

Myanma Railways
Ministry of Rail Transportation
The Republic of the Union of Myanmar

The Project for Installation of Operation Control Center System and Safety Equipment

Final Report

July 2014

JAPAN INTERNATIONAL COOPERATION AGENCY
Japan International Consultants for Transportation Co., Ltd.
Oriental Consultants Co., Ltd.

EI
CR(1)
14-107

The Project for Installation of Operation Control Center System and Safety Equipment

FINAL REPORT

List of Figures & Tables

Preface

Summary

TABLE OF CONTENTS

Page

Chapter 1	Background of the Project	1
1-1	Background of the Project	1
1-1-1	Current Situation and Issues	1
1-1-2	Development Plan	1
1-1-3	Social economic condition	2
1-2	Background, Circumstances and Overview of the Grant Aid Cooperation	3
1-3	Aid supported by Japan	3
1-4	Aid supported by Other Donor Countries	5
1-5	Implementation Organization of the Project	6
1-5-1	Organization and Personnel	6
1-5-2	Finance and Budget	8
1-5-3	Technical Level of MR	9
1-5-4	Existing Equipment	10
1-6	Current Circumstances around the Project	11
1-6-1	Current Circumstances of Infrastructure in Myanmar	11
1-6-2	Natural Conditions	12
1-6-3	Environmental and Social Considerations	14
Chapter 2	Contents of the project	22
2-1	Basic Concept of the Project	22
2-2	Outline Design of the Japanese Assistance	23
2-2-1	Design Policy	23
2-2-2	Basic Plan	29
2-2-3	Outline Design Drawing	76
2-2-4	Implementation Plan	212

2-3 Outline of Major Undertakings by the Government of Myanmar (GOM)	227
2-4 Plan of Operation and Maintenance	228

Chapter 3 Project Evaluation	231
3-1 Preconditions	231
3-2 Necessary Inputs by Recipient Country	231
3-3 Important Assumptions	231
3-4 Project Evaluation	232
3-4-1 Relevance	232
3-4-2 Effectiveness	233

Chapter 4 Conclusion and Challenges in the future	235
4-1 Conclusion	235
4-2 Challenges in the future	235

Appendices

- Appendix 1: Member List of the Study Team
- Appendix 2: Study Schedule
- Appendix 3: List of the Counterparts
- Appendix 4: Minutes of Discussions (M/D)
- Appendix 5: Soft Component Plan

List of abbreviations

Abbreviation	Official name
A/P	Authorization to Pay
ATP	Automatic Train Protection
B/A	Banking Arrangement
CITC	Central Institute Training Center
CTF	Cable Termination Frame
EOI	Expression of Interest
F/S	Feasibility Study
JICA	JAPAN INTERNATIONAL COOPERATION AGENCY
MR	Myanma Railways
OCC	Operation Control Center
OFC	Optical Fiber Cable
SSI	Solid State Interlocking
TFM	Track Function Module
TID	Traffic Information Display
TMS	Train Monitor System
TOR	Terms of Reference
UHF	Ultra High Frequency
YESB	Yangon City Electricity Supply Board

List of Figure

Figure number	Title
1-1	Organization Chart of MR (Operation & Administration Organization)
1-2	Maintenance Organization for Yangon Central and Pazundaung Stations
1-3	Maintenance organization for the section between Tongyi and Pyuntaza Stations in the Division 6
1-5	Climate Map
1-6	Annual Rainfall Map
2-1	Three components of the Grant Aid Project
2-2	Yangon central station
2-3	Track submergence (Westside)
2-4	Track submergence (Center)
2-5	One of the causes of the submergence
2-6	Inflow spot of the water
2-7	Pazundaung station
2-8	Around Yangon central station
2-9	Renewal plan at Yangon central station
2-10	Renewal plan at Pazundaung station
2-11	Total image of the interlocking renewal
2-12	Image of the new signal cabin room & signal equipment room
2-13	Route of Electric Power Line
2-14	Location of the level crossings between Toegyaungkalay and Ywathagyi
2-15	Summary of the traffic volume survey
2-16	The current handling rules for the level crossing
2-17	Device configuration and operational procedure for the automated level crossing
2-18	Power supply for the level crossing.
2-19	Connection with the generator
2-20	Control Diagram for Level Crossing
2-21	Outline Design of Kyan Sit Thar Level Crossing (1)
2-22	Outline Design of Kyan Sit Thar Level Crossing (2)
2-23	Existing Operation Control at Myanmar Railways
2-24	Implemented train diagram
2-25	Actual train diagram
2-26	The First Step of Operation Control Improvement

2-27	The Second Step of Operation Control Improvement
2-28	Image of Train operation indication panel
2-29	Auxiliary device of TMS
2-30	Workflow of the Train Timetable Scheduling System
2-31	Hardware configuration of the Train Timetable Scheduling System
2-32	Viewpoint of a two-minute diagram
2-33	Train monitoring system between configuration plan
2-34	Bago division OCC room equipment layout in Yangon central station
2-35	TMS introduction range and construction contents between Yangon to Pyuntaza station
2-36	The communication equipment system diagram for TMS
2-37	Outline of TMS Power Source
2-38	Surveillance Organization
2-39	Organization chart of Procurement supervision plan
2-40	Maintenance organization for Yangon Central Station and Pazundaung Station
2-41	Maintenance organization for the section between Tongyi Station and Pyuntaza Station
4-1	Kyang Sit Thar Level Crossing (A bicycle passes near a train after gate closing)
4-2	Yangon Central Station (Flood level reaches just below the platform level)

*Outline Design Drawing isn't included in the list.

List of Table

Table Number	Title
1-1	Actual results of technical and loan financial cooperation from Japan
1-2	Actual results of aid from other donor countries (signaling and communication)
1-3	Financial balance of MR
1-4	Current Circumstances of Infrastructure in Myanmar
1-5	Yangon Meteorological Data (Kaba-aye Observatory)
1-6	Scoping results of Environmental and Social Considerations
1-7	Terms of Reference for Environmental and Social Considerations
1-8	Results of Environmental and Social Considerations
1-9	Counterplan
2-1	Basic policy for design
2-2	Design Policy in consideration of natural environment and social economy
2-3	Construction Work Design Policy
2-4	Existing signalling system
2-5	Number of wayside equipment to be removed
2-6	Equipment plan for interlocking renewal
2-7	Traffic volume survey of the level crossings
2-8	Alarm time delay element
2-9	Necessary equipment for the automated level crossing
2-10	Necessary equipment for the generator
2-11	Types and purpose of use of train diagrams
2-12	List of interlocking devices between Yangon and Pyuntaza station
2-13	TMS Component Plan
2-14	Main equipment plan of the centralized train monitoring system (Telecommunication equipment)
2-15	Power Supply for TMS of Component Plan
2-16	Procurement supervision working month of the consultant
2-17	Implementation schedule for "Support for development of equipment inspection rules"
2-18	Implementation schedule for "Awareness education for level crossing users"
2-19	Implementation schedule for "Signal setting training for station staff and instruction for dispatchers"
2-20	Installation of Computer-Based Interlocking System at Yangon Central Station and Pazundaung Station

2-21	Installation of automated alarm device for Kyun Sit Thar Level crossing of Yangon-Mandalay Main Line
2-22	Installation of Centralized Train Monitoring System for the Yangon-Mandalay Main Line
2-23	Major undertakings by each Government
2-24	Maintenance items and cycles

PREFACE

Japan International Cooperation Agency(JICA) decided to conduct the preparatory survey and entrust the survey to Japan International Consultants for Transportation Co., Ltd. (consist of Oriental Consultants Co., Ltd).

The survey team held a series of discussions with the officials concerned of the Government of Republic of the Union of Myanmar, and conducted field investigations. As a result of further studies in Japan, the present report was finalized.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Republic of the Union of Myanmar for their close cooperation extended to the survey team.

July, 2014

Akira Nakamura
Director General,
Economic Infrastructure Department
Japan International Cooperation Agency

Summary

(1) Outline of the Union of Myanmar

The Union of Myanmar (hereinafter referred to as "Myanmar") is a nation with an area of approx. 677 km² and a population of approx. 50 million people. It is divided into climate divisions as shown in the map on the left side of the figure below. The map on the right side of the figure below shows the amount of precipitation in the nation.

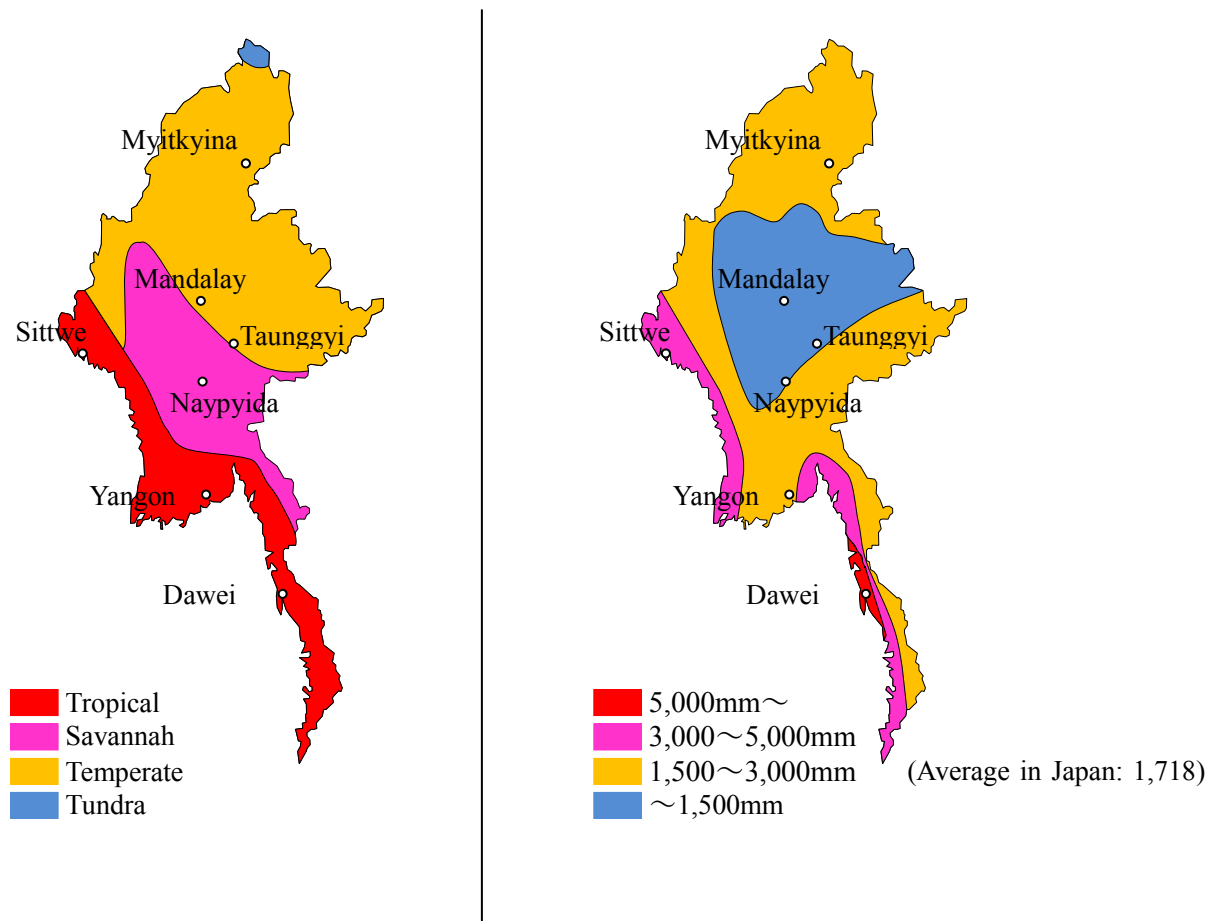


Figure 1: Climate conditions in Myanmar

The scope of this project includes the area around Yangon. In this area, even the premises of the stations are often submerged in the rainy season from May to October.

As for the economic conditions, IMF estimates that the nominal GDP of Myanmar is 53 billion dollars and the economic growth rate for FY 2012/2013 is 6.5%. The economic growth rate is expected to increase to 6.8% in 2014. The GDP per capita is 884 dollars, which is still in the lower level among the member states of the ASEAN. Under this situation, the Myanmar national government now aims to increase the annual GDP growth rate to 7.7% and the GDP per capita by 1.7 times in the 5-year plan from 2011 - 2015. However, there are many problems to tackle for

economic growth in Myanmar, such as the development of social infrastructure consisting of the supply of electric power, communication and transportation, development of legal framework to attract foreign investment, modernization of agriculture, and domestic job creation.

(2) Background, circumstances, and overview of this project

Myanmar Railways (MR) is considering the extension of the railway as the priority. In 29 small-sized stations which are not the junction stations, although renewal of the existing interlocking devices is conducted with onerous aid from India, China, Korea and other nations, the priority level for upgrading the existing facilities has been low.

However, the Ministry of Railway and Transportation placed the improvement and modernization of this main line as a new prioritized project in the Myanmar Development Cooperation Forum held in January 2013. The project specifically aims to decrease the travel time for passenger transportation between Yangon to Mandalay to 8 hours or less. According to the decision, the Myanmar national government requested us to conduct the F/S for the upgrade and modernization of this main line in February 2013. We completed the study in January 2014. Based on the results of the F/S, the Myanmar government requested Japan to grant a Yen loan for this modernization project in November 2013. Japan then promised to grant the loan in the summit meeting between Japan and Myanmar in December 2013.

As part of the actions for the project, work for the basic and detailed designs on the Phase 1 section (a 270 km section between Yangon and Taungoo) was started in July 2014.

In this project, the interlocking devices in Yangon Central Station and Pazundaung Station, in which the Yangon - Mandalay main line crosses with the other line, will be replaced to decrease the travel time in the main line. Furthermore, this project aims to improve safety and facilitate the operation of MR by introducing new automatic warning devices at level crossings and upgrading the signaling and communication facilities.

(3) Overview of the study result and project details

The figure below shows the overview of Myanmar, where this project is conducted, and the locations of the sites related to the project.

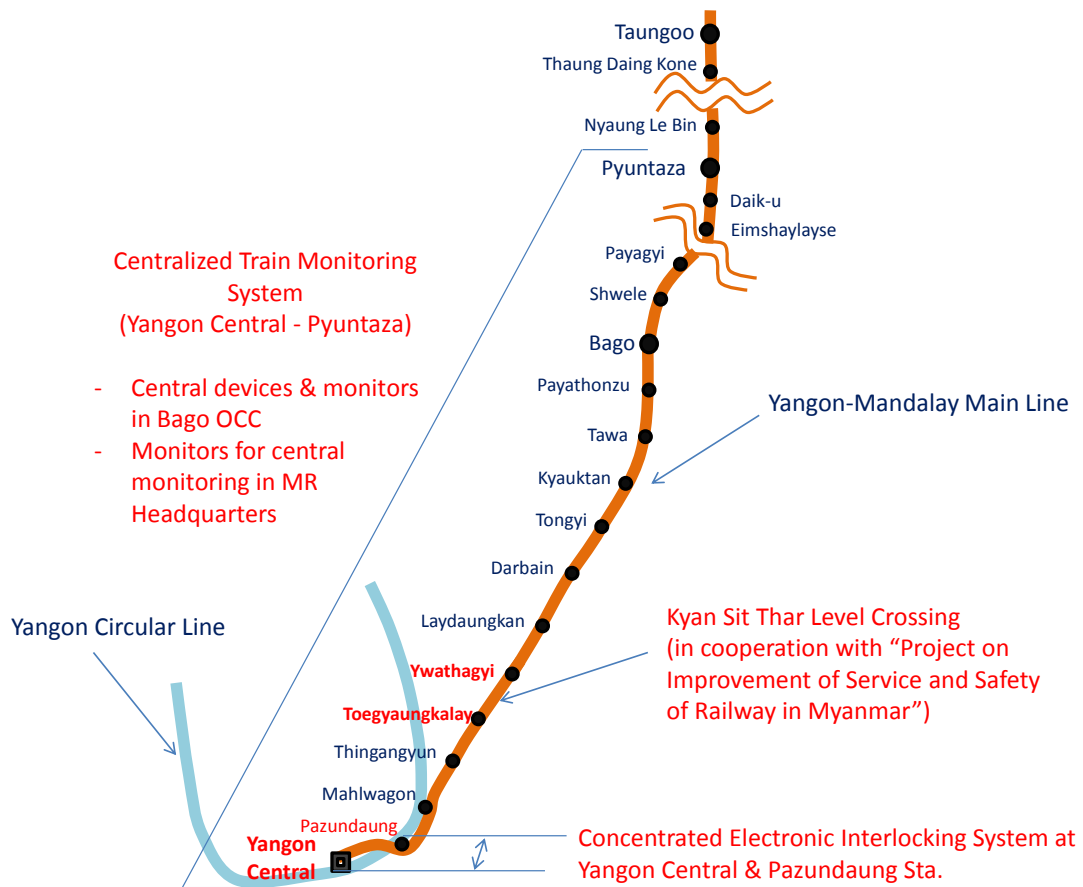


Figure 2: Overview of Myanmar and project site location

In this study, we proposed the necessary and appropriate components for capital investment that will be beneficial as a gratuitous financial cooperation project prior to the modernization project for the Yangon - Mandalay main line, with the purpose of contributing to the improvement of safety and transportation service of MR. Based on the results of the study by the Japanese government, discussion with MR and field study, we proposed the following three components as the specific scopes of the study:

- Upgrading to electronic interlocking devices (centralized control over Yangon Central and Pa Zun Daung Stations);
- Introduction of automatic warning devices in the Kyansittha level crossing located between Toe Gyaung Kalay and Ywar Thagyi Stations; and
- New introduction of central train monitoring devices in the Bago Division OCC (for the section between Yangon and Pyuntasa).

