Project Management, Deliverables Of Electrical Works In Quality MRT Project

By

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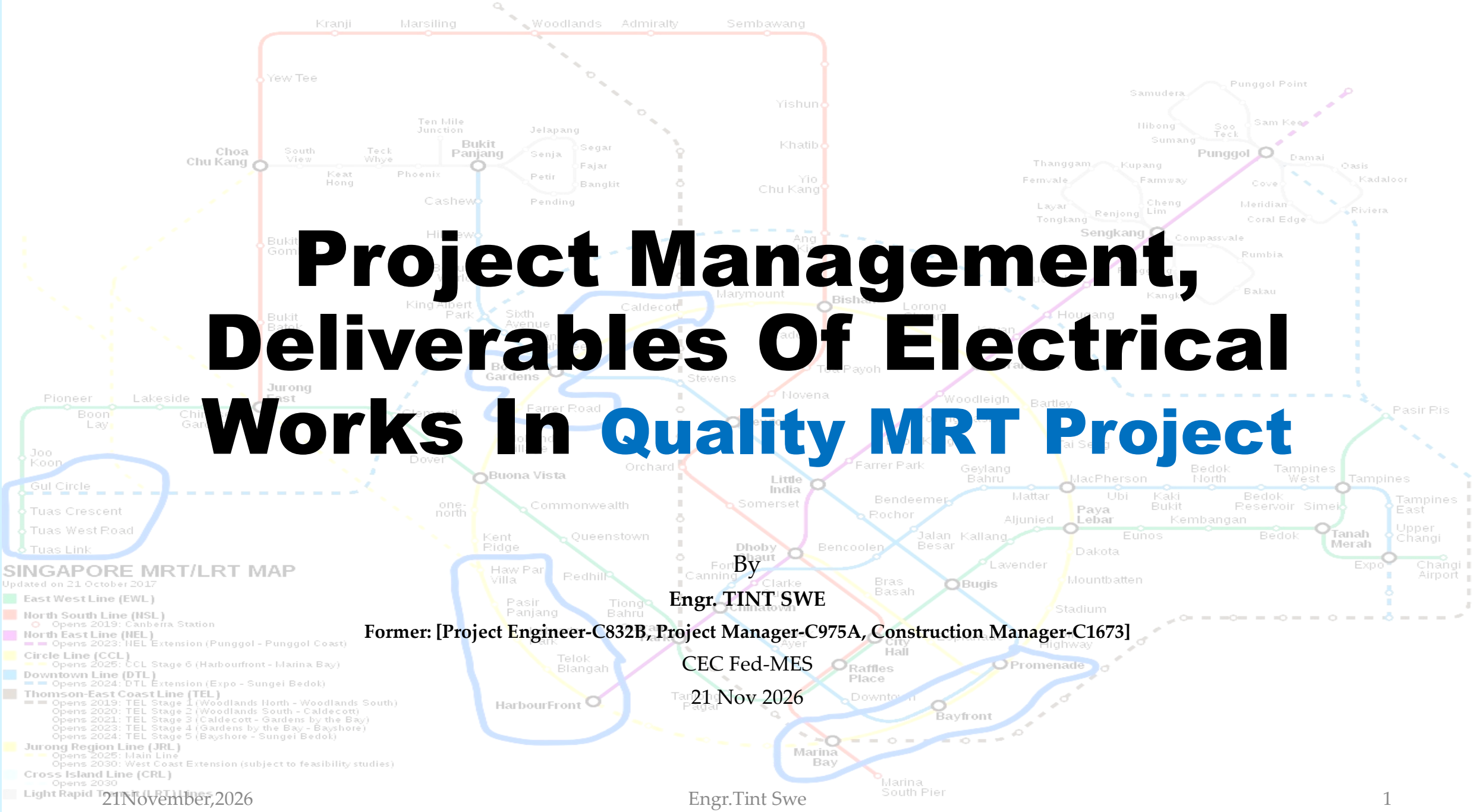
CEC Fed-MES

21 Nov 2026



AIM Of The Presentation

- Sharing the Efficient and Reliable Transportation System
- Less than 1% of National Energy Consumption of The country[total rail transportation] as two million people ride everyday, best energy saving service,
- Most Green and Sustainable Land Transport system,
- The Project execution activities
- The failsafe and system assurance of the project
- Role and Responsibility
- Project Life Cycle System Assurance
- Product , Material and Equipment Life Cycle Quality Assurance
- Bring the good samples and make it happened to our homeland

Project Descriptions

- Fully Automated Mass Rapid Rail Transit System
- Fully Underground
- Part of 29 +1 Stations and one Depot complete system
- Includes 8 Civil Defense Shelter (CD)Stations
- Line length : 39.5 km
- Built in six stages +1
- Track Guage : 1435mm (4 ft 8.5 in) Standard Guage
- Electrification : 750V DC, Third Rail
- Operating Speed : 70 ~ 90 km/h , limit of 78km/h(48mph)
- World longest Underground Rail system on it's kind,

Project Descriptions

- 3 car formation, Fully Automated Urbalis 300 Communication Based Train Control(CBTC) Signalling System,
- 0.45 million Riders per day
- Top speed 90km/h, operation 80km/h
- Total 70m length for three cars,
- Each train weighs 120tons
- 146 seats and two wheelchairs spaces,
- Each car has eight doors, emergency ventilation good for 45min,
- 462kW consume for a train for one complete loop run with AC and lights,
- 931 Passengers can carry in Three Cars.

Project Management

- **Timely** delivery to the Project
- Implement the project as per **scope** of work
- Competitive **Cost** to be spent in basic.
  - meet the required and agreed
  - Mitigate and get rid of possible and causes of **Risks**

1. **Scope** to define
2. Schedule to prepare
3. Select Material, Equipment, Methods, Man power, Machinery, Measurement
4. Assure the Work and construct the Quality achievement. No rework, replace, and minimum defects
5. Make sure all are recorded, documented, communicated, looks ahead, proactive, initiated, check recheck counter check. Assure the work with inspection, testing, etc.,

Where the Project's scope of work?

- Contract
- Contract Document
- Scope compile with Regulations, Codes, Standards, Authorities applicable Laws etc.,
- Coordination work, Addition and Alterations, Variation Order, EI-Engineer Instruction, Design Change, Special cases etc.,

Contract Document, I

- Instruction To Tenderers (Book 1)
- Form of Tender, Price Schedules and Schedules of Rates (Book 2)
- Conditions of Contract (Book 3)
- General Specifications (Book 4)
- Particular Specification (Book 5)
- Particular Specification (Book 5A)
- Particular Specification (Book 5B)
- Particular Specification (Book 5C)
- Particular Specification (Book 5D)
- Technical Specification (Book 6)

Contract Document, II

- Client's Tender Drawings,
- The Tender Addenda
- Tender Clarification Questions and Answer, [TCQ]
- TENDER EVALUATION Criteria:
  - Resources Management
  - Technical Proposal
  - Financial Capacity
  - Option Prices(if Any), and Schedule of Rates{price and BoQ]
  - Tenderers programme for the completion of the Works,[Method Statement]
  - Thoroughness of submission and information supplied
  - Compliance with Client's requirement.

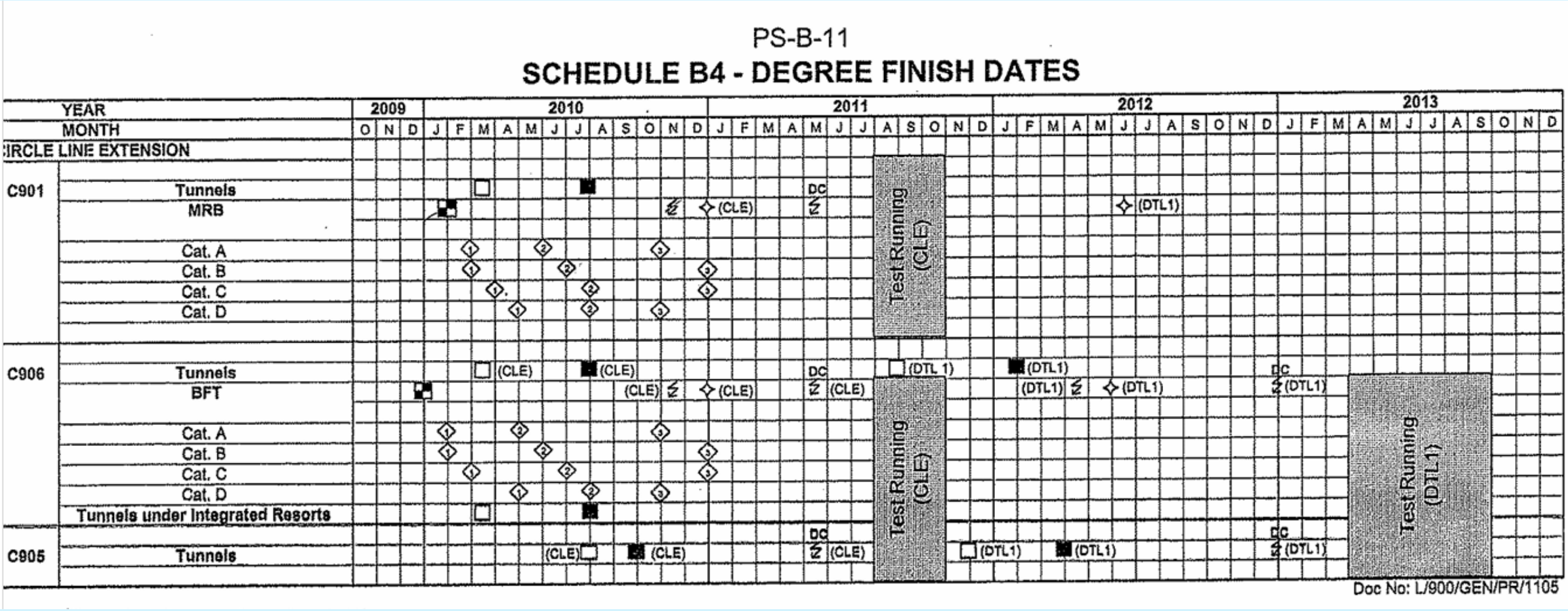
Contract Document, III

- Comment and advise to ALL other interface Designs
- Codes and Standards as referred in the contract and coordination
- SCDF Fire Safety Codes
- SFSRTS-Standard for Fire Safety of Rail Transit System
- LTA Civil Design Criteria
- LTA Architectural Design Criteria
- LTA Road Design Criteria
- Singapore Standards,
- Code of Practice of Singapore
- NFPA Fire Codes

Project Time Line

1 B4 **Programme**
2 Programming Plan
3 Baseline **Programme**
4 3 Month Rolling **Programme**
5 4 Week Rolling Programme
6 CIP ; Coordinated Integrated/Installation Programme (Station)
7 CIP ; Coordinated Integrated/Installation Programme (Tunnel)
8 TRIP; Track Related Installation Programme(Track)

Project Time Line; Schedule B4-Programme

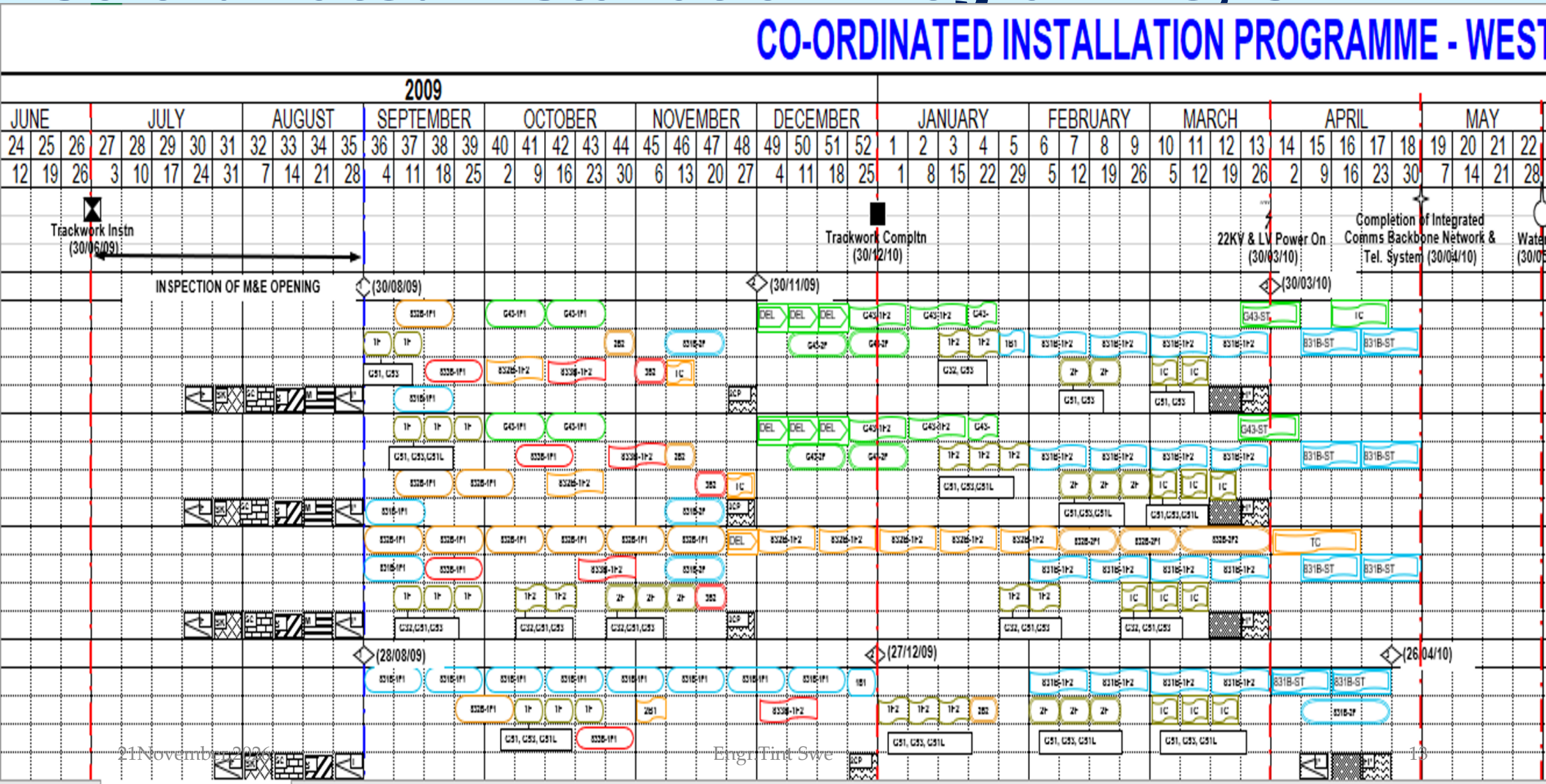


Project Time Line; Schedule B4-Programme

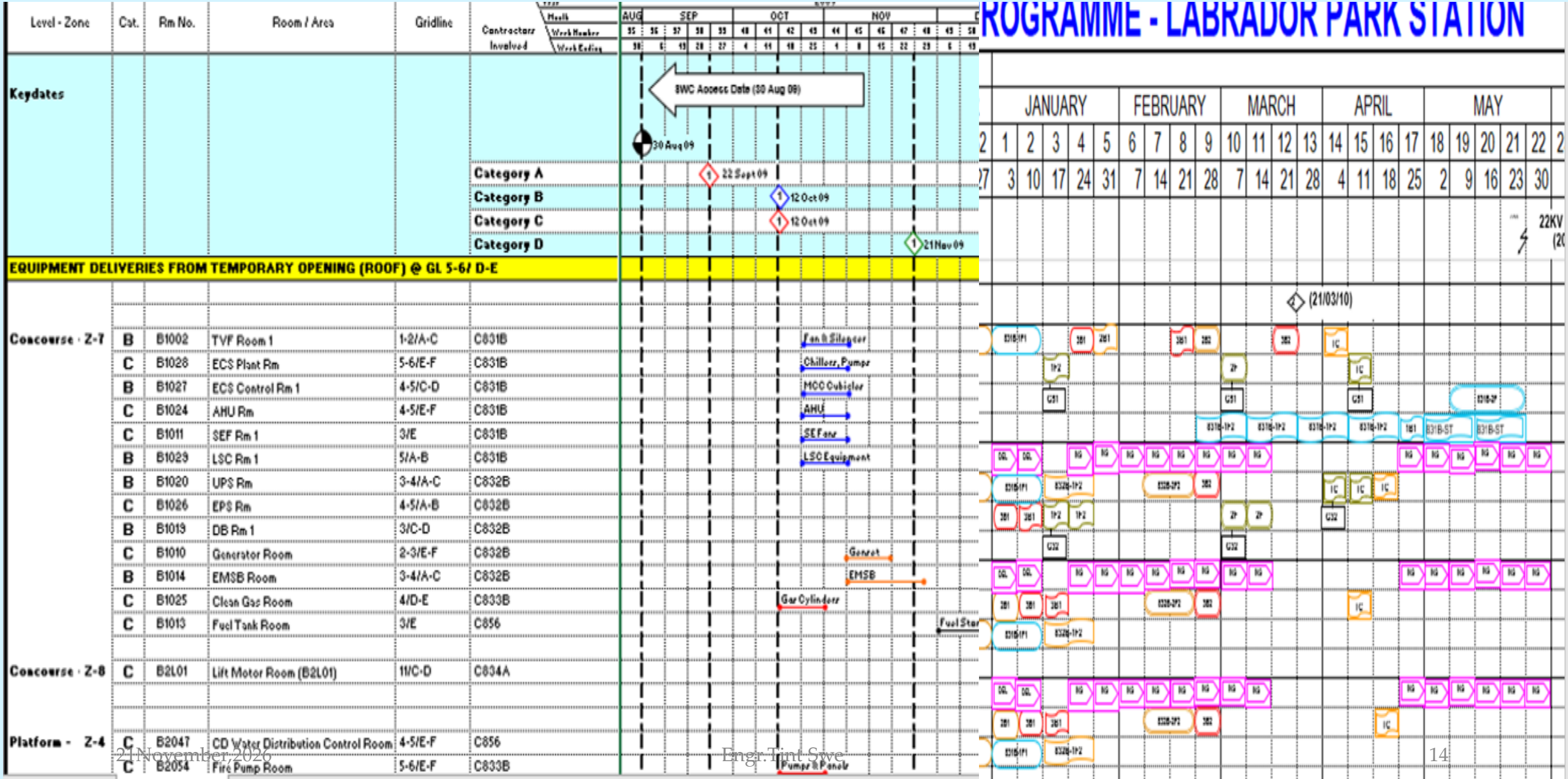
SCHEDULE B4 – DEGREE FINISHES

Type of Room	Designated SWC	Degree 1 Finish	Degree 2 Finish	Degree 3 Finish
Category A 22kV Switch Room Traction Transformer Room Traction Switch Room Service Transformer Room Tie Breaker Room LV Switch Room Includes cable chambers, passageways and corridors adjacent to these rooms and the associated battery rooms should the batteries be housed in separate rooms.	C830A C830A C830A C830A C830A C975	**Completion of the following:** **Civil** 1. Floor finishes 2. Installation of permanent doors with lock 3. 1st coat of paint 4. Testing of all cast-in lifting/pulling hooks	**Completion of the following:** **Civil** 1. 2nd coat of paint 2. Installation of removable panels after equipment delivery **SWC except for the designated SWC** 3. Installation of all first and second fix items	**Completion of the following:** **Civil** 1. Final cleaning and painting including sealing of openings **SWC** 2. All works including testing* except for integrated testing 3. Final cleaning

Co-ordinated Installation Programme, C I P



Co-ordinated Installation Programme, C I P



Co-ordinated Installation Programme, C I P

- Include All the construction **Area** of the Project
- Add the construction activities to be implemented in sequence
- Add the work duration with the respective contractor
- Area are mentioned in code with work activities
- Coordinated with the Degree Finishes, phase of FIX , Mile stone dates
- Coordinated with the Category [Priority]
- Integrated All construction activities of the Project with , time, finishes in one Schedule

TRIP Programme

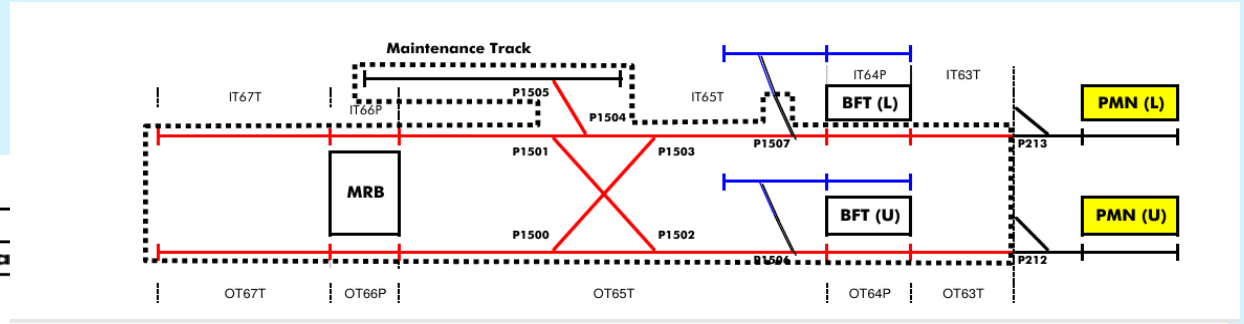
CCL Main Line Works Train Activities (Continuation)

Project Week			20/2011				
Date	Hours of Work		Contract	Train Details	Sector No.	Traction Power 750V DC On at	Activity
	Start	End		DBG-->HBF			
22/05/11 Sunday	0001	2359	C830/10	EMUs	IT35T - IT61T, OT35T - OT61T, CS38P, CS49T, CS55T	Yes	Train Testing (Gp10/20/31/311/43(AP)), Buffer Area Access to ISCS, SIG Room (Gp10/31/311/52), Platform Box 1 meter edge (Gp52), Shunting & Training
	0800	2200	C8353/C855	NA	OT48P (Platform Box)	No	Scaffold Erection & Art Works

CCL Main Line Works Train Activities (Continuation)

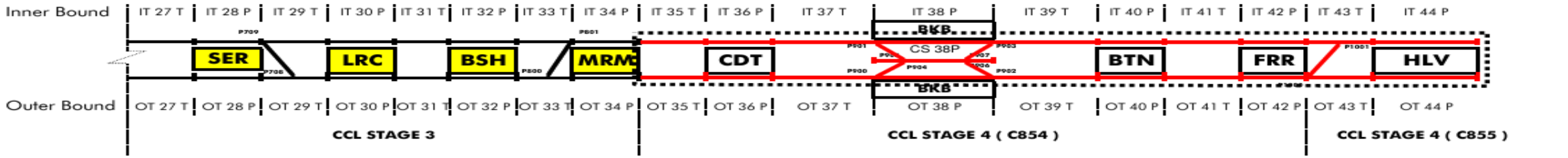
Project Week			20/2011					
Date	Hours of Work		Contract	Train Details	Sector No.	Traction Power 750V DC On at	Activity	Remarks
	Start	End		DBG-->HBF				
21/05/11 Saturday	0001	2359	C830/10	EMUs	IT35T - IT61T, OT35T - OT61T, CS38P, CS49T, CS55T	Yes	Train Testing (Gp10/20/31/311/43(AP)), Buffer Area Access to ISCS, SIG Room (Gp10/31/311/52), Platform Box 1 meter edge (Gp52), Shunting & Training	**Gp10 Possession.**
	0800	2100	C830/43 (AP)	NA	IT36P, IT38P, IT40P, IT42P, IT44P, IT46P, IT48P, IT50P, IT52P, IT54P, IT56P, IT58P, IT60P, OT36P, OT38P, OT40P, OT42P, OT44P, OT46P, OT48P, OT50P, OT52P, OT54P, OT56P, OT58P, OT60P (Gp43 CAT A Rooms)	No	Standby Emergency Access for T&C Team. Ongoing Testing of Platform Equipment at Interface with others	No Access to Trackside. Local coordination with Gp10 PIC.
	0800	2200	C8353/C855	NA	OT48P (Platform Box)	No	Scaffold Erection & Art Works	**M/S. LTA. [Scaffold & Ladder (Platform Box)].** No Access to Trackside. Local coordination with Gp10/AP/Gp52 PICs.

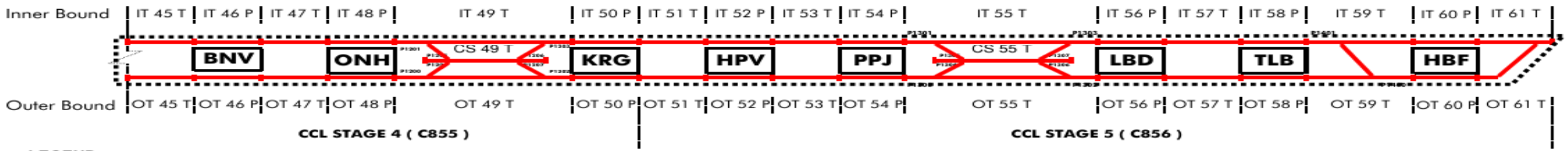
TRIP Programme



3.2 Extent of Defined Area in Mainline (CCL) (Continuation)

Project Week No.	Start		
20/2011	Monday	16/05/11	Sunda

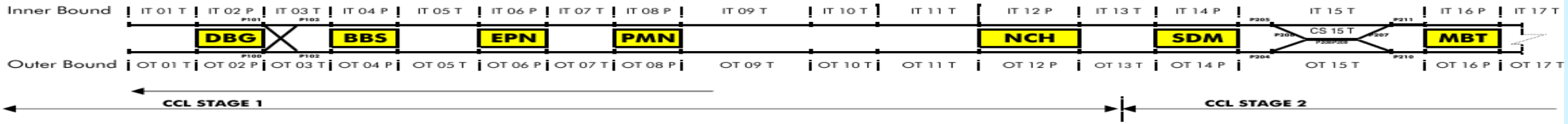


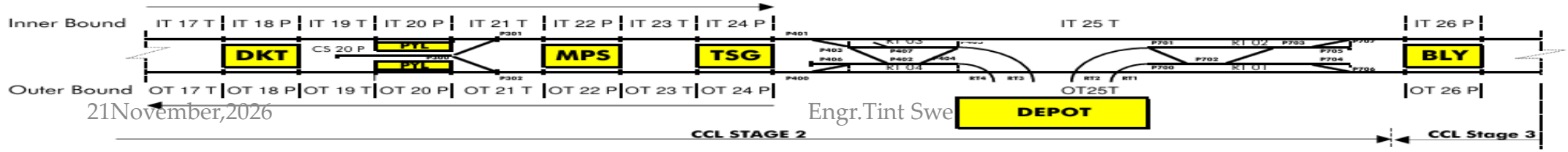


LEGEND:

3.2 Extent of Defined Area in Mainline (CCL)

Project Week No.	Start		End	
20/2011	Monday	16/05/11	Sunday	22/05/11





Coordination Model

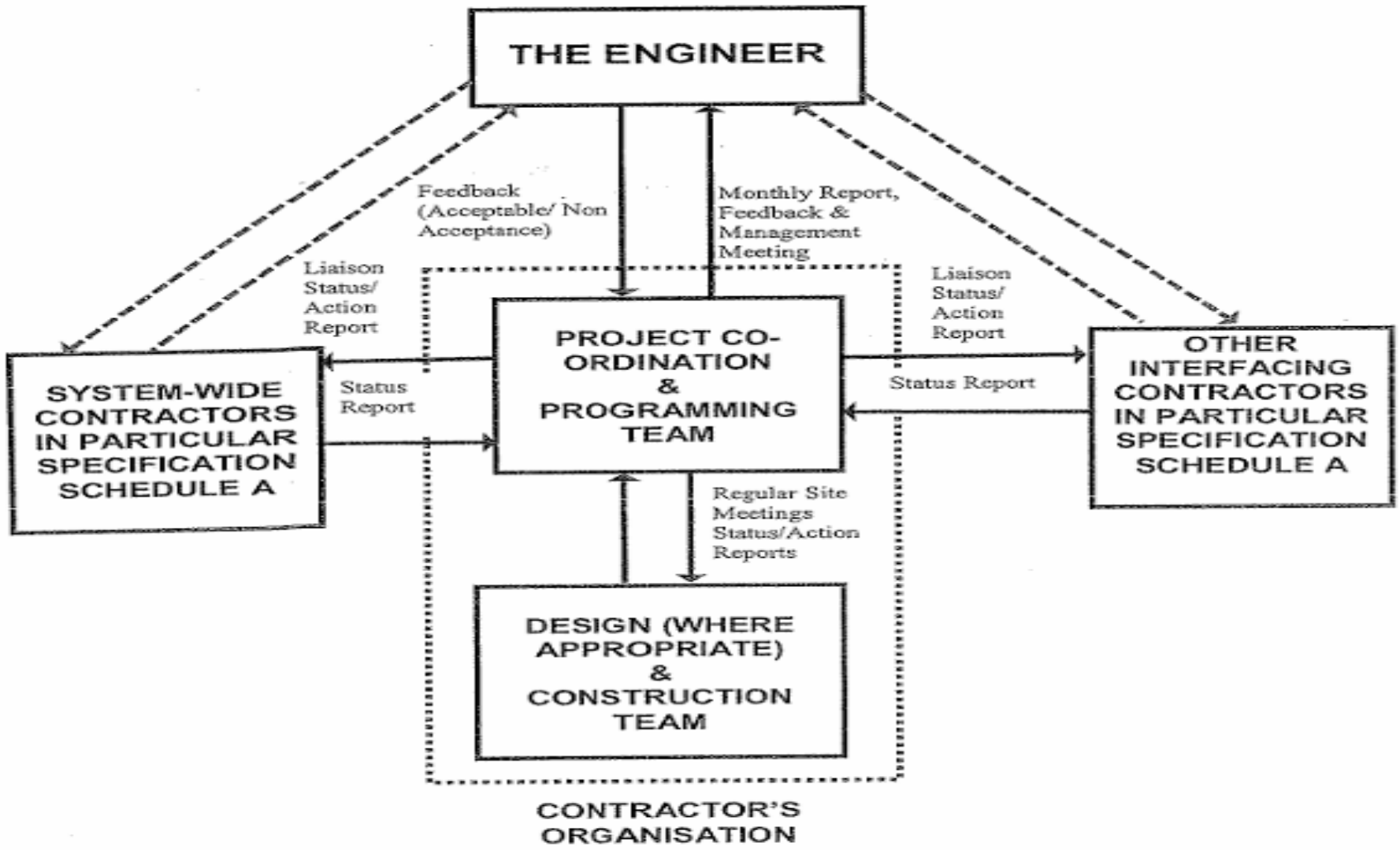


Figure 2 - Co-ordination Model

SCHEDULES: Contract Completion Dates

LIQUIDATED DAMAGES:

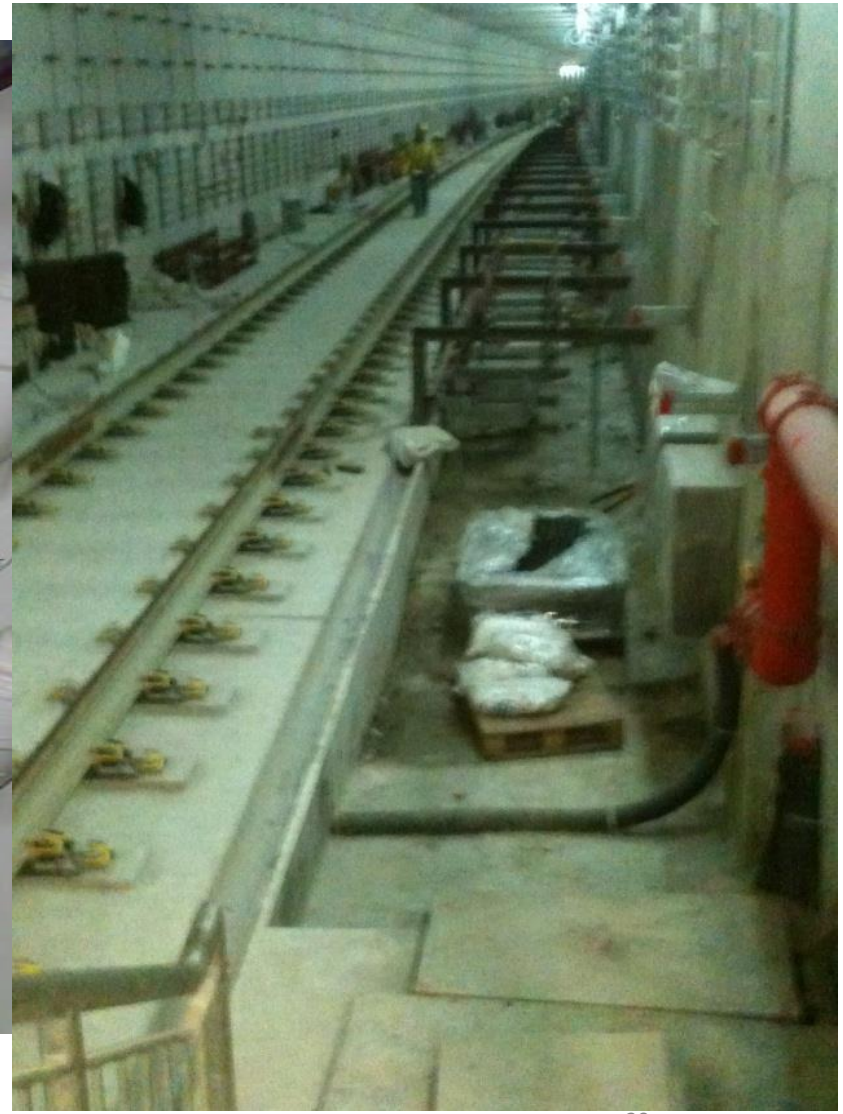
Whole of the Works	53.1	S$12,500 per calendar day
Section(s) or parts of the Works:		
(1) Completion of Main LV Switchboards Power-On and auxiliary supply to 22kV Switchgears for the following stations :	53.1	
(a) MRB Station		S$3,500 per calendar da
(b) BFT Station		S$3,500 per calendar day
(2) Completion of the Works to enable the commencement of Test Running of Circle Line Extension.	53.1	S$3,500 per calendar day
Limit of liquidated damages for delay	53.1	100% of the Contract Price
Defects Liability Period	55.1	18 calendar months

Note:
(1) In the event of concurrent delays, liquidated damages shall not exceed S$12,500 per calendar day.

