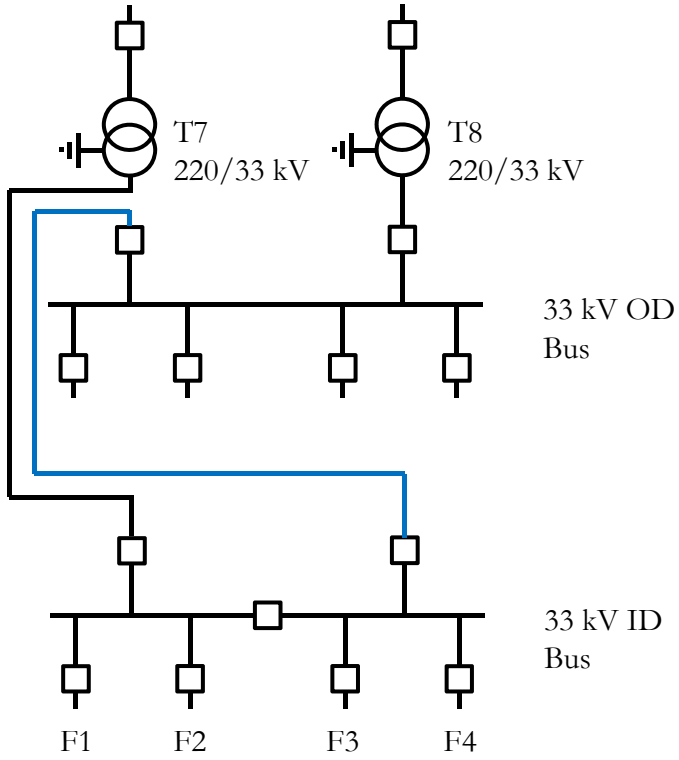
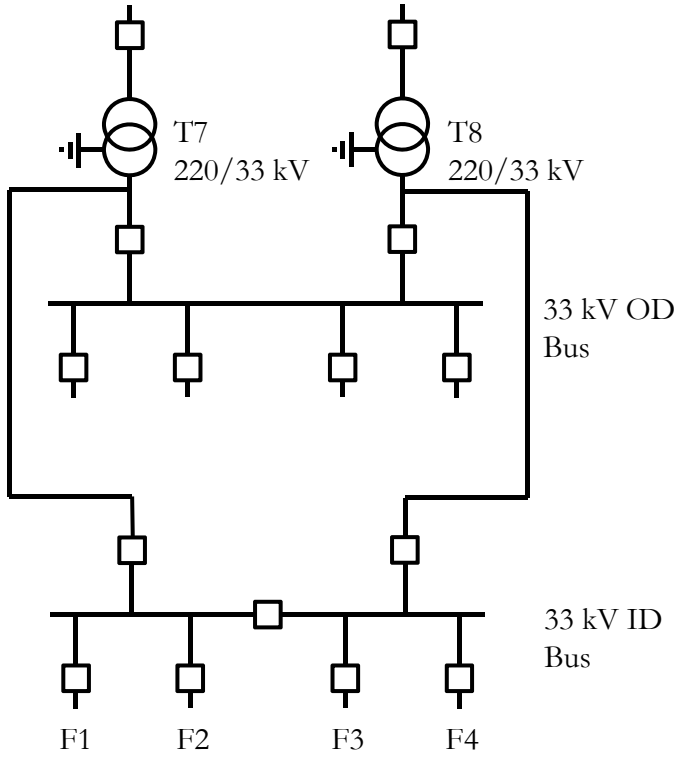
Cutover Sequence