We visited Myanmar 4 times for field studies and reported to the Myanmar government in October to November 2013 (approx. 25 days), January to February 2014 (approx. 15 days), February to March 2014 (approx. 10 days), and June 2014 (approx. 5 days).

The following shows the design concept for the facilities that will be introduced in this project:

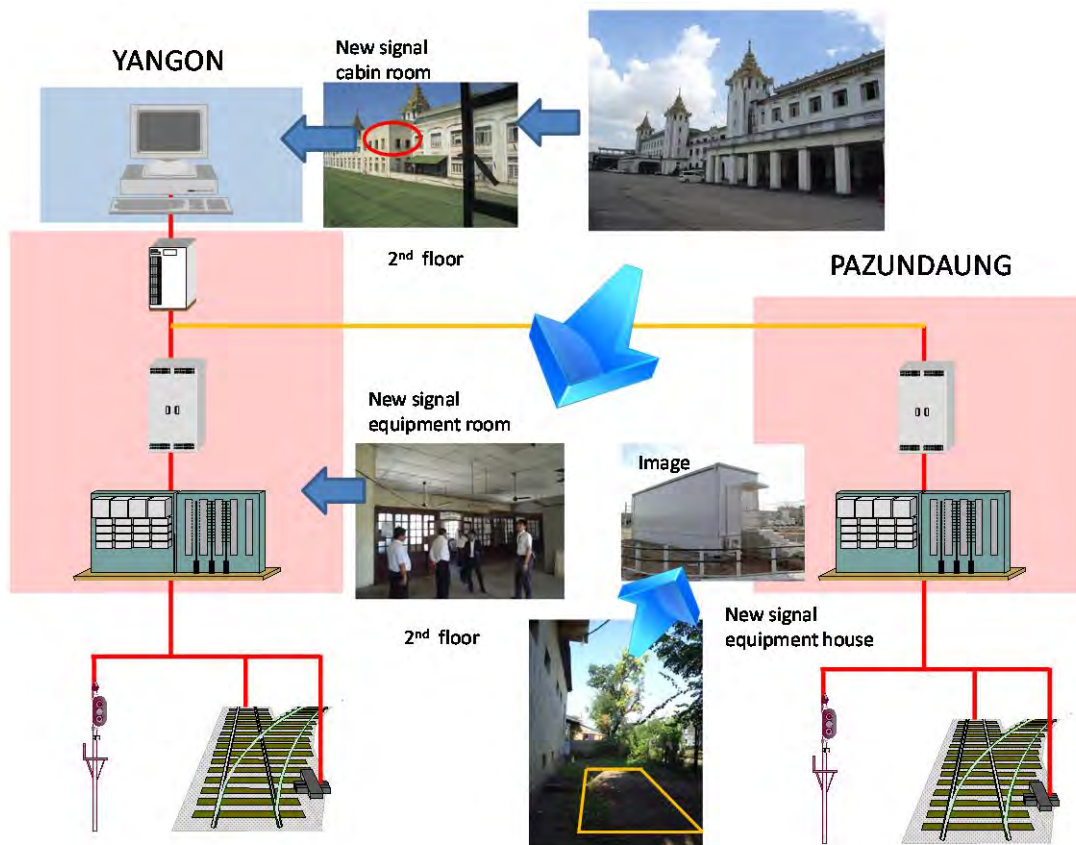


Figure 3: Concept of upgrading to electronic interlocking devices

Result of field study (Kyan Sit Thar level crossing)

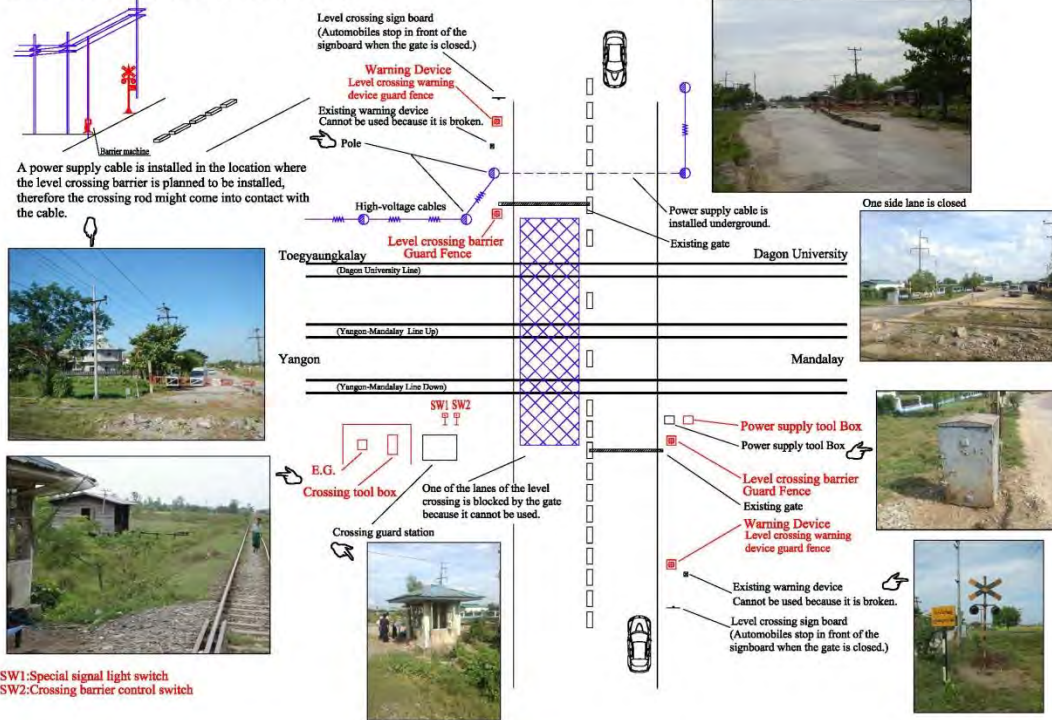


Figure 4: (2) Overview of automatic warning device for level crossing

<TMS install plan of existing Relay interlocking station>

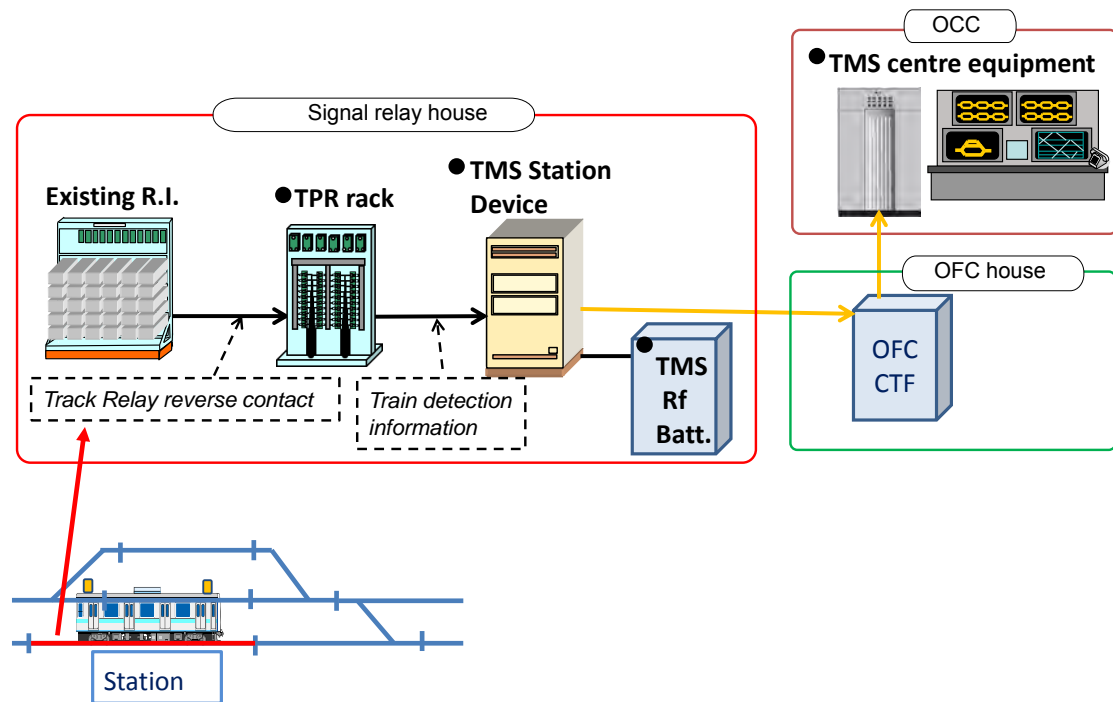


Figure 5: (3) Overview of centralized train monitoring device

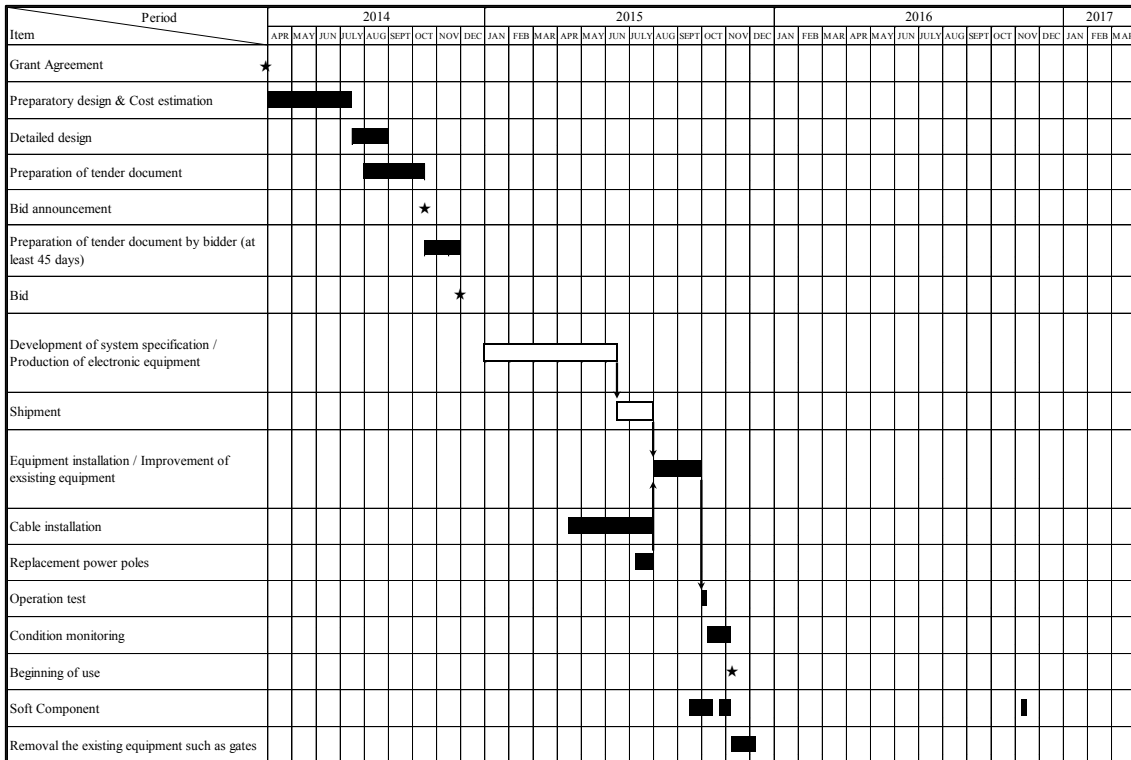


Figure 7: Term of works for introduction of automatic warning device for level crossing

Figure 8 shows the term of works for the introduction of the centralized train monitoring device.

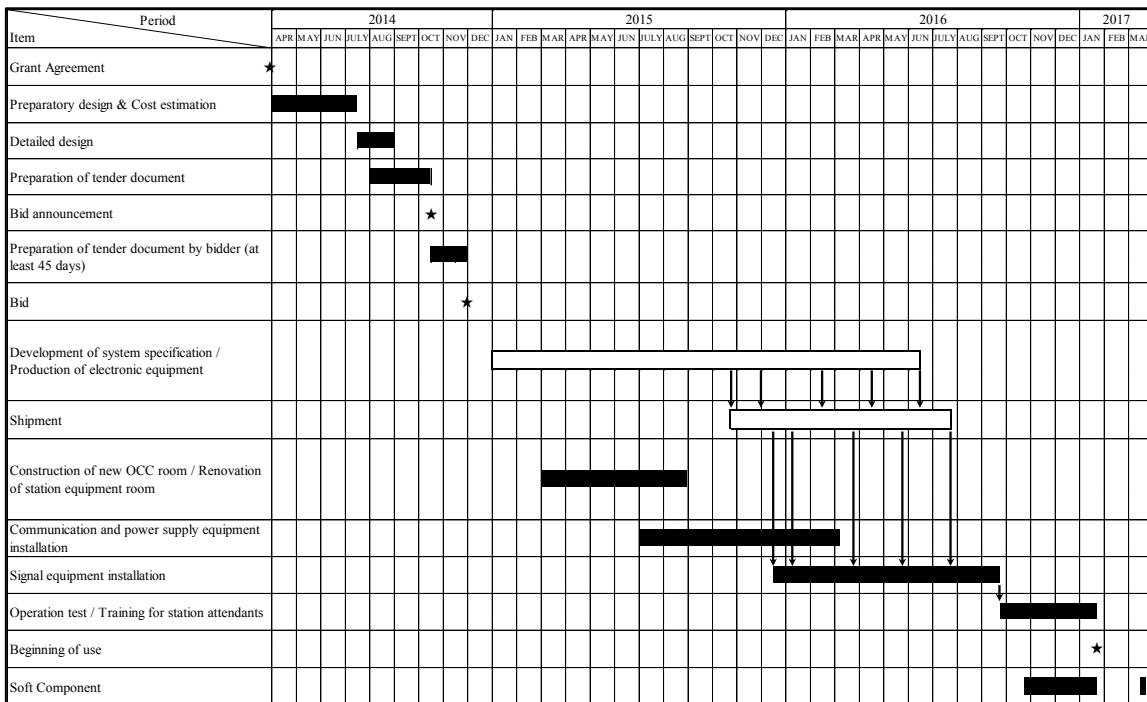


Figure 8: Term of works for introduction of centralized train monitoring device

(5) Evaluation of the project

First, we will discuss the validity and effectiveness of this project, and then indicate the evaluation of this project as a gratuitous financial cooperation project.

(a) Validity of the project

(1) Beneficiary of the project

We consider the following as beneficiaries of this project:

(1) The socioeconomic benefits will be brought all over Myanmar by the efficiency improvement of transportation service of the Yangon - Mandalay main line and Yangon Loop Line, and by the sophistication of train operation management for increasing transport capacity in the future.

(2) The reformation of the Kyansittha level crossing will improve the living environment for the people in the area by promoting the safety of not only the railway users, but also of the inhabitants along the line and road users.

(2) Necessity and urgency of the project

In the hearing of MR and the field study, it is revealed that there are problems related to inefficiency in MR's operation management, risk of equipment failure, and inappropriate behavior of passersby.

① In Yangon Central Station, the interlocking devices are submerged about 20 times a year. When the interlocking devices do not work due to submergence, the route is controlled by flag signaling and the manually operated handle. The submergence occurs because Yangon Central Station is located on depressed ground, therefore it is difficult to take drastic countermeasures.

② At the Kyansittha level crossing, although the level crossing guard gives instructions to the road users by flag signaling, bicycles and pedestrians enter the level crossing even while the gate is closed. The situation is also similar at the other level crossing near the Kyansittha level crossing.

③ Train location is determined and managed based on reports via radio communication only when an accident and/or operation disorder occurs. Track circuits are installed in limited sections and operation is controlled based on notifications sent by the stationmaster when the train departs from or arrives at the station.

(b) Effectiveness of the project

The following shows the quantitative evaluation of the project.

Table 1: Quantitative evaluation

Indicator name	Reference value (2013)	Targeted value (2016) [3 years after the project is completed]
(1) Real-time determination of train location	0%	100%
(2) Reduction of level crossing block periods	86 - 96 seconds	70 seconds

We expect the following four points as qualitative effects:

- (1) Enables management of operation even in the case of a future increase in the number of trains and speed limit.
- (2) Minimizes the occurrence of operation disorder risks by waterproofing measures to minimize the risk of failure, introduction of digital and redundant equipment to guarantee the continuous operation in the case of failure, and introduction of self-diagnosis functions to reduce the time required for detection and failure recovery.
- (3) Improves the safety of the road users, passengers, and train crew by installing a highly visible warning device.
- (4) Guarantees safe traffic through the level crossing even when the speed limit is increased in the future.

The economic cooperation policy of Japan for Myanmar (April 2012) defined the "support for development of infrastructure and organization required for sustainable economic growth" as an important area of cooperation. Furthermore, "Preparatory Study on Development Program for Yangon Urban Area (Urban Transportation)", a Japanese supporting program started in December 2012, adopts the modernization of the Yangon Loop Line as a priority project. In addition to the validity and effectiveness of this project mentioned above, this project is considered to meet these policies.

It is expected that this project will contribute toward improvement of the traffic efficiency of MR's railway operation, which the Myanmar government anticipates will bring socioeconomic

benefit to Myanmar. Furthermore, it is confirmed that the project complies with Japanese policies on support for Myanmar in consultation with the relevant authorities.

Field photograph and Completion prospective figure

(1) Field photograph



Pic-1: Yangon central station main building. The station has 174 routes. The interlocking manufactured by Westinghouse in uses since 1950.



Pic-2: Building of the current signal cabin. The highest floor is signal cabin, and 1 lower floor is signal equipment room.



Pic-3: Signal cabin of the Yangon central station. A couse-constituting is operated with levers.



Pic-4: Indicator panel in the signal cabin. The panel informs train on-rail in the station track. Pazundaung station is out of the range.



Pic-5: Signal equipment room. Relays and cables are used since 1950.



Pic-6: Facilities of the east side of Yangon central station. A track which people can enter freely.



Pic-7: Equipment of interlocking(Great Britain). It has been used since 1950, while repairing it.