	Clause	
Section or part of the Works:		
(1) Completion of Main LV Switchboards Power-On and auxiliary supply to 22kV Switchgears for the following stations :	50	
(a) BFT Station		15 November 2010
(b) MRB Station		22 November 2010
Note: This shall include power-on to the permanent lighting at 22kV Switchrooms, Service Transformer Rooms and Main LV Switchrooms		
(2) Completion of the Works to enable the commencement of Test Running	50	30 July 2011

2.3 POWER SYSTEM; Traction Power Transformer





Project Formation and Coordination

- Client- Authority>> LTA
- Authorities, Regulators>> Min of D, BCA, SCDF, Comm, PUB,EMA,SMRT, SBST,
- **Operator [SMRT and SBST]**
- Design Firms and Authority's Designers
- Civil Contractors
- SWC-System Wide Contractors
- Sub-contractors
- Nominated sub-contractors
- Manufacturer, Suppliers,

Project Management Plan

- To programme and management the site and project throughout the project life cycle.
- Detailed listing of activities and the outlines of each
- Manufacture, install and construction phase
- Testing and Commissioning phase
- Comprise with the Quality Assurance Plan>> System Assurance Plan
- Safety Plan
- Programme Plan
- Training Plan

Set Up Project Management Plan

- Procurement,
- Manufacturing,
- Inventory management,
- Installation programme of work,
- Testing and Commissioning of system,
- Drawing Control,
- Safety Control of Work programme,
- All forms of pertinent records for control and monitoring
- Programme Plan
- Training Plan

Frameworks Activities

Roles and Responsibility

- clearly define the Roles and Responsibilities,
- Fulfil Key positions with Key persons
- Also scope of work for each Key Persons

Contract Design Concept and Specification Evaluation

Flowchart 1 – Contract, Design Concept and Specification Evaluation

Table 1 -- Itemization of Contract, Design Concept and Specification Evaluation

Overall Installation Schedule

- Activities to execute the Project
- Considering with the design performance,safety,T&C,Training and Handover
- ***Cash Flow Projection and Progress Claim from planning:*** *the price schedule and schedules*

Overall Installation Schedule

- **Planning of civil work schedule**
- **Working volume and period of each activity**
- **Necessary manpower availability**
- **Major milestone date**
- **Lead time of material, (major)equipment procurement from submission date to delivery and installation**
- **Work Installation period**
- **Sequence Of Work-installation, Method Statement**
- **Traffic condition of project site**
- **Weather condition and public holidays**
- **Testing and commissioning**
- **Planning of Temporary Work>>** storage place,job site office,temporary power,internet,water,etc.,

Set Up Construction Plan

- The outline of the project
- The project location map
- Site Organization Chart
- Site safety organization chart
- The list of Sub-Contractor
- The list of manufacturer
- Main equipment delivery schedule
- Overall installation schedule
- Check list for the scope of work
- Installation detail and precaution
- Testing and commissioning procedure

Submission Of Design,Material and Equiment Approval

- System Configuration
- The Specifications
- **Necessary calculation**
- **Catalogue data**
- **Track project record**
- **CAD Drawing with quality and specification,**
- **Co-ordination with Civil and Other System-Wide Contractors**
- **Employment of Sub-contractor**
- ***Monitoring and Work Progress Programme***
- ***Quality Assurance Plan***
- ***System Safety Plan***
- ***Syatem Assurance Plan & Risk Management***
- ***Electromagnetic Compatibility Plan***

Co-ordination with Civil and System-Wide Contractors

To Provide by Own Team:

- All Information , reasonably required by the Interfacing Contractors
- In time and professional manner, to allow other contractors proceed with their design and construction activities

To Provide Information to CIVIL Contractor

- To provide accurate and exact information,
- **Timely and cooperation to produce Combined Services Drawings (CSD)**
- **Structural, Electrical and Mechanical Drawings (SEM)**
- ***Design Change Notice [Before the CSD target date of closing the information],***
- ***Attendance Request Form (ARF) to be raised after CSD closed information,***

Combine Services Drawings, [CSD]

- Show the Services routine, route direction
- Show the services, tray ,trunking , pipe, etc., at all over the Station, Tunnel and Ancillary
- Show the services positions in detailed, bottom Level, spacing, sizes,
- Show the services with respective contract,
- To coordinated with services with heavy, bulky, sensitivity and special requirement
- Sequence, delivery time, frequency of maintenance

Structural , Electrical, and Mechanical Drawing[SEM]

- Proceed to produce the SEM after the CSD confirm in principle
- As the Wall and Floor are all RCs the penetration and routes of services provide the opening
- SWC-System Wide Contractor to provide information on the size and bottom level of opening
- Coordination proceed to be confirmed with All SWCs and CIVIL contractor,
- Sealing of opening to be consider since the request to Civil Contractor,
- To join the Civil work construction all the way of wall and floor where own service present.
- SWC comments are taken into account throughout the project.

Equipment Delivery And Maintenance Plan(Drawing)

- Parts of the CSD and SEM design coordination process
- To inform and confirm the Major, Heavy , Bulky equipment Delivery, with Duration , Weight, Size, Mode of delivery, use of machinery, etc.,
- Coordinate mainly with Civil contractor, Client and other SWCs to route, access and timing,
- Concurrently , to be submitted to the site plan, route, method statement to Client via DAR-Design Acceptance Request form,
- SMRT and SBST Competent person, SIC,Training and submission for work and access >>

Coordinated Reflected Ceiling Plans

- All the ceiling mounted items to be coordinated,
- All the ceiling inside services to be coordinated to clear and not obstructing others,
- To match and ceiling contractor[Civil] to do their work seamlessly
- To request the access panels, knock-out panels and hatches' sizes and positions where required ,
- Sequence of the installation of all parties and ease of the maintenance,
- Mostly, public area ceiling, with acoustic, functional and decorated.
- Some area to coordinated for Combine Bracket/support,

Attend The Coordination Meetings

- Regular meeting with Client[monthly-Admin and management and fortnightly]
- Regular meetings called by Civil Contractor[weekly, fortnightly]
- Separate Meetings for safety, CSD, CIP, SEM, schedule and ad hoc meetings by Civil,
- Separate Meetings with SWC-System Wide Contractors,

Testing and Commissioning Phase

- Commissioning Team and Schedule Planning
- Co-ordination with Civil and Other SWCs
- Factory Test
  - Shipment
  - Delivery
- Site Testing and Commissioning
- Integrated Testing and commissioning,
- Respective LEW, PE or QP attendance to all Testing and commissioning,
- Major test operations shall operated by LEW, or PE.

Operation and Maintenance Procedures

- Inspection Manual for all system/equipment.
- Operation Manual for all system/equipment.
- Procedure of changing components of equipment requiring regular replacement.
- Maintenance instructions, calibration procedures and fault finding instructions for all systems.
- Precautions when carrying out operation and maintenance procedures.
- Storage and inventory systems.
- Procedures for systems fault findings.
- Identifying the period, inspections and actions required for periodic preventive maintenance e.g., daily, weekly, monthly and annually.
- **Test report, EMC reports**

Training Plan

- For All equipment , operation purpose
- Coordination with Client, as mentioned in the contract, and OPERATOR,
- Training at Class room, and practical work on site,
- Training Manual to be submitted and approved before launch,
- Training Manual is based and usually prepared by Manufacturer , and Suppliers.

AS-BUILT Drawing

- After the Whole Of the work Completed, to be prepared and submitted,
- The DAR-design acceptance request with all the documents
- O&M and Training Manuals are part of the Final Document Submission.

Submission To Client After The Work Completion

- As-Built drawings
- Operation and Maintenance Manual
- Special tools (if applicable)
- Test reports
- Close-out report on defect and outstanding works..

Range Of Project Management, Monitoring, Supervision and Coordination

- Start from Factory, Manufacturer, Origin to After Defect Liability Period
- Design , submission, procurement, transportation, delivery, installations,
- Testing and commissioning
- STC> site Testing and Commissioning
- ITC> Integrated Testing and Commissioning
- Trial Test Run
- Hand-over
- Defect Liability Period-2 Years

Design and Coordination

- Tender Stage Design, T
- Contract - Award Design, D
- Contractor Submission Design, W
  - Contractor's Manufacture Design
  - Shop-Drawing, Working Design
  - Contractor's Design Submissions-Revisions
- Construction Design-Approved Design, stickered,C
- Instruction, updates, proposal designs
- As-built Design

Implementation Stage Coordination

- Client Operation Team
- QP Design
- QP Supervision>> Construction
- Civil Contractors
- SWC-System Wide Contractors
- Sub-contractors
- Nominated sub-contractors
- Manufacturer, Suppliers,

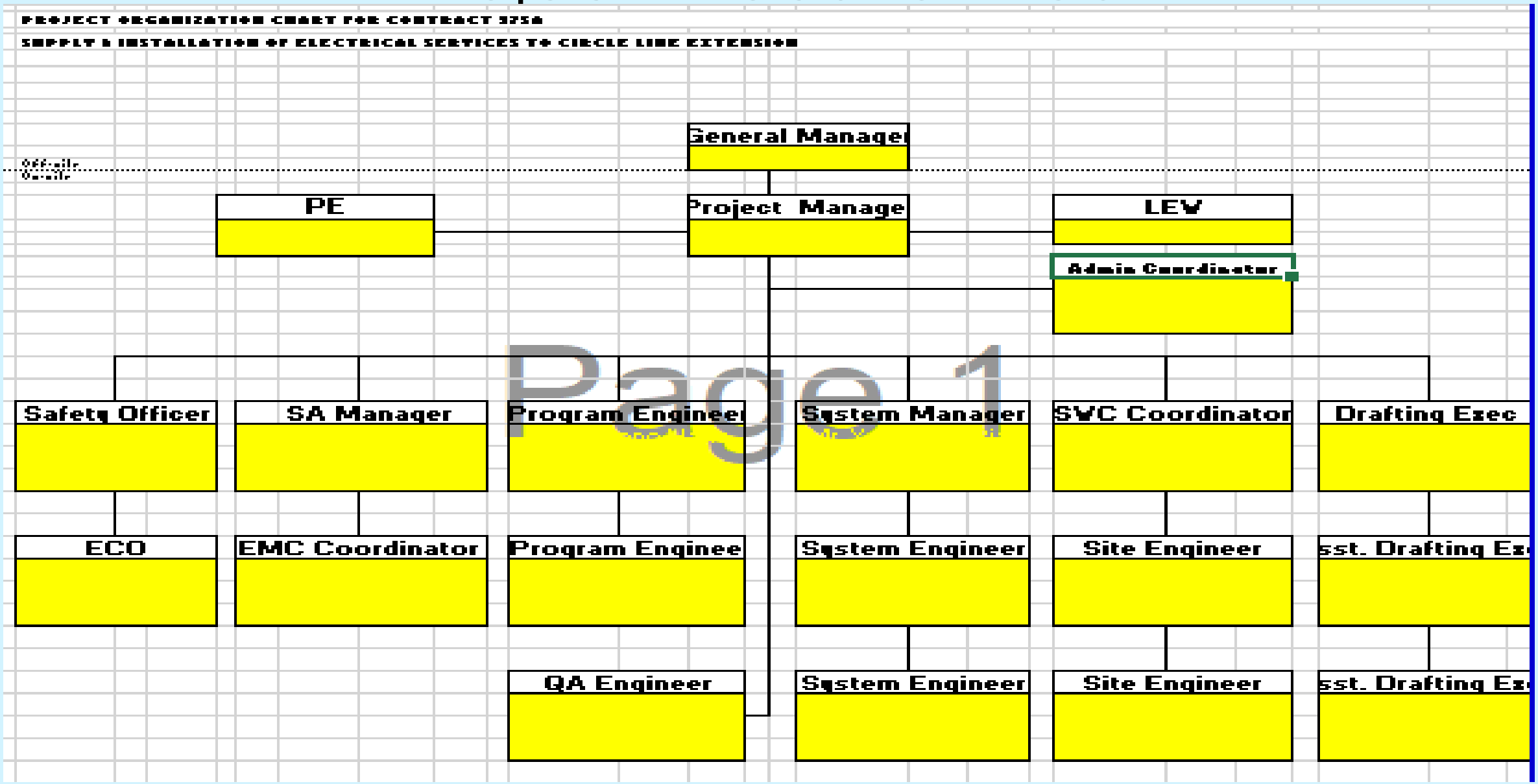
Nature Of Contract

- Client Operation Team
- QP Design
- QP Supervision>> Construction
- Civil Contractors
- SWC-System Wide Contractors
- Sub-contractors
- Nominated sub-contractors
- Manufacturer, Suppliers,

FORM OF TENDER

- Preambles to Price Schedules
- Price Summary
- Electrical System Summary
- Schedule A Design/Working Drawings
- Schedule B Supply, Manufacturing and Delivery
- Schedule C Installation
- Schedule D Site Testing and Commissioning and
- Schedule E Integrated Testing & Commissioning and Test Running
- Schedule F Training and Training Manuals
- Schedule G Operation and Maintenance Manuals
- Schedule H Maintenance Management System
- Schedule I System Assurance
- Schedule J As-Built Drawings
- Schedule K Attendance of Contractor's Licensed Electrical Worker After Power on

Project Execution Team



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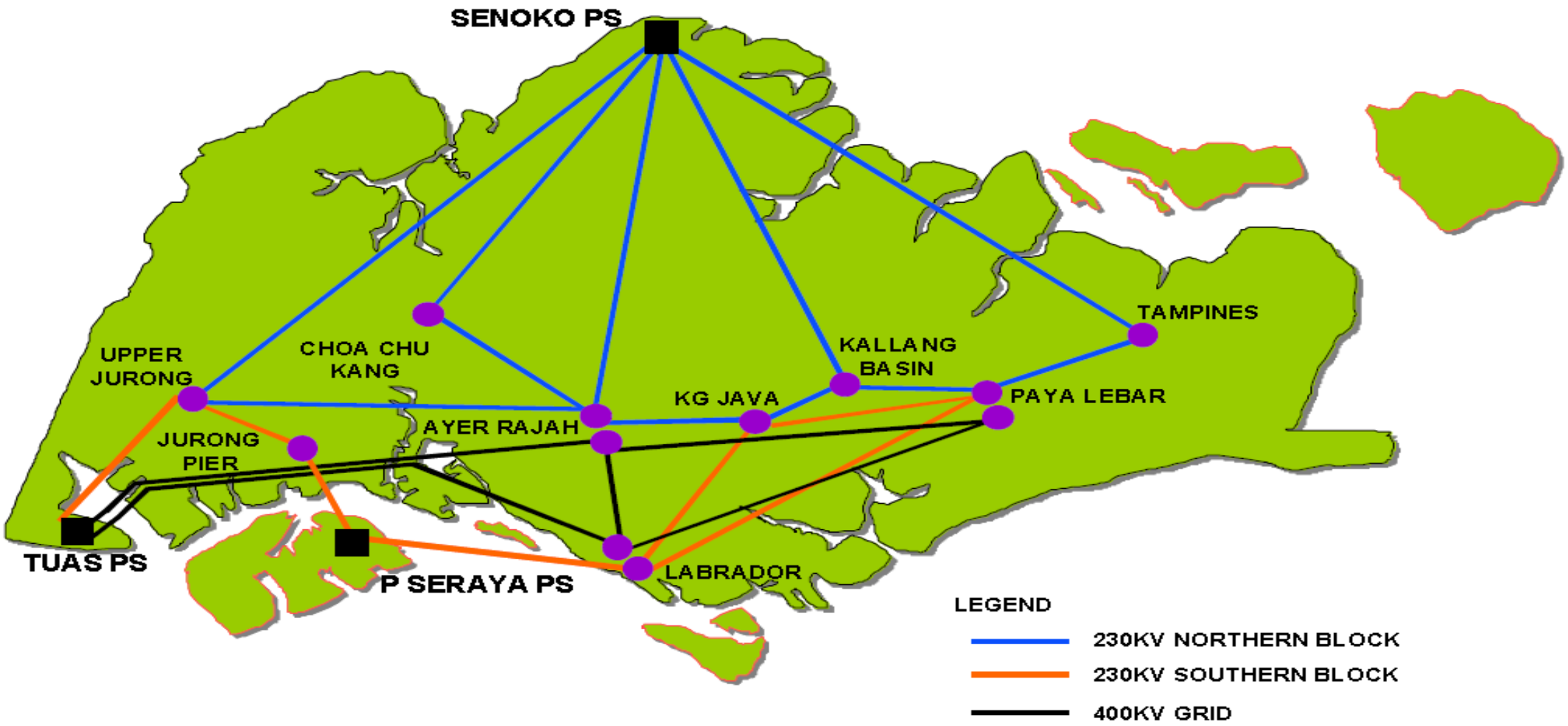
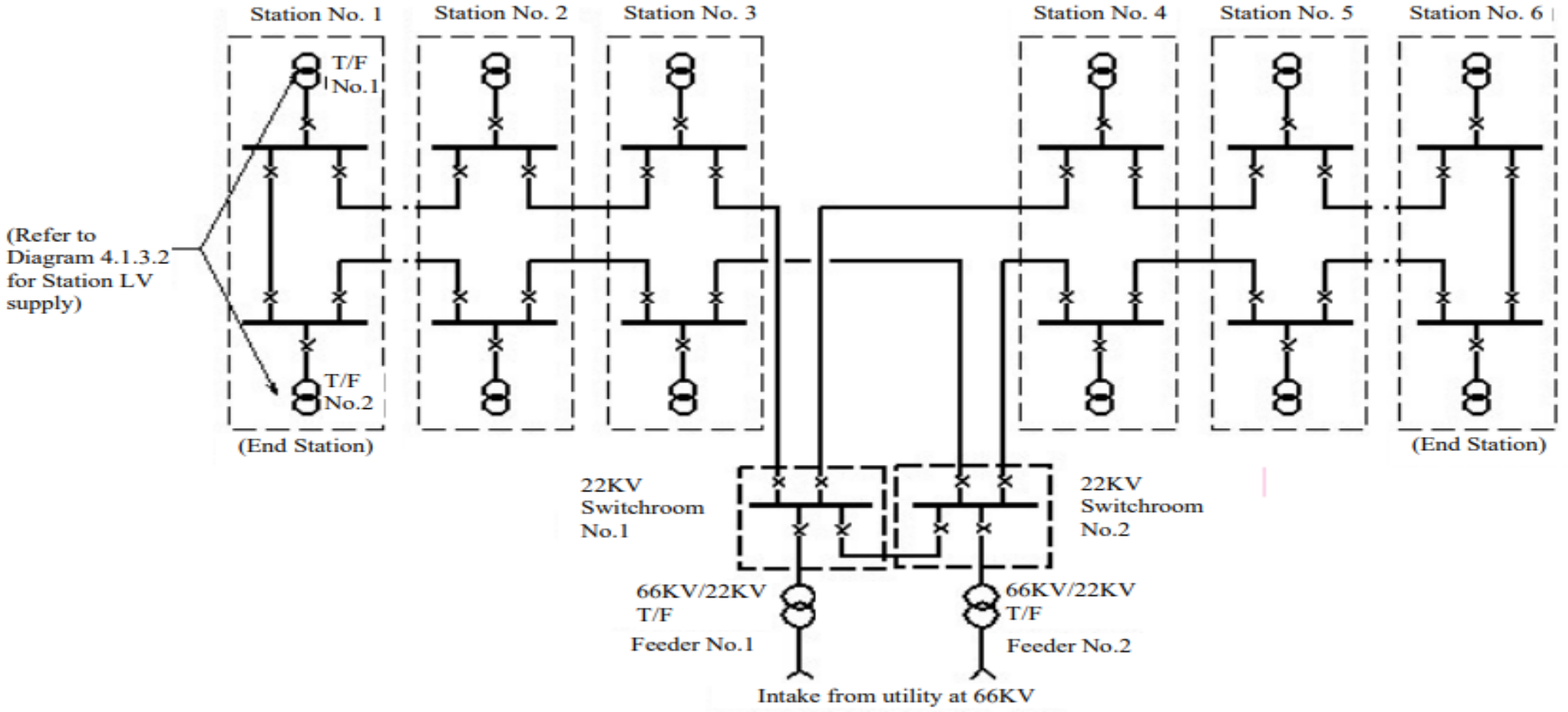
Primary Power Network



Typical Duel Feeder, HT Power Supply Scheme

Block diagram of typical RTS station dual feeder HT power supply Scheme



Monthly Report Format

OVERVIEW
1.1 Highlights of the reporting month
1.2 Planned activities for the forthcoming month
1.3 Matter of concern

SAFETY AND ENVIRONMENTAL MATTERS

CONTRACTOR'S ORGANISATION

PROGRAMME MATTERS

4.1 Status of programme submission
4.2 Physical progress report
4.3 Matters of concern
4.4 Attachment
- 4.4.1 Progress photographs
- 4.4.2 Physical progress S-curve
- 4.4.3 3-month rolling programme
- 4.4.4 Design register
- 4.4.5 Manufacturing progress monitor
- 4.4.6 4-week rolling programme
- 4.4.7 Resource chart

DESIGN

5.1 Design interface
5.2 Design submittals/approvals
5.3 CSD/SEM
5.4 Shop and Working Drawing submittals/approvals
5.5 Engineering queries

MANUFACTURING

6.1 Procurement, fabrication, shipment
6.2 QA/QC reports
6.3 Delivery status of major plants/equipment

INSTALLATION

7.1 Mobilisation, establishment and temporary works
7.2 Status of installation and site testing
7.3 Contractor's Equipment
7.4 Subcontractors

TESTING AND COMMISSIONING

8.1 Status of site testing
8.2 Pre-commissioning and commissioning status
8.3 TOP/TFP certification

CONTRACTUAL AND FINANCIAL

9.1 Progress payments
9.2 Contractor's projection of progress payment requests
9.3 Engineer's Instructions
9.4 Variations
9.5 Quotations
9.6 Claims

CORRESPONDENCE

10.1 Correspondence awaiting Engineer's response
10.2 Correspondence awaiting Contractor's response

SPARES

MANUALS

TRAINING

AS-BUILT DRAWINGS

ANY OTHER BUSINESS

1 Tender **Drawing**
2 Working **Drawing** / Shop drawing
2.1 Manufacturing Drawing
2.2 Detail Drawing
2.3 Delivery Route and Maintenance Drawings
3 Combine Services Drawings
4 Structural , Electrical and Mechanical Drawing
5 Construction Drawing
6 As-Built **Drawing**

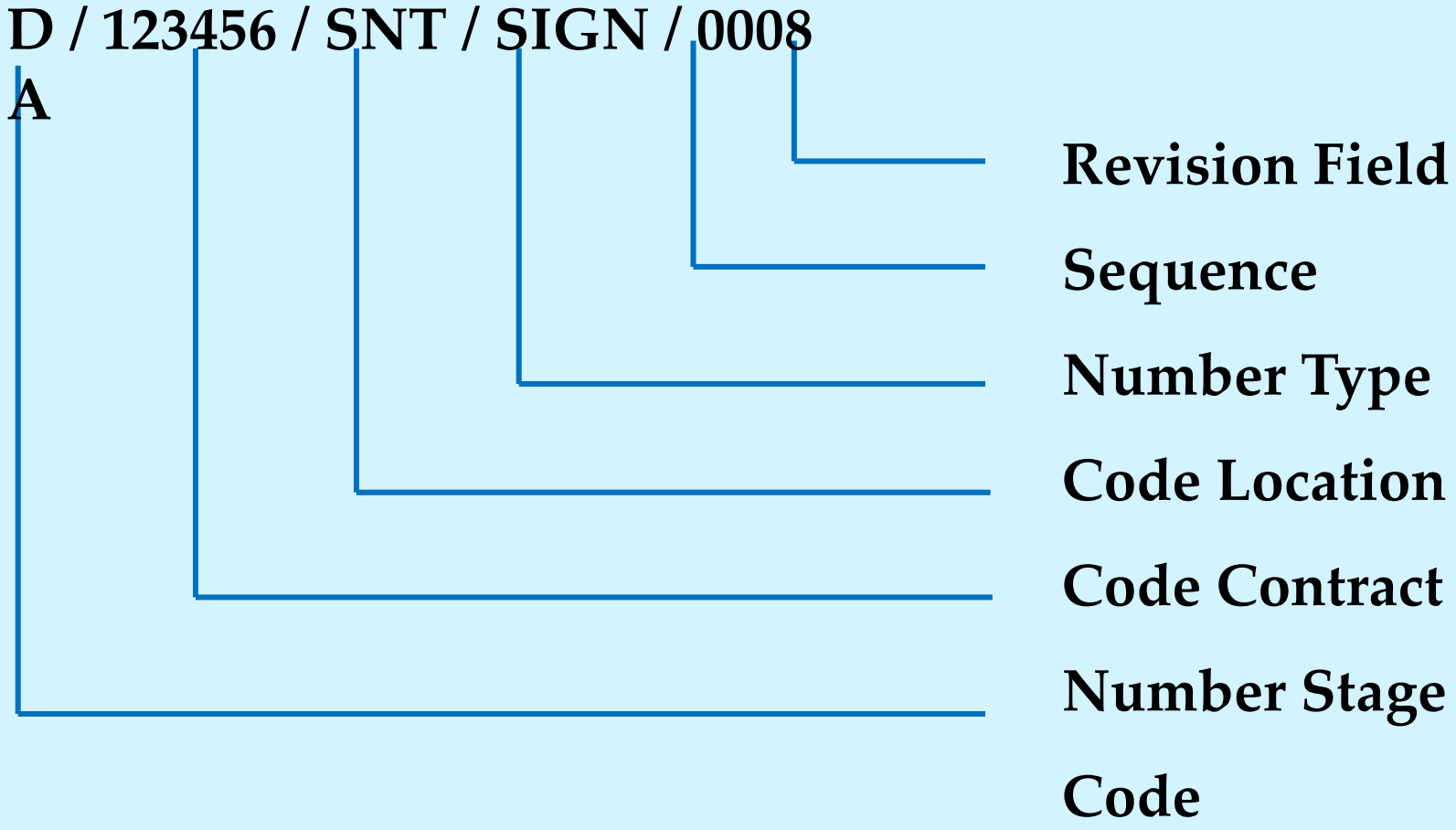
[Drawings are in MicroStation CAD Soft Ware]

Drawing Stage Code

L	**Client (For LTA Internal Use)**
P	**Consultant's Design Drawing before Tender Stage**
T	**Tender Drawing (Prepared by Contractor or**
D	**Consultant).**
W	**Contractor's Design Drawing**
A	**Working Drawings**
F	**As-Built Drawings**
C	**Temporary Works Drawings**
E	**Site Sketches by Contractor**
M	**Site Sketches by Engineer (For LTA Internal Use)**
Z	**Manufacturing/Fabrication Drawings**
	Submission to other Authorities

Drawing Numbering Format

Stage Code/Contract No./Loc.Code/Type Code/Seq.No./Rev Letter.

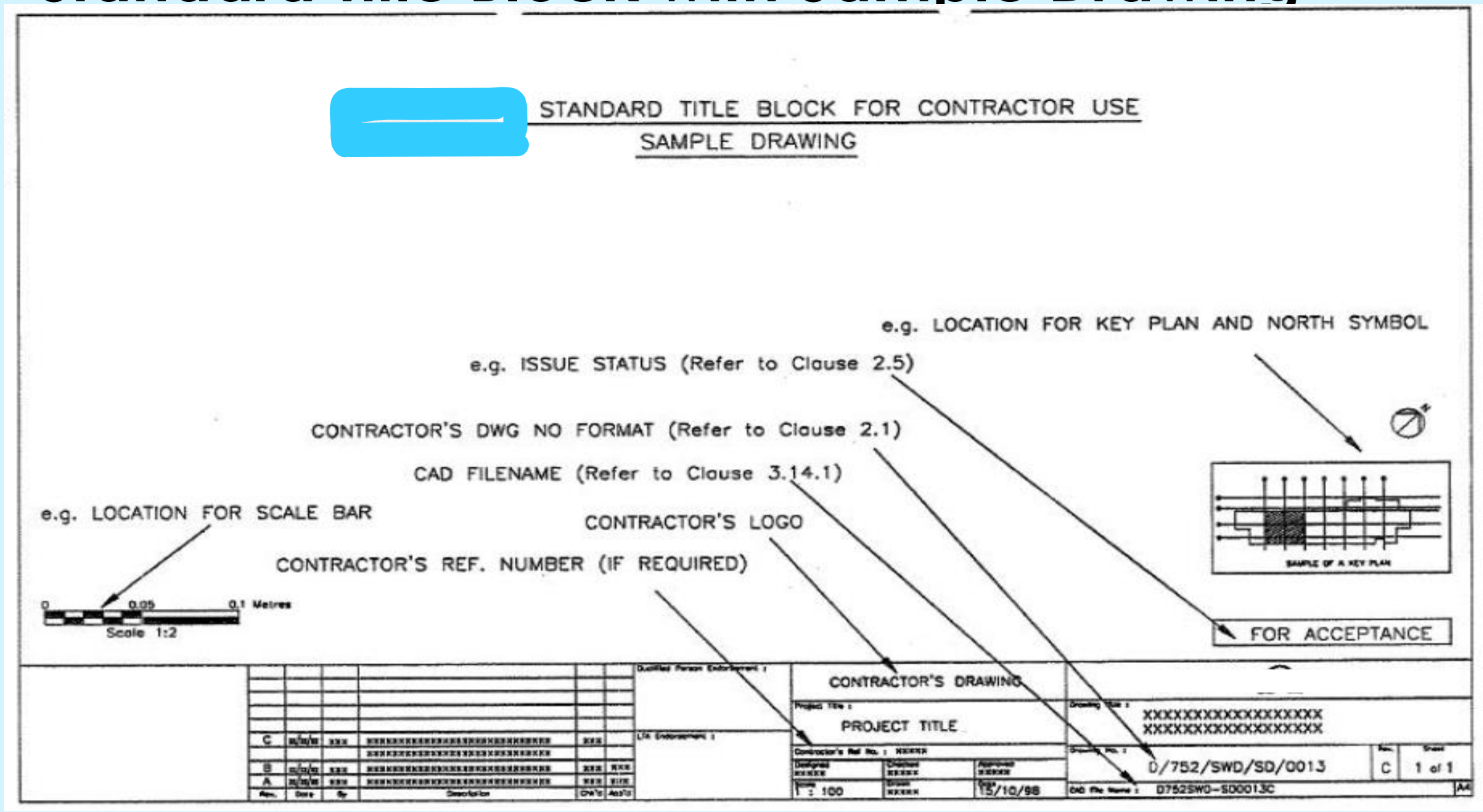


Drawing Issue Status

The Issue Status shall be located at the Lower Right-hand Corner, above/next to the title block so that it is visible when the drawing is folded. Contractor shall clearly specify the issue status on the drawing for each submission stage.