Temporary Tie Cable Option



Temporary Paralleling Option

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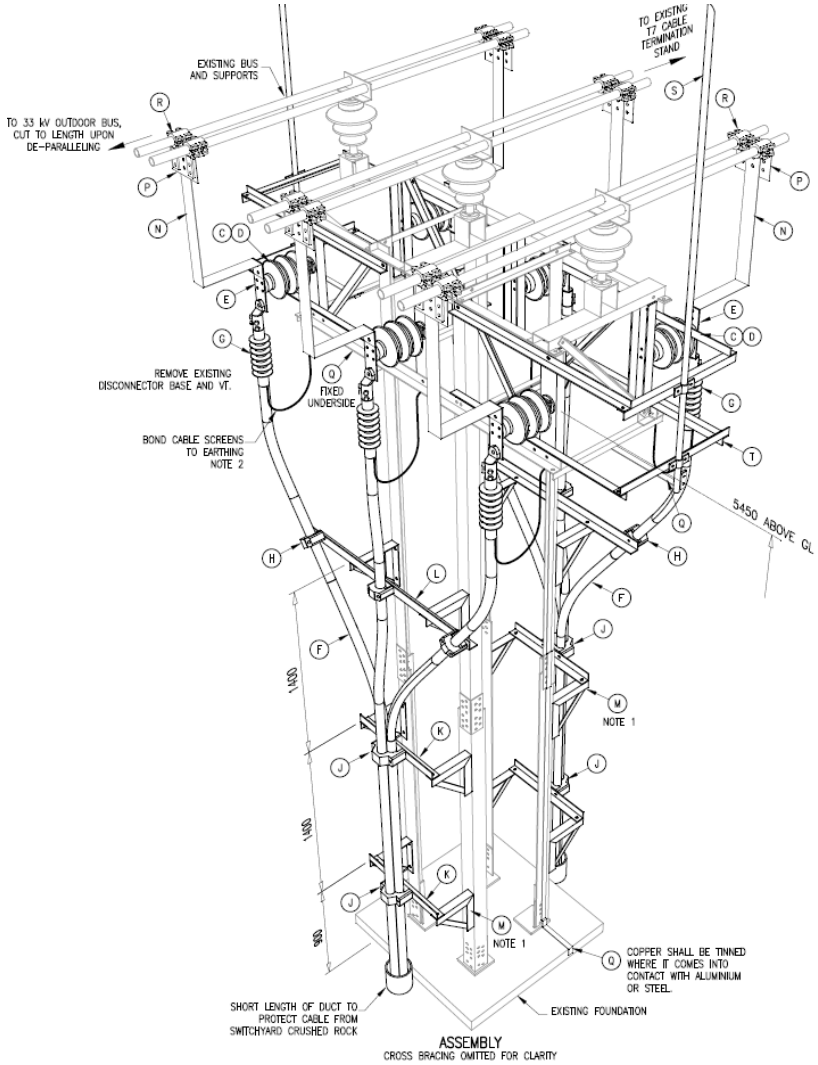
T7 Cable Termination Stand



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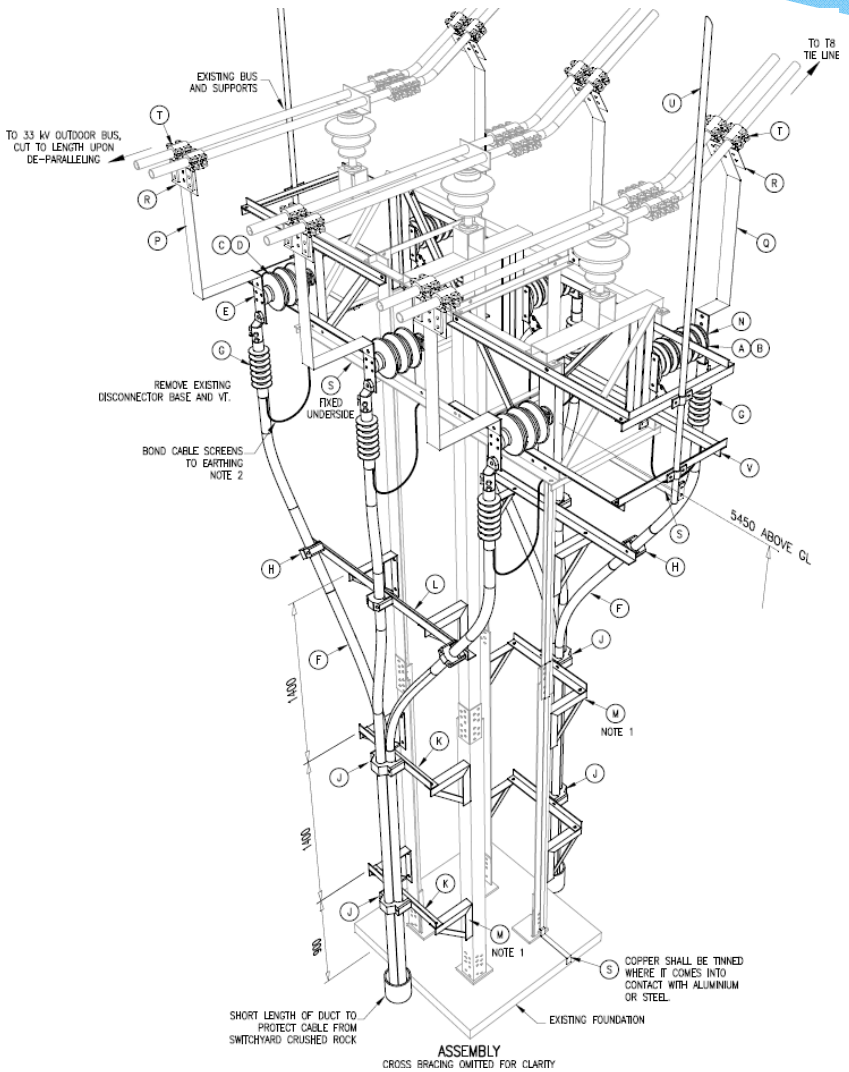
T8 Cable Termination Stand