Pic-8: Parts of Equipment of interlocking. Spare is nothing. It has been used since 1950, while repairing it. The state is not good.



Pic-9: Yangon central station has color lightning signals(LED).



Pic-10: Wayside signal box. In the box, there are relays for train detection. The state is not good by influence of flood.



Pic-11: In South-East side of Yangon central station, domestic wastewater is directed to the station and submerges signals.



Pic-12: In South-East side of Yangon central station of signal boxes. Garbage and wastewater are seen. Installation environment is very bad.



Pic-13: We look new signal cabin from existing signal cabin. There are 3rd floor in the main building.



Pic-14: Planned room. New signal cabin, OCC and signal equipment room are made.



Pic-15: The Pazundaung station yard 1.6km away from Yangon central Station. The loop line and the main line are grade crossing.



Pic-16: Indicator panel in the signal cabin of Pazundaung Station. It has been used since 1970. The station has 18 routes.



Pic-17: The appearance of Pazundaung station main building. Upper floor is signal cabin, and lower floor is signal equipment room.



Pic-18: State in the signal equipment room. A difference from Yangon central station is that there is middle track relay.



Pic-19: Equipment of interlocking(Germany). It has been used since 1970. At Pazundaung station, there is not the submergence.



Pic-20: Parts of Equipment of interlocking . It is connected by different method unlike Japanese general specifications.



Pic-21: German style signal(LED). The signal which is united with a course indicator.



Pic-22: Unlike Yangon central station, there is only the connection box in near the track. This is a horizontal connection box



Pic-23: Vertical connection box. Cable is buried directly and only end leaves from the ground.



Pic-24: Planned site of new signal equipment room. Plan to build 50 square meters of one-storied houses in the vacant land next to the existing building



Pic-25: In Yangon central station, the existing supply of electric power track is seen in the depths. A power supply is supplied from YESB power room.



Pic-26 An existing spare power supply is on the east side first floor of Yangon central station main building.



Pic-27: A low voltage electrical power cable at Pazundaung Station from the north side of Yangon central station will be buried.



Pic-28: Communication equipment in Yangon central station signal cabin. Cable laying is necessary for the new signal cabin to transfer facilities.



Pic-29: In Yangon central station communication equipment room. Cables are laid from here to the new signal cabin.



Pic-30 We look new signal cabin from existing signal cabin. A cable route is the same.



Pic-31: Although Kyan sit Thar level crossings are two lanes, collapsed one side is blocked now.



Pic-32: The schedule to which maintenance of ballast is also performed simultaneously with formation of an automatic alarm.



Pic-33: Although the way is very heavy traffic, it is used also as a school zone.



Pic-34: Although a gatekeeper receives a train whistle and has sent the interception signal, people are frequently crossing.



Pic-35: In the applicable section, since there is no signal, a gatekeeper receives train approach by a train whistle.



Pic-36: power lines are near the installation schedule of the barrier. There is possibility of contact of power line and the barrier.



Pic-37: Installation schedule place of automated level crossing control device and diesel generator. A retaining wall is needed.



Pic-38: There is a subterranean electric wire of 600v near Kyang Sit Thar level crossing. And the power receiving box has a terminal.



Pic-39 TMS station device is installed in signal equipment room of each station. Information is obtained also from existing equipment in part (Panugdawthi station)



Pic-40: Installation construction of SSI currently performed at the station in which TMS station device is installed (Laydaungkan station)



Pic-41: At Pyuntaza station, a spare room is remodeled to signal equipment room and TMS station device is installed.



Pic-42: Desk of Bago OCC. The check of train position is performed by only the telephone. Therefore, time is taken and it is not exact.



Pic-43: Central OCC in Naypyitaw station. The check of train position is performed by only the telephone. Therefore, time is taken and it is not exact, too.



Pic-44: TMS central device and station device are connected with the optical cable. The network is built through the rack.



Pic-45: End of terminal rack of optical cable. Optical cables from all TMS devices gather for the rack.



Pic-46: Since there is no rack in Eimshaylayse station, connection with existing optical cable is required.



Pic-47: TMS station device has a diesel generator for standby power supply. (Phingbongyi station)

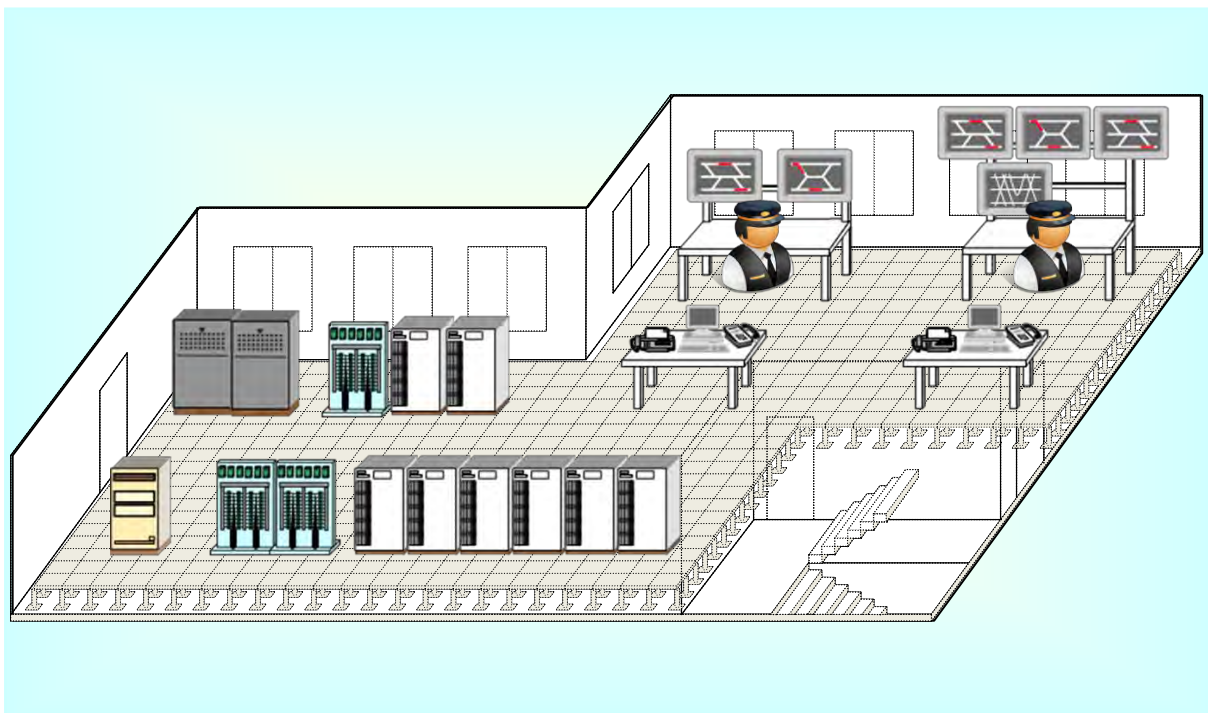


Pic-48: The solar power is installed at the station without city electric power. (Tawa station)

(2) Completion prospective figure



Installation of the automated level crossing alarm facilities between Toegyaungkalay and Ywathagyi completion prospective figure



Completion prospective figure of electric interlocking system and Train Monitoring System for Yangon-Pyuntaza section (Yangon central station)

Chapter 1 Background of the Project

1-1 Current Situation and Issues for the Concerned-Sector

1-1-1 Current Situation and Issues

MR has a totally railway network spreading as long as 5,934 km, however, priority has not been given to the renewal of the existing facilities due to a policy focusing on the extension of the total length of the railway. Therefore maintenance has not been appropriately conducted on the facilities and they are deteriorating. The quality of the transportation service has also declined by the decreased train speed, delays and derailment accidents, etc. With this situation, MR has been conducting renewal of the interlocking devices and performing upgrade work in 29 stations along the Yangon - Mandalay main line since about 2000 with loan aid from India, China and South Korea. However, the aid is targeting the smaller stations, but the old-style interlocking equipment which require significant manual operation still remain in many stations, including the major stations.

Among the major stations in which the interlocking devices are not being updated, Yangon Central Station, through which the trains of both the Yangon - Mandalay main line and Yangon Circular Line run, is using electric interlocking devices manufactured by Westinghouse in 1950 to control the 174 routes in the station. Not only the relays but also the signaling cables that constitute the backbone of the system have been used since operation first began. Furthermore, the railway premises in Yangon Central Station are often flooded during the rainy season. The electric point machines and signal boxes are submerged every time and the signaling system is damaged significantly. Besides that, Pazundaung Station, the next station of Yangon Central Station, is a bottleneck for transportation due to the crossing where the Yangon - Mandalay main line and Yangon Circular Line intersect with each other.

Most of the level crossings are not equipped with warning devices and their gates are operated manually. Additionally, no warning equipment is installed except for level crossings at station premises and the sections where the automatic blocking system has been introduced. For the level crossings without alarm equipment, the gatekeepers operate the gate manually and the safety of pedestrians walking through the level crossings is secured by only the flag signaling of the gatekeepers.

Four OCCs have been allocated to the Yangon - Mandalay main line, however, they are equipped only with the radio communication devices used for the communication between the stations and the OCC. There is no system for monitoring the whole section that each OCC has jurisdiction over. Therefore the recording of actual operation results is mostly executed by the dispatchers, and the OCCs cannot perform their primary tasks as the centralized management of the operation conditions for the entire route or provide appropriate instruction to stations and train crews.

1-1-2 Development Plan

There are several development plans concerning the railways in Myanmar.

For the Yangon - Mandalay main line (approx. 620 km), the Ministry of Rail Transportation adopted

the improvement and modernization of this main line as a new prioritized project in the 1st Myanmar Development Cooperation Forum. After the master plan study, the Myanmar government requested JICA to conduct F/S on the improvement and modernization of the main line in February 2013. In response to the request, JICA conducted the F/S, completing it in January 2014. Based on the conditions found above, the Myanmar government requested a yen loan for the railway modernization program in November 2013. According to the results of the project examination conducted by JICA for the request, the commitment for the yen loan was pledged in the summit talks between Myanmar and Japan. The basic design and detailed design work for the phase 1 section (the section consisting of the approx. 270 km between Yangon and Taungoo) of the Yangon - Mandalay railway development project started in July 2014. In this modernization project, it is planned to refurbish the interlocking devices and upgrade the signaling and communication facilities as well as the automatic warning devices for the level crossings in order to reduce the travel time of passenger transportation between Yangon and Mandalay to 8 hours or less. The Grant Aid Project covers a part of sections within the modernization plan.

Also, a similar modernization project is planned for the Yangon Circular Line (approx. 46 km), on which more than 200 trains per day are operated with intervals of approx. 15 minutes in the vicinity of Yangon Central Station during peak hours. After the master plan study, the F/S began in April 2014. Also this F/S is being conducted based on the assumption that there will be a renewal of the interlocking devices and installation of automatic warning devices at the level crossings.

Furthermore, there is another development plan in addition to the railway modernization. It is a redevelopment plan for the Yangon Central Station area, which has much potential as an economic center, to establish a railway station and town with state-of-art functionalities and various attractions suitable for Yangon, the major city in Myanmar. Currently several foreign enterprises have submitted proposals for the redevelopment of the area around the station. The Ministry of Rail Transportation will call for an Expression of Interest (EOI) in the near future.

1-1-3 Social economic condition

From the military government that has continued for many years in this country, the movement of democratization in Myanmar has recently become active. The new government, which was established in March 2011, accomplishes sudden economic growth by proposing reform, such as the introduction of a managed floating rate system and trade liberalization, in addition to action for national reconciliation. Significant improvement is expected in the economic environment of Myanmar, but reform of the central bank, opening of a new economic sector, and revision of the foreign investment law are future challenges. According to the estimates of the IMF, the nominal GDP of Myanmar is 53 billion U.S. dollars, the economic growth rate is 6.5% in the 2012/2013 fiscal years, and it is expected that economic growth will increase to 6.8% in 2014.

The industrial composition ratio (2012) of Myanmar GDP is: service industry 41.3%, agriculture

38.8%, and manufacturing 20%. Main import partners of Myanmar include China, Japan, Thailand, Singapore, and Indonesia. Main export destinations are China, Thailand, India, Singapore, and Hong Kong. However, a wide variety of problems such as social infrastructure development, improvement of the legal system for foreign investment, modernizing agriculture, and domestic employment creation are left as issues for the future economic growth of Myanmar.

1-2 Background, Circumstances and Overview of the Grant Aid Cooperation

Based on the circumstances and issues shown in section 1-1-1, the Japan side had considered which works should be conducted as the grant aid cooperation project.

For the interlocking devices, Yangon Central Station is where both the Yangon - Mandalay main line and Yangon Circular Line are operated and Pazundaung Station is where the lines cross each other and constitutes bottlenecks for transportation. Because of this, the Japan side decided to introduce electronic interlocking equipment that controls both the stations from a purpose to improve safety and reliability of the facilities and eliminates the crossings as soon as possible.

For the level crossings, because the passersby, including automobiles, are notified of the approach of trains only by the movement of the gate of the crossing, they sometimes continue traversing the level crossing until just before a train arrives there. For modernization and realizing high-speed in the future, it is essential to install automatic warning devices that notify passersby of approaching trains within a certain period of time before it arrives at the level crossing. The devices will be installed at level crossings that are not located on the station premises and have no warning devices as well as those that are located outside of the section where the automatic block system is introduced. They will be selected in consultation with MR, taking into consideration the technical training for road repair work of level crossings, which is now being conducted in the "Project on Improvement of Service and Safety of Railway in Myanmar".

As a part of the modernization of the railway, which will include the introduction of the CTC in the future, train operation management, which, so far, has been conducted separately by each station master, will be centralized into the OCC by integrating train location information. The train monitoring system (TMS) will be introduced while prioritizing the sections in which many trains are operated. When introducing TMS, the areas covered by the OCC will be taken into consideration.

1-3 Aid supported by Japan

Table.1-1 shows the actual results of the technical and loan financial cooperation provided by Japan for the Yangon - Mandalay main line.

Table.1-1 Actual results of technical and loan financial cooperation from Japan

Details of cooperation	Project period	Project name / others	Overview
Technical cooperation project	2013 - 2015	Project on Improvement of Service and Safety of Railway	Improve the capabilities for the maintenance and management of track by providing the necessary equipment, material and track maintenance training.
Cooperation preparatory study	2012 - 2013	Preparatory Survey on the Drafting of a National Transportation Program	Presented the development plan for transportation and traffic covering all transport modes and developed the transportation and traffic development strategy and the phased execution plan.
Development study	1985 - 1986	Main line railway development plan	Developed the long-term modernization plan for the main lines for the period until 2005.
	2007	The Yangon - Mandalay main line railway development plan	Reviewed the reformation plan for the Yangon - Mandalay main line.
Loan Assistance	1985 - 1993	Burma Railway Modernization Project (1)(2) Locomotives, Passenger Coaches and Freight Wagons Rehabilitation Project	Procurement of new rolling stock, rolling stock repair work, and improvement of rolling stock manufacturing techniques

Source: The Study Team

In addition to the projects above, the basic design and detailed design work for the section of approx. 270 km between Yangon and Taungoo in the Yangon - Mandalay railway modernization project started in July 2014.

1-4 Aid Supported by Other Donor Countries

Table.1-2 shows the actual results of aid from other donor countries in the signaling and communication fields for the Yangon - Mandalay main line.

Table.1-2 Actual results of aid from other donor countries (signalling and telecommunications)

Project period	Country name	Project name	Aid type	Amount (in thousands U.S. dollars)
FY1997 - 1998	Korea	All relay interlocking devices (Toegyaungkalay Station)	Loan	2,000
FY2000 - 2004	China	All relay interlocking devices (22 stations between Bago and Taungoo)	Loan	5,000
FY2008 - 2014	India	Optical fiber cable installation (section between Yangon and Mandalay)	Loan	7,074
		Installation of block equipment for double track (sections between Yangon and Ywathagyi and between Ywathagyi and Taungoo)		
		Electronic interlocking devices (6 stations: Laydaungkan, Darbain, Tongyi, Kyanktan, Tawa and Payathonzu)		

Source: The Study Team

In addition to the above, India has provided technical support for the installation of Computer Based Interlocking (CBI) system in Nay Pyi Taw Station.

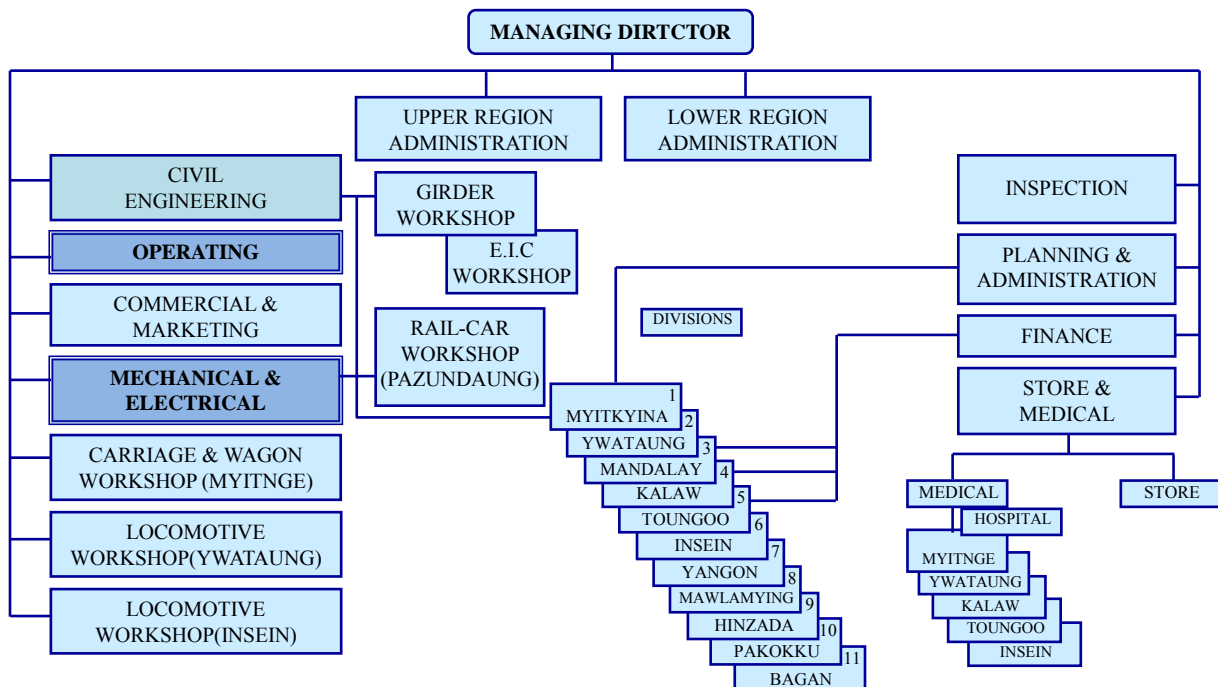
1-5 Implementation Organization of the Project

1-5-1 Organization and Personnel

The organization of MR, which is the implementation organization on the Myanmar side, consists of 6 major departments (Civil Engineering, Operating, Commercial & Marketing, Planning & Administration and Finance) and other supporting department (Inspection, Store & Medical). The operation of the railways is divided into 11 Divisions; 6 northern divisions and 5 southern divisions (Figure.1-1).