FOR ACCEPTANCE
FOR CONSTRUCTION
FOR AS-BUILT
FOR COMMENT ONLY
FOR INFORMATION ONLY
FOR REFERENCE ONLY
FOR CO-ORDINATION ONLY
FOR PLANNING PURPOSE ONLY
A drawing issued " FOR CONSTRUCTION" is for execution only by the Contractor responsible for the Contract numbered in the 'Contract Field" of the drawing number.

Standard Title Block with Sample Drawing



After Design Acceptance Submissions , successful drawing certified as FOR CONSTRUCTION status

Land Transport Authority

1 Hampshire Road Singapore 219428
Tel: 1800 - CALL LTA (1800 - 2255 582) Fax: (65) 6396 1002

DTLI Project Office Level 1
Services DLI (SVSDL1)
750 Victoria Street
Singapore 188062

Our ref C975A/EM/D19.000.000/6/11/180/130049
Your ref

14 September 2011

DID 6295 7342 Fax 6295 7356

Guthrie Engineering (S) Pte Ltd
6, Aljunied Avenue 3 #04-00
Singapore 389932

Attn : Mr Tint Swe – Project Manager

Dear Sir

CONTRACT 975A – CERTIFIED FOR CONSTRUCTION STICKERS

We enclose herewith a set of self-adhesive stickers for affixing onto the original accepted documents / drawings. Please submit 4 set of documents / drawings through DAR submission complete with stickers for our information.

Yours faithfully

MUJTABA MOHAMMAD SHARIQ
PROJECT MANAGER

Encl.

NT/kk

THIS DOCUMENT IS ACCEPTED BY THE ENGINEER SUBJECT TO COMPLIANCE WITH SINGAPORE GOVERNMENT LAWS, ORDINANCES AND REGULATION, THE APPROVAL OF STATUTORY BOARDS AND GOVERNMENT DEPARTMENTS HAVING JURISDICTION IN RESPECT OF ANY MATTERS THEREIN, THE PROVISIONS OF THE CONTRACT AND THE ENGINEER'S COMMENTS (IF ANY) ON DECISION SHEET

DS NO. : DS/975A/SAT/0001/B
DS DATE : 13 DECEMBER 2010
SIGNED :
ENGINEERS REPRESENTATIVE : MUJTABA MOHAMMAD SHARIQ
DATE ACCEPTED : 14/09/11
CERTIFIED FOR CONSTRUCTION S-0336

THIS DOCUMENT IS ACCEPTED BY THE ENGINEER SUBJECT TO COMPLIANCE WITH SINGAPORE GOVERNMENT LAWS, ORDINANCES AND REGULATION, THE APPROVAL OF STATUTORY BOARDS AND GOVERNMENT DEPARTMENTS HAVING JURISDICTION IN RESPECT OF ANY MATTERS THEREIN, THE PROVISIONS OF THE CONTRACT AND THE ENGINEER'S COMMENTS (IF ANY) ON DECISION SHEET

DS NO. : DS/975A/TC/0001/C
DS DATE : 13 DECEMBER 2010
SIGNED :
ENGINEERS REPRESENTATIVE : MUJTABA MOHAMMAD SHARIQ
DATE ACCEPTED : 14/09/11
CERTIFIED FOR CONSTRUCTION S-0337

THIS DOCUMENT IS ACCEPTED BY THE ENGINEER SUBJECT TO COMPLIANCE WITH SINGAPORE GOVERNMENT LAWS, ORDINANCES AND REGULATION, THE APPROVAL OF STATUTORY BOARDS AND GOVERNMENT DEPARTMENTS HAVING JURISDICTION IN RESPECT OF ANY MATTERS THEREIN, THE PROVISIONS OF THE CONTRACT AND THE ENGINEER'S COMMENTS (IF ANY) ON DECISION SHEET

DS NO. : DS/975A/HZMS/0002/D
DS DATE : 24 JANUARY 2011
SIGNED :
ENGINEERS REPRESENTATIVE : MUJTABA MOHAMMAD SHARIQ
DATE ACCEPTED : 14/09/11
CERTIFIED FOR CONSTRUCTION S-0338

THIS DOCUMENT IS ACCEPTED BY THE ENGINEER SUBJECT TO COMPLIANCE WITH SINGAPORE GOVERNMENT LAWS, ORDINANCES AND REGULATION, THE APPROVAL OF STATUTORY BOARDS AND GOVERNMENT DEPARTMENTS HAVING JURISDICTION IN RESPECT OF ANY MATTERS THEREIN, THE PROVISIONS OF THE CONTRACT AND THE ENGINEER'S COMMENTS (IF ANY) ON DECISION SHEET

DS NO. : DS/975A/MDS/0008/A
DS DATE : 26 JANUARY 2011
SIGNED :
ENGINEERS REPRESENTATIVE : MUJTABA MOHAMMAD SHARIQ
DATE ACCEPTED : 14/09/11
CERTIFIED FOR CONSTRUCTION S-0339

CIVIL DEFENCE SHELTER; BOMB BLAST VALVES, MCT, SHOCK MOUNT

LEGEND =

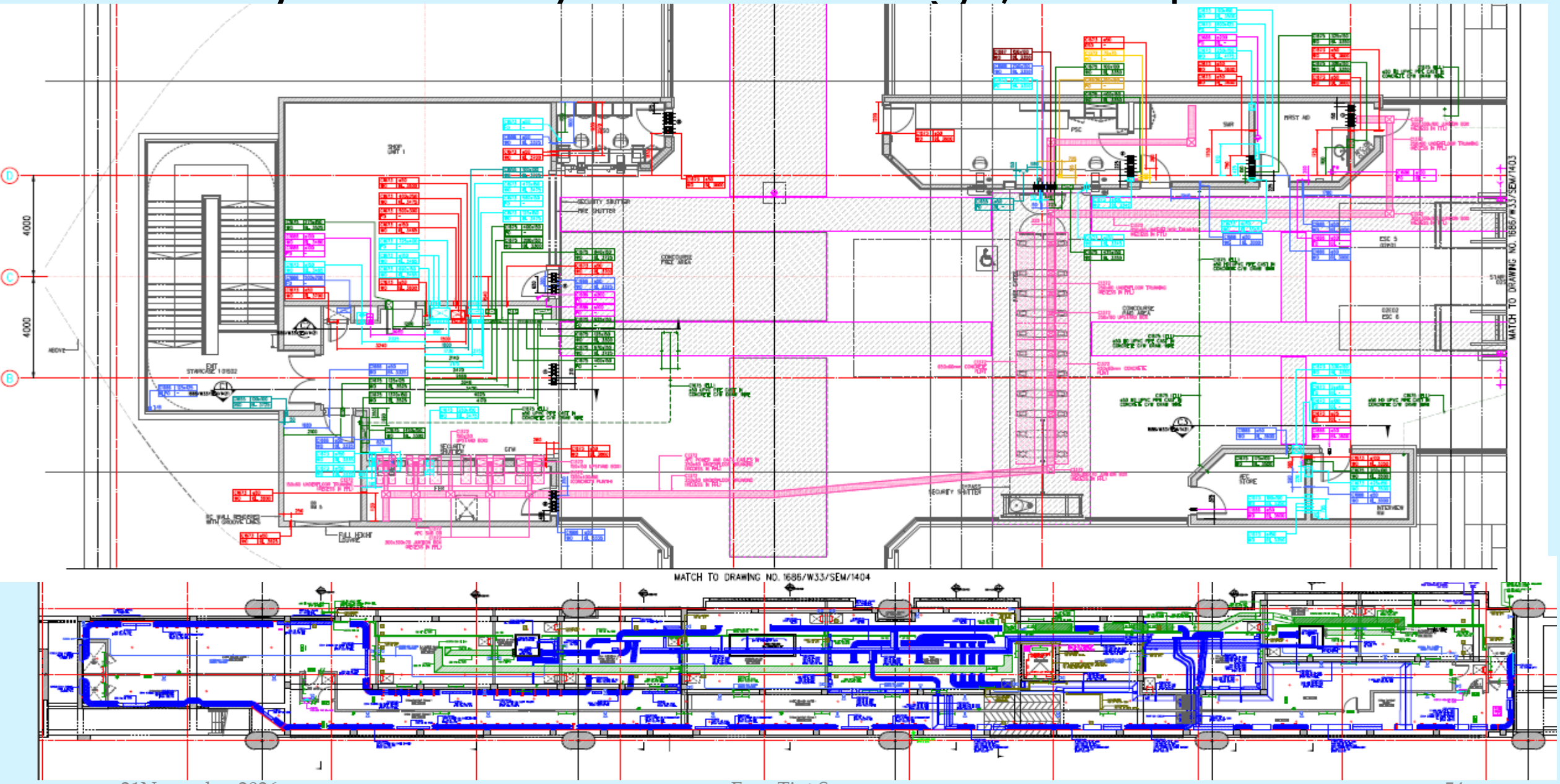
- BOUND OF SEMI-PROTECTION
- BOUND OF BLAST & GAS PROTECTION
- BOUND OF BLAST PROTECTION BLACK
- BOUND OF GAS PROTECTION
- BOUND OF DIRECT HIT (EARTH BACKED)
- BOUND SHELTERING AREA
- BOUND CD FACILITIES



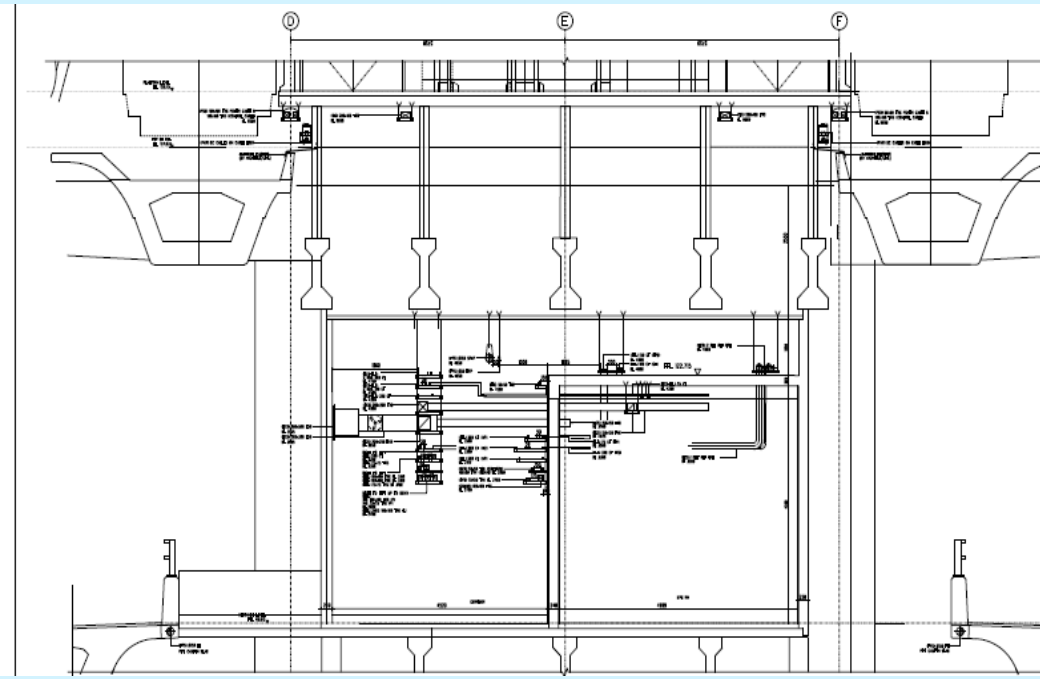


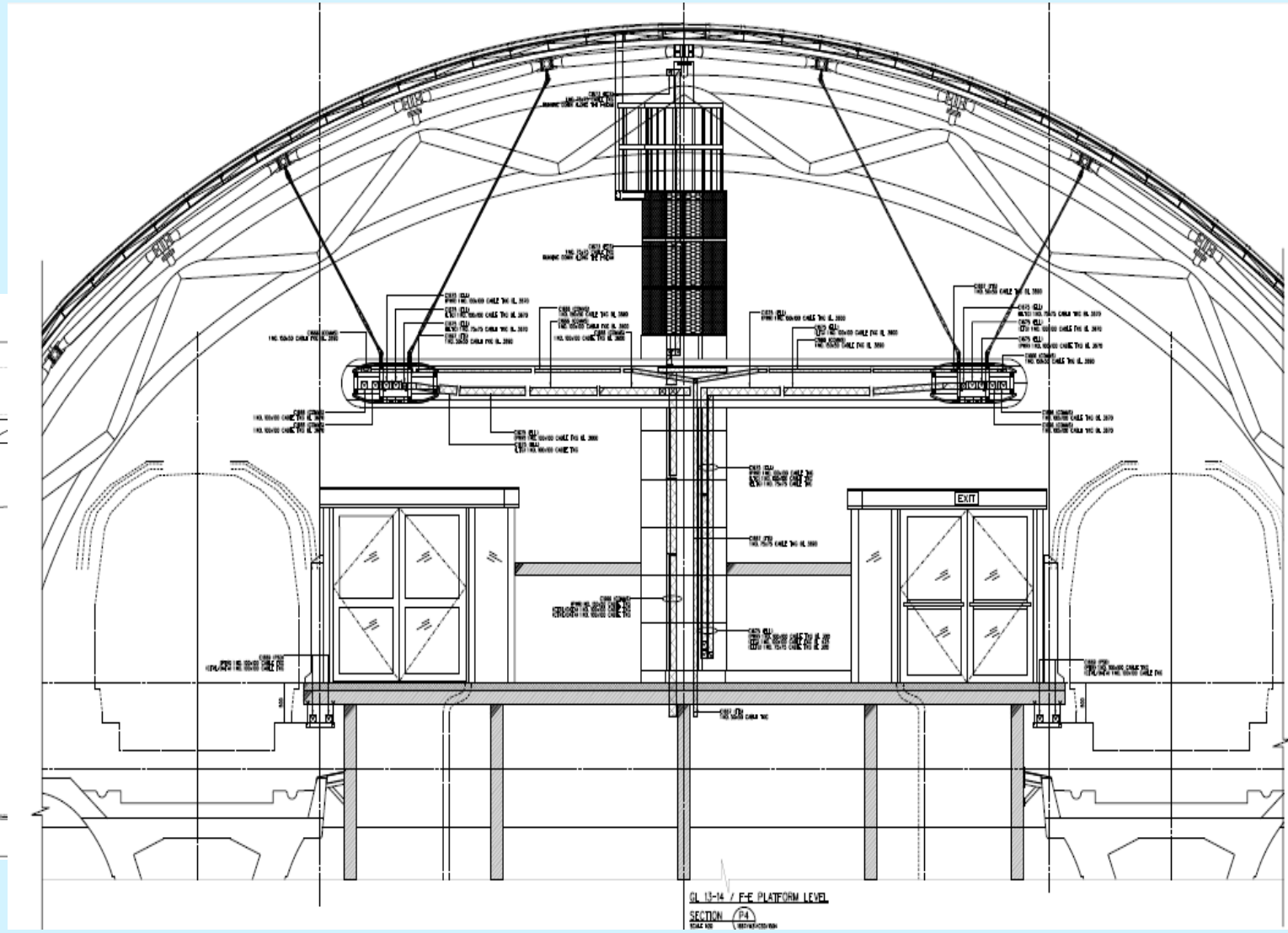


CSD / SEM Layout Drawings, samples

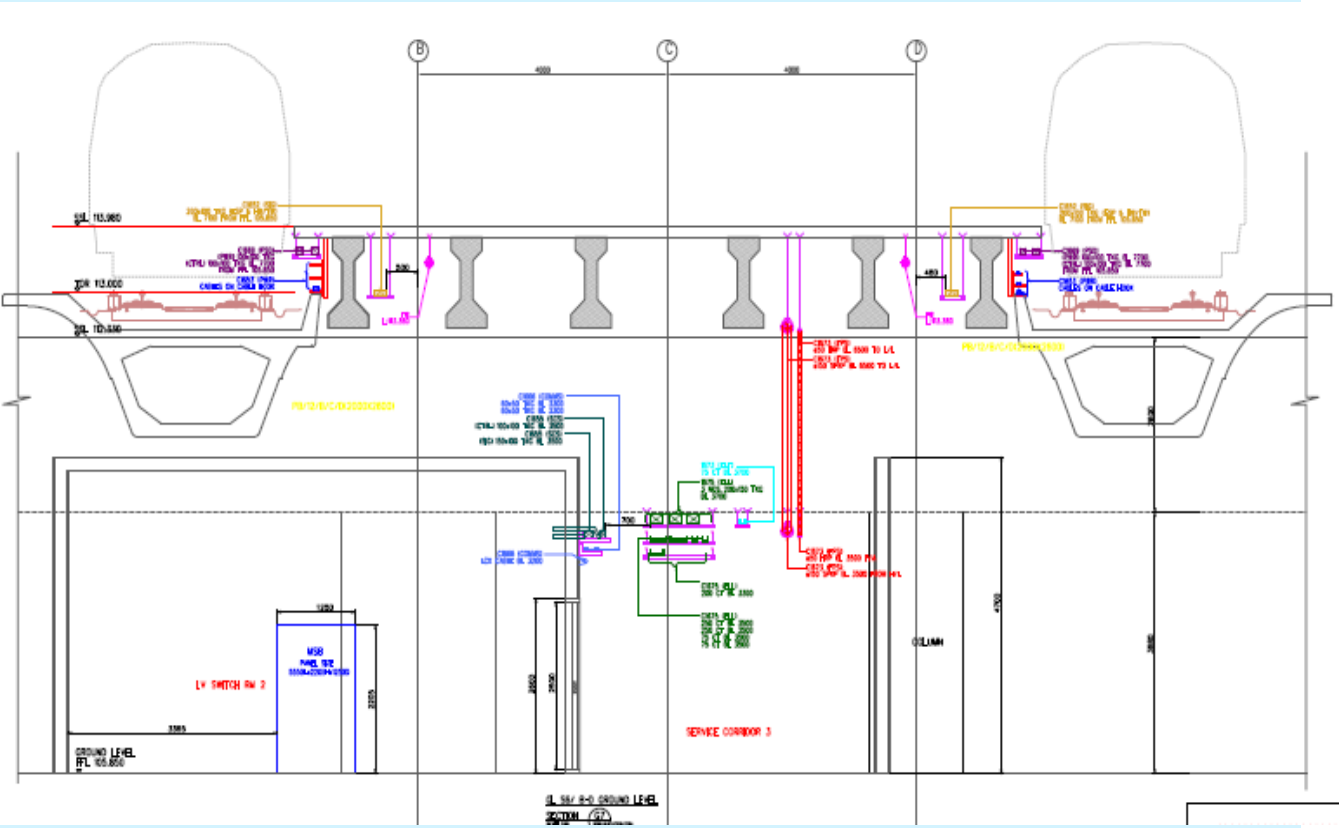


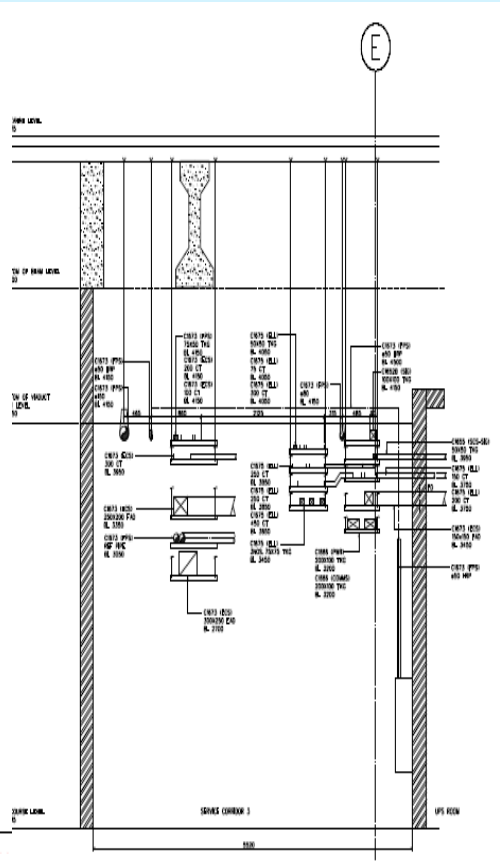
CSD/SEM Drawings in Elevation , Section



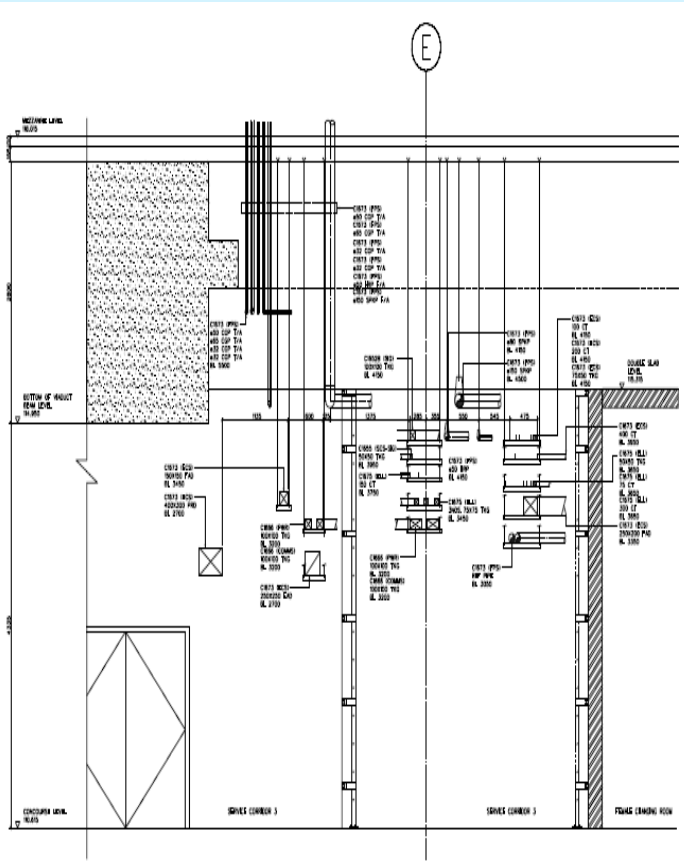


CSD/SEM Drawings in Elevation , Section

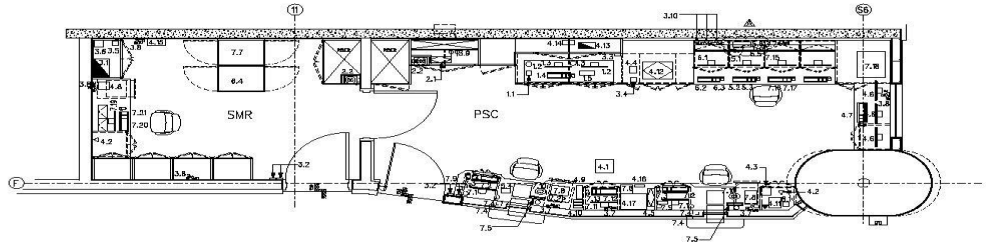




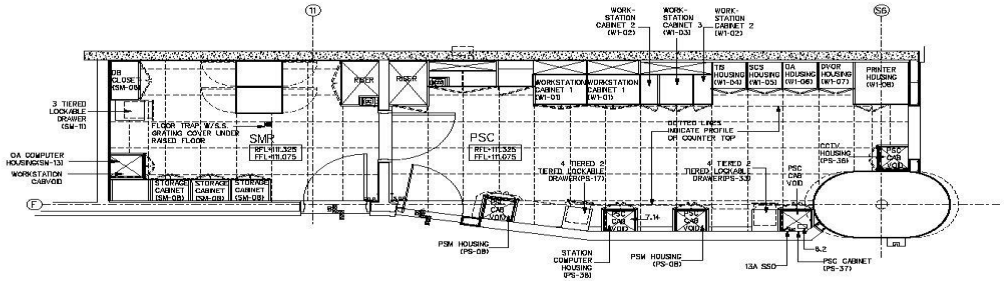
GL 2-3/D-E CONCOURSE LEVEL
SECTION (C1)



GL 2-3/D-E CONCOURSE LEVEL
SECTION (C2)



EW32 STATION PSC & SMR
EQUIPMENT GENERAL ARRANGEMENT LAYOUT



EW32 STATION PSC & SMR
BELOW TABLE DETAILED PLAN

EW32 STATION -PSC & SMR EQUIPMENT SCHEDULE

S/NO	SWC	DESCRIPTION	QTY	DIMENSIONS(LxDxH)	WEIGHT PER UNIT	TYPE OF MOUNTED
1.1	C1652B	EMERGENCY VITAL SIGNALING CONTROL PANEL	1	550(L)×448(B)×80(D)	20kg	DESKTOP(FLUSH MOUNTED)
1.2	C1652B	SIGNAL CONTROL WORKSTATION	2	1700(L)×850(H)×800(D)	12kg	DESKTOP
1.3	C1652B	SIGNAL 23" LCD MONITOR	2	530(L)×350(H)×120(D)	5kg	DESKTOP
1.4	C1652B	SIGNAL KEYBOARD & MOUSE	1	430(L)×150(B)	0.5kg	DESKTOP
1.5	C1652B	KVM SWITCH	1	550(L)×44.5(H)×165(B)	1.9kg	DESKTOP
2.1	C1673	FA REPEATER PANEL	1	1200(H)×800(W)×250(D)	87kg	WALL MOUNTED INSIDE CABINET
2.2	C1673	FIRE EXTINGUISHER	2	280(H)×340(W)×200(D)	10kg(CO_2) /7.2kg(DCP)	WALL MOUNTED INSIDE CABINET
3.1	C1675	DB-PSC	1	300×900×250	10kg	WALL MOUNTED INSIDE CABINET
3.2	C1675	LIGHT SWITCHES/DIMMER	4	90×90×40	0.5kg	WALL MOUNTED INSIDE CABINET
3.3	C1675	EMERGENCY LIGHT WITH BUZZER	1	150×300×150	2kg	MOUNTED ON ALUMINIUM PANEL
3.4	C1675	ACKNOWLEDGE BUTTON	1	90×90×40	0.5kg	DESKTOP
3.5	C1675	ISOLATER FOR TIS	1	200×200×200	1.5kg	WALL MOUNTED INSIDE CABINET
3.6	C1675	CLEAN EARTH BOX	1	500×500×200	5kg	ABOVE RAISED FLOOR
3.7	C1675	1G 13A MATTCHROME SSO(RCD)	4	150×90×40	0.5kg	WALL MOUNTED
3.8	C1675	2G 13A MATTCHROME SSO(RCD)	4	150×90×40	0.5kg	WALL MOUNTED
3.9	C1675	FUSED CONNECTION UNIT	2	90×90×40	0.5kg	WALL MOUNTED
3.10	C1675	13A MATTCHROME SSO	3	150×90×40	0.5kg	WALL MOUNTED
4.1	C1666	EPAX-LDB	1	300×300×200(D)	2kg	BELOW RAISED FLOOR
4.2	C1666	EPAX PHONE	2	240x135x180(D)(PSC)/177x200x59(D)(SMR)	0.5kg	DESKTOP
4.3	C1666	IPAX PHONE	1	285x85x197	0.3kg	DESKTOP
4.4	C1666	INTERCOM WITH SER	1	150x51x16	0.3kg	DESKTOP
4.5	C1666	PA CONTROL PANEL	1	400x120x120	0.5kg	DESKTOP(FLUSH MOUNTED)
4.6	C1666	CCTV LCD MONITOR	3	430x400x182	5kg	DESKTOP
4.7	C1666	CCTV KEYBOARD AND MOUSE	1	240x150x220	0.5kg	DESKTOP
4.8	C1666	PA SYSTEM(DVOR)	1	18" MONITOR	1kg	DESKTOP
4.9	C1666	AUTOMATIC PLATFORM ANNOUNCEMENT SYSTEM	1	510x110x150	2kg	DESKTOP ABOVE CD PLAYER
4.10	C1666	SINGLE WAY CHARGERS FOR RADIO	5	150x50x110	0.5kg	DESKTOP
4.11	C1666	TETRA RADIO MTM 300	1	211x111x242	2kg	DESKTOP
4.12	C1666	ETS CONTROL PANEL	1	700x700x450	7kg	FLUSH MOUNT ON DESK TOP
4.13	C1666	AC-DB	1	600x500x800	20kg	WALL MOUNTED INSIDE CABINET
4.14	C1666	DIGITAL CLOCK	1	144(L)x72(H)x58(D)	1kg	WALL MOUNTED
4.15	C1666	LDB-C1	1	250(L)x300(H)x150(D)	5kg	WALL MOUNTED
4.16	C1666	MU-INTERCOM WITH SER	1	166(L)x160(H)x51(D)	0.5kg	MOUNTED ON DESK TOP
4.17	C1666	TSP	1	450(L)x350(H)x75(D)	10kg	FLUSH MOUNT ON DESK TOP
5.1	C1655	SCS 17" MONITOR	1	410(W)x400(H)x250(D)	5kg	DESKTOP
5.2	C1655	SCS CPU(INSIDE CABINET)	1	175(W)x360(H)x417(D)	12kg	1 TO INCLUDE 1 NO. SSO DATA POINT
5.3	C1655	SCS KEYBOARD & MOUSE	1	240(W)x150(H)x220(D)	1kg	DESKTOP
5.4	C1655	SCS EMERGENCY PLUNGER	1	150x100x150(D)	0.3kg	FLUSH MOUNT ON DESK TOP
5.5	C1655	2X13A SSO	1	250x90x40	0.5kg	INSIDE CABINET
5.6	C1655	DATA POINT	1	90x90x40	0.5kg	INSIDE CABINET
5.7	C1655	SCS/EG/ITB	1	300x300x250(D)	20kg	INSIDE CABINET
6.1	C1667	TIS MONITOR 20"	1	481.5(W)x362.5(H)x152(D)	8kg	DESKTOP
6.2	C1667	TIS CPU	1	175(W)x360(H)x417(D)	12kg	INSIDE CABINET
6.3	C1667	TIS KEYBOARD & MOUSE	2	430x150	0.5kg	DESKTOP
6.4	C1667	19" RACK NETWORK EQUIPMENT & SERVER	1	600(W)x2200(H)x1000(D)	100kg	RAISED FLOOR MOUNTED
7.1	C1372	PSM 17" MONITOR	2	410(W)x400(H)x250(D)	10kg	DESKTOP
7.2	C1372	PSM CPU+RACK	2	500(W)x655(H)x300(D)	30kg	INSIDE CABINET
7.3	C1372	PSM KEYBOARD & MOUSE	2	460(W)x80(H)x170(D)/65(W)x35(H)x120(D)	1kg/1kg	DESKTOP
7.4	C1372	SPEAKER	4	90(W)x90(H)x90(D)	1kg	DESKTOP(INSIDE HOUSING WITH HINGE,REAR COVER WITH SPK HOLES)
7.5	C1372	PASSENGER DISPLAY UNIT	2	200(W)x250(H)x200(D)	1kg	DESKTOP
7.6	C1372	AFC EMERGENCY STOP SWITCH	1	200(W)x200(H)x150(D)	1kg	DESKTOP
7.7	C1372	19" RACK NETWORK EQUIPMENT	1	600(W)x1100(H)x600(D)	80kg	20A DP ISOLATOR FLOOR MOUNTED
7.8	C1372	RECEIPT PRINTER	2	300(W)x200(H)x200(D)	3kg	COUNTERTOP
7.9	C1372	BARCODE READER	2	64(W)x70(H)x180(D)	1kg	COUNTERTOP
7.10	C1372	SMART CARD READER	2	180(W)x40(H)x130(D)	1kg	COUNTERTOP
7.11	C1372	STATION COMPUTER MONITOR	1	410(W)x400(H)x250(D)	10kg	DESKTOP
7.12	C1372	STATION COMPUTER CPU	1	170(W)x450(H)x450(D)	12kg	INSIDE CABINET
7.13	C1372	STATION COMPUTER KEYBOARD & MOUSE	2	460(W)x80(H)x170(D)/65(W)x35(H)x120(D)	1kg/1kg	DESKTOP
7.14	C1372	STATION COMPUTER(AFC) RACK	1	500(W)x655(H)x300(D)	18kg	INSIDE CABINET
7.15	SMRT	OA MONITOR(PSC ROOM)	1	19"	5kg	DESKTOP
7.16	SMRT	OA CPU(PSC ROOM)	1	450(W)x450(H)x250(D)	10kg	INSIDE CABINET
7.17	SMRT	OA PC KEYBOARD & MOUSE(PSC ROOM)	2	450(W)x180(H)x40(D)	1kg	DESKTOP
7.18	SMRT	OA PC PRINTER	1	450(W)x450(H)x350(D)	5kg	DESKTOP
7.19	SMRT	OA MONITOR(SMR ROOM)	1	19"	5kg	DESKTOP
7.20	SMRT	OA CPU(SMR ROOM)	1	450(W)x450(H)x250(D)	10kg	INSIDE CABINET
7.21	SMRT	OA PC KEYBOARD & MOUSE(SMR ROOM)	2	450(W)x180(H)x40(D)	1kg	DESKTOP
7.22	SMRT	CD PLAYER	1	220(W)x150(H)x90(D)	1kg	DESKTOP
8.1	C1671A	MASTER INTERCOM	1	110(W)x220(H)x80(D)	4kg	DESKTOP
8.2	C1671A	POWER SUPPLY UNIT	1	153(W)x248(H)x77(D)	5kg	BELOW DESKTOP