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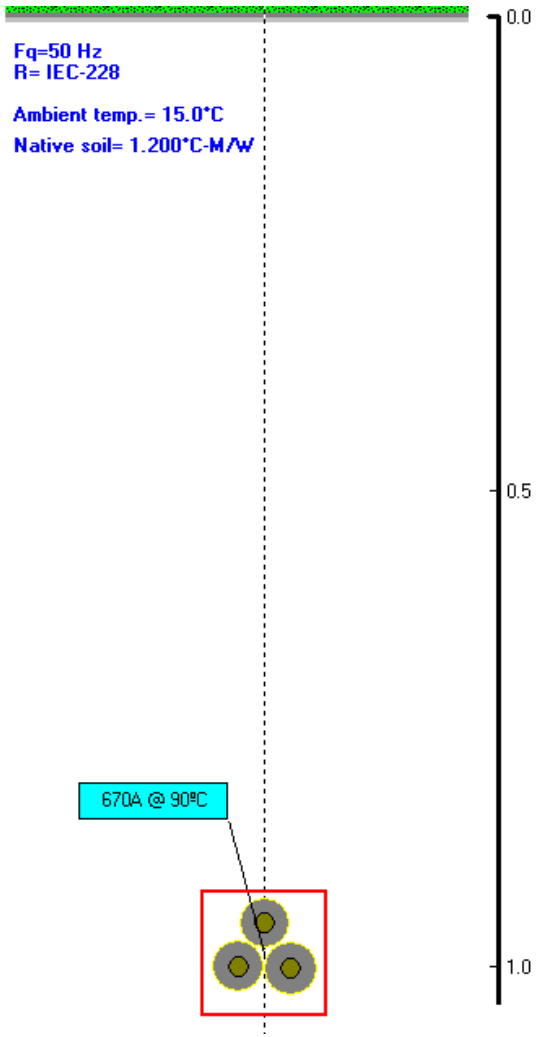
Cable Modelling

* Use CYMCAP to model the worst case cable corridors.
* Most important parameters to consider are:
  - Ambient Soil Temperature.
  - Soil Thermal Resistivity (TR).
  - Spacing between the cables.
* TR at Edgecumbe is extremely high! 6.25 °C.m/W.

Soil Thermal Resistivity Testing

* Testing carried out in a lab (Opus).
* Compaction level of the soil is a critical factor, hence two types of soil samples are collected:
  - In-situ (undisturbed) sample using push tubes.
  - Sample of around 15-20 kg at depth of burial.
* Testing can take up to 4-6 weeks.
* 3-point test or 4-point test report.