The facilities that will be introduced in this project shall be operated and maintained by the Operating Department including the Signal and Telecommunication section. (Some electric facilities such as the power receiving equipment shall be managed by the Mechanical & Electrical Department.)

These departments have the know-how of the operation and maintenance required for the facilities because they already have electronic interlocking devices similar to those that will be introduced in this project and devices that consist of relay circuits similar to those of the automatic level crossing warning device. Furthermore, regarding the organizational structure and personnel, approx. 600 staff members are engaged in operation and maintenance work for the MR Signal and Telecommunication Department.



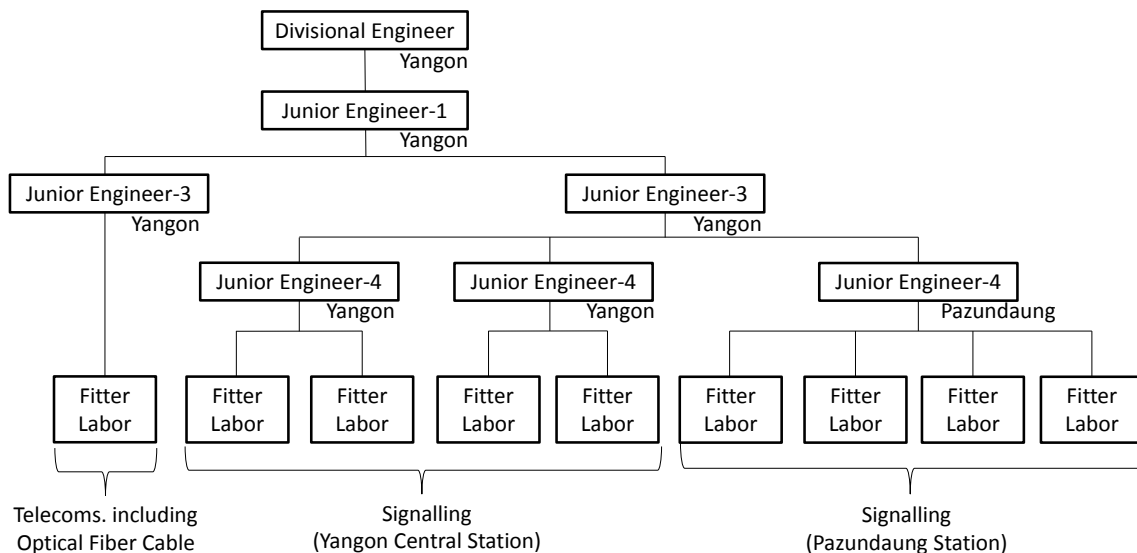
Source: MR materials

Figure.1-1 Organization Chart of MR (Operation & Administration Organization)

The project shall be covered by the Division 7 (Yangon Central - Darbain), the Division 6 (Tongyi – Thaug Daing Kone), and the Division 5 (Taungoo - Shanywa) .

Figure.1-2 shows the maintenance organization for the signaling equipment in Yangon Central and Pazundaung Stations. The maintenance organization for important equipment such as the interlocking devices, electric interlocking, and track circuit operates in shifts corresponding to 24-hour maintenance at each station. In the case of a malfunction or problem, the organization that mainly consists of Junior Engineer-3 and lower level workers promptly executes the required site tasks. Furthermore, a special organization that consists of experts has been established for the maintenance of the optical cables.

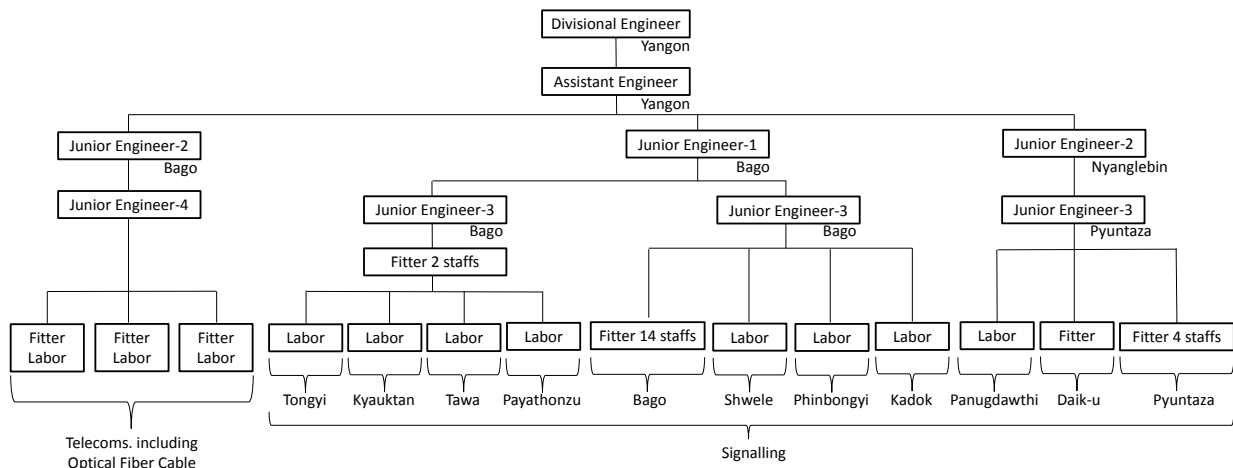
For the other stations in the Division 7, maintenance organizations specific to each station have been established. Organizations have been established so as to be capable of conducting maintenance works 24 hours a day, particularly for the signaling facilities located between Mahlwagon and Ywathagyi.



Source: The Study Team

Figure.1-2 Maintenance Organization for Yangon Central and Pazundaung Stations

Figure.1-3 shows the maintenance organization for the section between Tongyi and Pyuntaza in the Division 6. Unlike the organization for the Division 7 that covers the Yangon suburban section, the staffs are located in the major stations only based on the number of trains operated and the installation conditions of the facilities. Also, the organization for the Division 5 is similar to that for the Division 6.



Source: The Study Team

Figure.1-3 Maintenance organization for the section between Tongyi and Pyuntaza Stations in the Division 6

1-5-2 Finance and Budget

Table-3 shows the financial balance of MR for the past three years. Because the fare was raised three times, the financial balance has improved. However, it has not yet been possible to produce surplus due to such events as the opening of the highway, improvement to bus transportation and a decrease in customers due to the fare increase.

Although the operation and maintenance costs have increased by approx. 10% year to year in recent years, the maintenance expenditure for the signaling and telecommunication department has hardly increased. Therefore it has been impossible to secure the necessary spare parts and the MR engineers and staffs are only maintaining functionality by repairing the existing facilities, which are deteriorating.

Table.1-3 Financial balance of MR (Unit: Million Kyat)

Item		FY2010	FY2011	FY2012
Revenue	Passenger	20639.34	29,460.28	36,205.13
	Goods	8,288.01	16,734.96	19,623.33
	Others	4,237.27	4,803.63	5,826.15
	Total income	33,164.62	50,998.87	61,654.61
Expenses	Operating expenses	66,346.52	71,535.05	78,058.67
	(maintenance expenditure for signaling & communication facilities) *1	680680	680680	700
	Interest	61.66	12.61	4,217.61
	Profit & Loss on foreign exchange	(25.22)	(1.75)	-
	Total Expenses	66,382.96	71,545.91	82,276.28
Balance		(33,218.34)	(20,547.04)	(20,621.67)
Operating Ratio	Without interest	199.98%	140.26%	126.60%
	With interest	200.16%	140.29%	133.45%

Note) The fiscal year begins in April and ends in March.

*1 Including personnel costs. The personnel costs correspond to approx. 70% of this item.

Source: Prepared by The Study Team based on "Facts about Myanmar Railways Up to June 2013" and the other materials

The operation and maintenance costs for the facilities introduced in this project are included in the maintenance expenditures for signaling and communication equipment. Considering that the maintenance budget of MR is low and that currently spare parts for the existing equipment have not been secured sufficiently, it will be necessary to increase the maintenance expenditure. It is believed that MR can bear the additional expenses since the yearly average of operation and maintenance expenses is estimated to be approx. 165 million Kyat, which corresponds to only 0.2% of the total expenses of MR. Furthermore, it was confirmed that the budget will be secured for the operation and maintenance of equipment introduced in this project.

1-5-3 Technical Level of MR

The human resources development programs in the MR signal & telecommunication department vary widely between the executive candidates who graduated from university and other staffs. The executive candidates are engaged in various jobs such as those of Junior Engineer in various Divisions and have experience with managing and administrative tasks. During the process, they sometimes work for overseas projects and/or foreign manufacturers to improve their comprehensive technological ability.

Staffs other than the executive candidates, mainly the Junior Engineers, receive training for facilities maintenance and other tasks in the Central Institute Training Center (CITC) located in Myeikhtila. And there is a workshop for the signal equipment in Yangon. MR staff members repair the equipment by themselves without outsourcing except in such cases as a failure of IC boards that cannot be repaired by the MR's staff. Failed VHF and UHF communication devices are repaired in Nay Pyi Taw. MR's staffs are also engaged in the design and execution of new installations and renewal work for part of the relay interlocking devices.

According to the conditions above, it is considered that MR's staff has a high level of technical capability. In the maintenance method which MR has adopted, on the other hand, although inspections are regularly conducted on the major facilities, such as the electric point machine and track circuit in the stations which are important for operation such as Yangon Central Station, most of the signal and telecommunication facilities are maintained using breakdown maintenance. Its inspections and repairs are conducted only after a device fails because of the constant lack of the spare parts. Therefore signs of deterioration for the devices in advance seem to be generally overlooked.

For the new equipment that will be introduced in this project, preventive maintenance rather than breakdown maintenance will be required to maintain the equipment in an appropriate condition. In this project, the study team shall establish a maintenance system that enables MR itself to maintain the equipment at an appropriate condition and to find failure and to restore early in order to improve reliability and lifespan.

1-5-4 Existing Equipment

For the interlocking equipment in Yangon Central Station, the electric interlocking devices manufactured by Westinghouse have been in use since 1950 and control 174 routes. Not only the relays but also the signal cables that constitute the backbone of the system have been used since the beginning of operation and have obviously deteriorated. Also in Pazundaung Station, all of the relay interlocking devices manufactured by Siemens have been used since their introduction in 1970 without being upgraded, and deterioration has progressed. Although these two stations are located next to each other, no block system has been installed between them and the wiring configurations of interlocking devices, signals and electric point machines are completely different from each other because they were made by different manufacturers.

Most of the level crossings are not equipped with warning devices and their gates are currently operated manually. Also, there are no warning facilities installed at the Kyan Sit Thar Level Crossing and other level crossings located between Toegyaungkalay and Ywathagyi except for the level crossings in station premises. For the level crossings without warning facilities, the safety of the passersby walking through the crossings is secured only by the whistle of the train, the gate that is manually operated by the gatekeepers and the flag signaling of them.



The OCCs are only equipped with radio devices for communication between the station and the OCC, and have no facilities for monitoring the whole route. Therefore, although the recording of actual operation results is mostly conducted by the dispatchers, they cannot perform their primary tasks of centralized management of the operation condition for entire routes and appropriate instruction.

1-6 Current Circumstances around the Project

1-6-1 Current Circumstances of Infrastructure in Myanmar

Table.1-4 shows the current circumstances of infrastructure in Myanmar, related to the project.

Table.1-4 Current Circumstances of Infrastructure in Myanmar

Item	Circumstance
Electricity	<p>In Myanmar, 72% of the electric-generating capacity is hydroelectric power generation. Therefore, in the dry season, the electric-generating capacity decreases.</p> <p>For proper use of electronic devices, power-generating and power-receiving facilities must be improved for important-to-safety of train transportation.</p>
Gas	Not applicable to the project.
Water	Not applicable to the project.
Telephone	Dedicated phone line is needed for train traffic communication.
Road	<p>In the last ten years, the number of vehicle registrations has grown approximately 10 times, but road maintenance and improvement are inadequate.</p> <p>Trains might be better than trucks for equipment transportation in places which have only narrow roads to the station.</p>  <p>Ex. Road to station</p>
Others	<p>In rainy seasons, localized floods occur in urban areas because of inadequate river improvement work. At such areas, preventive measures should be taken against floods.</p>  <p>Flood in Yangon Station</p>

Source: The Study Team

1-6-2 Natural Conditions

To review the installation method in consideration of natural conditions, the study team collected government-issued publication and interviewed MR officials.

1) Myanmar Climate Map / Annual Rainfall Map

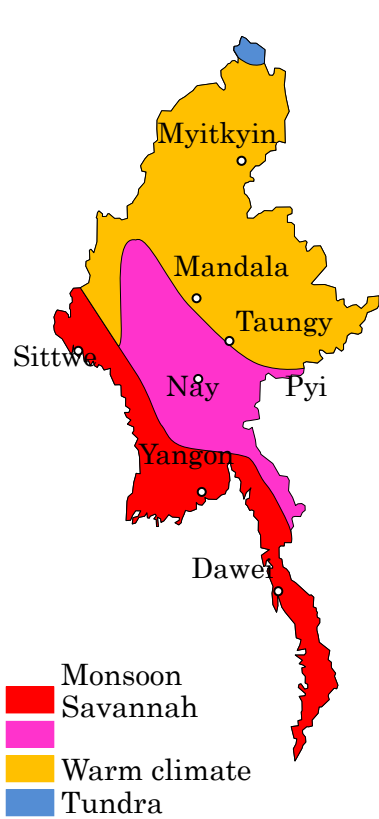


Figure.1-4 Climate Map

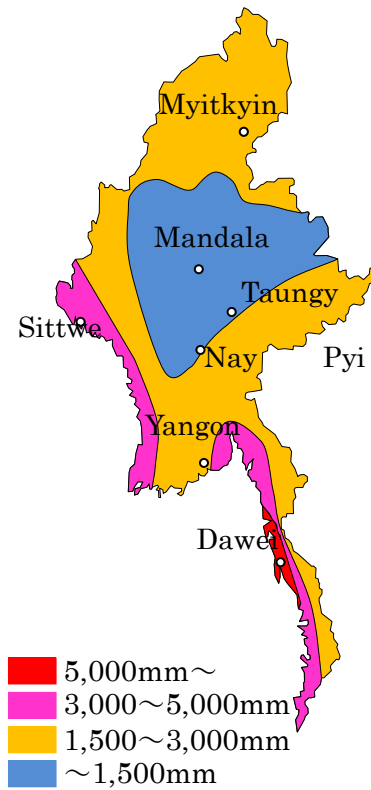


Figure.1-5 Annual Rainfall Map

Source: Department of Meteorology and Hydrology (Myanmar)

2) Temperature / Rainfall / Humidity

Table.1-5 Yangon Meteorological Data (Kaba-aye Observatory)

Item	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC
	DRY		HOT			RAINY					DRY	
Max Temperature(°C)	33.5	35.6	36.9	37.6	32.9	30.8	30.2	30.1	30.8	32.7	33.9	32.9
Min Temperature(°C)	16.6	18.1	20.6	23.2	22.9	22.3	22.1	22.2	22.2	22.2	20.1	16.9
Avg Temperature(°C)	25.0	26.8	28.7	30.4	27.9	26.6	26.2	26.1	26.5	27.4	27.0	24.9
Rainfall (mm)	0.6	1.6	16.7	76.9	447.5	562.9	573.3	527.8	460.6	200.0	38.0	11.8
Humidity (%)	79	70	73	74	87	90	92	94	93	85	78	80

Source:Department of Meteorology and Hydrology (Myanmar)

3) Earthquake

Myanmar can be divided into 3 seismically active regions, namely the Northwestern Region, the Central Lowland, and the Shan-Yunnan Region. During the 20th century, at least 18 large earthquakes occurred along the Central Lowland where the well-known Sagaing Fault passes through.

4) Lightning Strikes

According to the MR staff, 3 lightning strikes occurred around the Yangon area this year as follows:

- Place: Yangon Central Station

Damaged equipment: Main WCR relay (1 unit)

Date: 6. 5. 2013

- Place: Mingalardon Station

Damaged equipment: 660V Main Transformer (1 unit) and Track Transformer (3 units)

Date: 25. 6. 2013

- Place: Danyingone Station

Damaged equipment: 660V Main Transformer (1 unit) and Track Transformer (5 units)

Date: 27. 8. 2013

5) Flood

Myanmar receives practically all its rainfall between mid-May and October, during which flooding is common. The riverine floods are common in the river delta while the flash floods and landslides are frequent in the upper reaches of the river systems, which are normally the mountainous areas. In the cities and towns, localized floods occur from time to time.