LEGEND

	SUPPLY/FRESH AIR DIFFUSER C/W VCD (C1673)		CEILING SPEAKER (C1666)
	RETURN/EXHAUST AIR DIFFUSER C/W VCD (C1673)		FLEXIBLE DUCT (C1673)
T	ROOM THERMOSTAT C/W 3 SPEED SELECTOR (C1673)		1x28W, 1x58W & 2x28W WEATHERPROOF FLUORESCENT FITTING C/W LOW LOSS BALLAST (SUSPENDED / WALL MOUNTED) (C1675)
S	SMOKE DETECTOR (UNDER RAISED FLOOR) (1673)		AXIAL FAN (C1673)
	SURFACE MOUNTED ISOLATOR (C1675)		HEAT DETECTOR (EXPOSED) (C1673)
	SILENCER (RECTANGLE TYPE) (C1673)		HEAT DETECTOR (CONCEALED) (C1673)
R	REFRIGERANT PIPE (C1673)	BL	BOTTOM LEVEL OF SERVICES FROM FFL
	EXPOSED SPRINKLER (C1673)	F/A	FROM ABOVE
	CONCEALED SPRINKLER/UNDER DUCT SPRINKLER (C1673)	F/B	FROM BELOW
	SUB-BOARD / DISTRIBUTION BOARD	FAD	FRESH AIR DUCT
SAD	SUPPLY AIR DUCT	DN	DOWN
T/A	TO ABOVE	TKG	TRUNKING
T/B	TO BELOW	RAD	RETURN AIR DUCT

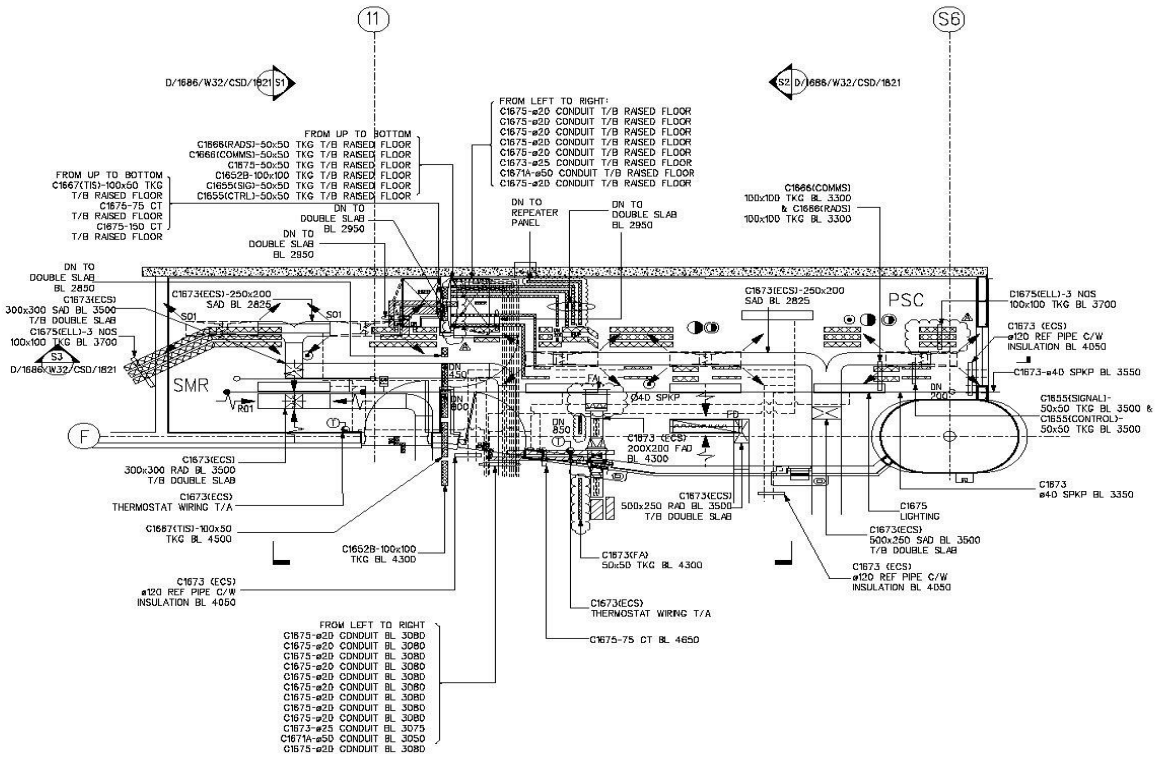
0 0.5 1 1.5 2 2.5 Metres
Scale 1:50

SWCs SIGN-OFF TABLE

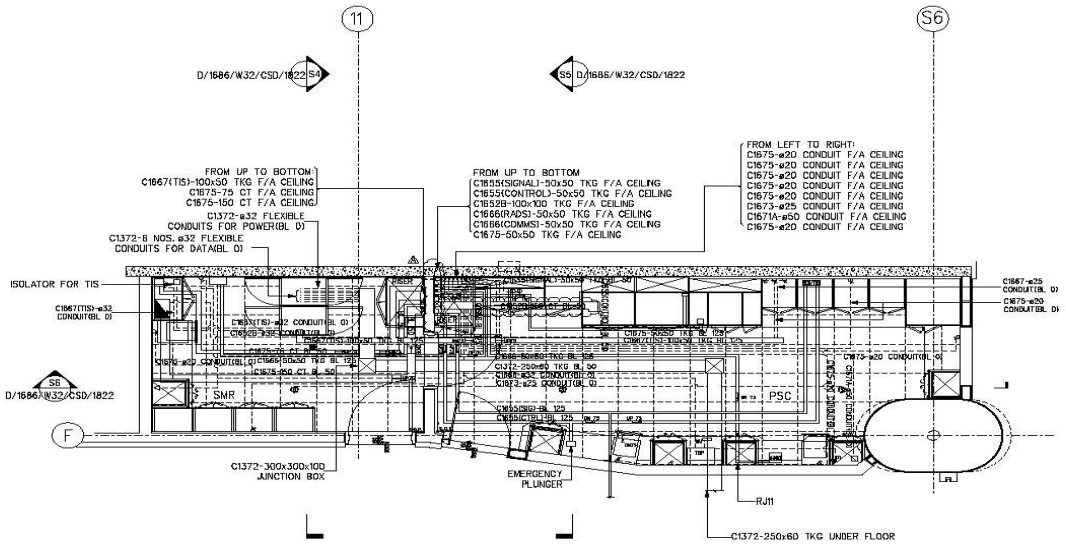
CONTRACT	C1372	C1652A/B	C1653	C1655	C1666	C1667	C1669	C1671A/B	C1673	C1675
NAME										
SIGNATURE										
DATE										

UPDATED FINAL DESIGN FOR ACCEPTANCE

CSD / SEM Drawings for Station Manager Room-SMR, Passenger Service Center-PSC



EW32 STATION PSC AND SMR
ABOVE FALSE CEILING CABLE ROUTE LAYOUT

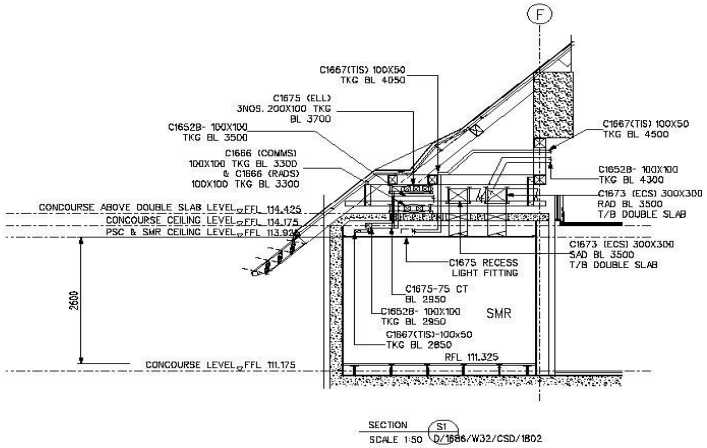


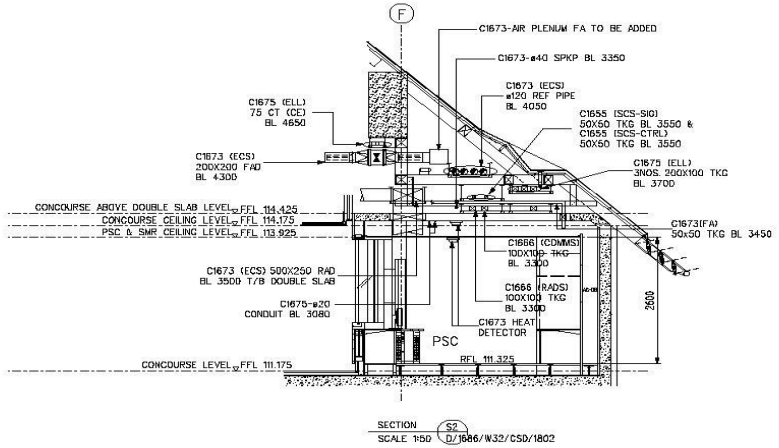
EW32 STATION PSC AND SMR
BELOW RAISED FLOOR CABLE ROUTE

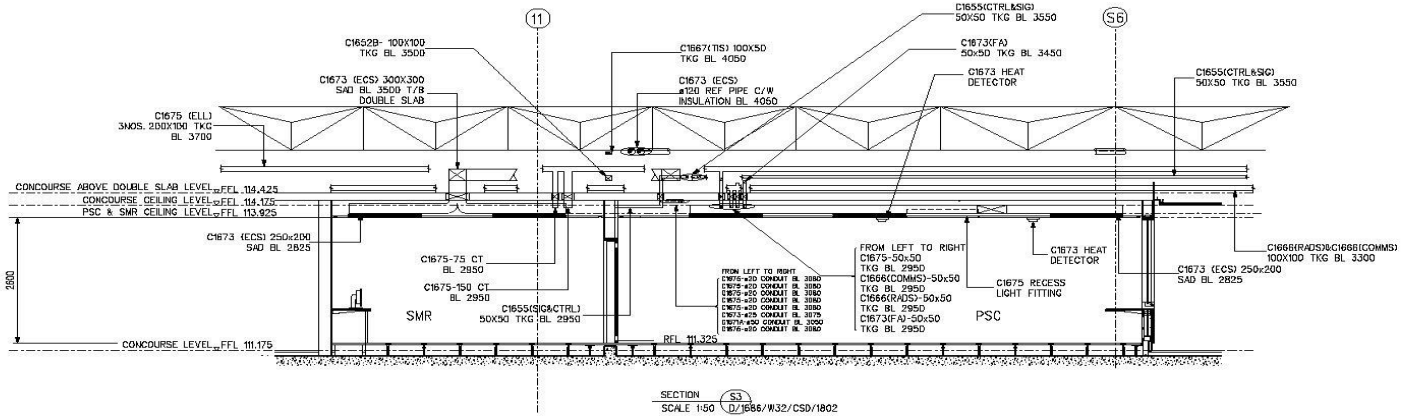
SWCs SIGN-OFF TABLE										
CONTRACT	C1372	C1652A/B	C1653	C1655	C1666	C1667	C1669	C1671A/B	C1673	C1675
NAME										

0 0.5 1 1.5 2 2.5 Metres

CSD / SEM Drawings for Station Manager Room-SMR, Passenger Service Center-PSC







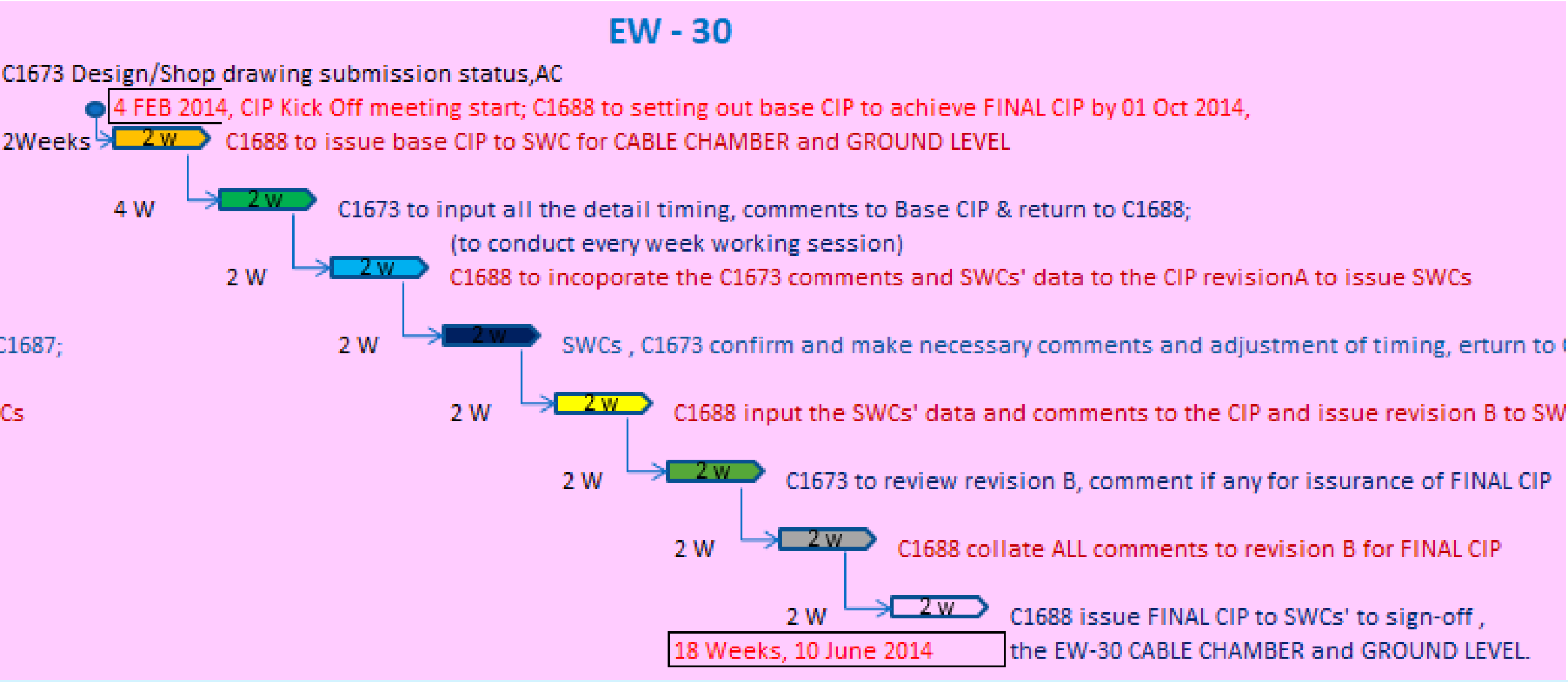
SWCs SIGN-OFF TABLE										
CONTRACT	C1372	C1652A/B	C1653	C1655	C1666	C1667	C1669	C1671A/B	C1673	C1675
NAME										

0 0.5 1 1.5 2 2.5 Metres

CSD / SEM Drawings for Station Manager Room-SMR, Passenger Service Center-PSC

Co-ordinated Installation Programme, **CIP**

C1673- CIP Coordination Flow Chart



DCN : Design Change Notice, ARF : Attendance Request Form

Sembawang Engineers & Constructors Pte Ltd
Registered Office
460 Alexandra Road, #27-01 PSA Building, Singapore 119963
T +65 6305 8788 F +65 6305 8588
www.sembawangenc.com

Your Ref :
Our Ref : C906/LTA/EM/ARF/1365/kfh

08 Aug 2011

LAND TRANSPORT AUTHORITY
1 Hampshire Road
Singapore 219428

Attn: Mr. Chong Swee Ming

Dear Sir,

CONTRACT 906
CONSTRUCTION AND COMPLETION OF BAYFRONT STATION INCLUDING ASSOCIATED TUNNELS FOR DOWNTOWN LINE STAGE 1
ARF No. AR/C906/C975A/001 - To Open the Ceiling Panels at Concourse Level for C975A to Lay the Cables for Additional AFC Isolator in SMR (DTL)

We refer to the above captioned and enclosed herewith 1 no. ARF issued by C975A.

1) C906/C975A/001- dated 05 August 2011

Please note that the ARF is to open the ceiling panels (non accessible type) for C975A to lay cables for additional AFC isolator in SMR (DTL)

We would appreciate it if you would process and issue us an Engineers Instruction (EI) to cover this ARF.

Thank you.

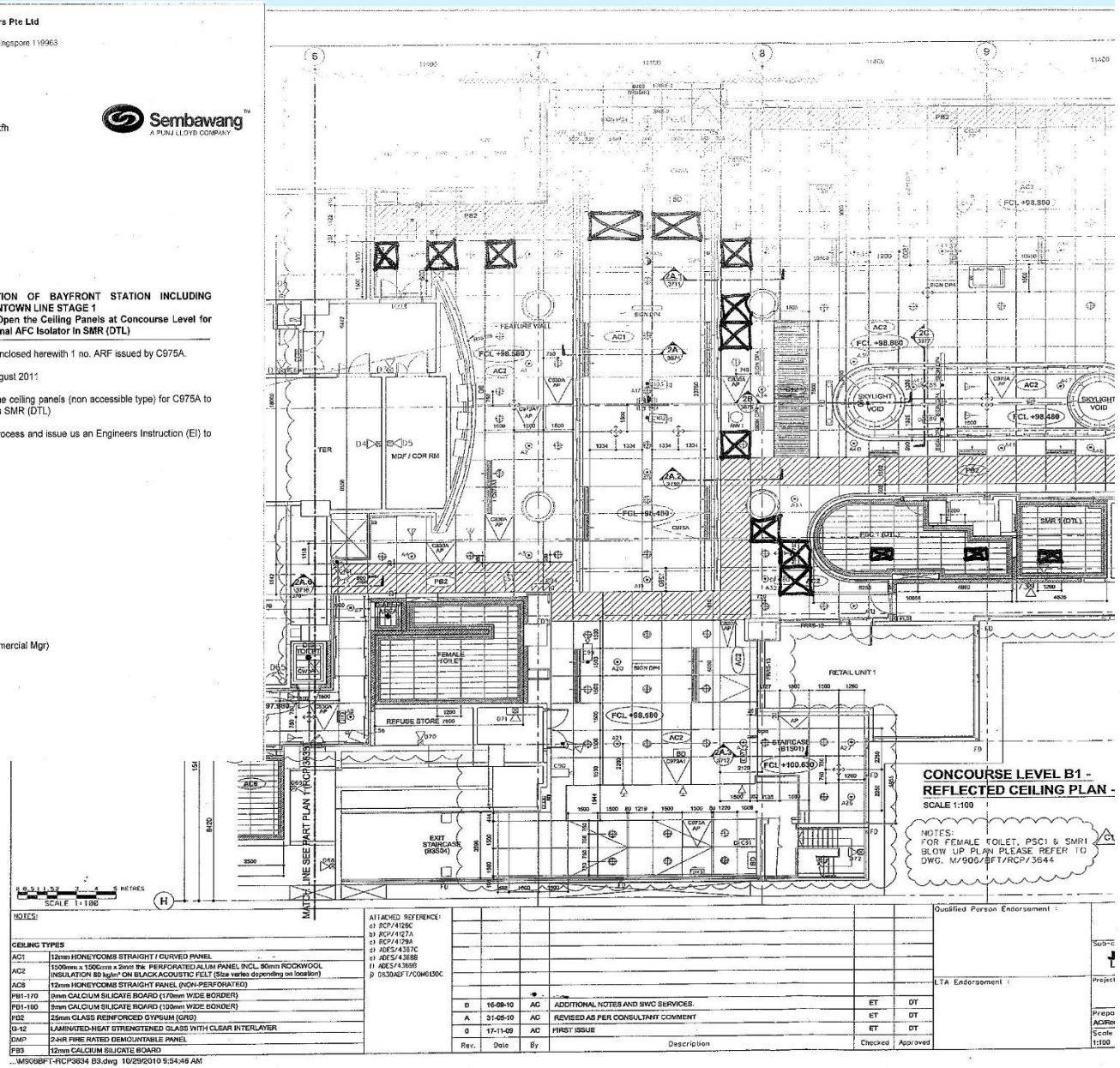
Yours faithfully,

Hilary Weerasinghe
Project Manager

Encl.

cc: Lee Seng Chuan (SEC – Commercial Mgr)

Registration Number 198206192W



Attendance Request Form

DOWNTOWN LINE (DTL1) PROJECT	ATTENDANCE REQUEST
E&M Contract No: C975A Name : Mr. Tint Swe (E&M Contract Representative) Signed: Dated: 4th August 2011 The work listed below is requested to be undertaken by C906 as described below:-	Civil Contract No : C906 Ref No: AR / C906 / C975A / 001 Sheet 1 of 1 Site Co-ordination Meeting Dated:

Item	Description of Work	Location	Required Period
(1)	Request to open the ceiling panels at Concourse level as per the attachment in order to lay the cables for additional AFC isolator inside the DB closet at the SMR room 1 DTL. (Refer to the attachment drawing for details)	(BFT station) Concourse level	12th September 2011

Assessment by C906 :

Assessment	* Completed on DTL1 review copy Only PM (Civil)	* Completed on DTL1 review copy only PM (E&M)	Civil Contractor	E&M Contractor
Name :			Hilary Weerasinghe	Mr. Tint Swe
Date :			8/8/11	4th August 2011
Signature :				

Endorsement of this form by the Contractor represents confirmation on the scope of attendance is understood and will be provided as identified above. It does not prevent the Contractor from disputing that the attendance is not included within the contract.

* Assessment remarks

Parallel Activities of Design , Procurement, Safety, Submissions and Installation Works

Land Transport Authority

1 Hampshire Road Singapore 219428
Tel: 1800 CALL LTA ; 1800 2255 582; Fax: (65) 6396 1002

DTL3 Project Office Level 1
Services DTL1 (SVSDL1)
750 Victoria Street
Singapore 188062

Our ref: C975A/EM/F35.000.000/2/11/66/60294
Your ref:
DID 6299 7188 Fax 6299 6920

15 April 2011

Guthrie Engineering (S) Pte Ltd
6, Aljunied Avenue 3 #04-00
Singapore 389932

Attention : Mr Tint Swe
Project Manager

Dear Sir

CONTRACT 975A
LETTER OF APPRECIATION FOR CIRCLE & DOWNTOWN LINES E&M (CDL E&M)
ANNUAL SAFETY FORUM

The CDL E&M Annual Safety Forum was successfully held on 8 April 2011.

We would like to thank you and your WSHO, Mr. Kelvin Tan, for participating in our safety forum as well as sharing with the audience on the measures and initiatives that your organisation has adopted in achieving Workplace Safety and Health (WSH) excellence in the construction industry.

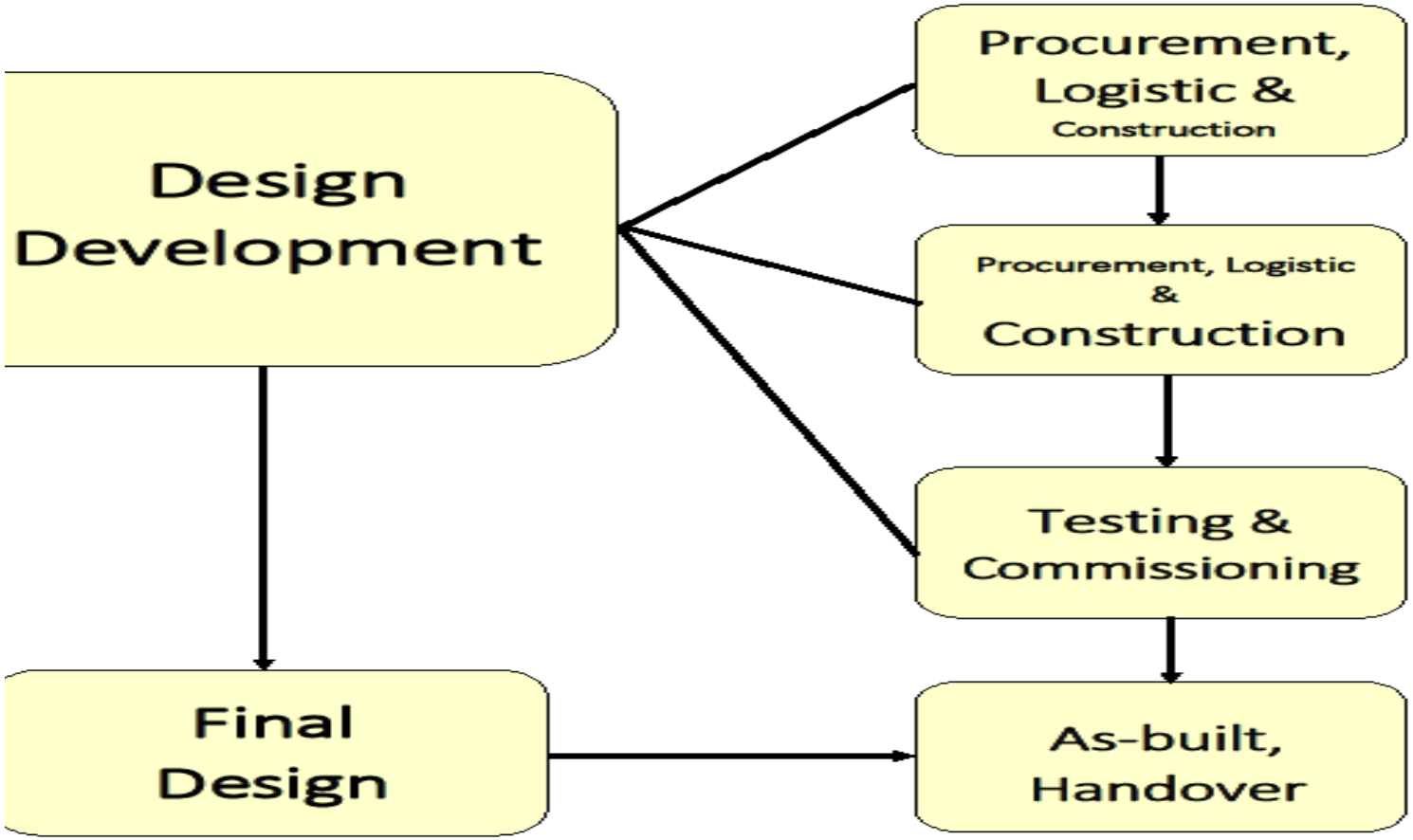
We look forward to your continual support for future LTA's events and projects.

Yours faithfully,

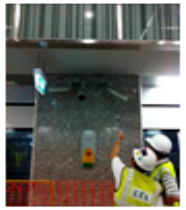
ONG BOON ANN
DIRECTOR, E&M (CIRCLE & DOWNTOWN LINES)

cc:

Design vs. Construction Activity



Requirement, Installation and Coordination Issues

No.	Photo	Location / Description	Remarks
1.		Concourse GL 8 (2 signage)	Signage to shift one panel's space each PMN: C906 will open up ceiling to identify any other services running through the new proposed area; for feasibility of the signage shifting Will feedback by Wednesday, 27 July 2011
2.		Concourse GL 19 (2 signage)	Signage to be shifted to one panel diagonally away PMN: C906 will open up ceiling to identify any other services running through the new proposed area; for feasibility of the signage shifting Will feedback by Wednesday, 27 July 2011
3.		Upper Platform	C830A to finalise the camera position by 25 July 2011. From there, to identify if exit sign is obstructing camera view. C830A has checked and confirmed that no blockage. **Issue closed.**
4.		Upper Platform	C830A to finalise the camera position by 25 July 2011. From there, to identify if exit sign is obstructing camera view. C830A has checked and confirmed that no blockage. **Issue closed.**
5.		Lower Platform Exit sign blocking view to PID	Exit sign to be shifted to in between security camera and PID QPD (Archi) has confirmed shifting of the exit sign is acceptable. C975A has agreed to do a card board mock up at the new proposed location by 27 July prior to a joint inspection.
6.		Lower Platform Exit sign blocking view to PID	Exit sign to be shifted to in between security camera and PID QPD (Archi) has confirmed shifting of the exit sign is acceptable. C975A has agreed to do a card board mock up at the new proposed location by 27 July prior to a joint inspection.
7.		Lower Platform Floor standing signage obstructing camera view	Camera's view blocked by floor standing signage Civil (shift signage, hack floor tile) and E&M (install a new CCTV) contract admin to come out a costing and weigh which is cheaper to adopt. Target by this week.
8.		Ground Level Entrance A Exposed conduit	D (DTL1) advised that concealment is not necessary as entrance A structure is temporary and will be integrated with future developments. Previous agreement with LTA Architect/Aedas/C830A/LTA System team: To paint the exposed conduit to suit wall colour. **Issue closed.**
9.		Ground Level Entrance B / IR Entrance Exposed conduit for ITB/CCTV	Pending MBSIR to advise if box-up for shutter motor would be done. If yes, to discuss with MBSIR to extend the box-up Previous agreement with LTA Architect/Aedas/C830A/LTA System team: To paint the exposed conduit to suit wall colour.

Electrical Contract Deliverables

Technical Specification > Installation [Supply and Installation Of Electrical Services]

- TS and drawings are intended to be mutually explanatory, all works required in one, even if not in the other, shall be fully executed.
- TS >> scope of work, technical requirement of all system, equipment, and components to be supplied, installed, tested and commissioned under the Contract.
- The TS and Authority's drawings >> basic design for Contractor to develop and generate his detail design and working drawings for the works.

  - i.e., The Contractor shall be responsible for:
    - (a) Selection of equipment to meet the requirement
    - Verification of the voltage drop for services
    - Sizes of cables
    - Prepare to allow the increase of price from minimum cable sizes
    - Protection devices discrimination schemes, include over-current protection, overload protection, electrical protectice devices and electrical fault levels,
    - Design of electrical control circuit,
    - Lux level calculation
    - Calculation for 110V DC battery sizing
    - Calculation for UPS and EPS battery sizing
    - Support system for Plant
    - EMC system analysis
    - Design of Acoustic and vibration isolation
    - Design od all software

Electrical Contract Deliverables

SCOPE Of WORKs, <covered by this document include the following sub-system>

a) Main Switchboards, sub-boards & final distribution boards.
b) LV distribution system including mains, submains, and final sub-circuit cables, associated switch gears,
c) Emergency Power Supply(EPS) system,
d) Uninterrupted power supply system(UPS) System,
e) Telephone Distribution System,
f) Station and Tunnel Lighting system includes Tunnel- ITESS, XPES and Blue Light Station, and Emergency Lighting
g) 110V dc battery charger systems for LV switchboards
h) Equipotential bonding
i) EARTHING System
j) Lightning protection system
k) Electromagnetic compatibility requirement
l) Cable support systems
m) Attendance of Contractor's Licensed Electrical Worker
n) LV power interface requirement with System-Wide Contractors(SWC)
o) System Assurance
p) Testing and Commissioning
q) Monitoring and control system for MSBs, SDBs, DBs, OG Boxes and DC battery system, etc'.

Electrical Contract Deliverables

Equipment and Systems to be supply Electrical Power to :

1) ATM> Automated teller Machine
2) Block Terminal
3) Blue Light Station
4) EBOPS> Emergency Battery Operated Power Supply
5) EMC> Electromagnetic Compatibility
6) EMI> Electromagnetic Interference
7) EPB> Equal Potential Bonding
8) IDF>
9) ISCS
10) ITB
11) ITESS
12) MDF
13) OCC
14) PSC
15) PSD
16) XPESS
17) Electrical Power interfacing requirement with respective system-wide Contractors(SWC) and Civil Contractors.