CYMCAP Modelling



Product Sheet No. 251-23 A

Conductor Size (mm²)	Nominal Diameters: Insulation (mm)	Nominal Diameters: Insulation Screen (mm)	Wire Screen: Area (mm²)	Wire Screen: No. & Size (No. x mm)	Thickness of Sheath PVC/HDPE (mm)	Nominal Overall Diameter (mm)	Linear Mass (kg/m)
50	24.5	26.1	20	36 x 0.85	1.0 / 1.0	32.3	1.03
70	26.0	27.6	20	36 x 0.85	1.0 / 1.0	33.8	1.14
630	46.4	48.0	20	36 x 0.85	1.3 / 1.4	55.7	3.58
800	51.0	52.6	20	36 x 0.85	1.4 / 1.4	60.5	4.28
1000	55.1	56.7	21	37 x 0.85	1.5 / 1.5	66.2	5.19

Product Sheet No. 251-23 B

Conductor Size (mm²)	Conductor AC Resistance at 50 Hz and 90°C (Ohm/km)	Inductive Reactance at 50 Hz (Ohm/km)	Conductor to Screen Capacitance (µF/km)	Nominal PVC Duct Size (Multi Way) (mm)	Current Ratings (A)		
50	0.822	0.150	0.14	100 (NZ)	190	167	146
70	0.568	0.139	0.16	100 (NZ)	236	204	177
630	0.0630	0.099	0.35	200	914	674	617
800	0.0509	0.095	0.39	200	1057	759	694
1000	0.0422	0.092	0.43	200	1197	841	768

Note:

1. The values in this table are for installation conditions of:

Soil Temperature	15 °C
Soil Thermal Resistivity	1.2 K.m/W
Depth of Burial	1.0 m
Screens bonded both ends	

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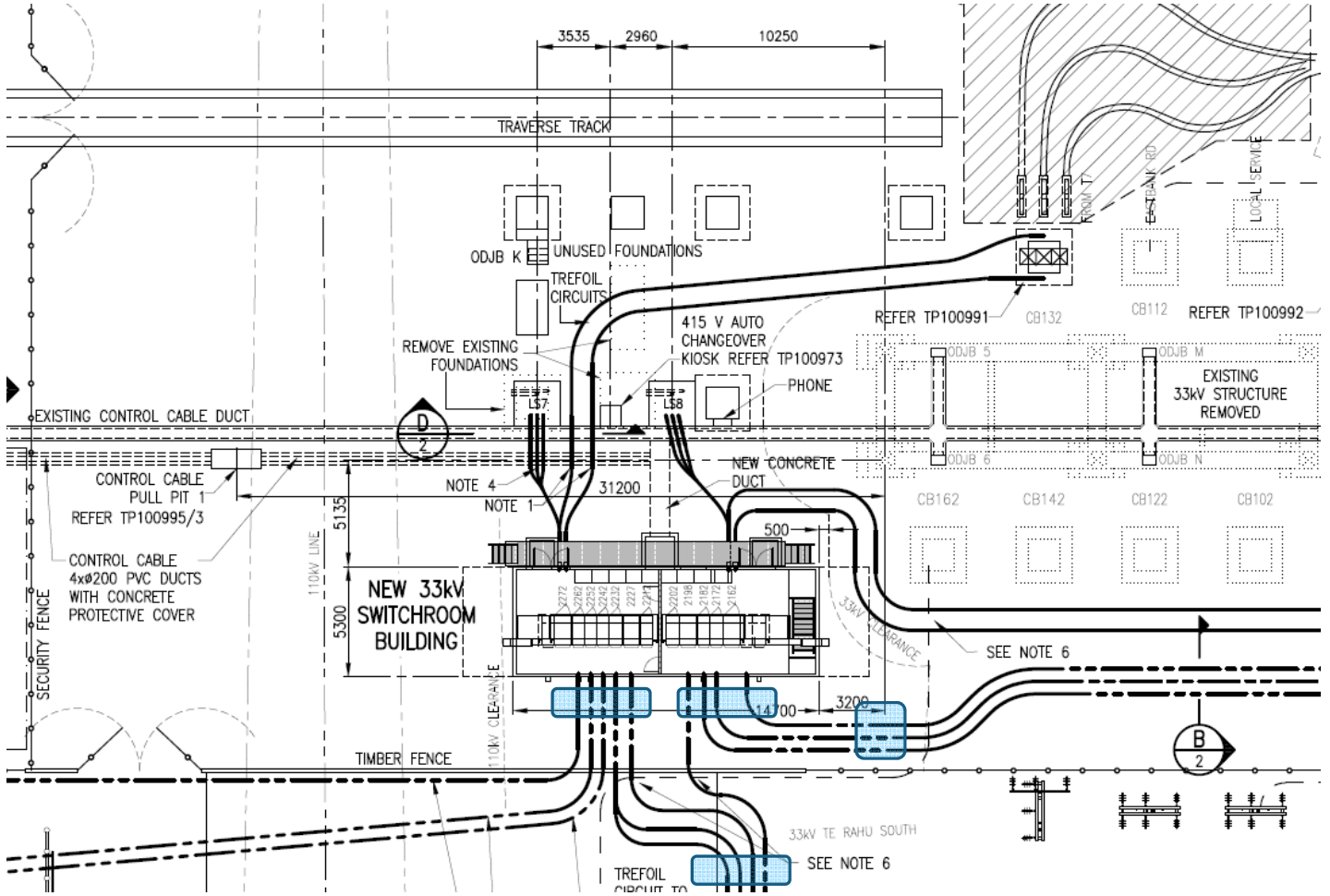
Cable Corridors