1-6-3 Environmental and Social Considerations

(1) Environmental Impact Assessment

i) Scoping of Social and Environmental Considerations of the Business Plan

According to guidelines for Environmental and Social Considerations, we explore the impact on pollution abatement, natural environment, and social environment.

Table.1-6 Scoping results of Environmental and Social Considerations

Classification	No	Item	Assessment		Reason of Assessment
			Before/During Construction	After Construction	
Pollution abatement	1	Air pollution	B-	B-	-During Construction Exhaust gas from the construction machine might make air pollution. -After Construction Exhaust gas from the power generator might make air pollution.
	2	Water pollution	B-	D	-During Construction Because of the excavation work, muddy water might spread around.
	3	Rubbish	B-	D	-During Construction Appropriate management of waste is needed for construction waste soil and removal equipment.
	4	Land pollution	D	D	Construction that creates land pollution is not expected.
	5	Noise/Oscillation	B-	B-	-During Construction Construction vehicle might make noise pollution. -After Construction Humming of power engine generator might make noise pollution.

Classification	No	Item	Assessment		Reason of Assessment
			Before/During Construction	After Construction	
Pollution abatement	6	Ground subsidence	D	D	Ground subsidence is not expected during construction.
	7	Odor	D	D	Odor is not expected during construction.
	8	Riverbed pollution	D	D	Riverbed pollution is not expected during construction.
Natural environment	9	Sanctuary	D	D	There are no national parks or sanctuaries in or around the project scope.
	10	Ecosystem	D	D	Ecosystem effects are not expected because construction is to be conducted on railway land.
	11	Precipitation	D	D	Impact on precipitation is not expected during construction.
	12	Landform/ Geology	D	D	Impact on landform or geology is not expected during construction.
Social environment	13	Resident relocation	D	D	Resident relocation is not expected because construction is to be conducted on railway land.
Social environment	14	Poorest segment of the population	D	B+	-After Construction Improvement of railway infrastructure will have a positive impact on revitalization of economic activity.
	15	Minority group	D	D	There are no minority groups living in the project scope.
	16	Employment	B+	D	-During Construction Construction work is expected to generate jobs.

Classification	No	Item	Assessment		Reason of Assessment
			Before/During Construction	After Construction	
	17	Use of land/ Use of resources	D	D	Impact is not expected because construction is to be conducted on railway land.
	18	Use of water	D	D	Impact on use of water is not expected.
	19	Social infrastructure / Social service	D	D	Impact on social infrastructure and social service is not expected.
	20	Social capital / Regional Decision-making Organization	D	D	Almost no impact is expected.
	21	Bias of damage and convenience	D	D	No impact is expected.
	22	Conflict of interests	D	D	The occurrence of interest opposition in the region is not expected.
	23	Cultural heritage	D	D	Impact on cultural heritage is not expected.
	24	Landscape	D	D	No impact is expected on landscape.
Social environment	25	Gender	D	D	Negative impact is not expected on gender.
	26	Children's rights	D	D	Negative impact is not expected on children's rights.
	27	HIV/AIDS	B-	D	-During Construction HIV/AIDS infection may spread due to influx of construction workers.

Classification	No	Item	Assessment		Reason of Assessment
			Before/During Construction	After Construction	
	28	Labor environment	B-	D	-During Construction Workers must be considerate of the working environment.
Others	29	Accident	B-	D	-During Construction Workers might collide with a train during construction.
	30	Climate change	D	D	No impact is expected on climate change.

Source: The Study Team

Grade:

A- : serious negative impact

A+ : very positive impact

B- : negative impact

B+ : positive impact

C : impact is unknown / continuing study is needed

D : no impact / study is not needed

ii) Terms of Reference for Environmental and Social Considerations

Table.1-7 shows survey items and survey procedures about the scoping results “A”, “B” and “C”, in terms of reference for environmental and social considerations

Table.1-7 Terms of Reference for Environmental and Social Considerations

Impact expected	Survey item	Survey procedure
Air pollution	During construction / After construction	Make a hearing investigation of relevant organizations
Water pollution	After construction	Make a hearing investigation of relevant organizations
Rubbish	During construction	Make a hearing investigation of relevant organizations / Confirm the law
Noise/Oscillation	During construction / After construction	Make a hearing investigation of relevant organizations
HIV/AIDS	During construction	Make a hearing investigation of relevant organizations
Labor environment	During construction	Make a hearing investigation of relevant organizations / Make a hearing investigation of other project managers
Accident	During construction	Make a hearing investigation of relevant organizations

Source:The Study Team

iii) Results of Environmental and Social Considerations

Table.1-8 shows the results based on survey procedure.

Table.1-8 Results of Environmental and Social Considerations

Impact expected	Assessment of scoping		Assessment after survey		Reason of Assessment
	Before/During Construction	After Construction	Before/During Construction	After Construction	
Air pollution	B-	B-	D	D	-During Construction The impact on air pollution is not serious because the transportation frequency is low. -After Construction The impact on air pollution is not serious because the power generator only operates during electrical outage.
Water pollution	B-	D	D	D	-During Construction The impact to water pollution is not serious because the excavation soil will be backfilled.
Rubbish	B-	D	B-	D	-During Construction There is no legal restriction about waste disposal method under the laws of Myanmar, but appropriate management of waste is needed.

Impact expected	Assessment of scoping		Assessment after survey		Reason of Assessment
	Before/During Construction	After Construction	Before/During Construction	After Construction	
Noise/Oscillation	B-	B-	D	D	-During Construction The impact on noise / oscillation is not serious because the transportation frequency is low. -After Construction The impact on noise / oscillation is not serious because the power generator only operates during electrical outage.
HIV/AIDS	B-	D	D	D	-During Construction HIV/AIDS infection is not serious because the number of workers will not be so large.
Labor environment	B-	D	B-	D	-During Construction The labor environment should be considered as follows: - Working long hours under high temperature must be avoided. - Frequent, adequate hydration.
Accident	B-	D	B-	D	-During Construction Awareness of accidents is needed, due to carrying heavy equipment and fieldwork performed near the rail.

Source: The Study Team

iv) Counterplan

Table.1-9 shows counterplans regarding the survey results “A”, “B” and “C”

Table.1-9 Counterplan

Item	Phase	Counterplan	Implementing Agency
Rubbish	During construction	-Appropriate management of waste. -Promote the recycling of rubbish.	Contractor
Labor environment	During construction	-Avoid working long hours under high temperature. -Frequent, adequate hydration.	Contractor
Accident	During construction	Education of workers to prevent accidents.	Contractor

Source:The Study Team

(2) Acquisition of Land / Resident Relocation

Acquisition of land and resident relocation is not expected because construction is to be conducted on railway land.

Chapter 2 Contents of the project

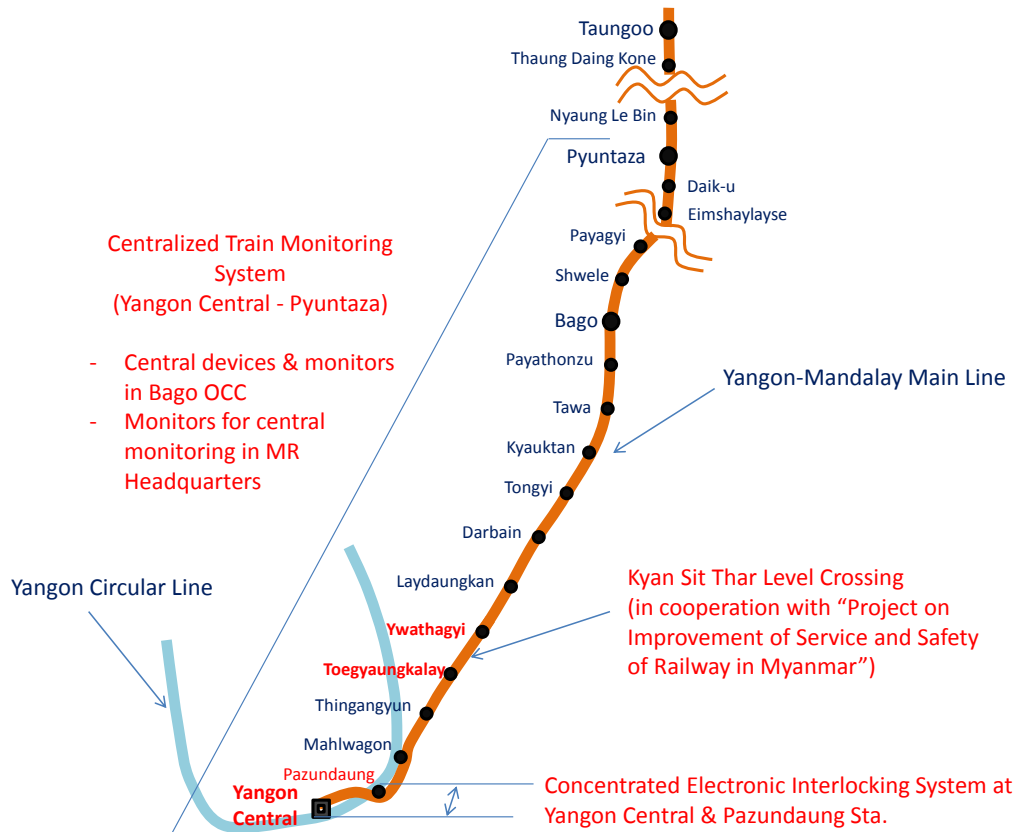
2-1 Basic Concept of the Project

At the 1st Myanmar Development Cooperation Forum in January 2013, the Ministry of Rail Transportation adopted the improvement and modernization of the Yangon - Mandalay main line (approx. 620 km) as a new prioritized project. In this modernization project, it is planned to refurbish the signal and telecommunication facilities in order to reduce the travel time of passenger transportation between Yangon and Mandalay to 8 hours or less. The Myanmar government requested a yen loan for this modernization program in November, 2013. According to the results of the examination of the project that was conducted by JICA for the request, the commitment for the yen loan was pledged at the summit talks between Japan and Myanmar. Basic design and detailed design work for the phase 1 section (the section of approx. 270 km between Yangon and Taungoo) of the Yangon - Mandalay railway development project started in July, 2014. In the Grant Aid Project, a part of the work for sections of the modernization project shall be carried out.

The Japan side will contribute capital investment that will be beneficial as a Grant Aid Project prior to the modernization project for the Yangon - Mandalay main line for the purpose of contributing to the improvement of MR's safety and transportation services. Furthermore, setting "contributions to the improvement of MR's safety and transportation services" as the aim of the project, the following three components shall be constructed to accomplish the "arrangement of equipment that contributes to the improvement of MR's transportation capacity and safety" (some equipment is planned to be put into operation by around the autumn of 2015). (Figure.2-1)

- i) Introduction of Concentrated Electronic Interlocking System (at Yangon Central Station and Pazundaung Station)
- ii) Introduction of automated level crossing alarm facilities at the Kyan Sir Thar Level Crossing located between Toegyaungkalay Station and Ywathagyi Station
- iii) Introduction of Centralized Train Monitoring System in the section of Bago Division OCC which have jurisdiction from Yangon Central Station to Pyuntaza Station (This includes the installation of new operation information displays in Nay Pyi Taw Central OCC.)

In addition, the study team proposes details of which Myanmar will take charge, implementation plan, and items that require special attention for the operation and maintenance of projects. Also the study team will prepare the soft component plan (the technical assistance plan) to facilitate the operation and maintenance of the projects.



Source: The Study Team

Figure.2-1 Three components of the Grant Aid Project

2-2 Outline Design of the Japanese Assistance

2-2-1 Design policy

(1) Basic policy

For this project, the both countries have selected components to be carried out with higher priority in the railway modernization project for the Yangon - Mandalay main line in Myanmar with an aim to improve MR's safety and transportation service.

Table.2-1 shows items from the basic policy for designing each component.

Table.2-1 Basic policy for design

Component	Basic policy for design
i) Introduction of Concentrated Electronic Interlocking System at Yangon Central Station and Pazundaung	<ul style="list-style-type: none"> - Installation of a new signal cabin and signal equipment room on the 2nd floor of Yangon Central Station. (Shared with the new Bago Division OCC) - Installation of a sub-equipment room for the signaling

Station	<p>system in Pazundaung Station in order to control the signals and electric point machines in the station.</p> <ul style="list-style-type: none"> - Renewal of the signals, electric point machines, and train detection devices. - Along with the renewal of the electric point machines, the parts of the turnouts (tongue rails) and the sleepers related to the electric point machine will be replaced.
ii) Introduction of automatic warning device at the Kyan Sir Thar Level Crossing located between Toegyaungkalay Station and Ywathagyi Station	<ul style="list-style-type: none"> - Installation of an electric level crossing barrier. (The gate will be operated by the gatekeeper.) - Introduction of gate signals to notify the train drivers of the warning sound and the descent of the crossing barrier. - A back-up device will be installed for the level crossing control devices because they are likely to be influenced by the conditions of the track.
iii) Introduction of Centralized Train Monitoring System in the section of Bago Division OCC which have jurisdiction from Yangon Central Station to Pyuntaza Station	<ul style="list-style-type: none"> - A new Bago Division OCC will be established in the 2nd floor of Yangon Central Station. (Shared with the new signal cabin.) - Bago Division OCC will be equipped with an operation indication panel that shows train location information, a device that shows the diagram for the day and the management equipment of the train numbers. - Train detection devices will be installed at each station in order to obtain train location information. The existing optical cables will be used for data transmission. - The Central OCC located at the MR headquarters in Nay Pyi Taw will be equipped with a monitor that reflects the indication for Bago Division OCC.

Source: The Study Team

To facilitate the operation and maintenance of these components, the Japan side will provide "Support for development of equipment inspection rules", "Awareness education for level crossing users" and "Signal setting training for station staff and education and guidance for dispatchers" as the soft component (the technical assistance).

For the design criteria, because there are no internal provisions to be followed for design in MR, our plan will comply with the "Technical Regulatory Standards on Japanese Railways" as well as the electricity laws, labor laws, environmental protection laws, and telecommunication laws in Myanmar.

(2) Design Policy in consideration of natural environment and social economy

The proposal of design policy in consideration of natural environment and social economy is shown in Table.2-2.

Table.2-2 Design Policy in consideration of natural environment and social economy

Item	Proposal
Air temperature	<p>i) Proposal of Outdoor Works</p> <p>There is no legal restriction about outdoor work under the laws of Myanmar, but the labor environment should be considered as follows:</p> <ul style="list-style-type: none"> - Working long hours under high temperature must be avoided. - Frequent, adequate hydration. <p>ii) Proposal of Electronic Devices</p> <p>There is no legal restriction about electronic standards under the laws of Myanmar, but temperature regulation control should be required for proper use of electronic devices.</p>
Rainfall/Flood	There is no legal restriction about the installation method of equipment under the laws of Myanmar and MR regulation, but preventive measures against floods should be taken.
Earthquake	There is no legal restriction about the installation method of equipment under the laws of Myanmar and MR regulation, but heavy equipment in particular should be prevented from falling.
Lightning strike	There is no legal restriction about electronic standards under the laws of Myanmar, but electronic equipment should be protected from lightning strikes through the use of protective devices.
Social economy	To reduce the maintenance cost, reliable and durable electronic devices should be used.

Source: The Study Team

(3) Construction and procurement circumstances in Myanmar

In Myanmar, there are experienced local contractors for civil and architectural facilities installations including reinforced concrete foundation works, steel or concrete

support structures, production and installation of wayside terminal boxes, cable installations, utility buildings, etc.

Japanese contractors shall employ such local contractors for installation of facilities. However, the local contractors do not have sufficient experience on the modern railway signals, communications, and level crossing facilities installation. Therefore, Japanese contractors shall assign Japanese site installation supervisors who are skilled in detailed design, the software, system integration tests, initial trial operations, and site installation of specialized facilities for railway signals, communications, and level crossings.

Common civil and architectural construction materials such as cement, reinforcing bars, and formworks are supplied in the Myanmar market. Imported special steel materials, cables, and the like are also available in the local market.

(4) Policy for operation and maintenance

Currently MR basically maintains the signalling and telecommunications after breakdown, which is repaired after they fail, although regular inspections are conducted before equipment fails in the main stations. Furthermore, MR only keeps a very small amount of spare parts because of the tight budget, so it is very hard to secure the spare parts required for the repair of failed equipment. The spare parts should typically be secured by the implementation organization in the country. However, in the Grant Aid Project, the Japan side will prepare the spare parts that are considered to be necessary for maintaining the facilities for at least one year, taking into consideration of incidental failures caused by a natural disaster such as lightning and heavy rains.

The amount of the yearly average operation and maintenance expenses for the equipment to be prepared for this project is estimated to be approximately 165 million Kyat. This amount corresponds to approximately 79% of MR's maintenance expenses for signal and telecommunication section (excluding the personnel costs). Considering that the maintenance budget of MR is lean and spare parts for the existing equipment have not been sufficiently secured, it will be necessary to increase maintenance expenditures. It is considered that MR can bear the expense because the amount of the average yearly operation and maintenance expenses corresponds to only 0.2% of MR's total administrative expenditures. Furthermore, it was affirmed that the budget will be secured for the operation and maintenance of the equipment newly introduced through this project by MR.

The operation and maintenance staff operate in 24 hours a day, in Yangon Central Station and Pazundaung Station. There is also a special team for maintenance of the optical cables. In an interview, the executive taking charge of the signaling &

communication department said that maintenance can be conducted with the current organization. Therefore, they will not request an increase in the operation & maintenance staff for this project.

In MR, the maintenance staffs are trained through the guidance by upper-level staff and on-the-job training (OJT) to learn practically how to cope with repair failures. MR repairs any failed equipment by itself and reuses it. Therefore it is considered that the current maintenance staff have a high level of skills and ability, however, it is necessary to refine the maintenance schemes, such as the inspection rules.