Electrical Contract Deliverables



Traction Transformer Room

22kV Transformer room Earth Bar



22kV~0.4kV,1.6MVA Transformer, 400V Busduct to





HT side of 22kV TR Cables

Electrical Contract Executions In Mass Rapid Transit Rail System



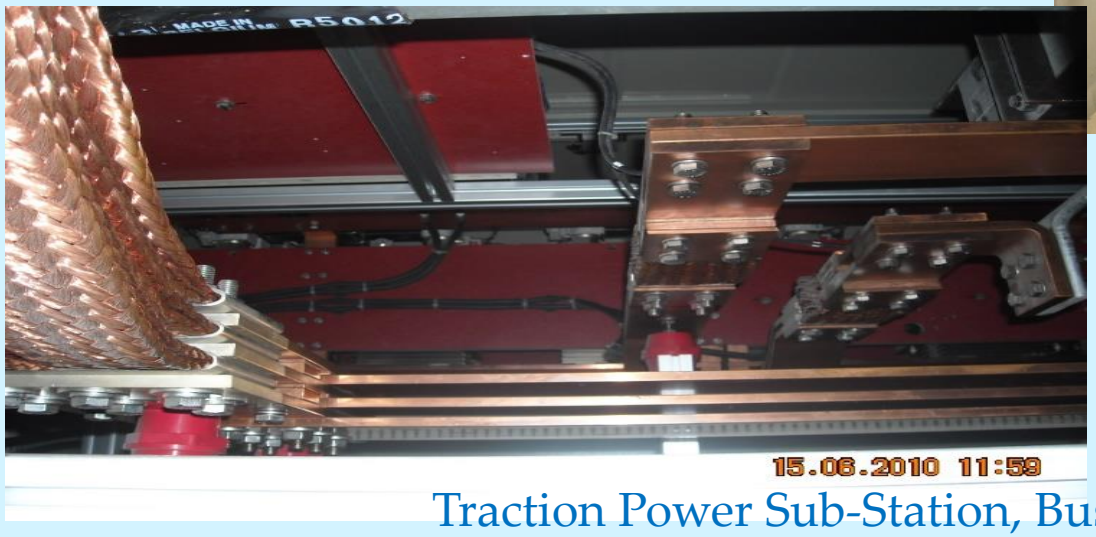
22kV Switchgear room



Services at service corridor



Escalator Pit Electrical Items



Traction Power Sub-Station, Busbars

Services At Cut & Cover Tunnel Installations

Cut and cover tunnel Brackets

F R Tunnel Cables

Blue Light Station

Tunnel Fire Hydrant

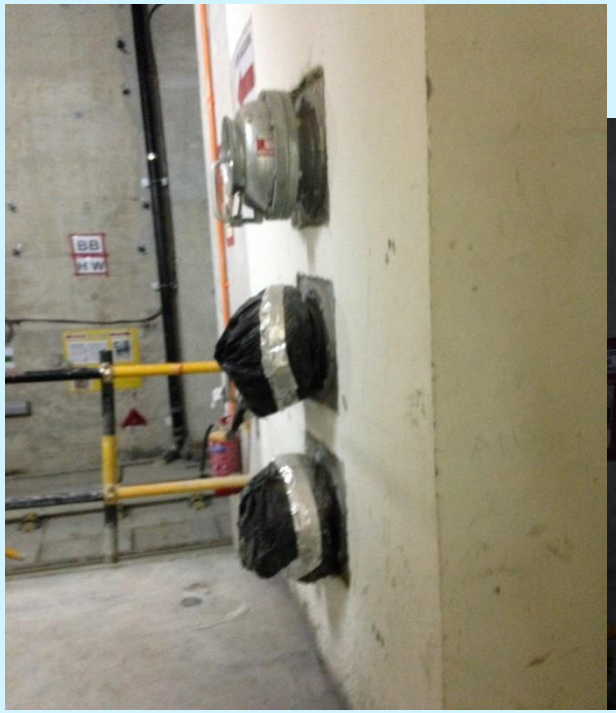
Tunnel UG Pipes



Services Installation







Services Installation

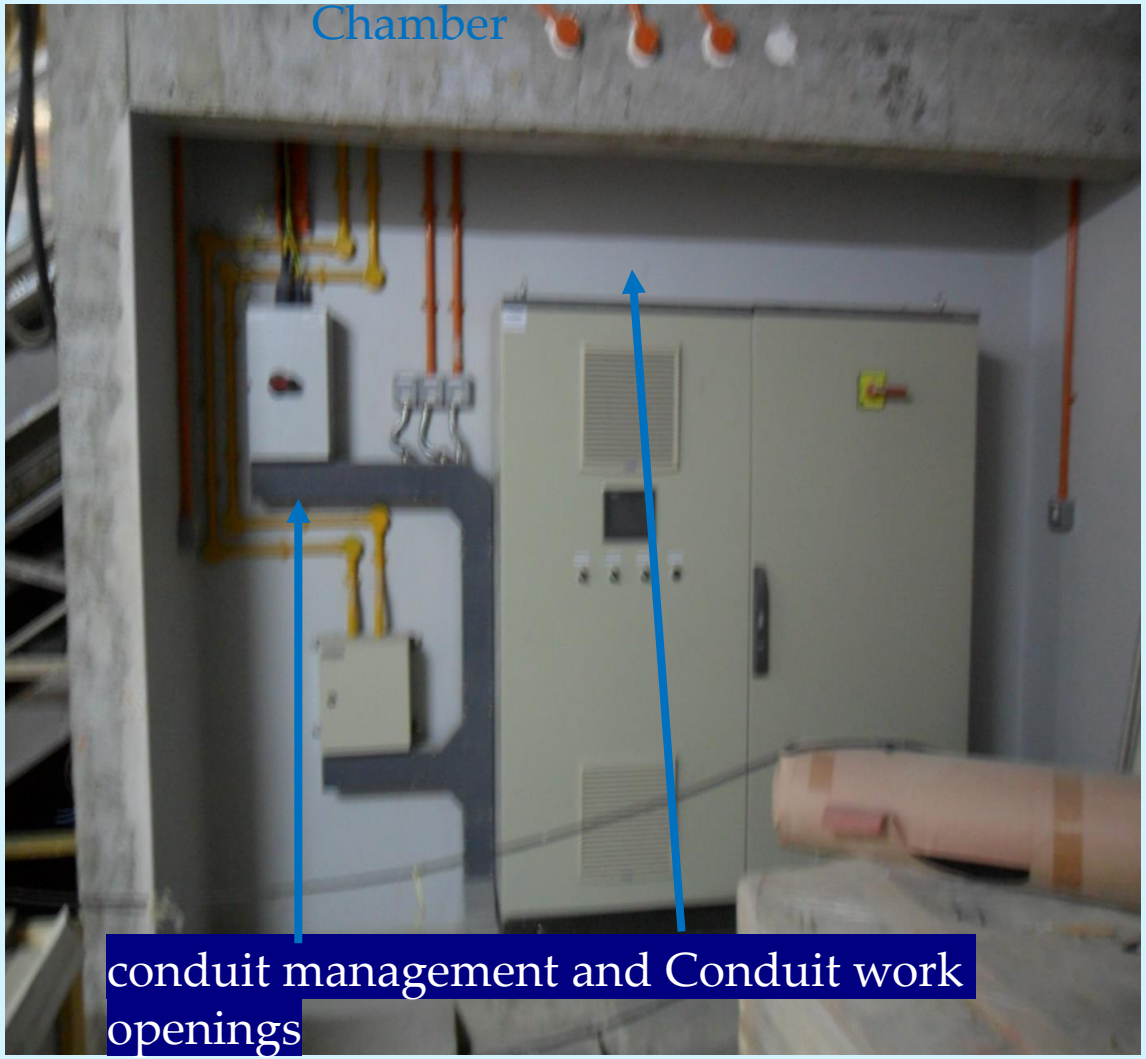


Congested services installation area



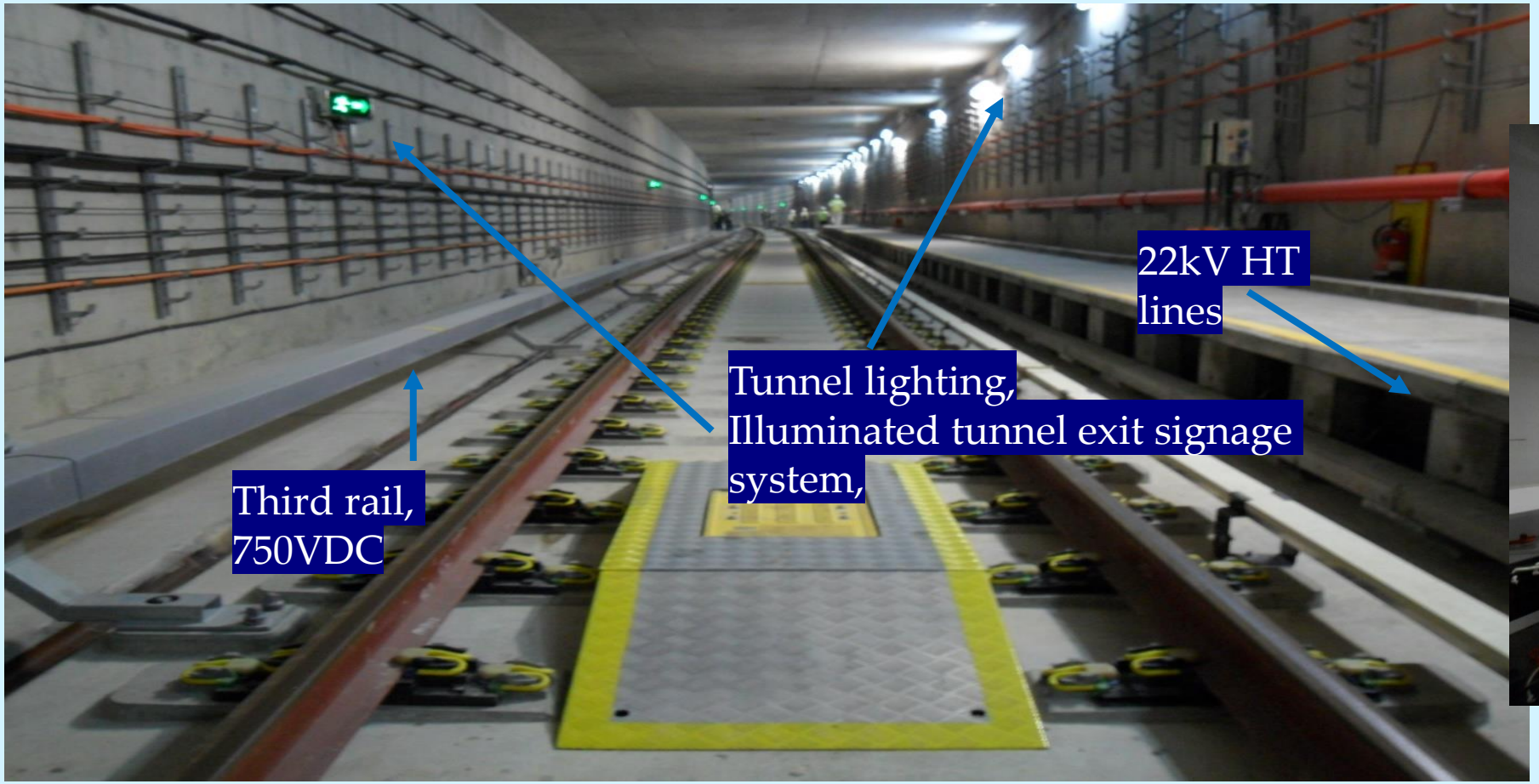
Cable Chamber level

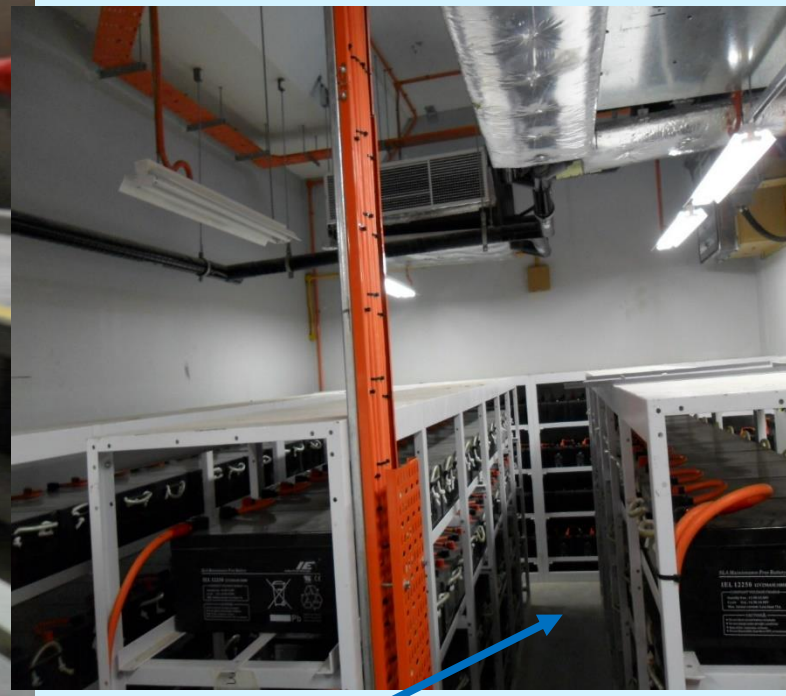
Escalator Control Panel Chamber



conduit management and Conduit work openings

Services Installations





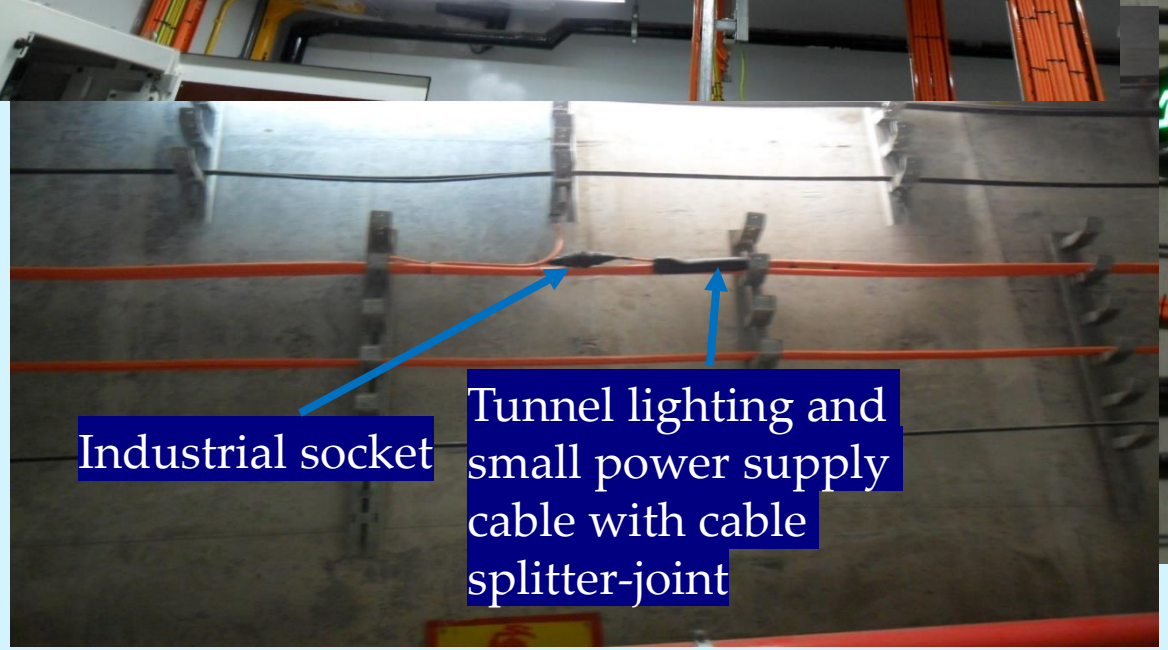
Services Installations



UPS room FCU



ITESS: Duel Direction



Industrial socket

Tunnel lighting and small power supply cable with cable splitter-joint



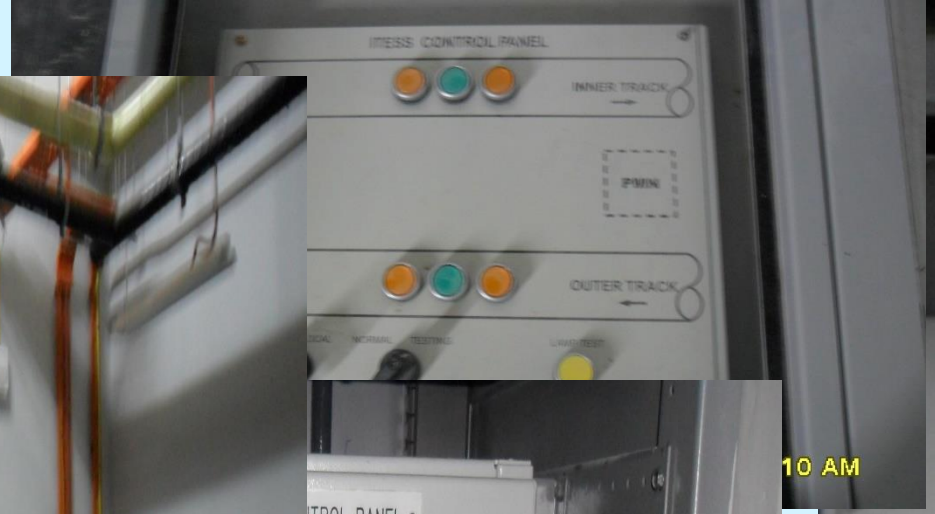
CD Shock Mounts, shock absorbers





Engr.Tint Swe

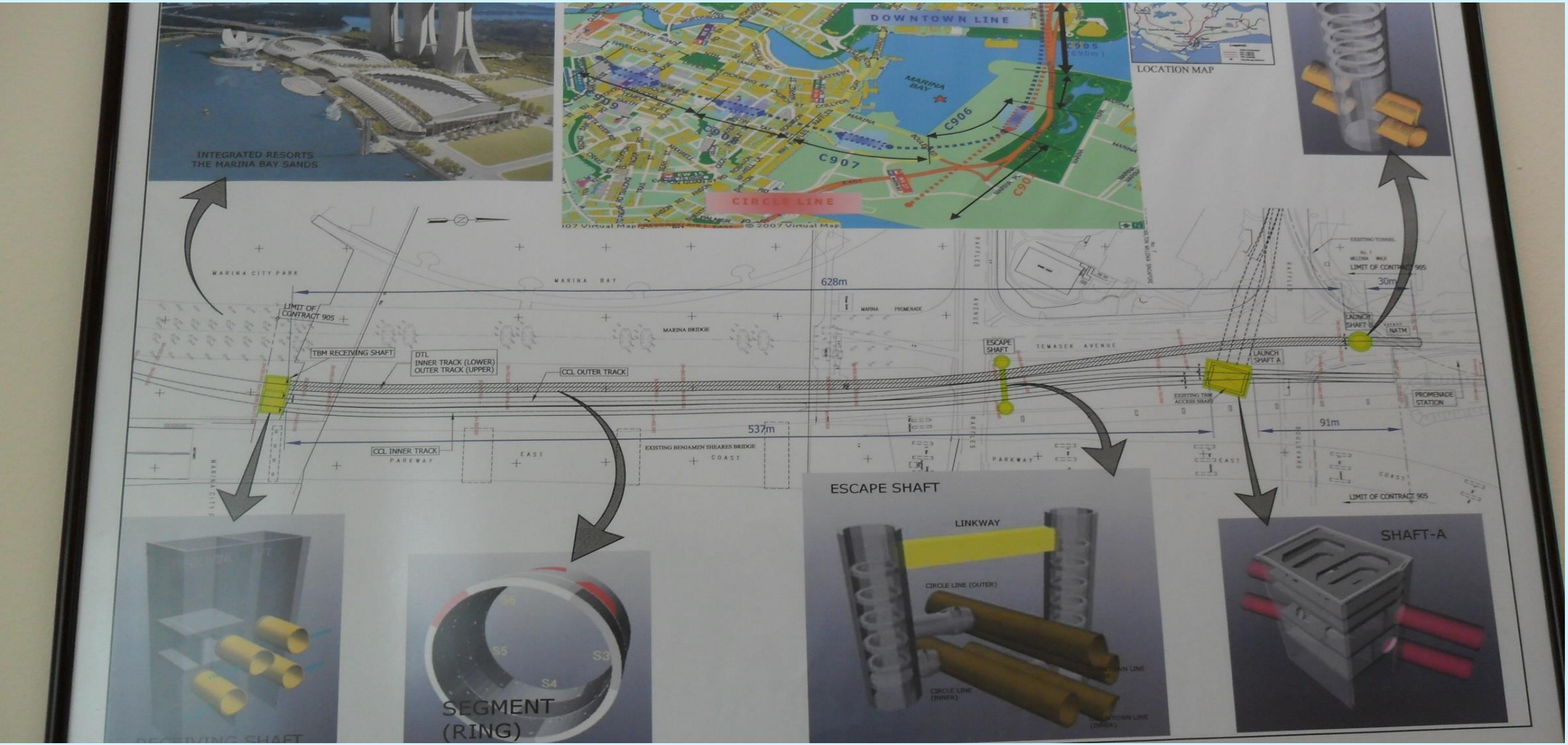

2011/02/25 11:19 AM


ITESS CONTROL PANEL
INNER TRACK
PWN
OUTER TRACK
10 AM

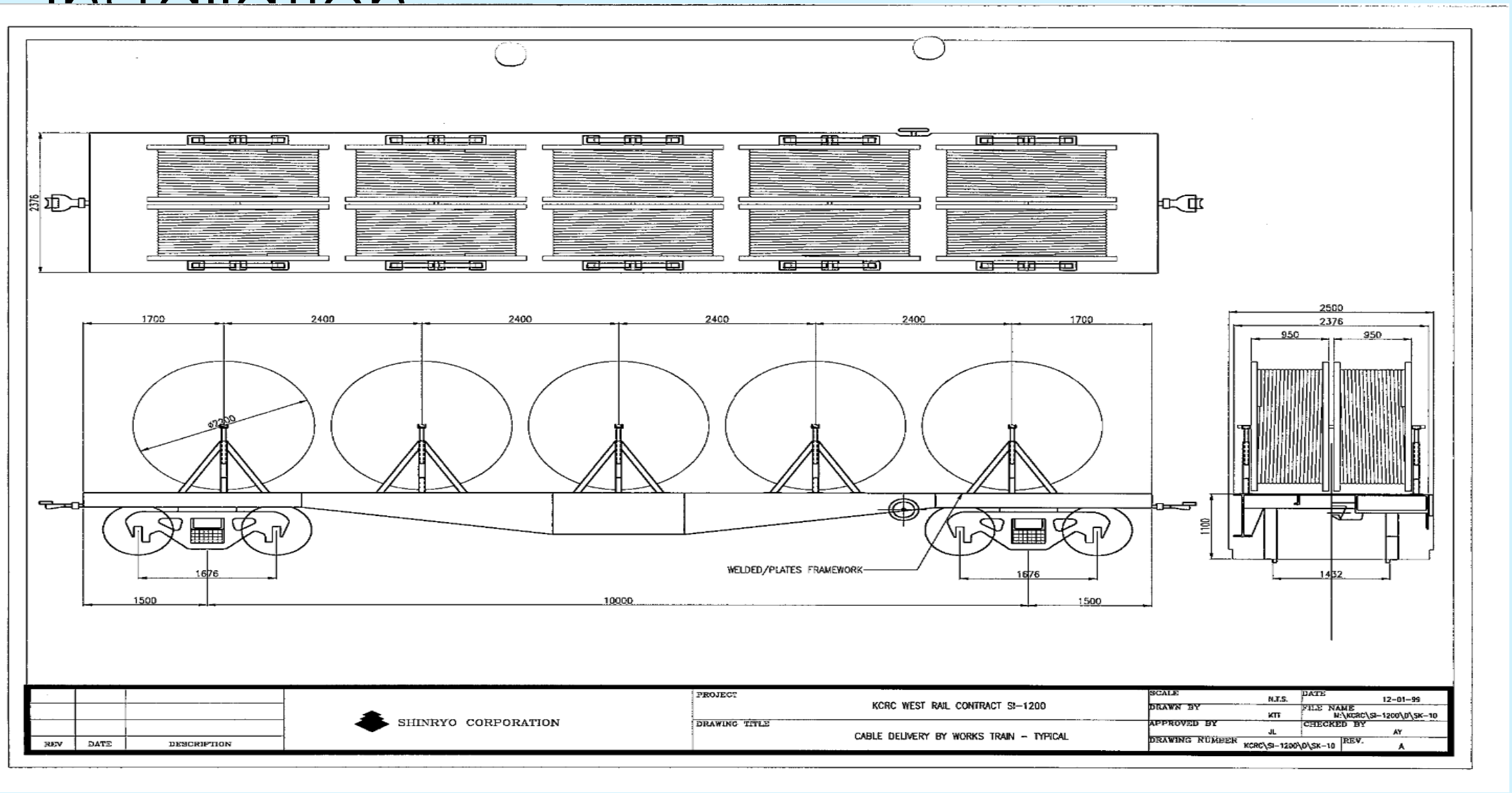
TROL PANEL
2011/02/25 11:06 AM


2011/02/25 11:09 AM
OUTER TRACK
PWN
BFT
INNER TRACK
ITESS CONTROL PANEL

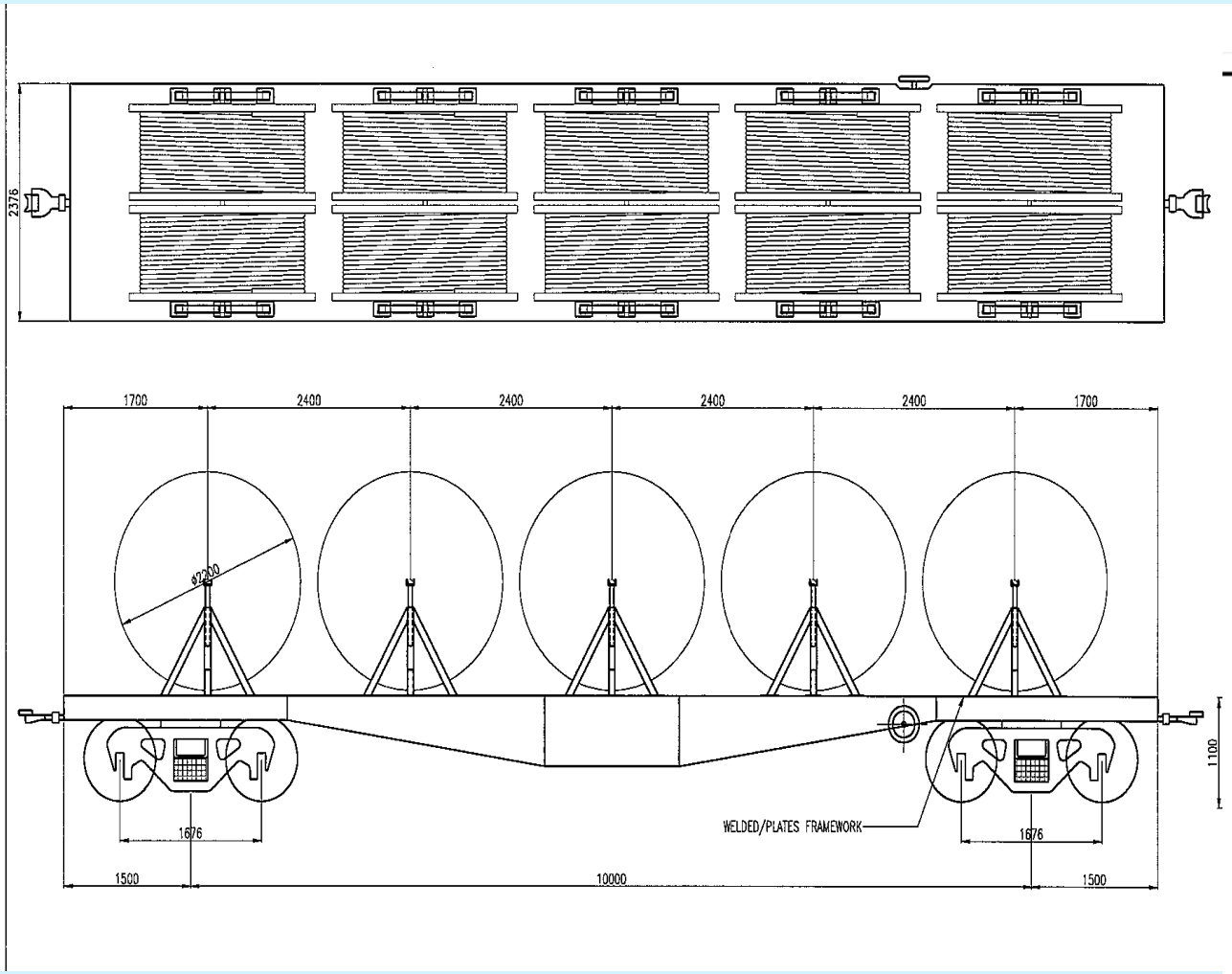
Tunnel Escapr Shaft with Tunnel Routes Position