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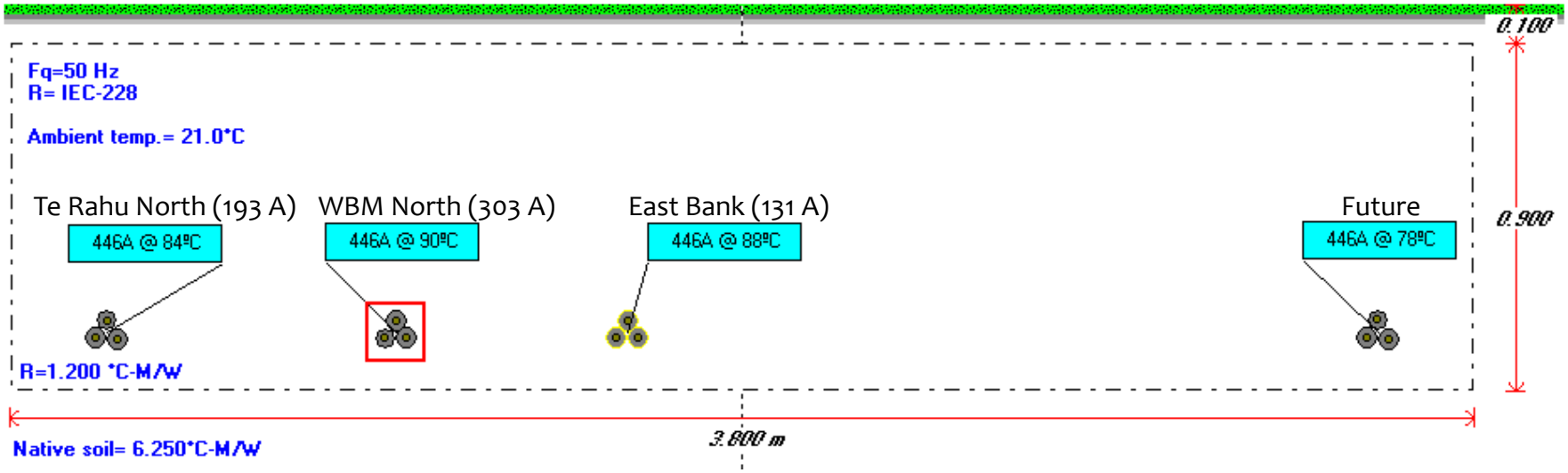
Edgecumbe Cable Modelling



Cable Type	630 mm² Al 1C XLPE 3 kA Wire Screen
Existing Peak Demand	36 MVA
Achievable Rating	102 MVA

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Summary

* New switchroom location was chosen to work in conjunction with existing site layout.
* Temporary paralleling arrangement most desirable.
* Identify soil type and carry out TR testing.
* Important to model various cable corridors around the switchroom.

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Questions

* Queries/Comments to:

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