Because the operation procedures and operation & maintenance methods of the equipment that will be procured in this project differ from those of the existing equipment, the initial operation training will be provided by technicians delegated from the manufacturer, apart from the soft components which is technical assistance by consultants.

(5) Construction Work Design Policy

Table.2-3 shows the construction work design policy in consideration of natural conditions and trackside installation.

Table.2-3 Construction Work Design Policy

Item	Design Policy
Countermeasures against temperature	Air-conditioning equipment is needed to control temperature for proper use of electronic devices.
Flood countermeasures	Concrete foundation for equipment should be installed higher than usual to take preventive measures against floods.
Countermeasures against lightning strikes	Electronic equipment should be protected from lightning strikes through the use of protective devices.
Anticrime measures	Equipment should be installed in rooms or equipment boxes that can be locked for safety, and security guards are needed for temporary storage. Cables should basically be buried or installed in high places.
Countermeasures against electricity outage	Batteries and engine generators are needed for electricity outages.
Trackside installation	Trackside installation should be kept at a sufficient distance away from rails for safe passage of trains.

Source: The Study Team

(6) Procurement method

Automatic level crossings and train monitoring systems are not installed in MR. As for the electronic interlocking device, the first devices for MR is currently being constructed at the Yangon suburbs and Nay Pyi Taw. For design and procurement of major equipment, it is necessary to carefully carry out guidance of the initial start-up operation and maintenance, to take into account inexperience in design, construction, operation, and maintenance.

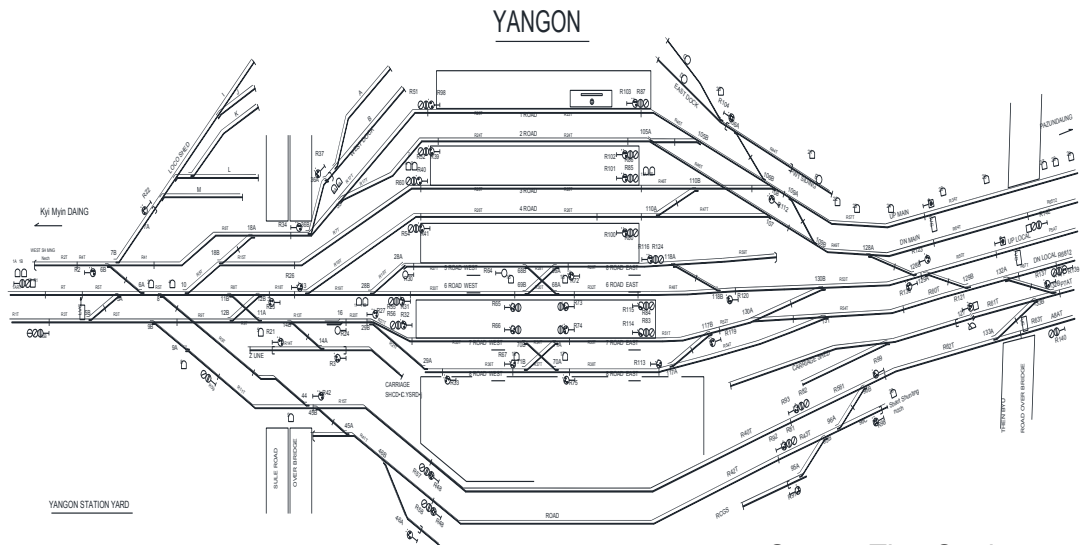
2.2.2 Basic Plan

(1) Installation of the concentrated electric interlocking system at Yangon central and Pazundaung station

① Outline of plan

In the section between the Yangon central station and Pazundaung station, the Yangon Circular and Yangon - Mandalay Main Line has been operating on a four-track line. At Pazundaung station, the Yangon Circular and Yangon - Mandalay Main Line cross each other. Though this section has high traffic density, trains are operated by telephone contact between Yangon central station and Pazundaung station, but they cannot mutually confirm train positions directly. Delays are caused by train crossing, especially at Pazundaung station, because many trains come from Yangon central station and the neighboring stations of the Main Line and Yangon Circular.

Because of the present situation, MR has a plan to improve rail alignment between Yangon central station and Pazundaung station. However, there is problem that the states of signalling device of Yangon central station and Pazundaung station are not enough to change rail alignment because both interlocking device are old and it is difficult to secure those spare parts. Use of Yangon central station's interlocking began in 1950 and use of Pazundaung station's interlocking began in 1970.



Source: The Study team

Fig.2-2 Yangon central station

In these circumstances, a plan was proposed. The plan implements a concentrated Electronic Interlocking System at Yangon central station and Pazundaung station. The purpose of this plan is to shorten delays by operating the train route intensively in Yangon central station's signal cabin.

(a) Yangon central station

Yangon central station has 174 routes (Fig.2-2 & Table.2-4). The interlocking, a relay logic device manufactured by Westinghouse (Great Britain), the component equipment of interlocking, relays, cables, and power supplies have all been in use since 1950. There are colour lighting signals (LED) and DC track circuits (single rail track circuit). The track relays are in wayside signal boxes. The train detector detects trains position through reaction relays of track circuits that are in the signal equipment room.

In Yangon central station, track submergence often happens in the rainy season (Fig. 2-3 & Fig. 2-4). Therefore, the wayside signal equipment is in poor condition.

There are no Automatic Train Protection (ATP) systems. However, there are some derailment turnouts at important route intersections.

The problem with this station is the poor drainage of the station yard. Domestic wastewater is directed to the north-west of the station and the soil is no good (Fig.2-5 & Fig.2-6). Electric point machines and the signal box tend to be submerged when flooding occurs frequently during the rainy season. Equipment that was submerged can only be used after drying and repair. If the device loses function due to flooding, the station attendant

conducts train operation through route composition with the hand wheel and cues train drivers with a Semaphore Flag until the devices are restored.

This situation is harsh with the signalling equipment, even the latest waterproofed ones. Other than the modernized construction of station facilities, it is necessary to examine water improvement measures.



Source: MR

Fig.2-3 Track submergence (Westside in the station)



Source: MR

Fig.2-4 Track submergence (Center in the station)



Source: MR

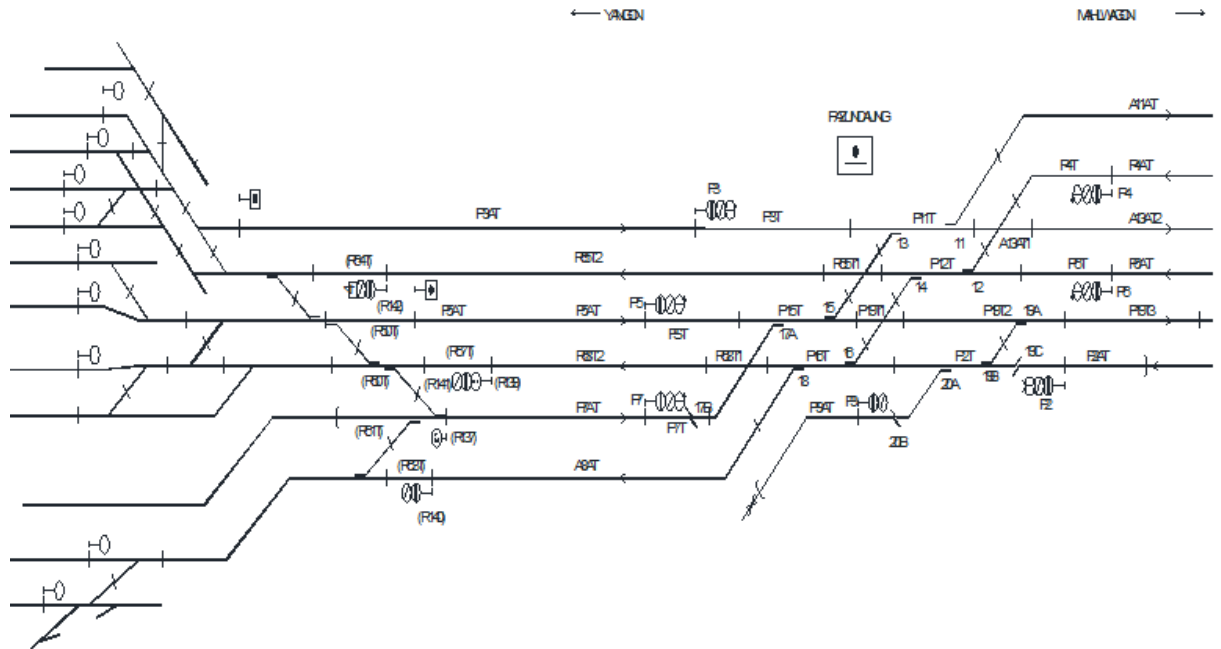
Fig.2-5 One of the causes of the submergence



Source: MR

Fig.2-6 Inflow spot of the water

PAZUNDAUNG



Source: The Study Team

Fig.2-7 Pazundaung station

(b) Pazundaung station

Pazundaung station has 18 routes (Fig. 2-7 & Table.2-4). The interlocking, a relay logic device manufactured by Siemens (Germany), the component equipment of interlocking, relays and cables, and power supplies, have been used since 1970.

There are Siemens-style colour lighting signals (with route indicator, LED) and DC track circuits (single rail track circuit). There are no ATP systems.

As for the difference with Yangon central station, the basic design concept of the interlocking is to concentrate the equipment in the signal equipment room. Therefore, there are some track relays for block signals in Pazundaung's signal equipment room.

In addition, there is no flooding in the Pazundaung station yard, unlike Yangon central station.

(c) About interlocking renewal

The study team proposes to install new signal equipment with existing signal equipment in parallel during construction. Because the condition of existing signal equipment is poor, the study team deems the use of this equipment to be difficult. Therefore, through this construction,

the study team will have a plan to modernize both the interlocking device and the wayside signal equipment.

The new interlocking system of Yangon central station and Pazundaung station is planned to be centrally operated at Yangon central station. The new system installed in each station is operated at Yangon central station by delivering information through optical cables. Refer to (d) for information about the new signal cabin and new signal equipment room. In particular, as a flooding countermeasure for the rail, the study team proposes to install and raise NS type electric point machines by 200 mm (8") ~ 300 mm (1'). NS type was chosen because the operational performance in rainy Japan and the option for submergence measures are substantial. Also, the study team suggests the H-DC track circuit system for the train detector system. The merits of H-DC track circuits are as follows. The length of the track circuit is less than 300 m (985'), and the train detection sensitivity provided is more than 0.5 ohms. In addition, the system is suitable for the bad condition of the rail because the voltage between the rails is more than 5A in 12V, short circuit electric current.

(d) New signal cabin and new signal equipment room

The existing signal cabin and signal equipment room of Yangon central station and Pazundaung station are in one building, respectively. But there is not enough space to install new equipment in the building. Therefore, it is a necessary condition to secure new space for a new interlocking system.

In Yangon central station, MR will arrange new space for a new signal cabin and new signal equipment room on the 2nd floor of the Yangon main building. The space is big enough to set up a new signal cabin, OCC, and new signal equipment room on one floor.

On the other hand, in Pazundaung station, MR will arrange new space for a new signal equipment house near the existing signal cabin building. The space is about 50 square meters, and is enough to install a new interlocking system at Pazundaung station (Fig. 2-10 & 2-11).

(e) Relation with the Yangon Central Railway Station redevelopment project

Around Yangon central station, there are many redevelopment projects, including the establishment of commercial facilities. A new signal cabin and signal equipment room is necessary for this interlocking renewal plan, but they will be established in an existing building because there is no land to newly build them in Yangon central station.

Initially, there were suggestions from DIVISION7 of MR for the new signal equipment room and new signal cabin, and the study team planned to install them in the SINO building, which is used by DIVISION7 of MR. However, there is information of a redevelopment plan that around this building. Therefore, the study team held a meeting about this with U Htun Aung Thin, the

General Manager of Lower Myanmar administration of MR. The study team concluded to build a new signal equipment room and signal cabin in the Yangon central station main building because there is no redevelopment plan due to its historic value (Fig. 2-12).

As a concrete location, MR and the study team will secure approximately 230 square meters in the 2nd floor of the Yangon central station main building and will install there, as discussed in a meeting with U Kyaw Kyaw Myo, the Assistant General Manager of DIVISION7.



Source: The Study Team

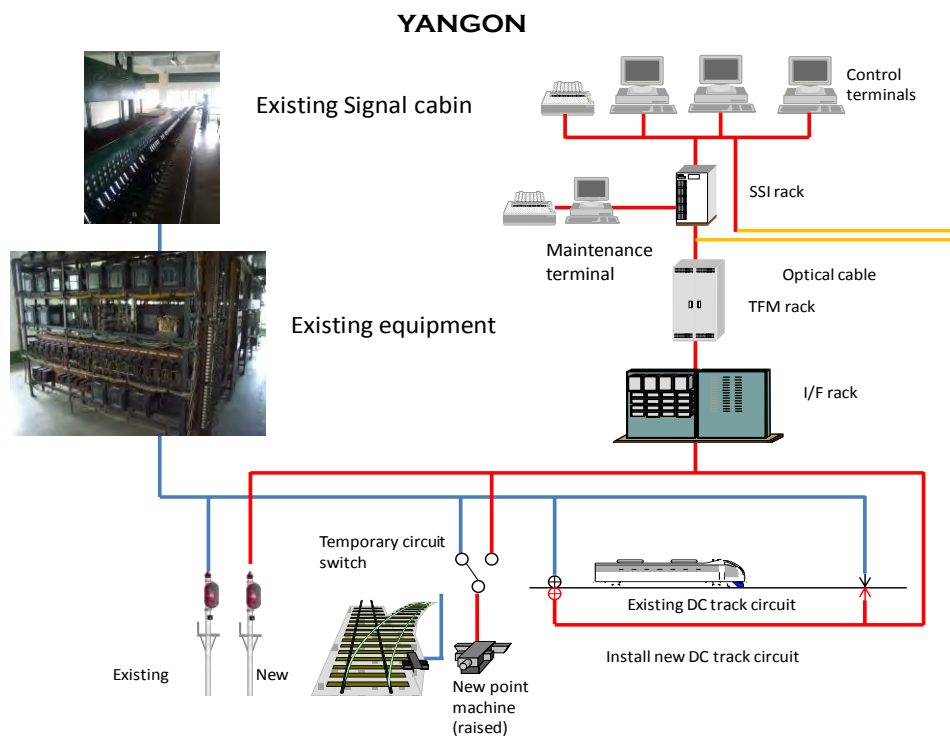
Fig.2-8 Around Yangon central station

Table.2-4 Existing signalling system

	Yangon central station	Pazundaung station	Remark
Number of Routes	174	18	
Interlocking system	Electric Interlocked (Westinghouse, G.B.)	Relay Interlocked (Siemens, Germany)	
Beginning of use	1950	1970	
Signal aspect	Colour light signal	Same as on the left	
Train detection system	DC track circuit (Single rail use)	Same as on the left	
Number of track circuit	59	29	

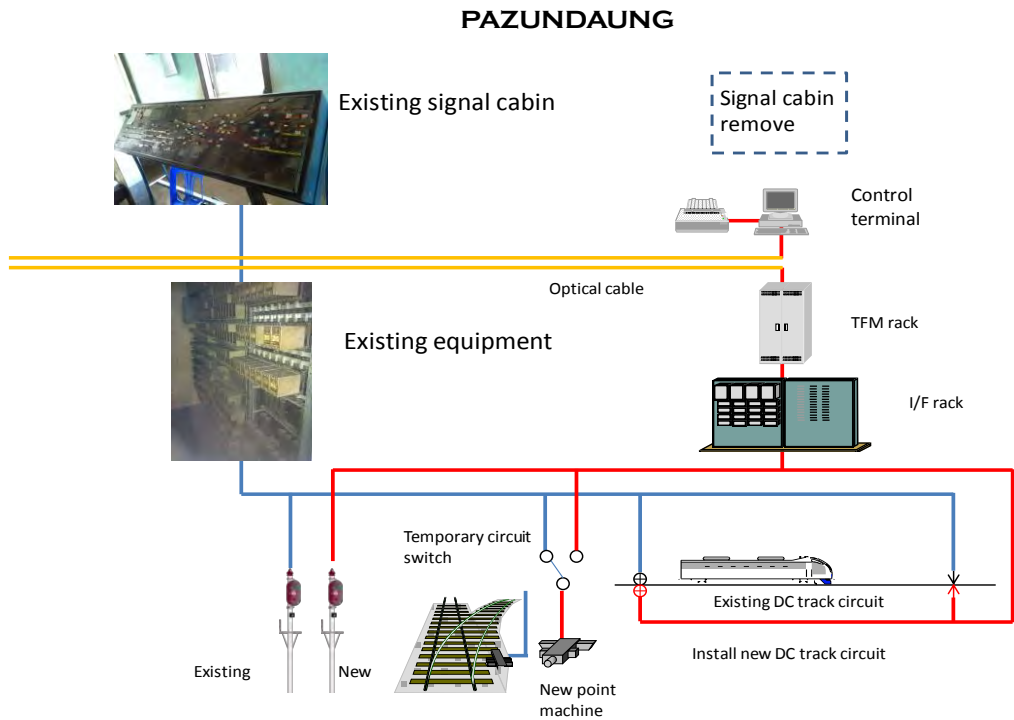
	Yangon central station		Pazundaung station		Remark
Automatic Train Protection system	None		Same as on the left		Depends on train driver's attention and derail switches.
Rail spec	75-lb. A.S.C.E. Rail (Near 37 kg Rail)		Same as on the left		The rail between Yangon ~ Mandalay was maintained in 2011.
Number of switches	1:81/2	45	1:81/2	11	Same as Japanese rail standard: 8#switch, 12#switch
	1:12	12	1:12	None	
Number of Derail switches	10		3		