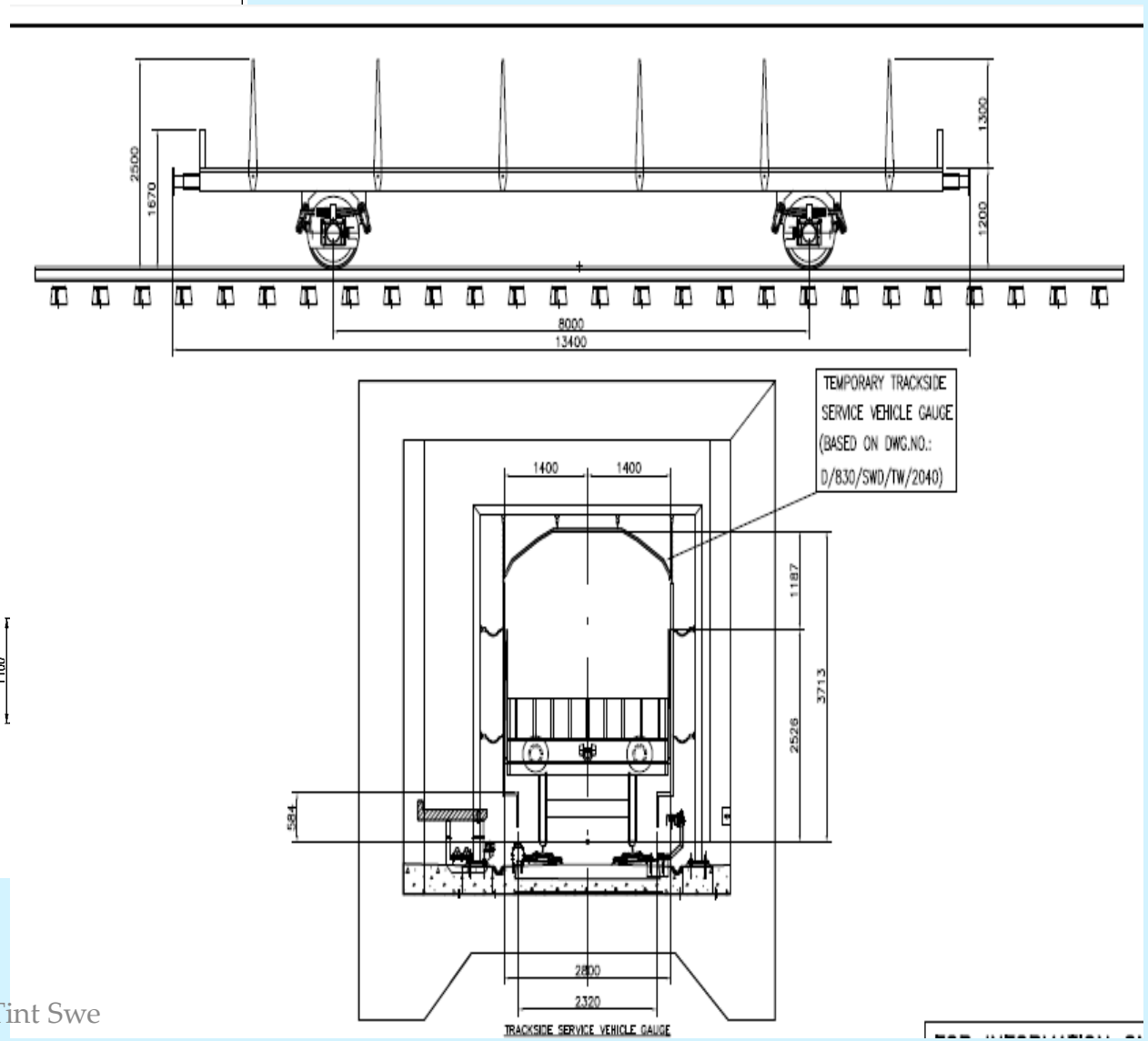


FLAT WAGON For Tunnel Cable Installation

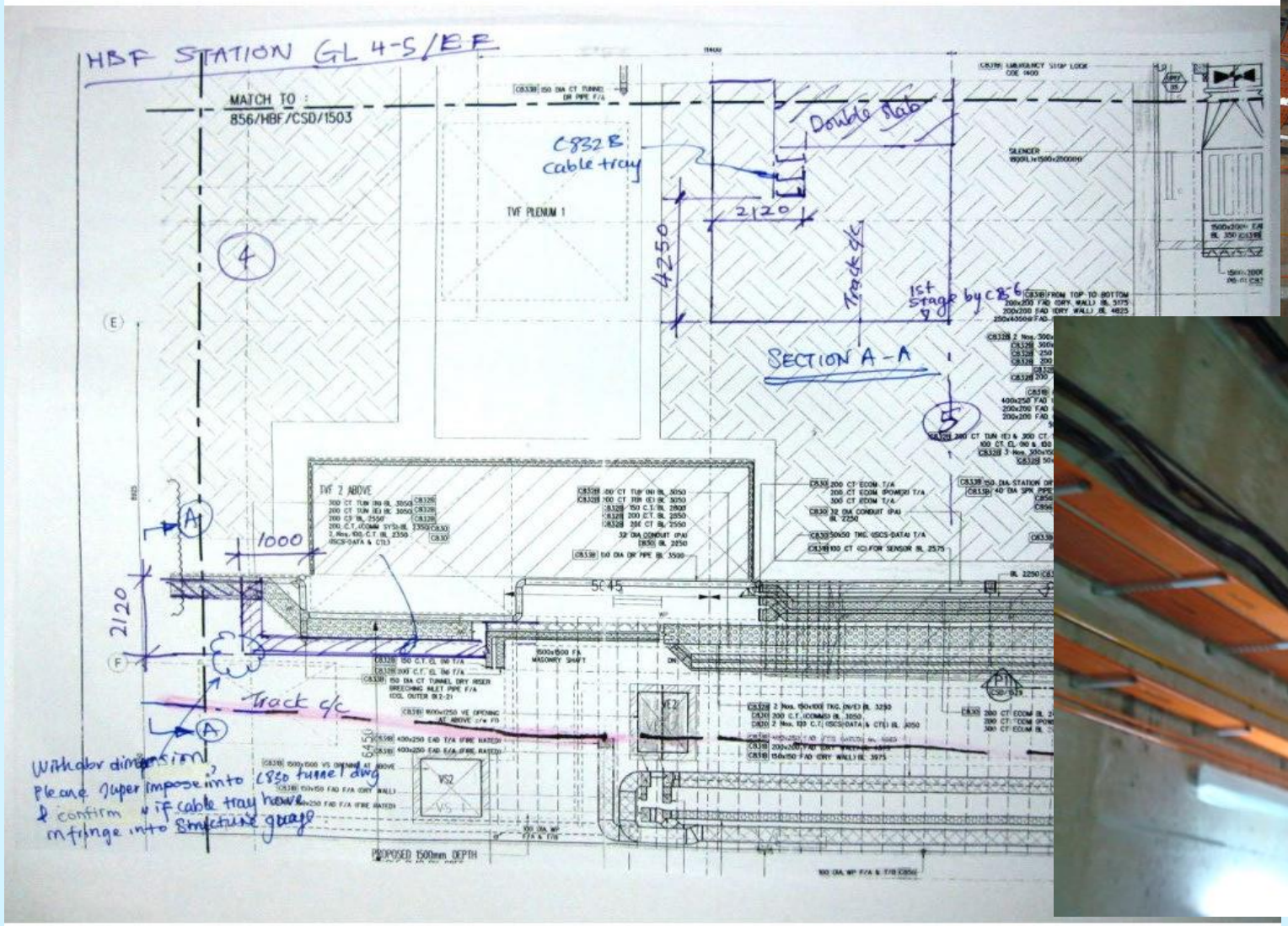


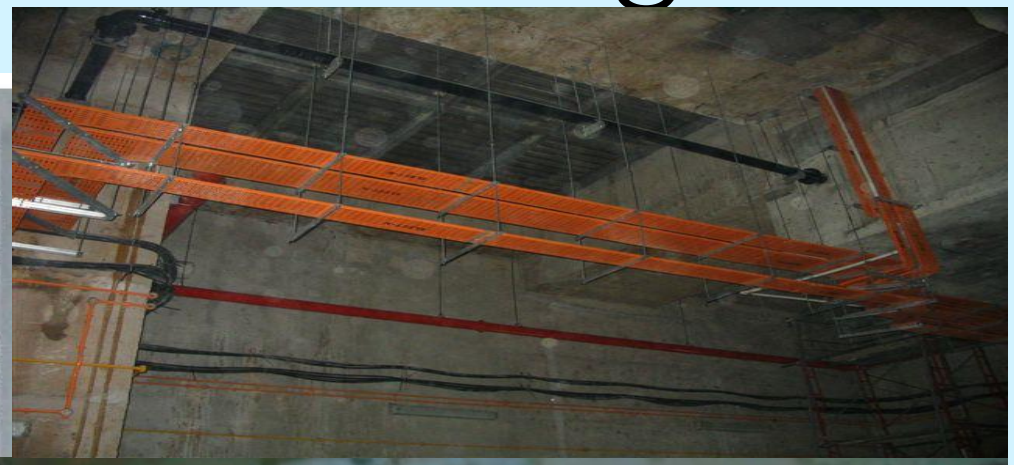
Trackside Service Vehicle /Work Train and flat wagon





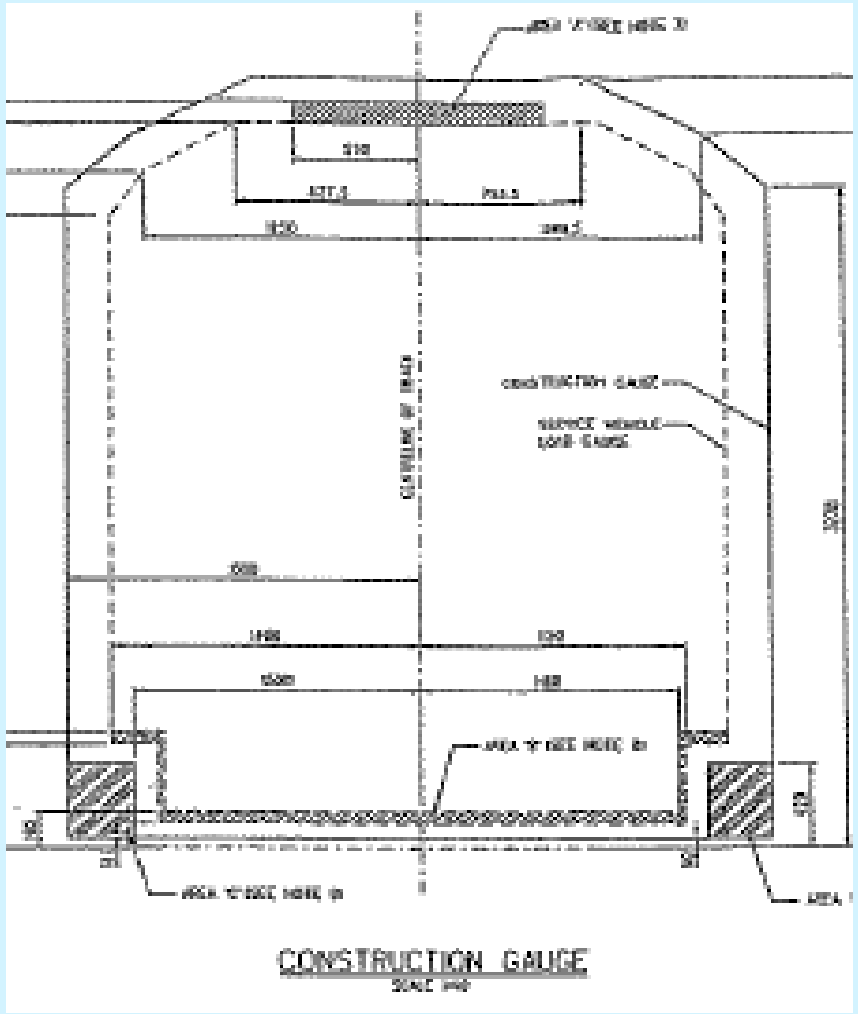
Cable Tray Exposed to Track Guage

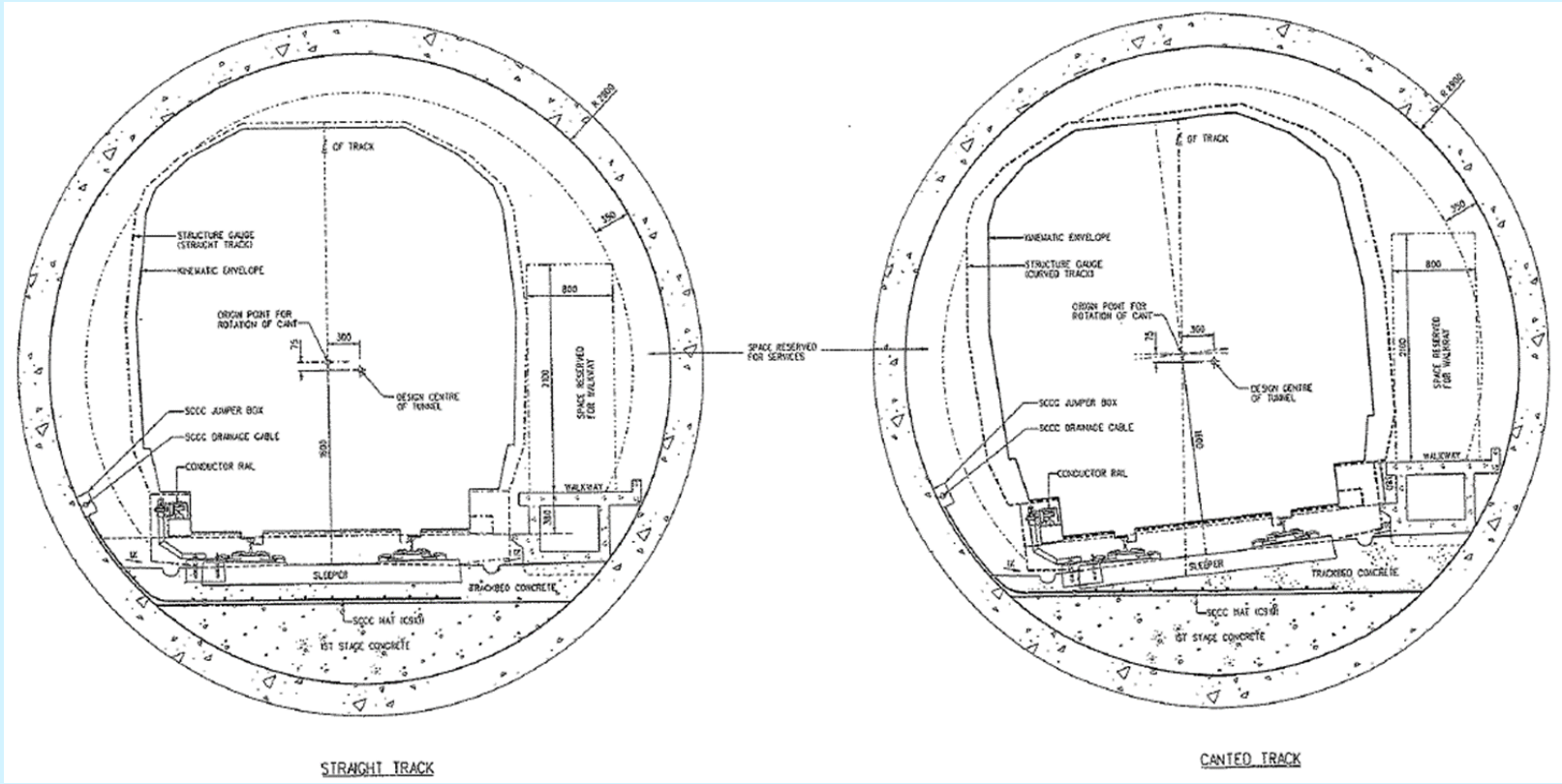




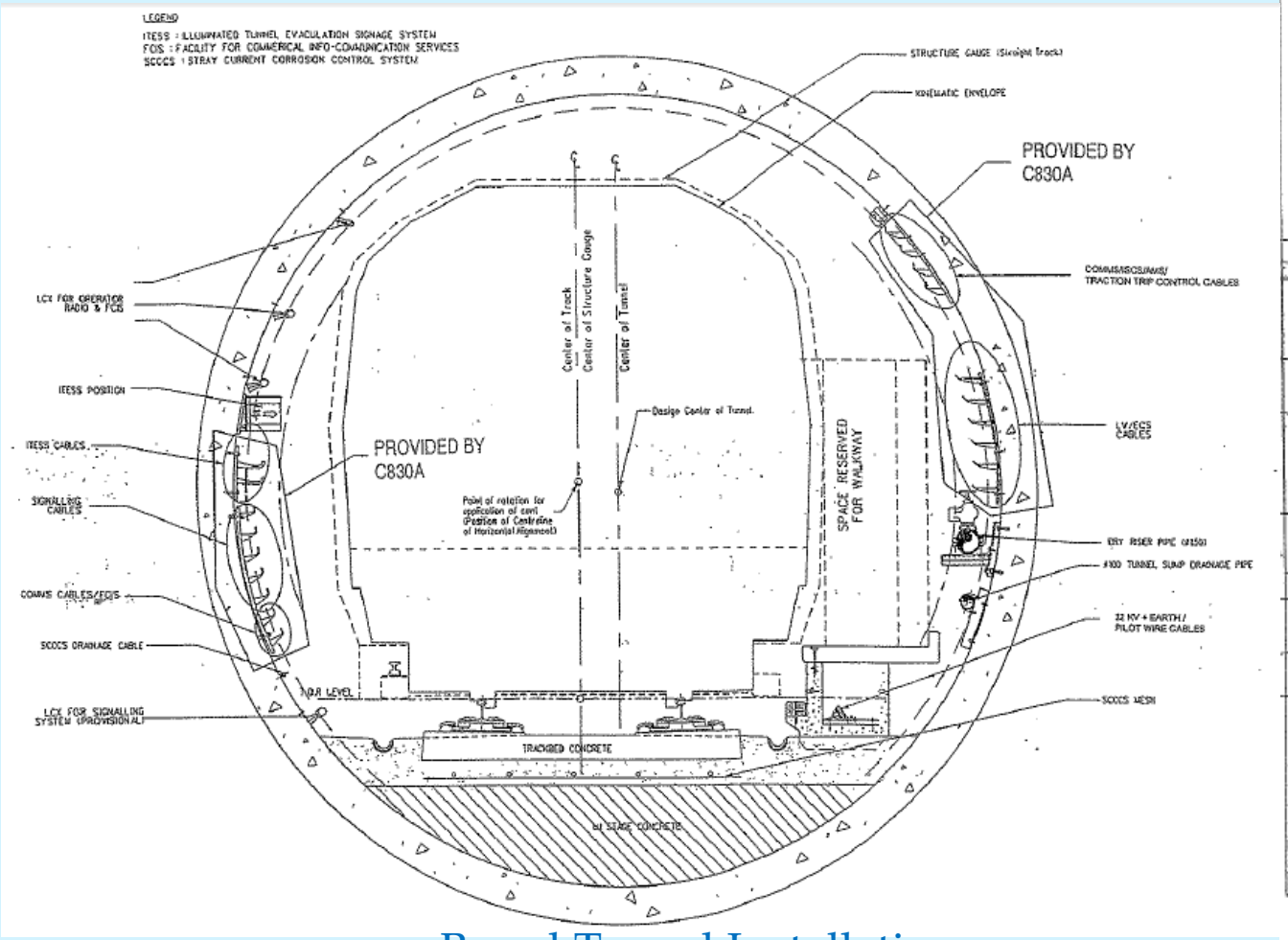


Construction Gauge and Train Movement



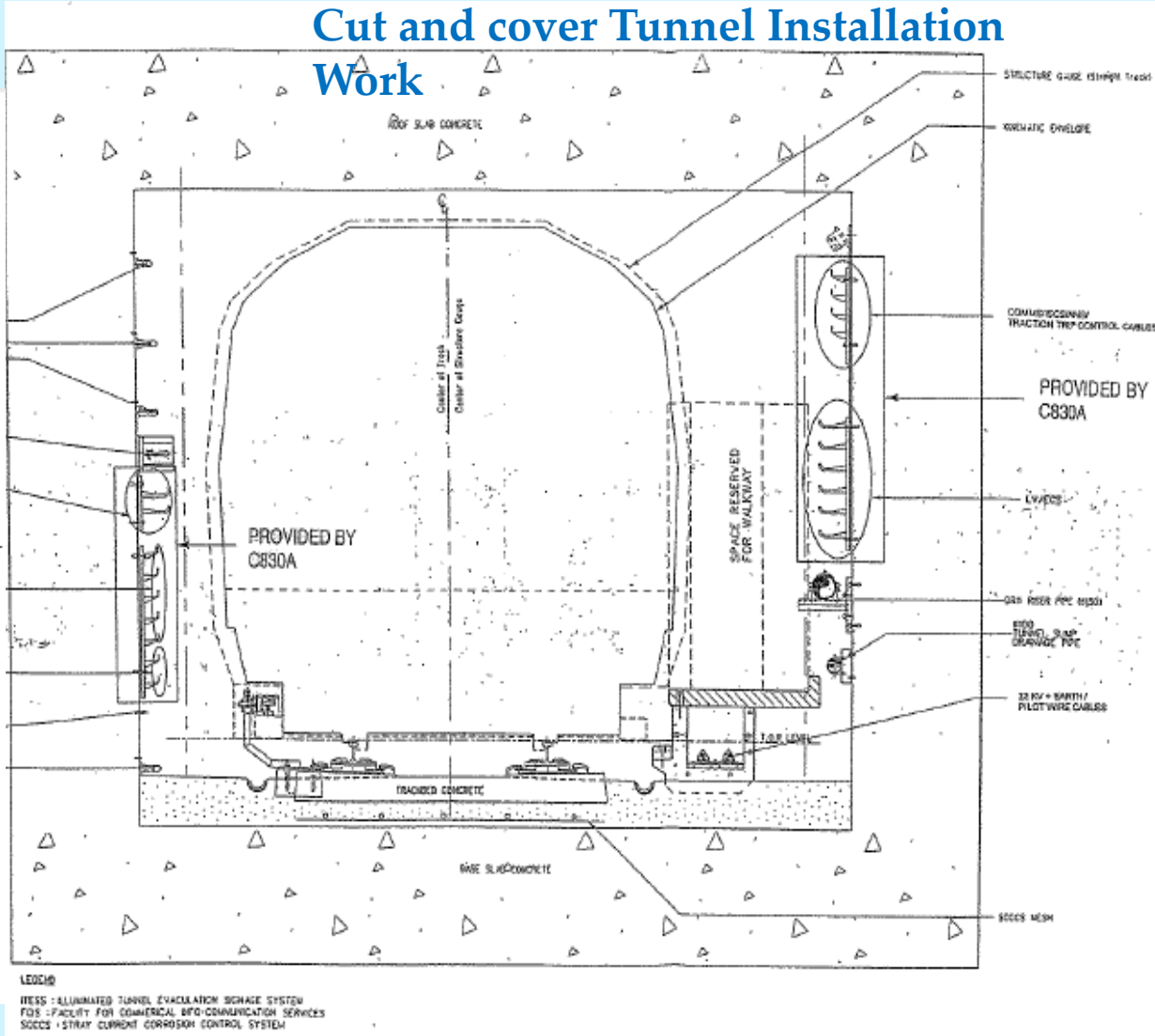


Electrical Installation at Tunnel; Track Related Installation Programme



Bored Tunnel Installation Work

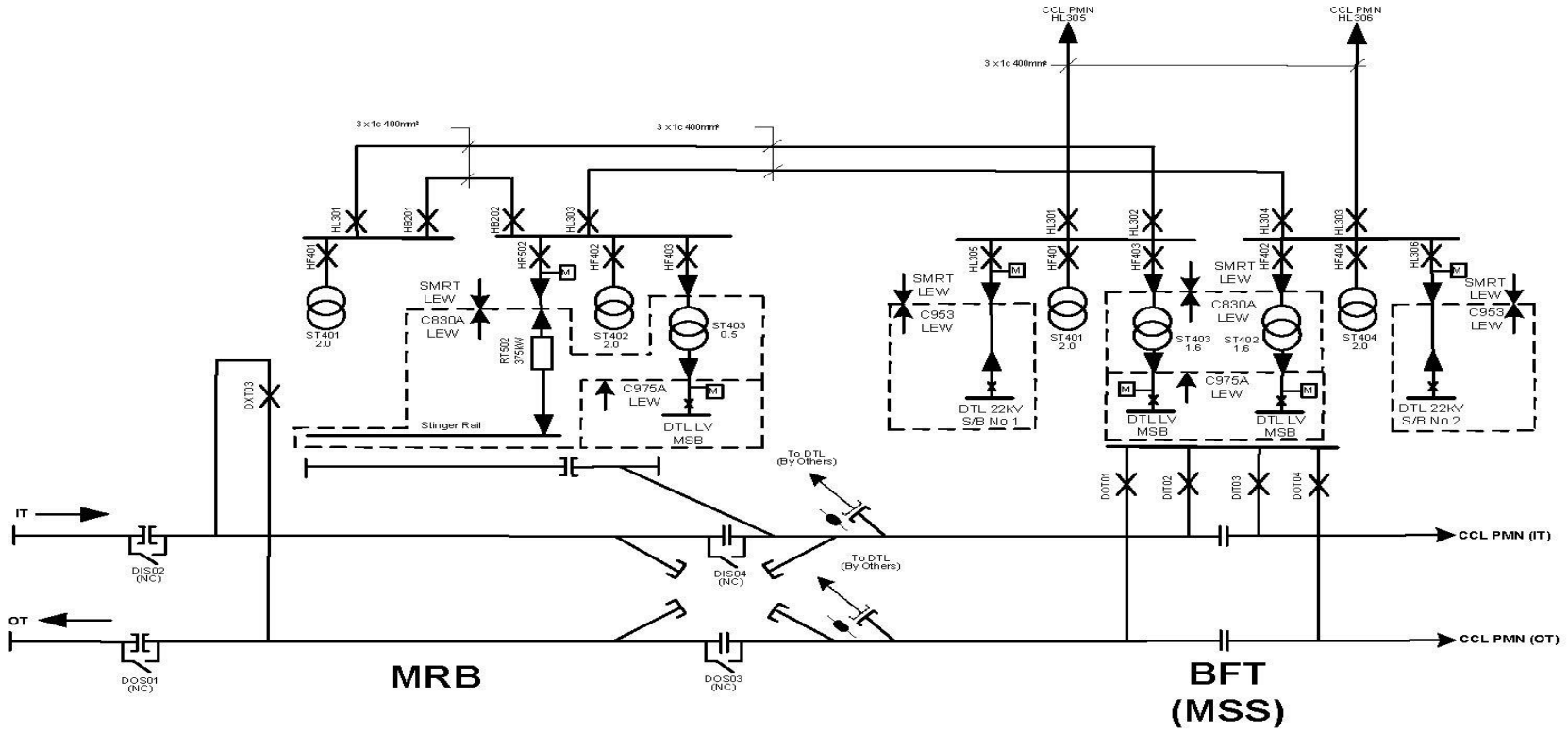
Cut and cover Tunnel Installation Work



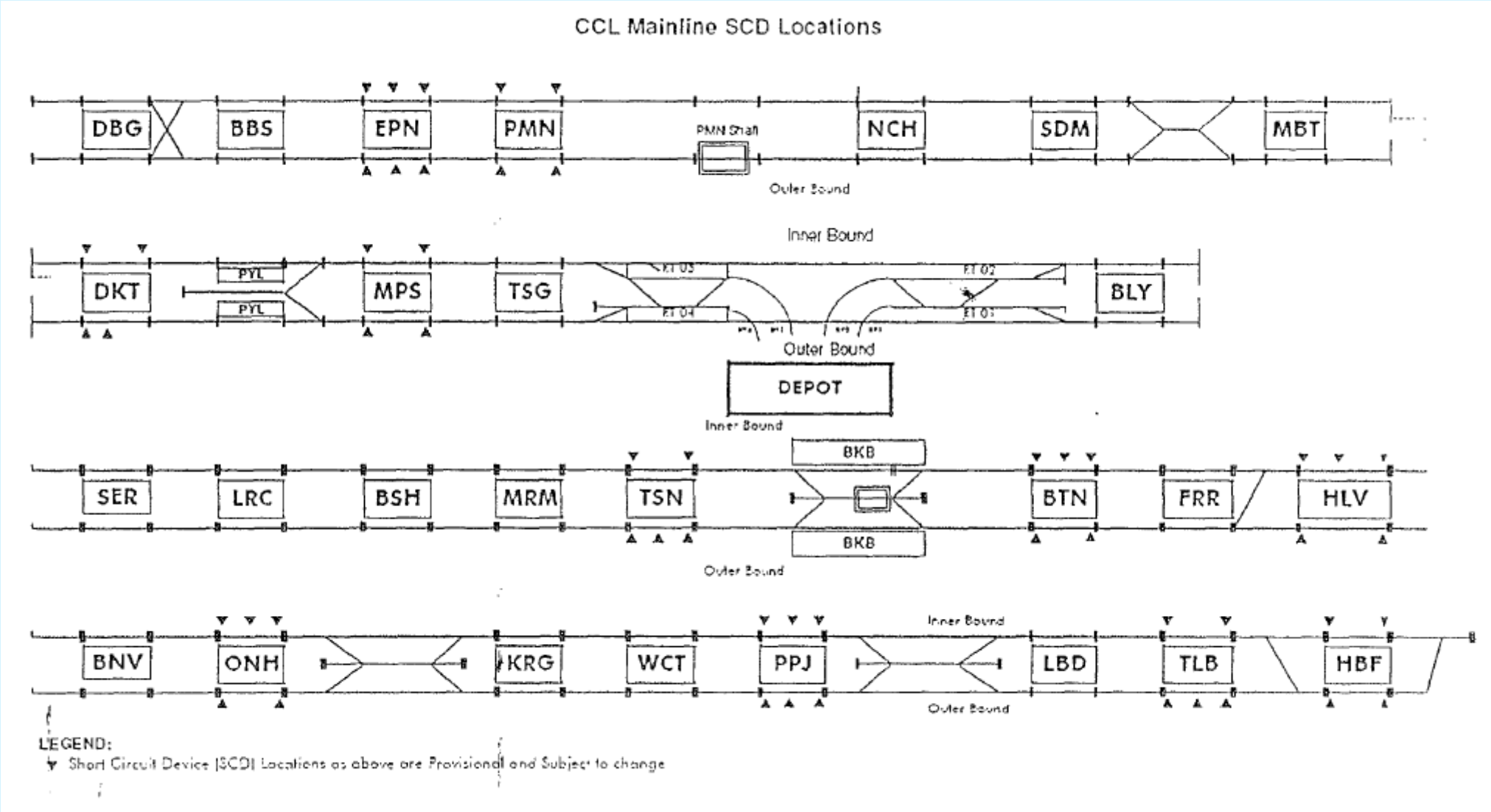
TYPICAL E&M SERVICES LAYOUT AT CUT & COVER TUNNEL

L E W Boundary Demarcation, Indemnity Form

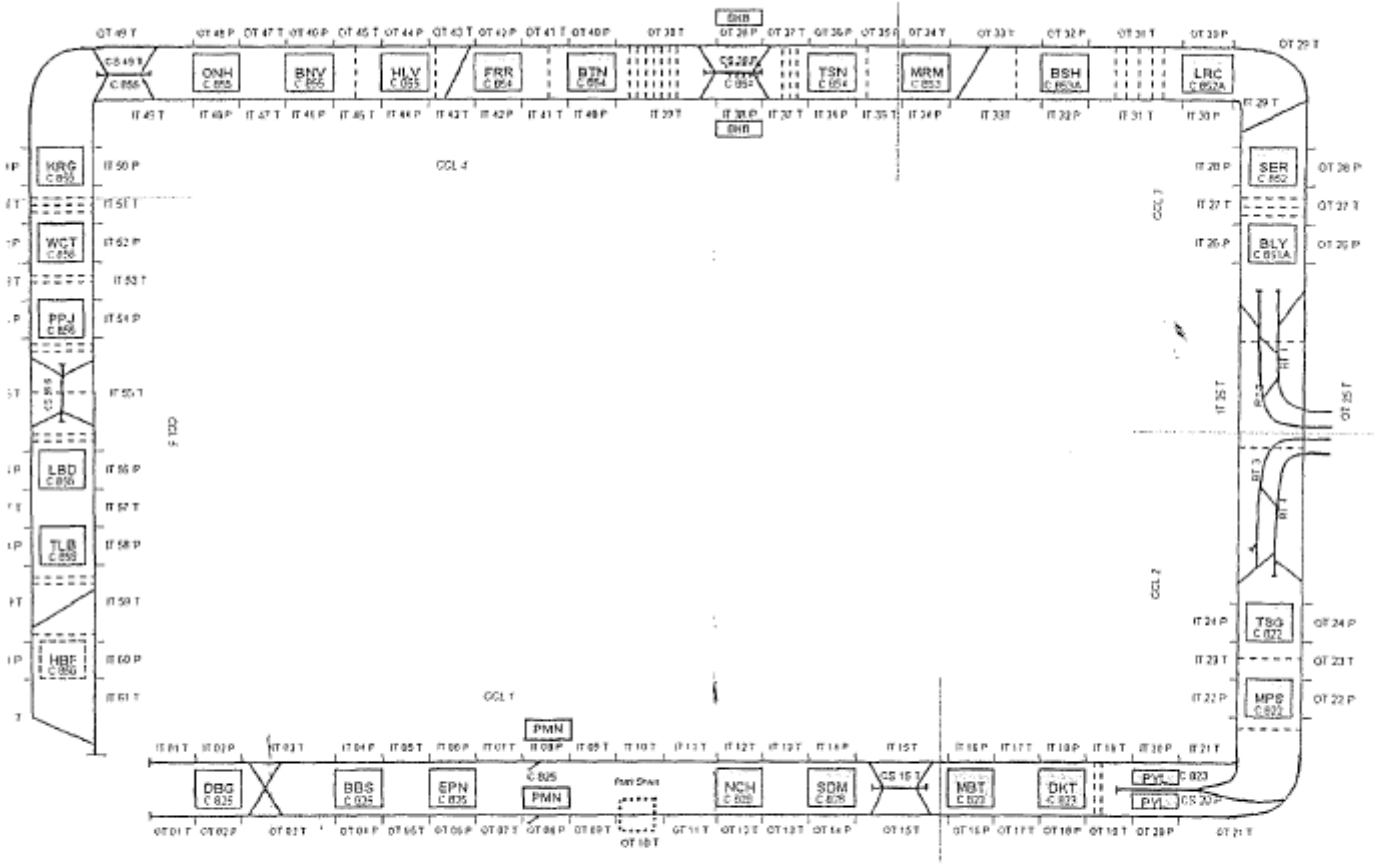
Demarcation of LEWs Boundaries CLE (BFT and MRB)



Note:
DTL BFT 22kV Feeders scheduled for power-on on 16 April 2012


CCL Mainline SCD Locations
DBG
BBS
EPN
PMN
PMN Shaft
NCH
SDM
MBT
Outer Bound
Inner Bound
DKT
PYL
PYL
MPS
TSG
ET 05
ET 04
ET 02
ET 01
BLY
Outer Bound
DEPOT
Inner Bound
SER
LRC
BSH
MRM
TSN
BKB
BKB
BTN
FRR
HLV
Outer Bound
BNV
ONH
KRG
WCT
PPJ
Inner Bound
LBD
TLB
HBF
Outer Bound
LEGEND:
Short Circuit Device (SCD) Locations as above are Provisional and Subject to change

Appendix 1 Schematic of CCL Mainline



Scher
KCD Depot

SINGAPORE Circle Line	Title: C830 – Construction Submission Site Works & Logistic Facilities Submission – Group 41 - Trackworks –WORKS TRAIN MANUAL			
Project Reference: 83001-09-Y000-MTI+0028		Rev: H	Doc Status: Approved	Date: 30-Nov-09
Internal Reference: DAR/830/TRW/0110				Page: 65/94

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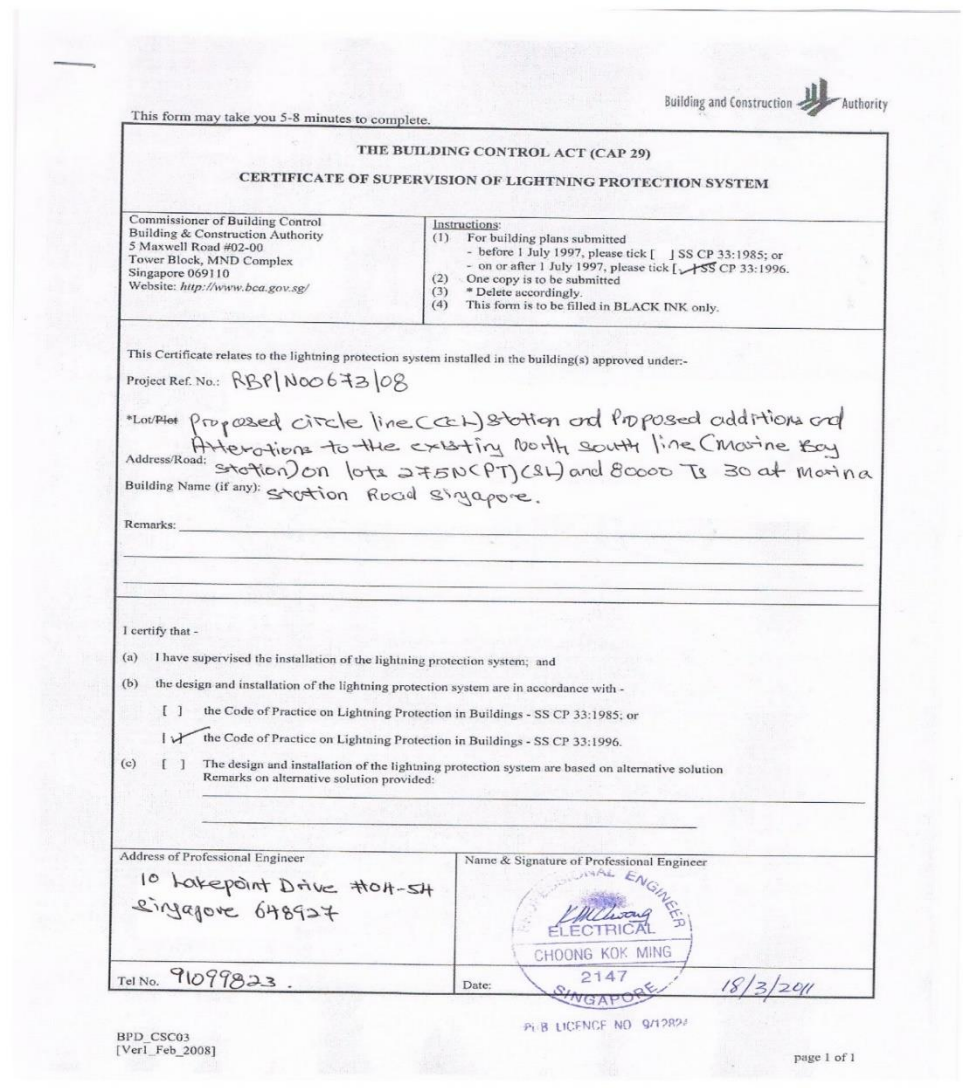
Ref. Form: UM07031E.DOC

FORMS To Be Completed and Submitted



This form may take you 5-8 minutes to complete.

Building and Construction Authority

THE BUILDING CONTROL ACT (CAP 29)

CERTIFICATE OF SUPERVISION OF LIGHTNING PROTECTION SYSTEM

Commissioner of Building Control
Building & Construction Authority
5 Maxwell Road #02-00
Tower Block, MND Complex
Singapore 069110
Website: *http://www.bca.gov.sg/*

Instructions:
(1) For building plans submitted
- before 1 July 1997, please tick [ ] SS CP 33:1985; or
- on or after 1 July 1997, please tick [✓] ~~SS~~ CP 33:1996.
(2) One copy is to be submitted
(3) * Delete accordingly.
(4) This form is to be filled in BLACK INK only.

This Certificate relates to the lightning protection system installed in the building(s) approved under:-

Project Ref. No.: RBP/N00673/08

*Lot/~~Plot~~ Proposed circle line(CCL) station and Proposed additions and Alterations to the existing North south line(Marine Bay

Address/Road: station)on lots 275N(PT)(SL) and 80000 Ts 30 at Marina

Building Name (if any): station Road Singapore.

Remarks: _____

I certify that -

(a) I have supervised the installation of the lightning protection system; and

(b) the design and installation of the lightning protection system are in accordance with -

[ ] the Code of Practice on Lightning Protection in Buildings - SS CP 33:1985; or

[✓] the Code of Practice on Lightning Protection in Buildings - SS CP 33:1996.

(c) [ ] The design and installation of the lightning protection system are based on alternative solution
Remarks on alternative solution provided:

Address of Professional Engineer	Name & Signature of Professional Engineer
10 Lakepoint Drive #04-5H Singapore 648927	PROFESSIONAL ENGINEER ELECTRICAL CHOONG KOK MING 2147 SINGAPORE
Tel No. 91099823.	Date: 18/3/2011

PE/B LICENCE NO 9/12894

BPD_CSC03
[Ver1_Feb_2008]

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Rev:291011

To: SMRT Trains Ltd's Licensed Electrical Worker

INDEMNITY
(To be completed in triplicate)

Electricity Supply: 22kVac & 750Vdc for C830A Circle Line Extension (CLE)
Bayfront (BFT) – ST402 and ST403
Marina Bay (MRB) – RT502, 750Vdc System and ST403
taking supply from SMRT Circle Line Extension (CLE)

LTA contract No: C830A

Drawing No: Please refer to attach drawing

Location: CLE C830A BFT & MRB Stations

In consideration of the above Works with the CCL MRT Electrical Installation,

I, **Er XX**, EMA Licence No: X/XX hereby indemnify **Er. Nicholas Neo Tiong Tian/ Er.Tay Poh Kuang,** CCL SMRT's Licensed Worker, in respect of any loss or damage whether arising under stature, common law or contract and against all actions, suits, claims, demands, cost, penalties and expenses arising from or in connection with the above Works.

I hereby further certify that:

i) The Electrical installation of my Works complies with the Electricity Act, the Electricity Regulations and the relevant Standard Codes of Practice in Singapore

ii) I am satisfied that the Electrical Installation of the above Works is fit for operation and shall submit all the relevant documents as and when required by EMA or LTA/SMRT.

iii) I shall submit a Making Alive Request Form to LTA before the turn-on of electricity supply for the Electrical Installation of my Works.

iv) I shall ensure that no work is carried out on the Electrical Installation of my Works unless a valid Permit-To-Work (PTW) has been issued by me, and shall comply with the PTW system of LTA/SMRT for any interfacing electrical works between my Works and LTA/SMRT.

Page 1 of 2

Rev:291011

v) I shall inspect and test the Electrical Installation of my Works at intervals recommended by the manufacturers until the handover of the Electrical Installation of my Works to LTA.

vi) I shall notify LTA/SMRT of any defect that is likely to compromise the safety or electrical integrity of the Electrical Installation of my Works and shall make good or remove the defect expeditiously.

vii) I shall submit an Incident Report immediately to LTA/SMRT for any accident causing or resulting in loss of life or hurt to person or seriously damage to property in connection to the Electrical Installation of my Works, and shall assist EMA, LTA/SMRT and other appointed and statutory agencies in the subsequent investigation.

viii) I shall submit an Incident Report immediately to LTA/SMRT for tripping causes by CLE power supply system to CCL power system.

ix) Under Para vii) and Para viii), and in co-operation with System Wide Contractor(S) who has (have) indemnified me, I shall endeavor to assist LTA/SMRT in such investigation.

Dated this _____

EMA LICENCE NO: X/XXX

Signature and Stamp

Licensed Electrical Worker

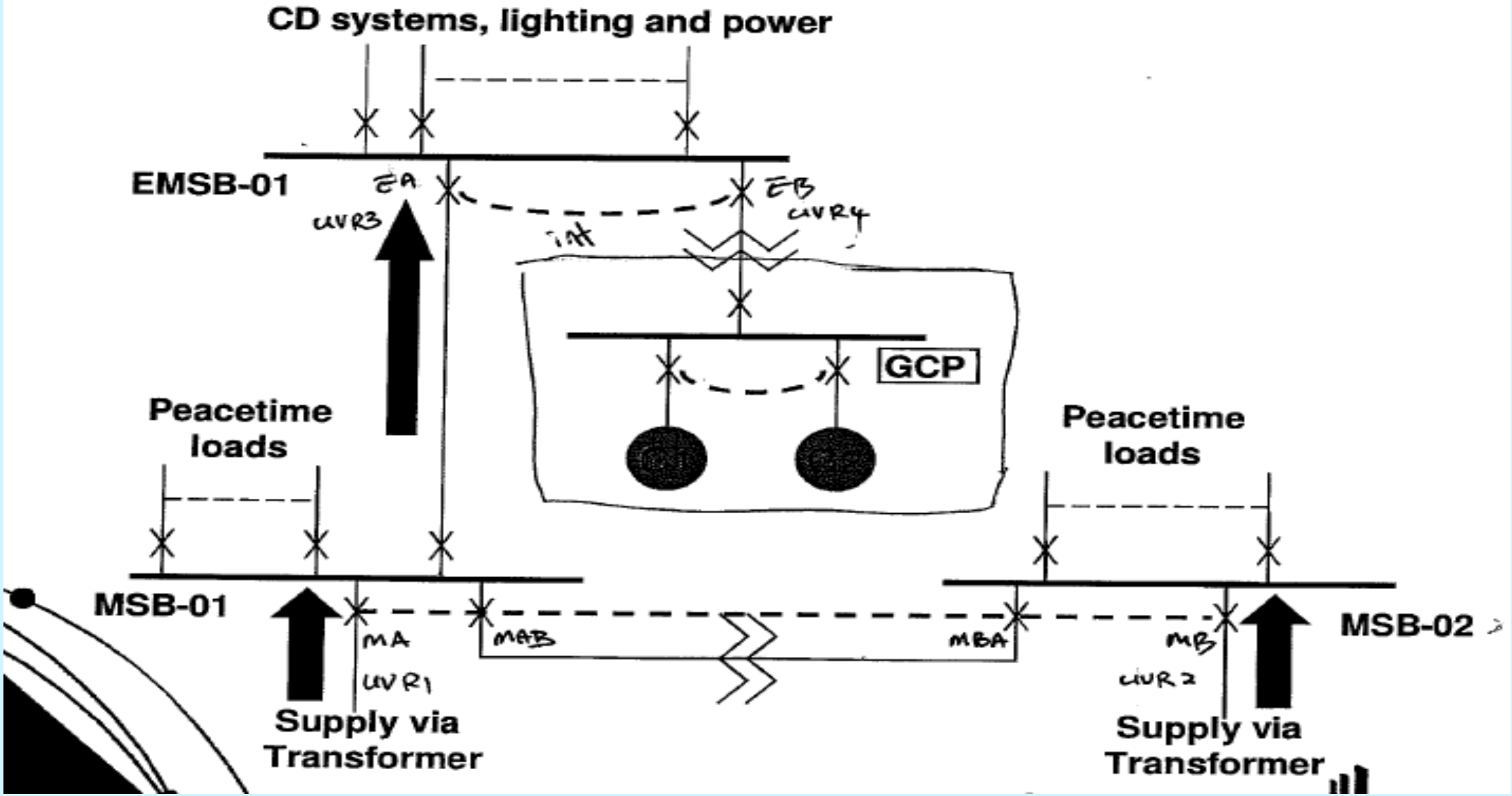
In the presence of

Signature: _____

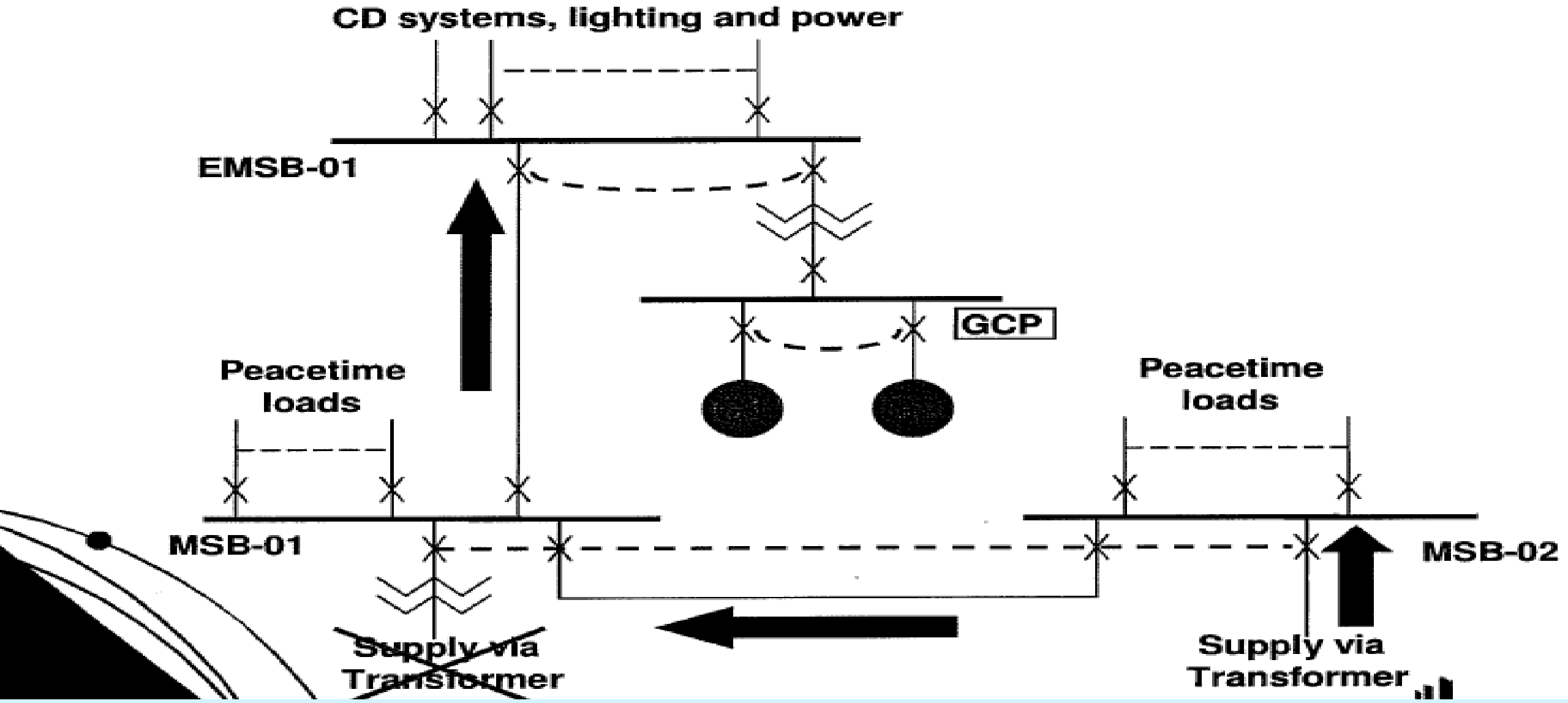
Name: _____ (LTA, Land Transport Authority)

Page 2 of 2

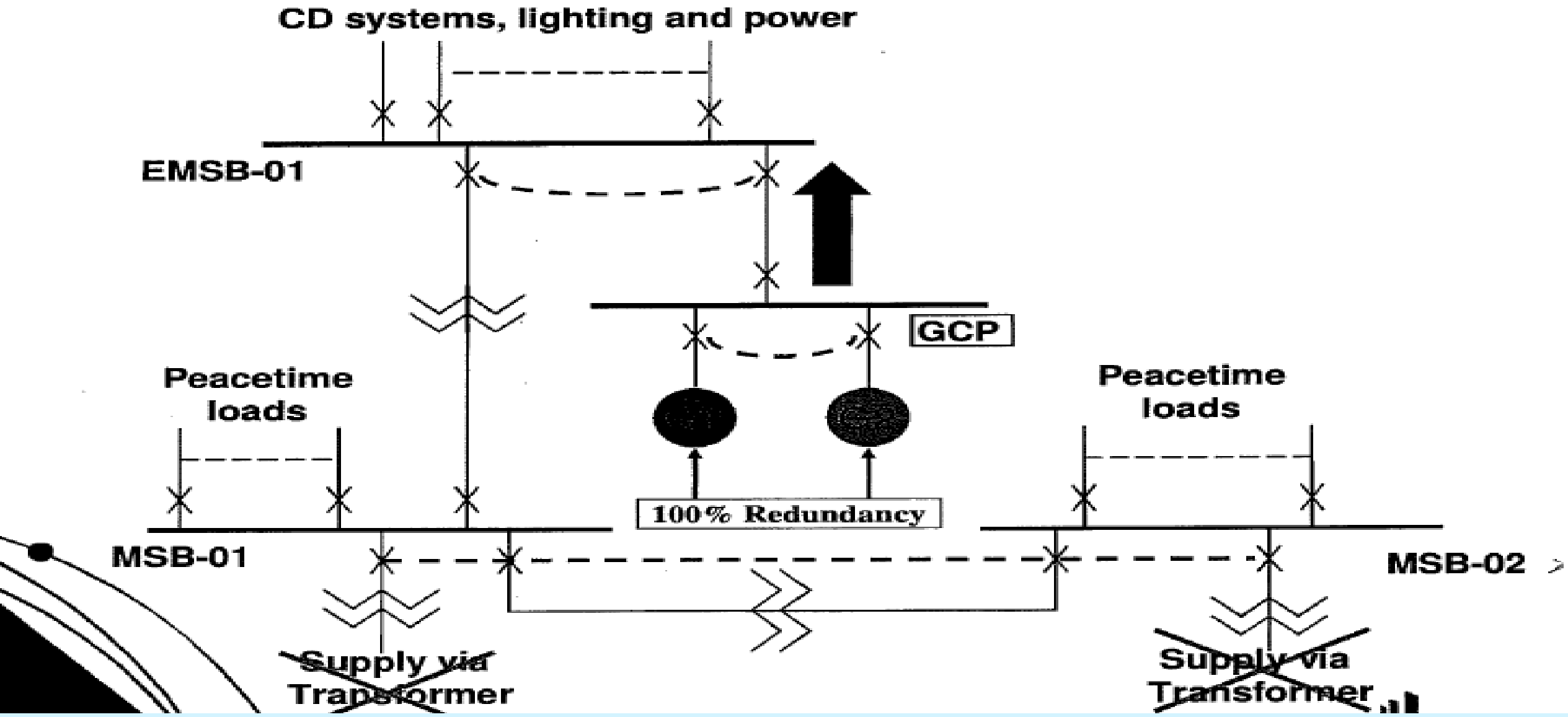
Electrical Distribution (Normal)



Electrical Distribution (TX1 Fault)

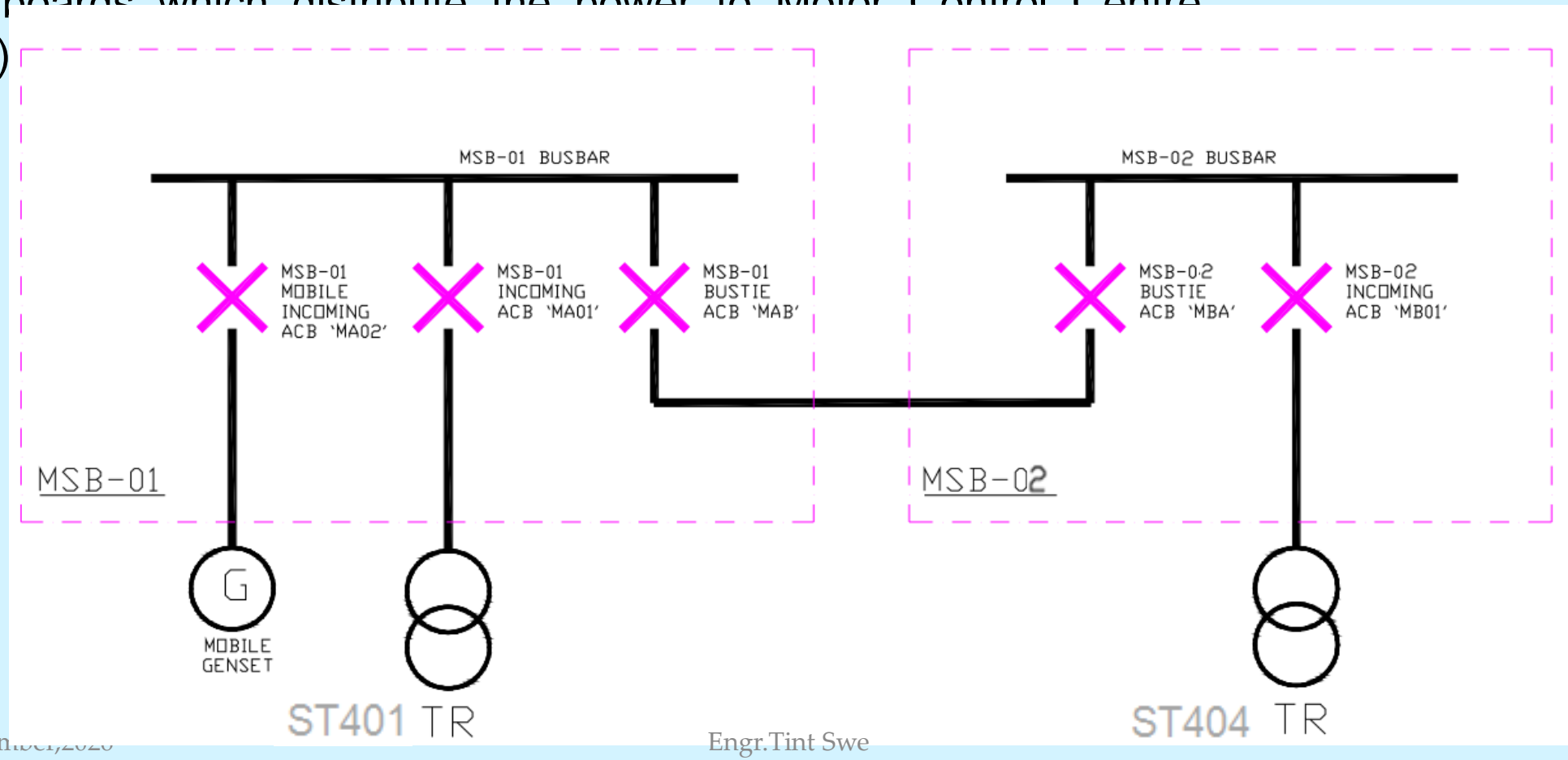


Electrical Distribution (Genset)



LV Switchboards and Associated sub systems including Public & Tunnel Lighting Control Panels and Itess

Main Switch Board also known as 'MSB-**' part of the low voltage switchboards which distribute the power to Motor Control Centre (MCC)



Mode Of Operation of Two MSBs

(A) Single Transformer Power Failure					
Scenarios	Transformer 1 - Breaker	Tie-breaker - NO	Tie-breaker - NC	Transformer 2 - Breaker	Remarks
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Transformer 1 - power outage	OPEN	CLOSE	CLOSE	CLOSE	Auto transfer takes place
Transformer 1 - power restore	2nd Step Manual CLOSING of breaker either under Remote (via ISCS) or Local position	1st Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	CLOSE	Operator shall restore/normalise the power after revenue hour to avoid a power interruption during the restoration process.
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Transformer 2 - power outage	CLOSE	CLOSE	CLOSE	OPEN	Auto transfer takes place
Transformer 2 - power restore	CLOSE	1st Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	2nd Step Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power after revenue hour to avoid a power interruption during the restoration process.

Both Transformers Power failure Concurrently

(b) Both Transformers Power Failure Concurrently

Scenarios	Transformer 1 - Breaker	Tie-breaker - NO	Tie-breaker - NC	Transformer 2 - Breaker	Remarks
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Both transformers failure at the same time	CLOSE	OPEN	CLOSE	CLOSE	Breaker status - remain
Both transformers power restore at the same time	CLOSE	OPEN	CLOSE	CLOSE	Full power restore as per normal state
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Both transformers failure at the same time	CLOSE	OPEN	CLOSE	CLOSE	Breaker status - remain
Transformer 1 - First to restore power	CLOSE	CLOSE	CLOSE	OPEN	Auto transfer takes place
Transformer 2 - Restore power at later time	CLOSE	1st Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	2nd Step Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power after revenue hour to avoid a power interruption during the restoration process.
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Both transformers failure at the same time	CLOSE	OPEN	CLOSE	CLOSE	Breaker status - remain
Transformer 2 - First to restore power	OPEN	CLOSE	CLOSE	CLOSE	Auto transfer takes place
Transformer 1 - Restore power at later time	2nd Step Manual CLOSING of breaker either under Remote (via ISCS) or Local position	1st Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	CLOSE	Operator shall restore/normalise the power after revenue hour to avoid a power interruption during the restoration process.

(C) Both Transformers Power Failure At Intervals					
Scenarios	Transformer 1 - Breaker	Tie-breaker - NO	Tie-breaker - NC	Transformer 2 - Breaker	Remarks
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Transformer 1 - power outage first	OPEN	CLOSE	CLOSE	CLOSE	Auto transfer takes place
Transformer 2 - power outage followed	OPEN	CLOSE	CLOSE	OPEN	Both tie-breakers close only
Both Transformer power restore at the same time	1st Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	2nd Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	3rd Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power manually. Note (*) - Step 1 & 3 are interchangeable depending on Operator's choice.
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Transformer 2 - power outage first	CLOSE	CLOSE	CLOSE	OPEN	Auto transfer takes place
Transformer 1 - power outage followed	OPEN	CLOSE	CLOSE	OPEN	Both tie-breakers close only
Both Transformer power restore at the same time	1st Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	2nd Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	3rd Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power manually. Note (*) - Step 1 & 3 are interchangeable depending on Operator's choice.
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Transformer 1 - power outage first	OPEN	CLOSE	CLOSE	CLOSE	Auto transfer takes place
Transformer 2 - power outage followed	OPEN	CLOSE	CLOSE	OPEN	Both tie-breakers close only
Transformer 1 - First to restore power	Manual CLOSING of breaker either under Remote (via ISCS) or Local position	CLOSE	CLOSE	OPEN	Operator shall restore/normalise the power manually.
Transformer 2 - Restore power later time	CLOSE	1st Step Manual OPENING of breaker either under Remote (via ISCS) or Local position	CLOSE	2nd Step Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power after revenue hour to avoid a power interruption during the restoration process.

(D) Remote Control ON/OFF test under PLC failure					
Scenarios	Transformer 1 - Breaker	Tie-breaker - NO	Tie-breaker - NC	Transformer 2 - Breaker	Remarks
Normal State	CLOSE	OPEN	CLOSE	CLOSE	
Both Incoming PLC failure	CLOSE	OPEN	CLOSE	CLOSE	All breaker status remain.
Under tripping conditions from healthy MSB to the faulty MSB	OPEN	OPEN	CLOSE	OPEN	No auto-changeover under tripping conditions from healthy MSB to the faulty MSB
Both Transformer power restore at the same time	1st Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	OPEN	CLOSE	2nd Step* Manual CLOSING of breaker either under Remote (via ISCS) or Local position	Operator shall restore/normalise the power manually. Note (*) - Step 1 & 2 are interchangeable depending on Operator's choice.

Motorized Molded Case Circuit Breaker (motorized MCCB)

Motorized MCCB is used as a feeder breaker on MSB panel which rated current ranges from 60A ~ 800A. Motor operators provide the possibility of opening and closing an MCCB on application of electrical control signals.



- **Over current Relay & Earth Fault Relay (OCR & EFR)**

  Over current and Earth Fault relay can be found at the incoming section and feeder of the MSB panels . It protects electrical equipments & networks against over-current and ground fault. It provides an over current protection ranges from instantaneous (time) to a maximum of <u>200%</u> of rated current.



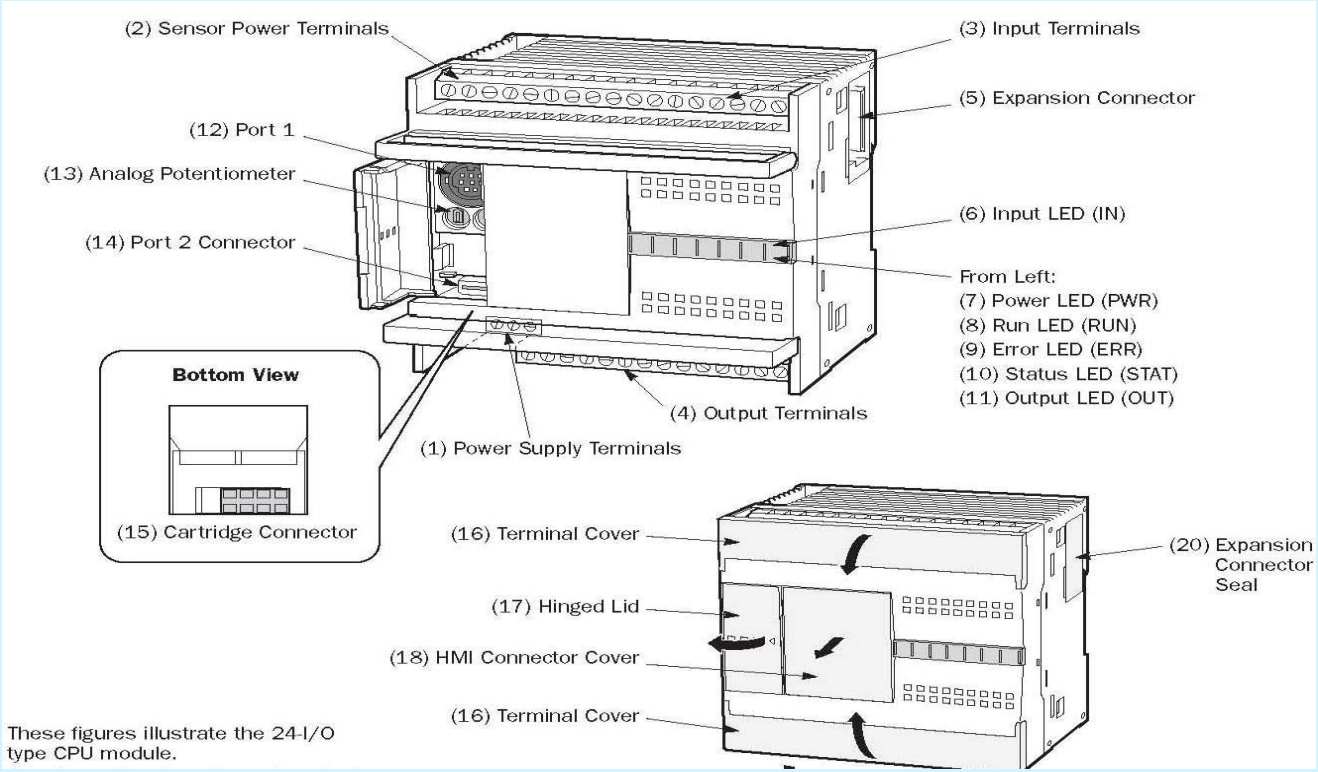
h Fault Relay (EFR)

h Fault Relay is installed at the incoming ion of SB panels and feeder at MSB els. It is a protection device against fault ent ranges from instantaneous to a imum of 40% of rated current.