Source: The Study Team



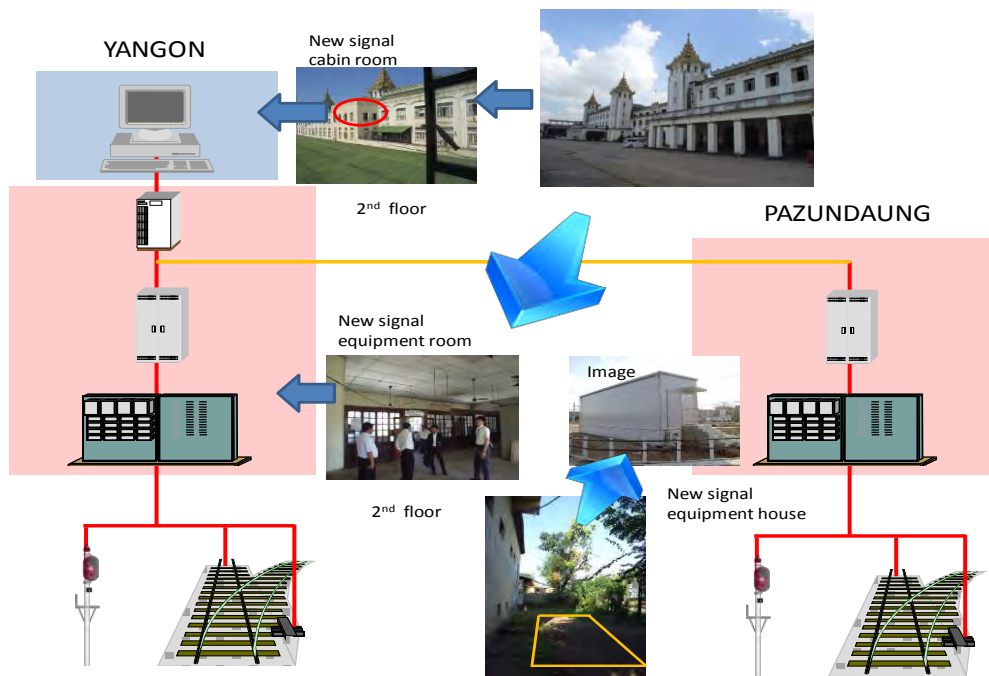
Source: The Study Team

Fig.2-9 Renewal plan at Yangon central station



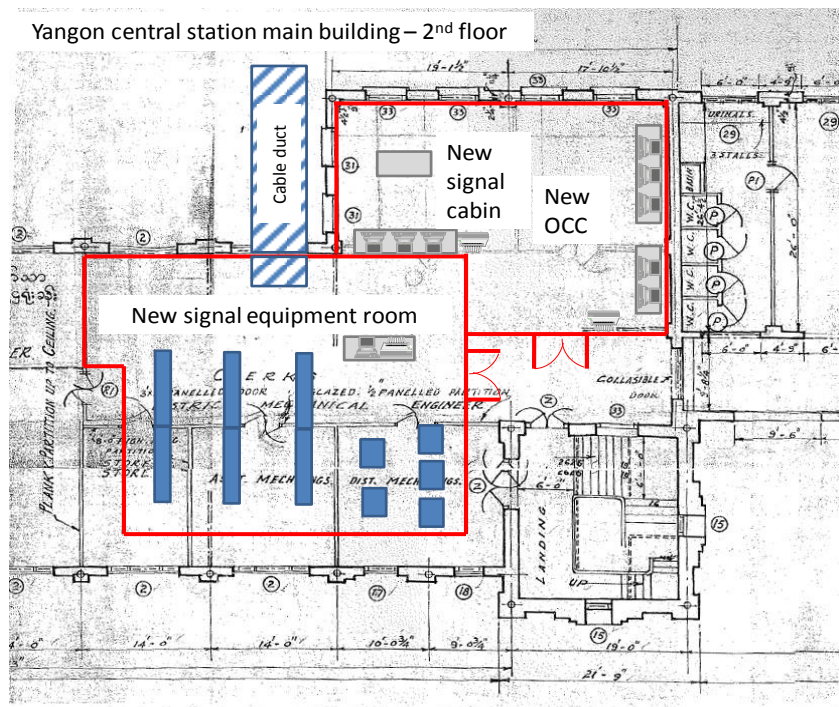
Source: The Study Team

Fig.2-10 Renewal plan at Pazundaung station



Source: The Study Team

Fig. 2-11 Total image of the interlocking renewal



Source: The Study Team

Fig.2-12 Image of the new signal cabin room & signal equipment room

(f) Power supply system

Yangon central station receives electric power from a 1000 kVA transformer of a YESB (Yangon City Electricity Supply Board) power distribution post located 250 m west of the station. This project consumes 210 kW from this power source.

The electric power source of the Yangon central station electronic interlocking system is composed of the YESB power distribution post, MR power distribution post, Yangon new electric power room, Yangon central station electronic interlocking machine room, Pazundaung electronic interlocking machine room, and existing step-up transformer of the Yangon central station signal power room.

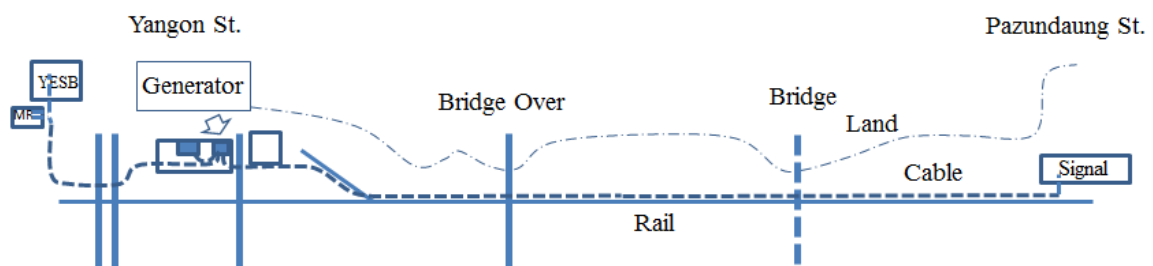
An electric power cable connects the YESB power distribution post and MR power distribution post. The electric power cable to the Yangon new electric power room is connected to the circuit breaker installed in the MR power distribution post. The power distribution system applies 3-phase 4-wires 400V and 4-core power cables. The power cable is covered with protective cover, protective tubing, and concrete trough in outdoor cases. Pavement is cut to place the concrete trough. Cleat is set on the beam under the roof to protect the power cable. Cables along the wall are installed on the cable rack.

In the new electric power room, a diesel engine generator 210 kVA 3-phase 4-wires 400V is installed after relocation of the existing 25 kVA generator, and automatically provides electric

power in case of a YESB power outage. This electric power is connected to a 25 kVA 400V/660V step-up transformer for the Pazundaung electronic interlocking machine room and the existing 230V/660V step-up transformer.

The Yangon new electric power room and Yangon central station electronic interlocking machine room are connected by a 3-phase 3-wires 400V system. A cable rack is installed along the wall. Cleat is set on the beam under the roof to protect the power cable. The power cable crosses the platform in the pit and goes up to the machine room, covered by cable duct along the wall. This route is shared with signal wires, and partition walls keep the clearance. The power cable goes into the machine room free access floor through the 2nd floor window.

The new electric power room and Pazundaung station electronic interlocking machine room are connected by a single phase 660V system. A cable rack is installed along the wall. Cleat is set on the beam under the roof to protect the power cable. Pavement is cut to place a synthetic resin trough from the edge of the SINO building. A power cable is installed on the ground surface to avoid interference with underground signal wires, goes over the gutter with a through bridge, and goes under the rail and switching equipment and beside the bridge.



Source: The Study Team

Fig.2-13 Route of Electric Power Line

(g) Removal of wayside signalling equipment

This project requires the renewal of the signalling system at Yangon central station and Pazundaung station. However, scope of this project does not include removing existing signalling device. Therefore, removing works of existing signaling device becomes MR side burden sharing and it needs to discuss about this matter with MR. It occurs at both stations of Yangon center Station and Pazundaung Station. The number of wayside equipment needed to be removed is shown in Table.2-5

Table.2-5 Number of wayside equipment to be removed

Equipment	Unit	Qty.		
		Total	Yangon central Station	Pazundaung station
Colour light signal	Set	35	28	7
Shunting signal	Set	44	44	0
Route indicator	Set	2	2	0
Switch machine	Set	81	67	14

Source: The Study Team

Points of confirmation and topics for discussion with MR are as follows.

- Disposal of the removed equipment
- Does not remove the existing interlocking at Yangon central station and Pazundaung station.

② Station route control and yard shunting work

(a) Yangon central Station

Yangon station is a terminal station of the Yangon – Mandalay trunk line as well as that of the Yangon Circular line. To serve the operation of the aforementioned lines, there are eight departure/arrival tracks, a locomotive siding track, a route to the freight yard, a route to the locomotive depot, and other groups of serving lines in Yangon station.

The shunting work at Yangon station includes train departure preparation at the departure/arrival line, changing locomotives, and locomotive siding, but all the shunting work is decided by the station master of the day and not planned in advance. Route control for station yard work, except for the freight yard and locomotive depot, is operated by the ‘first class electro-mechanical interlocking device located in the station signal control room. There are 174 routes controlled by this interlocking device (machine), and the usage of each route ranges from 80 to 400 per day, which is quite numerous.

The station shunting work is investigated to consider reducing the number of routes controlled by the interlocking device, and it is assessed that four or five routes could be managed at the site. However, reducing only four or five routes does not have significant effect to the electronic interlocking device’s cost. Moreover, managing at the site requires complicated procedures and communication with the station signal control room and is likely to cause human errors. Taking the above into consideration, it is decided that control of all the existing routes be performed by the new electronic interlocking.

(b) Pazundaung Station

Pazundaung station is an intermediate station which controls the signal and setting block system for Mandalay trunk line trains and Yangon Circular line trains. There are 18 routes in Pazundaung station and those are controlled by the ‘first class electro-mechanical interlocking device’ installed about 40 years ago.

(c) Shunting work after Installation of Electronic Interlocking

Installation of electronic interlocking integrates Pazundaung station’s shunting work control with Yangon station, thus signal control at Pazundaung station will be reduced. The organization of the Yangon station signal control room requires three staff, one control staff for the north area, one for the south area, and one for coordination. One additional reserve staff to the aforementioned three will enable operation of the signal control room.

The existing shunting work does not seem to be previously planned and the staff do not even have ‘station shunting operation diagrams.’ The daily shunting plan is described on this ‘shunting operation diagram’. Work with the shunting operation diagram is absolutely necessary to perform work smoothly as scheduled and maintain reliable train operation. Therefore sufficient education/training for MR staff on preparing the diagram in addition to training on electronic interlocking system operation is recommended.

③ Equipment plan

Major equipment newly installed at Yangon central station and Pazundaung station are shown in Table.2-6. The study revealed that the particular manufacturers can produce the electric point machines which meet the specific requirement designed by the study team. The project shall secure the competition from now on.

It provides a training device for electronic interlocking system because this is first time to install the system in DIVISION 7. The engine generator should match the signal equipment and the generating noise should be taken into consideration. The wayside power cable is installed in a trough on the ground surface.

Table.2-6 Equipment plan for interlocking renewal

Equipment	Major specification	Qty.	Purpose of use
Electronic interlocking system	System configuration - SSI rack (Duplex, 192 routes, Program control) - TFM rack (Duplex)	1 unit	Electronic interlocking system

Electronic interlocking system	<ul style="list-style-type: none"> - Control terminal (Factory computer) - Maintenance terminal (Factory computer) 		
I/F rack	<p>Include as follows</p> <ul style="list-style-type: none"> - Relay rack - FT rack - OT rack - Equipment table - Temporary rack 	2units	<p>The relay rack is used for train detection and signal control.</p> <p>The FT/OT rack and the equipment table is used for I/F to the wayside signal equipment.</p> <p>The temporary rack is used for change point machines.</p>
Lightning resistant transformer (LT)	<p>Voltage fluctuation: 3% or less</p> <p>Efficiency: Over 95%</p> <p>Surge transfer: 1/1000 or less</p> <p>Insulation classification:</p> <p>Class H for receiving power</p> <p>Class B for supplying power</p>	16sets	To protect from lightning surges
Uninterruptible power supply system (UPS)	<p>True on-line, double conversion topology with integral automatic bypass</p> <p>Input Voltage range: AC 220V ~ 240V</p> <p>Phase: Single phase plus ground</p> <p>Frequency: 50/60 Hz Auto-sensing</p> <p>Rated power: 5 kVA</p> <p>Overload: 60 minutes</p>	2sets	Emergency power to a load when the input power source fails
Colour light signal	<p>LED lighting</p> <p>Sight distance: 600 m</p> <p>Colour:</p>	29sets	Pass information relating to the

	<ul style="list-style-type: none"> - G Green (JIS E 3303) - Y Yellow (JIS E 3303) - R Red (JIS E 3303) 		state of the line ahead to train drivers
Electric shunting signal	<p>LED lighting</p> <p>Sight distance: 200 m</p> <p>Colour: White (JIS E 3303)</p>	52sets	Signal for shunting
Route indicator	<p>LED lighting</p> <p>Sight distance: 200 m (or 100 m for shunting)</p> <p>Colour: White (JIS E 3303)</p>	43sets	
Electric point machine	<p>Operating Voltage: AC105V±20%(Single phase)</p> <p>Rated frequency: 50/60 Hz</p> <p>Control Voltage: DC 24V+20%</p> <p>Stroke: Throw bar 185 mm</p> <p>Lock bar 130~185 mm</p> <p>Operating time: approx. 7 sec or less</p> <p>Overload clutch: Magnetic</p> <p>Indirect lock method</p>	81sets	For turnout switch
Connection parts	<p>Include as follows</p> <ul style="list-style-type: none"> - Front rod - Connection rod - Switch adjuster - Tie-bar - Sole plate - Spike screw - Tongue rail - Synthetic sleeper 	81units	Connect a turnout to an electric point machine
Raised base for electric point machine	<p>Include as follows</p> <ul style="list-style-type: none"> - Raised base (200 mm, 300 mm) - Throw bar adapter - Rock rod coupling joint 	67units	For submergence measures
Training Device for electronic interlocking system	<p>System configuration</p> <ul style="list-style-type: none"> - SSI rack - TFM rack - Control terminal - Site simulator 	1unit	For operating training and maintenance training

Diesel engine generator	3-phase 4-wires 400V 210 kVA class	1set	Emergency power in case of power outage
Transformer	Single-phase 400V:660V 25 kVA	1set	
Electric wire	Cross-linked polyethylene insulated vinyl sheath cable	1978m	
Concrete Trough	Width 150 mm	148m	Protection of electric wire
Synthetic Resin Trough	Width 70 mm	999m	Protection of electric wire
Electrical Wire Tube	Various kinds	122m	Protection of electric wire

Source:The Team Team

(2) Installation of the automated level crossing alarm facilities between Toegyaungkalay and Ywathagyi

① Selection of the level crossing to be automated

There are currently five level crossings, shown in Fig.2-14, between Toegyaungkalay and Ywathagyi. Two of them near Yangon are located in a station yard.



Source:The Study Team

Fig .2-14 Location of the level crossings between Toegyaungkalay and Ywathagyi

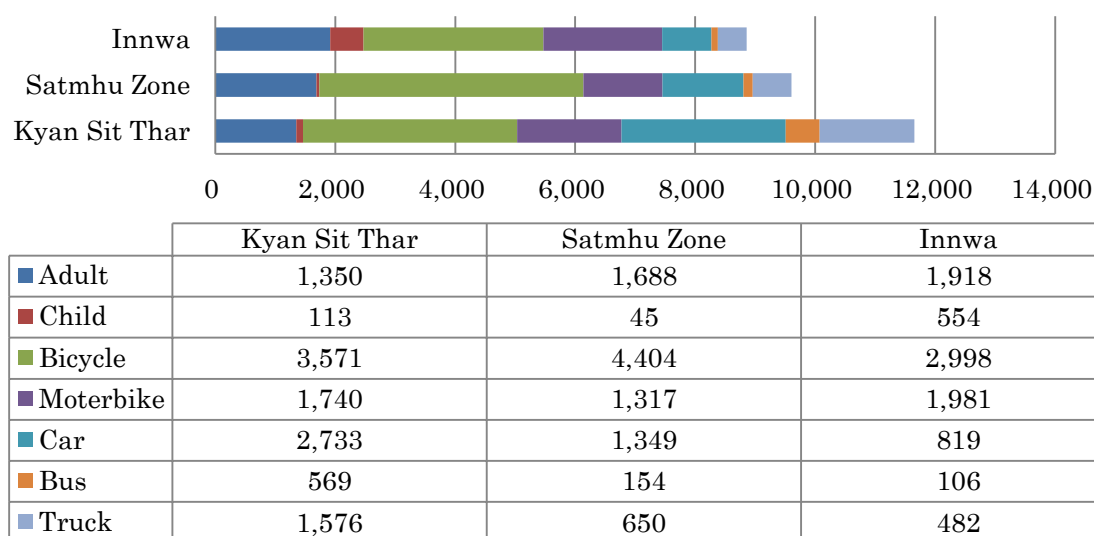
When a level crossing in a yard is automated, the wiring of the interlocking device must be changed in a short period of time, which increases the risk of accidents. Therefore, these two level crossings in the station yard were excluded, and the traffic volume survey of the remaining level crossings was conducted in order to choose an appropriate one. (Shown in Table.2-7 and Fig .2-15)

Table.2-7 Traffic volume survey of the level crossings

Sunday								Sun 16 / Feb / 2014							
Level Crossing	Foot traverser		Bicycle	Moterbike	Car	Bus	Truck								
	Adult	Child													
Kyan Sit Thar	714	61	1,830	837	1,371	237	664								
Satmhu Zone	828	27	1,953	640	504	3	205								
Innwa	1,016	246	1,349	1,005	462	9	193								
Weekday								Mon 17 / Feb / 2014							
Level Crossing	Foot traverser		Bicycle	Moterbike	Car	Bus	Truck								
	Adult	Child													
Kyan Sit Thar	636	52	1,741	903	1,362	332	912								
Satmhu Zone	860	18	2,451	677	845	151	445								
Innwa	902	308	1,649	976	357	97	289								

- (a) Survey was conducted on both Sunday and a weekday .
 (b) Foot traversers were counted in two groups, Adult and Child (under 14 years old).
 (c) Bicycles were counted as one regardless whether they were ridden by an adult or child.