PLC

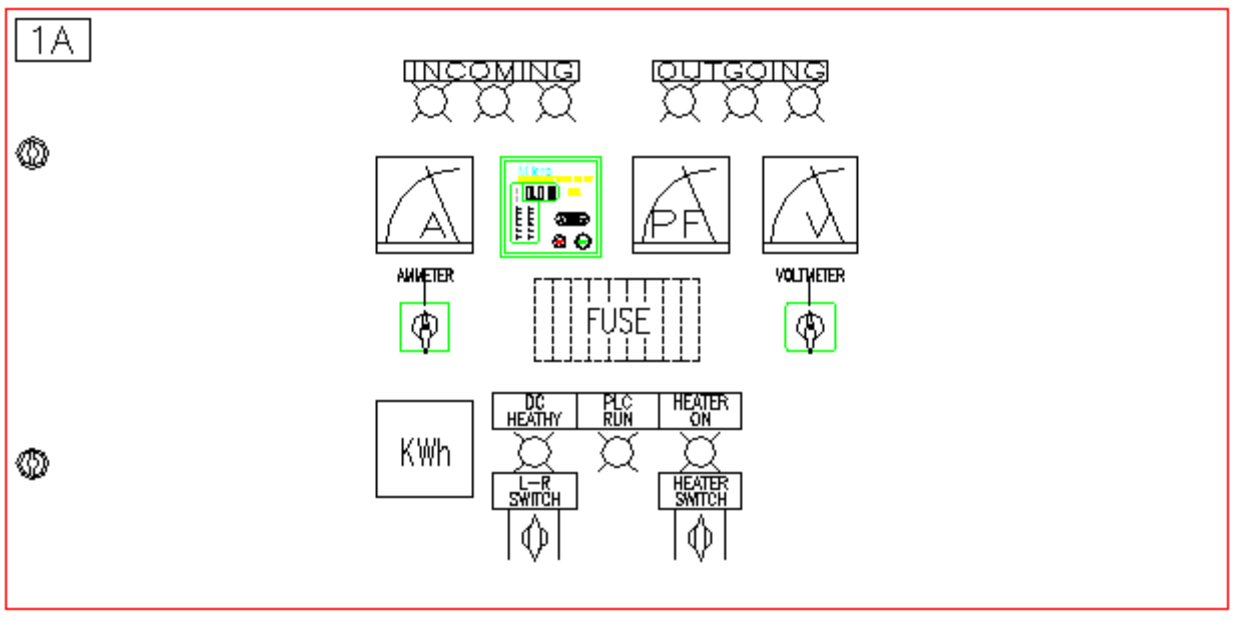
PLC is programmable logic control which has micro processor based. It enable to control all output via input signal as per logic programming. (PLC model : FC4A-C24R2C)

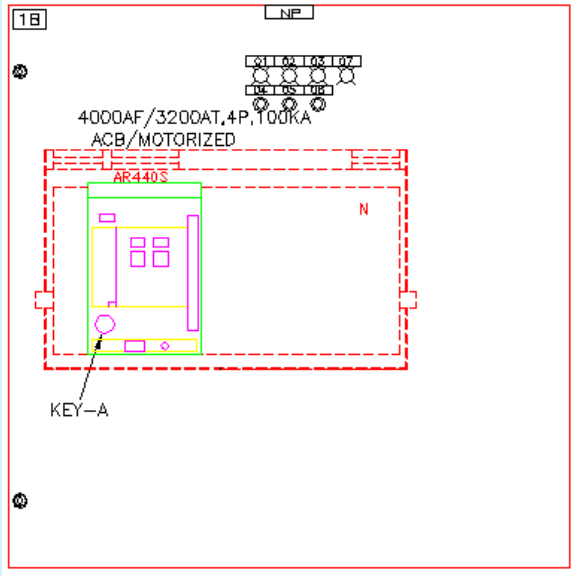


Opening Operation

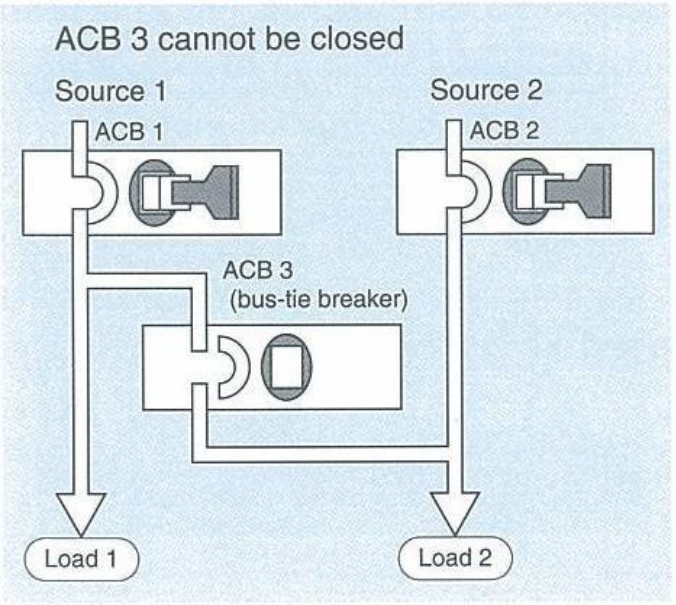
Electrical Operation with Remote/Local Selector Switch

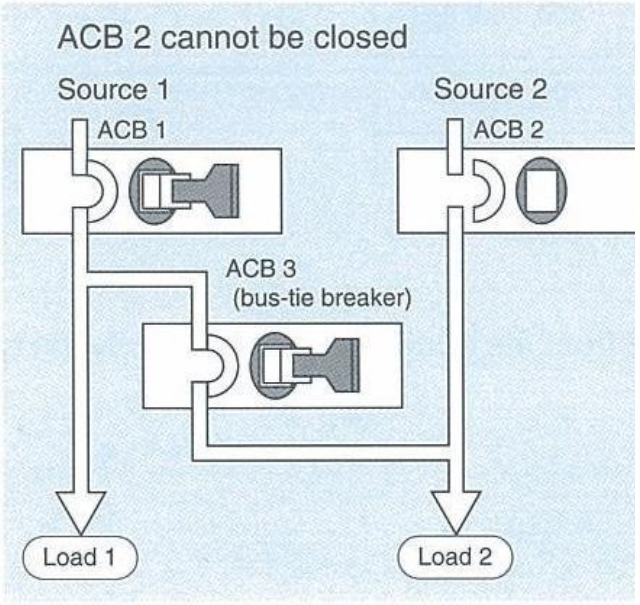
At Remote mode, ACB is automatically opened by means of PLC control. And at Local mode, ACB can open by pressing of pushbutton on the panel door.

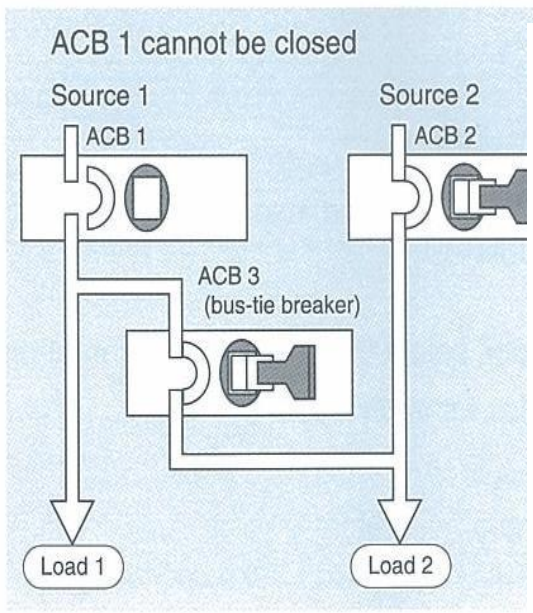


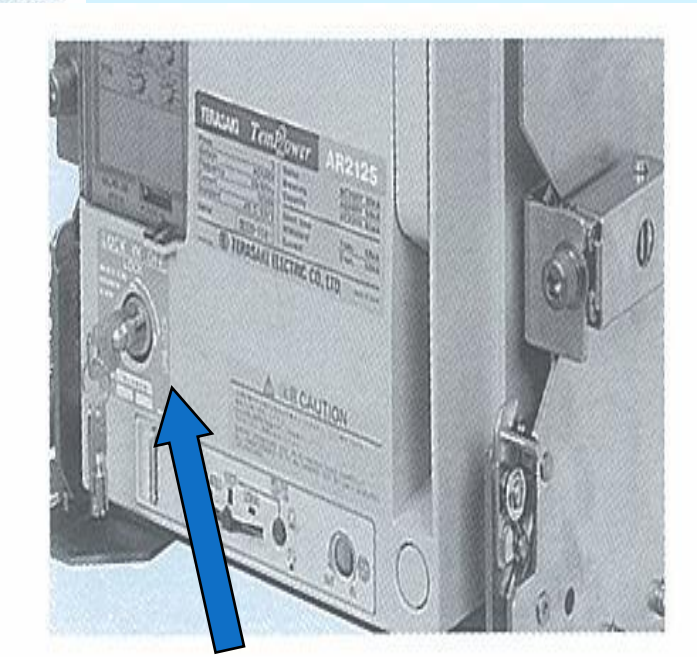


Castle Key-Mechanical Interlock for Safety









ACB Castel Key Interlocking Sequence

-For closing ACB, insert key and turn to release OFF button and it is possible to close.

-For locking ACB, pressing the OFF button, turn the key and remove key. OFF button is locked to its position and operation of ACB is not possible

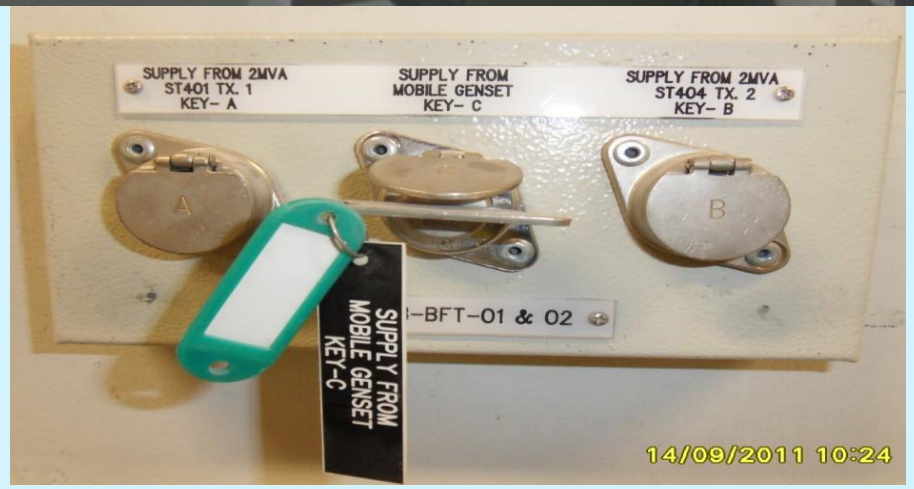
Interlock in MSB Room

ACB Castel Key Interlocking Sequence with Mobile Genset

- Remove Castel Key from ACB ‘MA01’ (Key marking A)
- Remove Castel Key from ACB ‘MB01’ (Key marking B)
- Insert Castel Key A & B into key exchange box to release Castel Key C for Mobile Genset Operation.

Note: Ensure that all Castel key having different key markings.





TYPICAL LV Switch Room







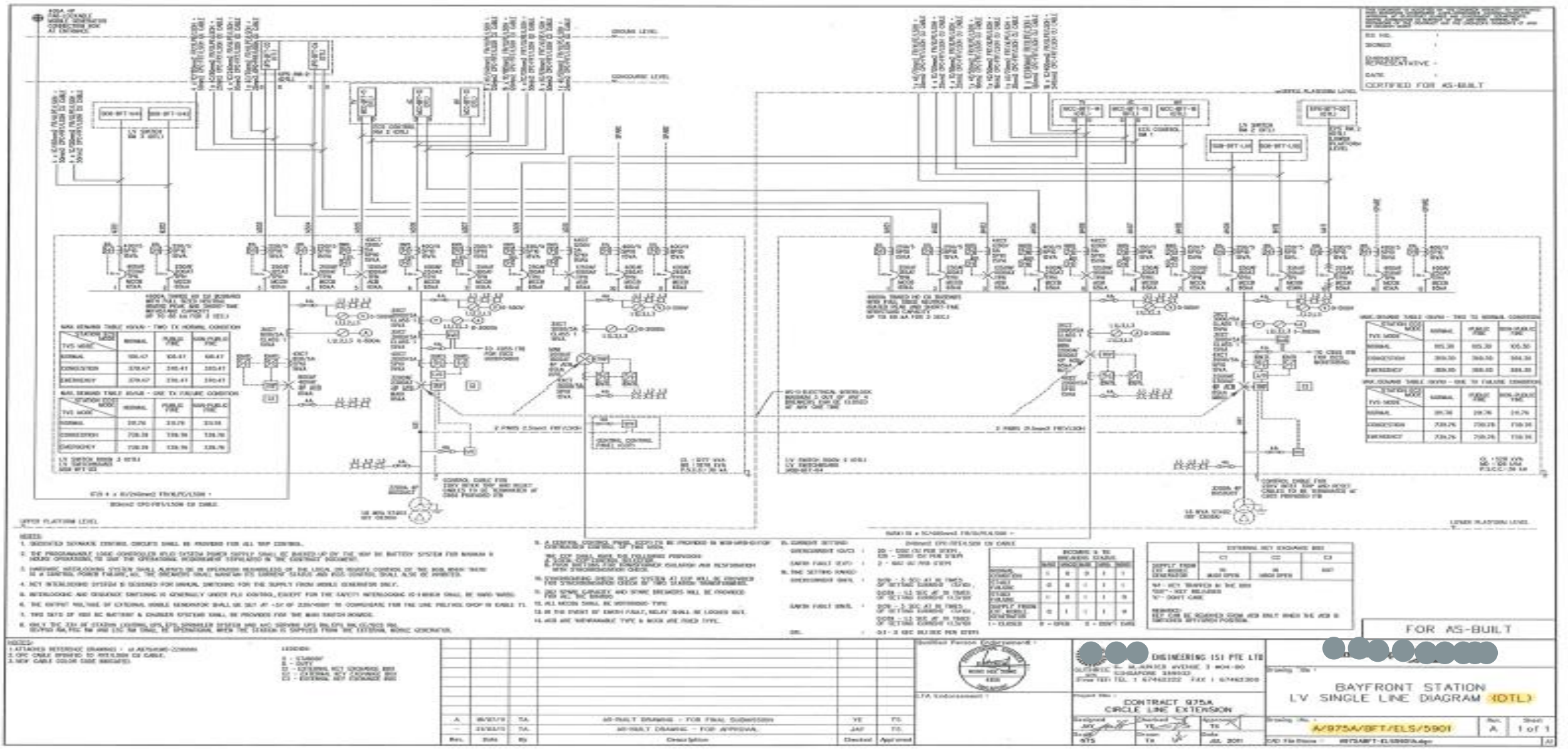




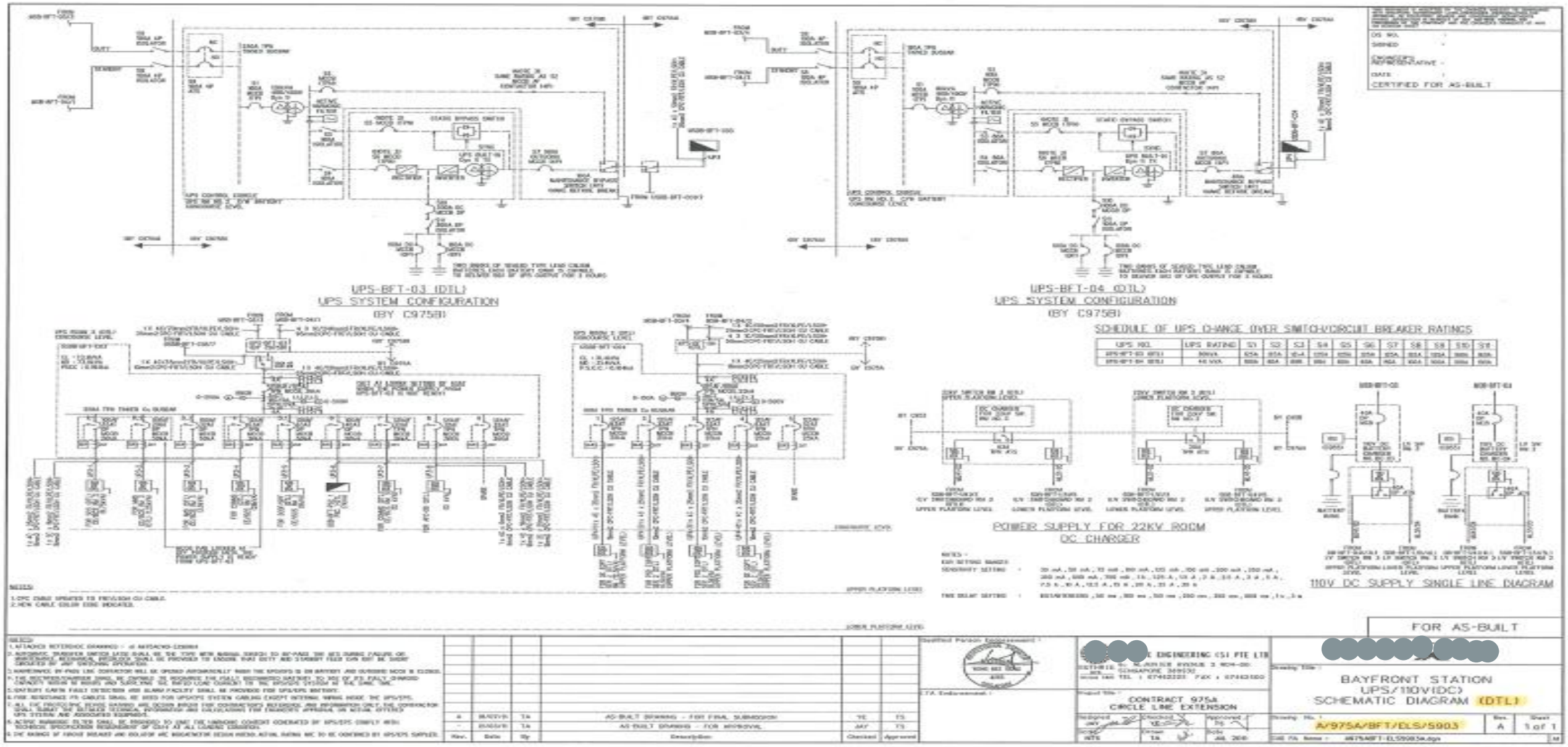
Generator Connection Box,1500A for Mobile Gen-Set for Non-CD Station



Main Switchboard Single line Diagram

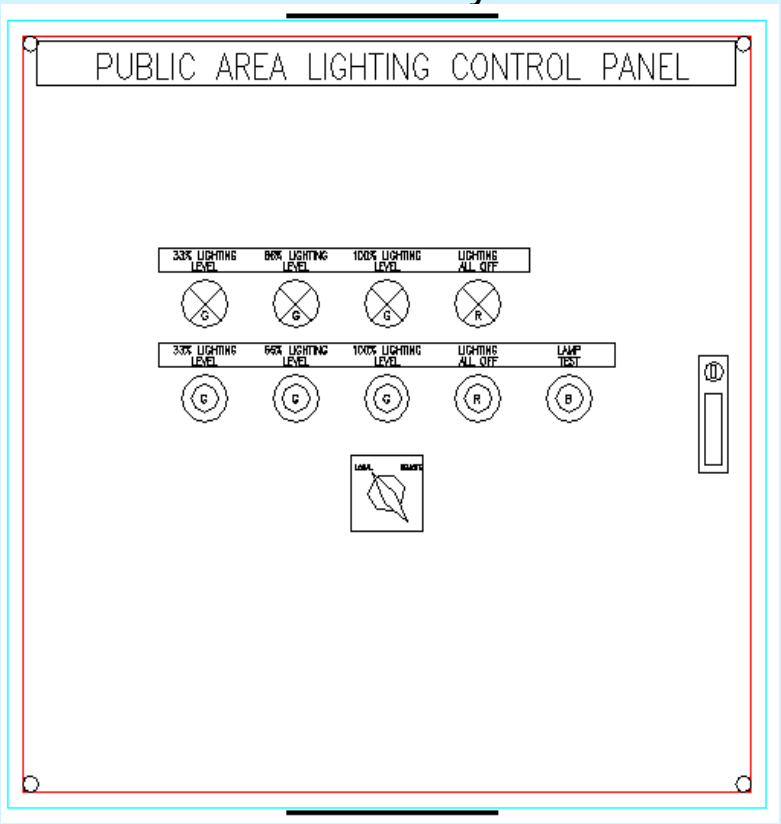


UPS and EPS Single Line Diagram



Public Lighting Control Panel

Lighting in public area of concourse and platform shall be controlled by ISCS at PSC via C830A's ITB in the DB rooms. The public lighting control panel is designed such that the lighting in these areas could be controlled through PLC to achieve 3 levels – 100%, 66%, 33% and also "lighting - all off" This involves receiving signal from C830A and converting this into group switching of lighting by PLC.



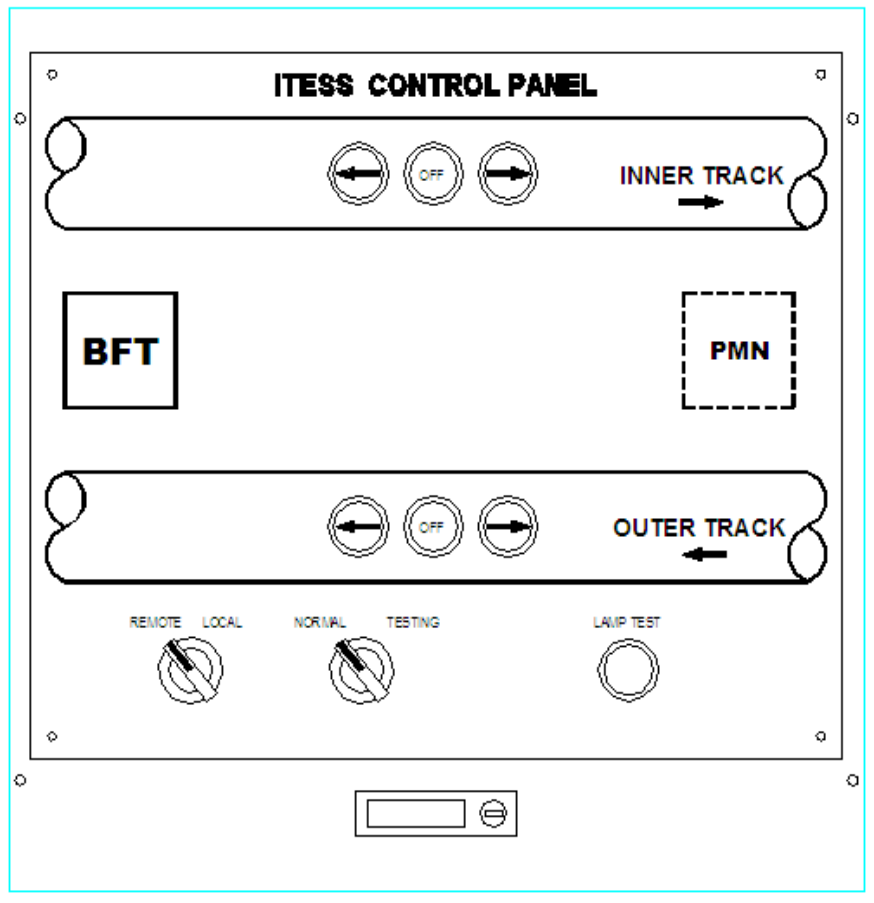
a. When public lighting is On by 'Manual', cannot off using remote control.

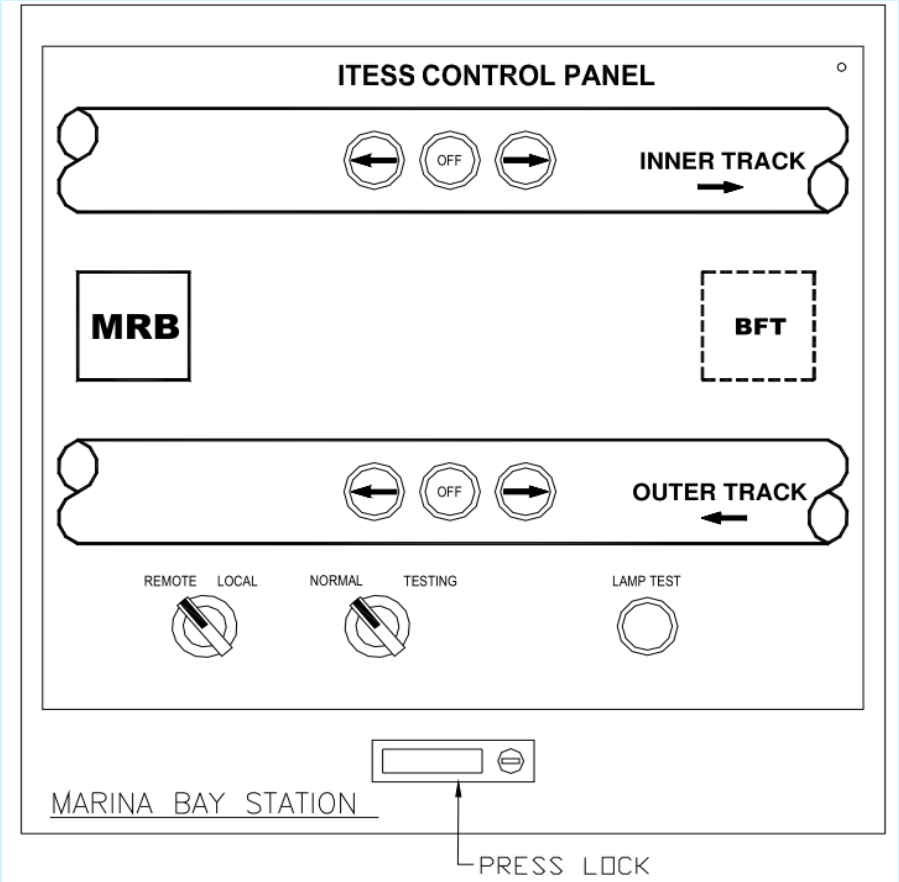
b. When public lighting is On by 'Remote', cannot off using manual.

c. When public lighting is On by "By-pass', cannot off using remote control.

Illuminated Tunnel Evacuation Signage System (ITESS),XPESS Control Panel

ITESS control panel is located in PSC room console top controlling the escape route signage with the tunnel in case of emergency.





TUNNEL Installations[cut&cover/Bored]

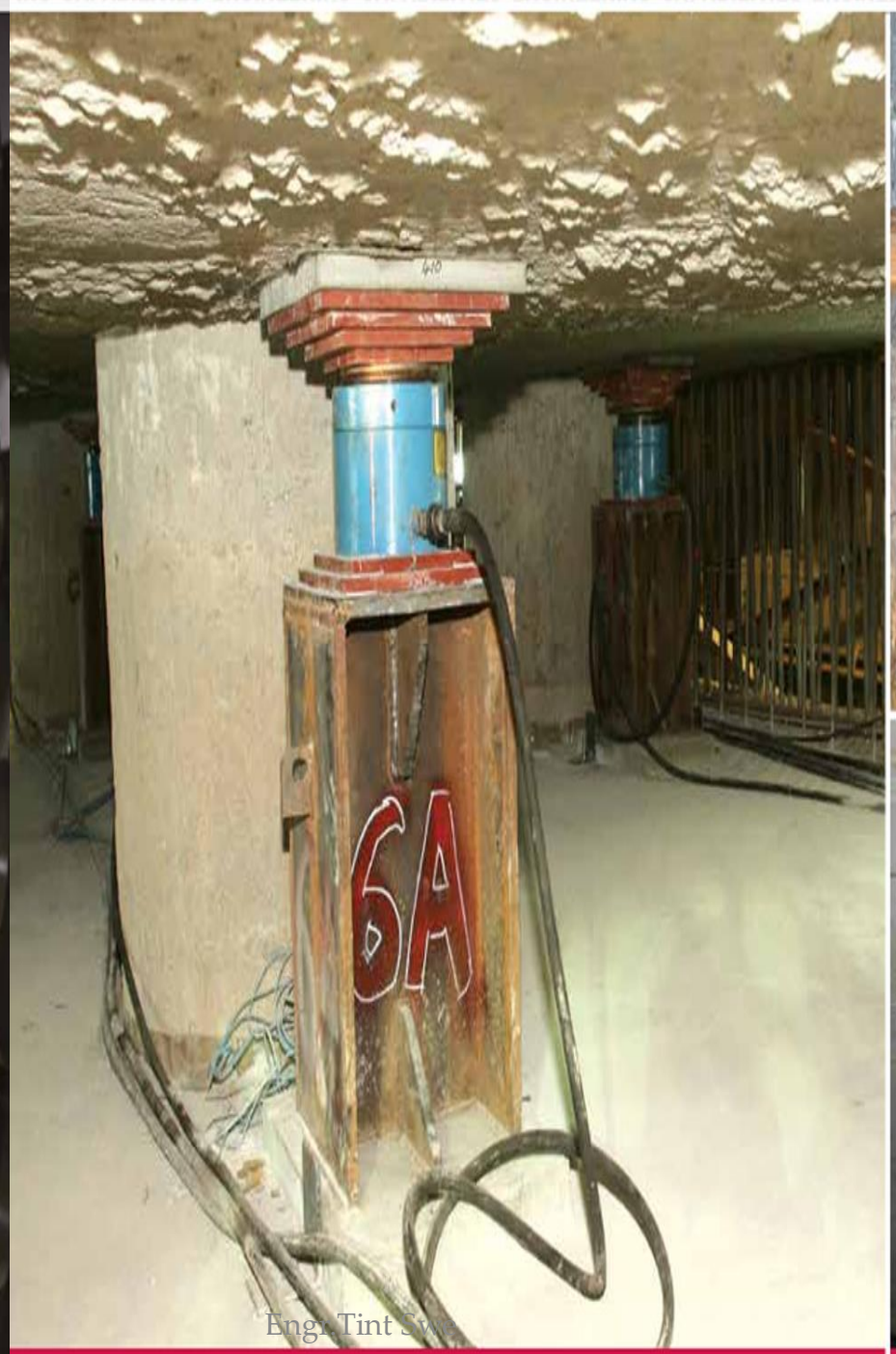






The Operation Control Centre in Kim Chuan Depot is the "brain" controlling the entire Circle Line system.





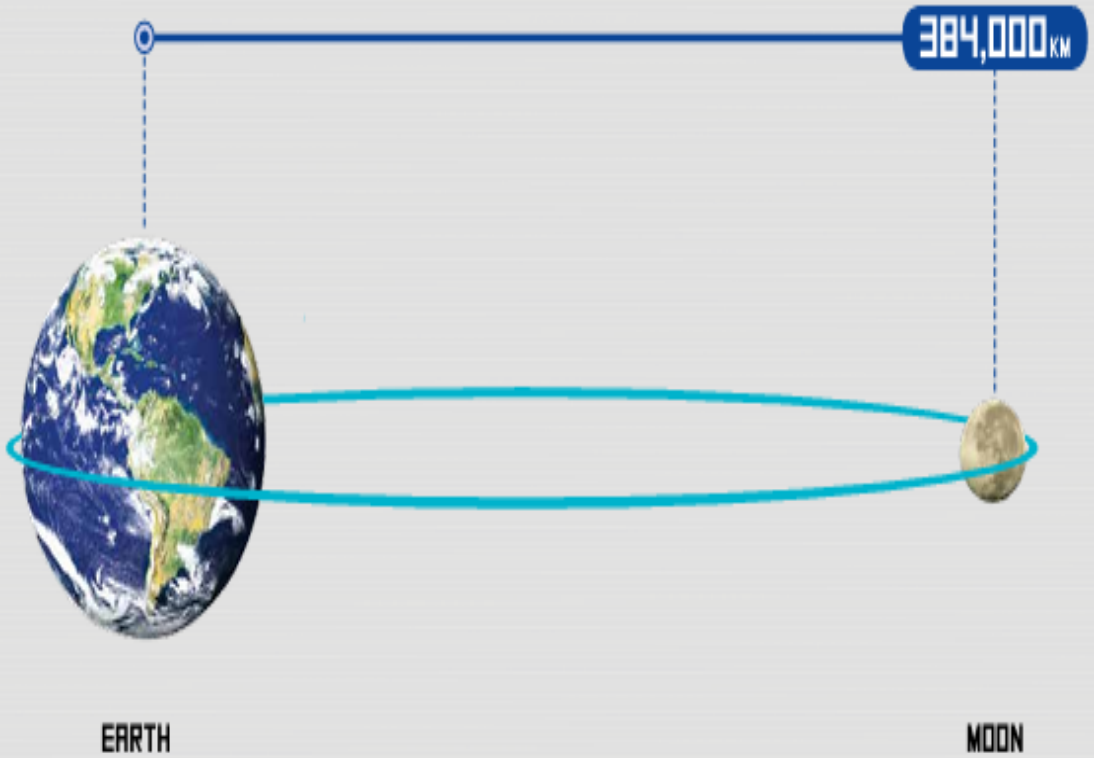
Preload Jacking at P115E





Wire Saw Used for Cutting Bored Piles

The designed lifespan of each DTL train, assuming a travel distance of 130,000 km per year **30 YEARS**



The distance covered by a DTL train in 30 years would be 10 times the distance between the earth and the moon.















The Automatic Storage and Retriev
System, located at Kim Chuan
Depot is the tallest underground
automated warehouse storage syst
in Singapore. The 23m-high system
is the central warehouse for the Cir
Line and can hold up to 24,000 tra
spare parts.

Thank you