Source: The Study Team



Source: The Study Team

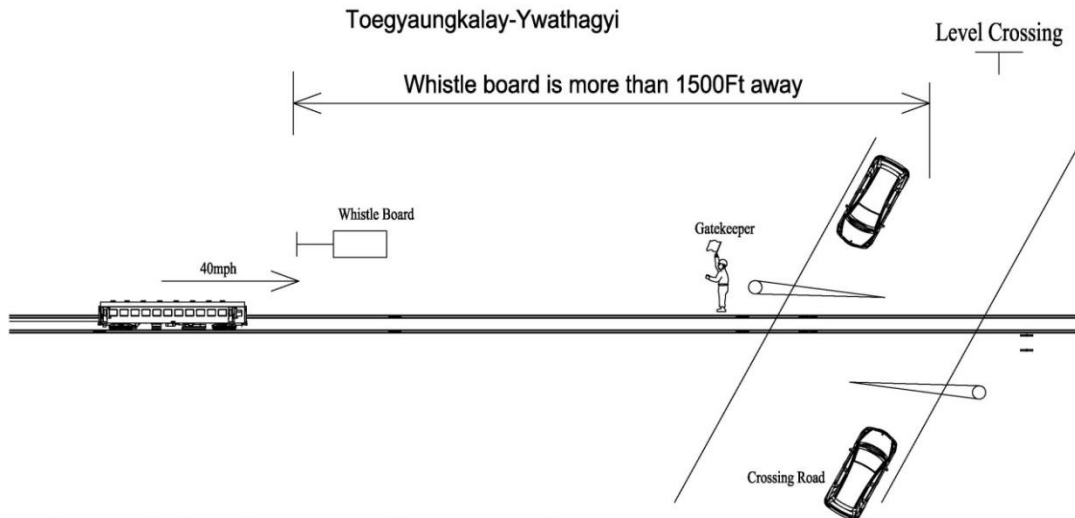
Fig.2-15 Summary of the traffic volume survey

Based on the survey, the Kyan Sit Thar Level Crossing was selected because it had the most traffic, its volume of passing traffic including cars was well balanced in various categories, and the burden on its gatekeeper was rather heavy.

② Present situation

With regard to the above-mentioned section, no safety device is installed at this moment and the passing traffic safety of each level crossing is ensured only by the train's alarm whistle, the barrier machine manually handled by the gatekeeper, and his flag signaling. (Shown in Fig .2-16)

The current handling rules for Level Crossing



- The train driver blows the whistle soon after he notices the Whistle Board.
- The gatekeeper closes the gate soon after he recognizes the alarm whistle.
- The gatekeeper waves the flag at the train driver as the sign of moving forward, after he closes the gate.
- The train driver checks the gatekeeper's flag and passes through the level crossing.
- After the train passes through the level crossing, the gatekeeper opens the gate.

Source: The study Team

Fig.2-16 The current handling rules for the level crossing

Under the consideration of the above-mentioned situation, the level crossing warning alarm is installed in order to warn the passing traffic, including cars, and the electric barrier machine is also introduced in order to reduce the gatekeeper's burden and shorten the gate closing time. (As for choosing the appropriate barrier machine type, it should be noted that there is no height restriction for the passing traffic of the level crossing.)

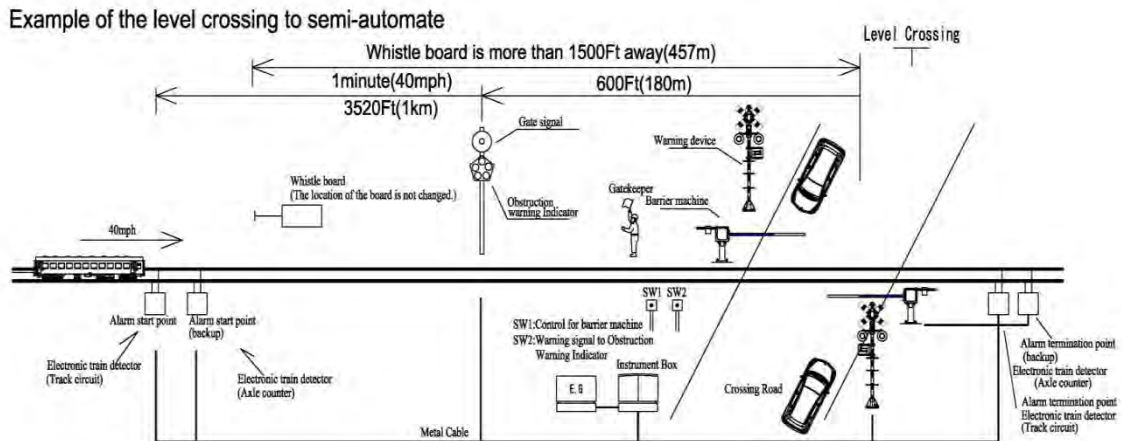
At the same time, the level crossing control device, including the train detector, and the gate signal (i.e. gate close indicator) are installed in order to control the warning alarm and inform the train driver of the gate close.

In order to automate the level crossing alarm, the current handling rules for the level crossing were carefully studied. The new operational procedure for the automated level crossing is shown in Fig.2-17.

③ After implementation

Considering the combination with the existing operation, the final configuration will become as shown in Figure 2-17 after a part of the operation of the level crossing will be automatized. For the operation in the future, we plan to station a crossing guard for a certain period after the implementation to let the train drivers and the level crossing users accustom to the new system, and then introduce a fully-automatized system in the next step.

MR is required to, as the manager and operator of the facilities, internally discuss the improvement and amendment on the operation including any change in the rules while continuously monitoring the situation after the implementation. Because it is quite natural that the intended situation will change due to a new finding that will be recognized after the new equipment is introduced and started to operate and increasing familiarity of the operator and users for the new facilities operator.



Operation of the warning device

- The warning device starts to ring when the train passes through the alarm start point.
- The alarm warns the crossing traffic including cars, that the train will come soon.
- The alarm stops to ringing when the train passes through the alarm termination point.

Operation of the barrier machine

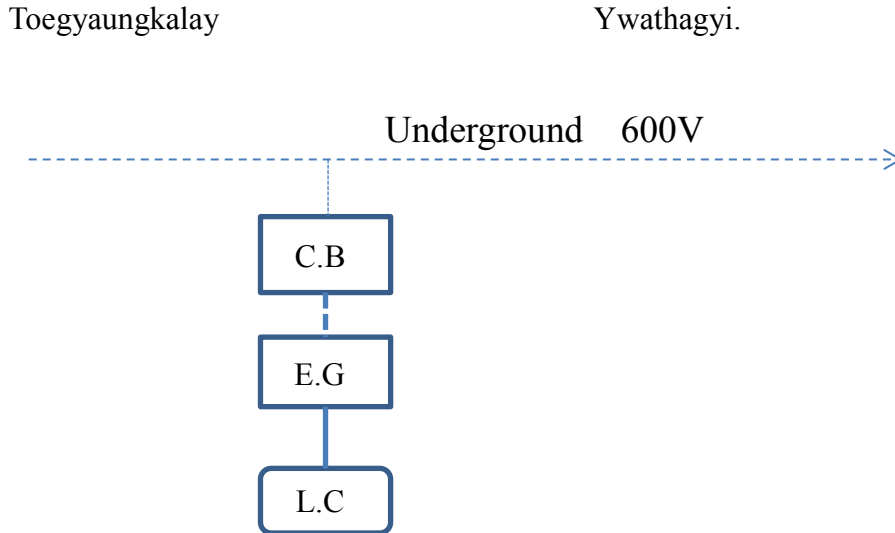
- The train driver blows the whistle soon after he notices the Whistle Board.
- Soon after the gatekeeper recognizes the alarm whistle, he handles the SW1 so that the barrier bar closes the gate.
- The Gate Signal is turned on when the gate is closed completely.
- The gatekeeper waves the flag at the train driver as the sign of moving forward.
- The train driver checks the Gate Signal and the gatekeeper's flag, and passes through the level crossing.
- After the train passes through the level crossing completely, the gatekeeper handles the SW1 so that the barrier bar is opened.

Source: The Study Team

Fig.2-17 Device configuration and operational procedure for the automated level crossing

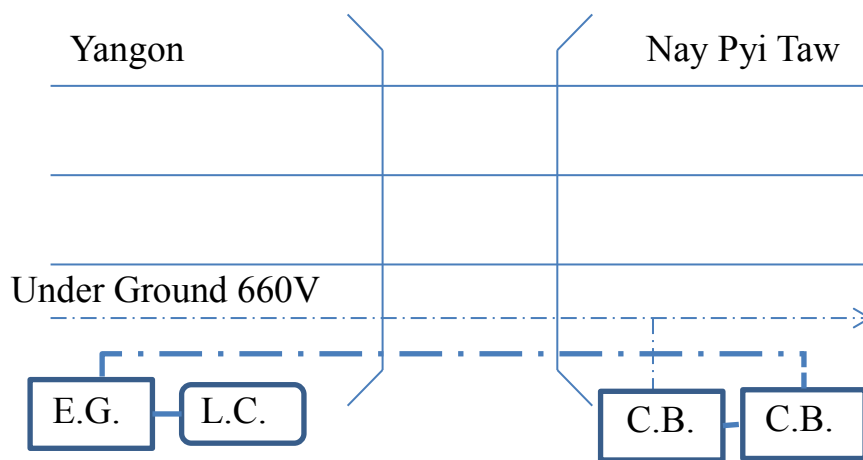
In usual, power supply of the level crossing uses 600V underground electric wire between Toegyaungkalay and Ywathagyi.

The voltage is changed for level crossing by converter and a diesel generator is installed as an emergency power supply.



Source: The Study Team

Fig.2-18 Power supply for the level crossing



Source: The Study Team

Fig.2-19 Connection with the generator

③ Alarm rule

The train speed limit of the Yangon-Mandalay Trunk Line and the University Line between Toegyauungkalay and Ywathagyi is as follows:

Y-M Trunk Line: 40 mph (64.37 km/h)

University Line: 25 mph (40.23 km/h)

The gate signal (i.e. crossing gate close indicator) is set up at a location of 600 ft (183 m)

away from the center of the level crossing. The alarm start point is decided based on the calculation of the distance traveled in one minute for a train to run from the alarm start point to the gate signal, at a speed of 40 mph.

Since it takes 70 seconds for a train to run from the alarm start point to the level crossing, the alarm continuation time is also set to 70 seconds.

The operating train speed of the Yangon-Mandalay Main Line and the University Line between Toegyauungkalay and Ywathagyi is as follows:

Y-M Trunk Line: 25 mph (40 km/h)

University Line: 10 mph (16 km/h)

Based on the above-mentioned study and under the consideration that the alarm continuation time is 70 seconds, the calculated alarm time delay element is shown in Table.2-8 At the time of actual installation work, however, the alarm time delay element must be adjusted.

Table.2-8 Alarm time delay element

	Yangon-Mandalay Main Line		University Line	
	Speed limit	40(mph)	64.37(km/h)	25(mph)
Alarm start point T	3520(Ft)	1072.9(m)	2200(Ft)	670.56(m)
Alarm start point A	3,511(Ft)	1070.11(m)	2,191(Ft)	667.77(m)
Arrival time at level crossing (s)	70.30(s)		76.40(s)	
Operating speed	25(mph)	40.23(km/h)	10(mph)	16.09(km/h)
Alarm start point T at operating speed	2,200(Ft)	670.56(m)	880(Ft)	268.22(m)
Alarm start point A at operating speed	2,191(Ft)	667.77(m)	871(Ft)	265.44(m)
Arrival time at level crossing at operating speed (s)	76.40(s)		100.90(s)	
Alarm time delay element (s)	7.00(s)		25.00(s)	

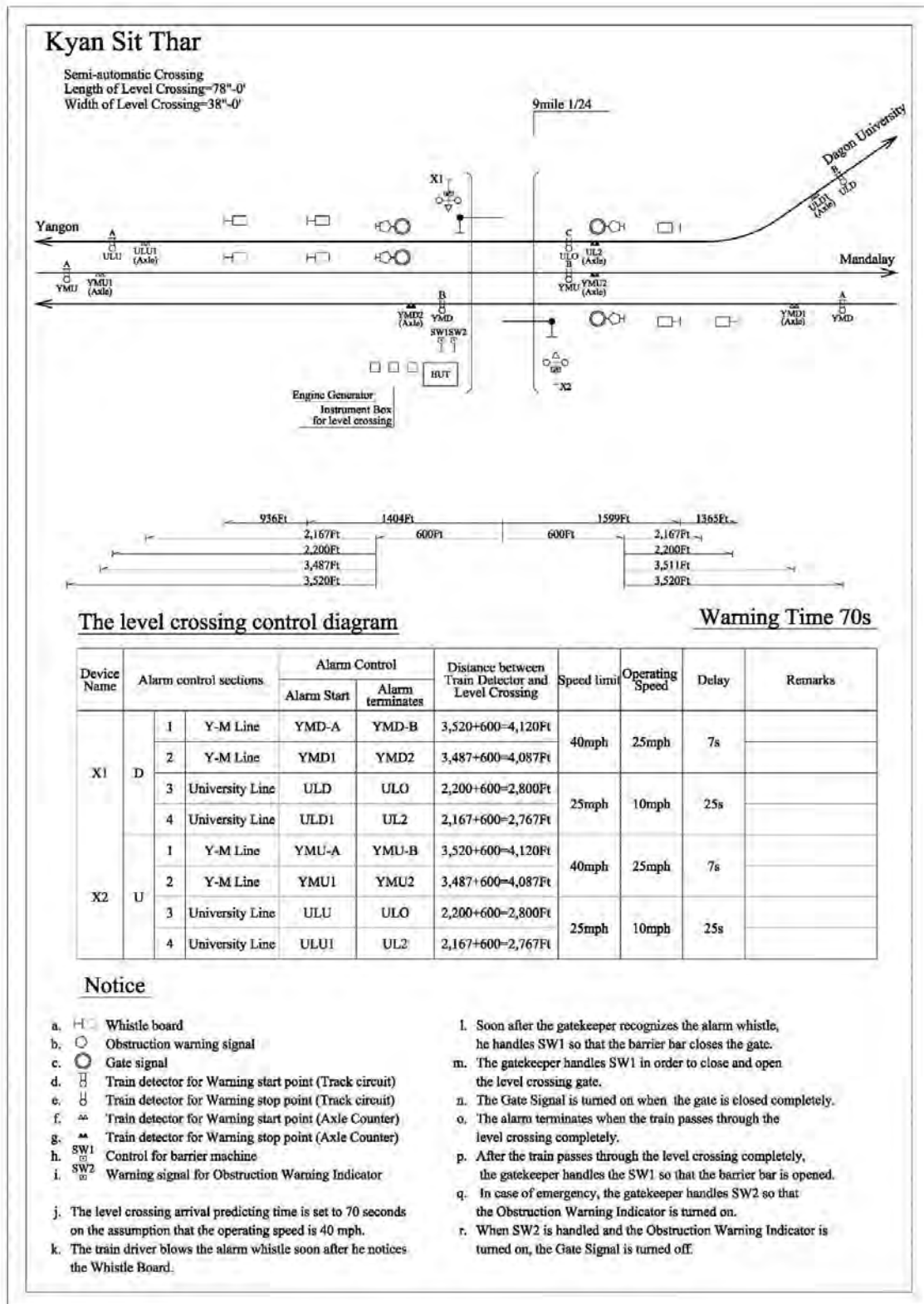
Source:The study Team

Alarm time delay element: Time lag from when the train passes through the alarm start point to when alarm starts to ring

T: Electric train detector based on track circuit

A: Electric train detector based on axle counter

The Control Diagram for Level Crossing in consideration of the alarm time delay element is as follows: (shown in Fig .2-18)



Source: The Study Team

Fig.2-18 Control Diagram for Level Crossing

④ Necessary equipment for the automated level crossing

Based on the field survey, the necessary equipment for the automated level crossing is as follows:

Table.2-9 Necessary equipment for the automated level crossing

Equipment	Specification	Unit	Quantity	Purpose of use
Level crossing control device	Circuit control: Relay Train detection method: Electronic train detector (H type), backed up by using axle counter Blackout operating time: 8 hours (by using both battery and emergency generator) Rumbling condition: Based on the control diagram. Adjustable Barrier machine is controlled by handling switch.	set	1	To control the Warning device, Barrier machine, Gate signal, etc.
Warning alarm	Type: Type 'A', corrosion protection type Component: Warning sign, Warning light (using LED), and Loudspeaker (with volume change function) Operating voltage: DC 24V	set	2	When the train comes, the alarm warns the crossing traffic.
Electric barrier machine	Type: Weight type, straight bar Component: Barrier bar (made of FRP), and Breakage preventer Operating voltage: DC 24V Movement at the time of failure: Barrier bar closes the gate.	set	2	To close the gate.
Gate signal (i.e. crossing gate close indicator)	Type: LED (use truck marker as a substitute) Operating voltage: 30V Sight distance: 200 m Luminous color: Green	unit	4	Signal is turned on after barrier bar closes the gate completely.

Obstruction warning signal	Type: Rotating type, using LED Operating voltage: 24V Sight distance: 800 m Luminous color: Red	unit	4	To warn train driver of emergency.
Control cable	Type: Corrugated steel tube armored and vinyl rust prevention cable, CVV-MAZV Purpose: Control system, (laid underground) Specification: Based on JIS C 3401 Rating: 600V, 60°C	km	6.8	To connect devices.

Source: The Study Team

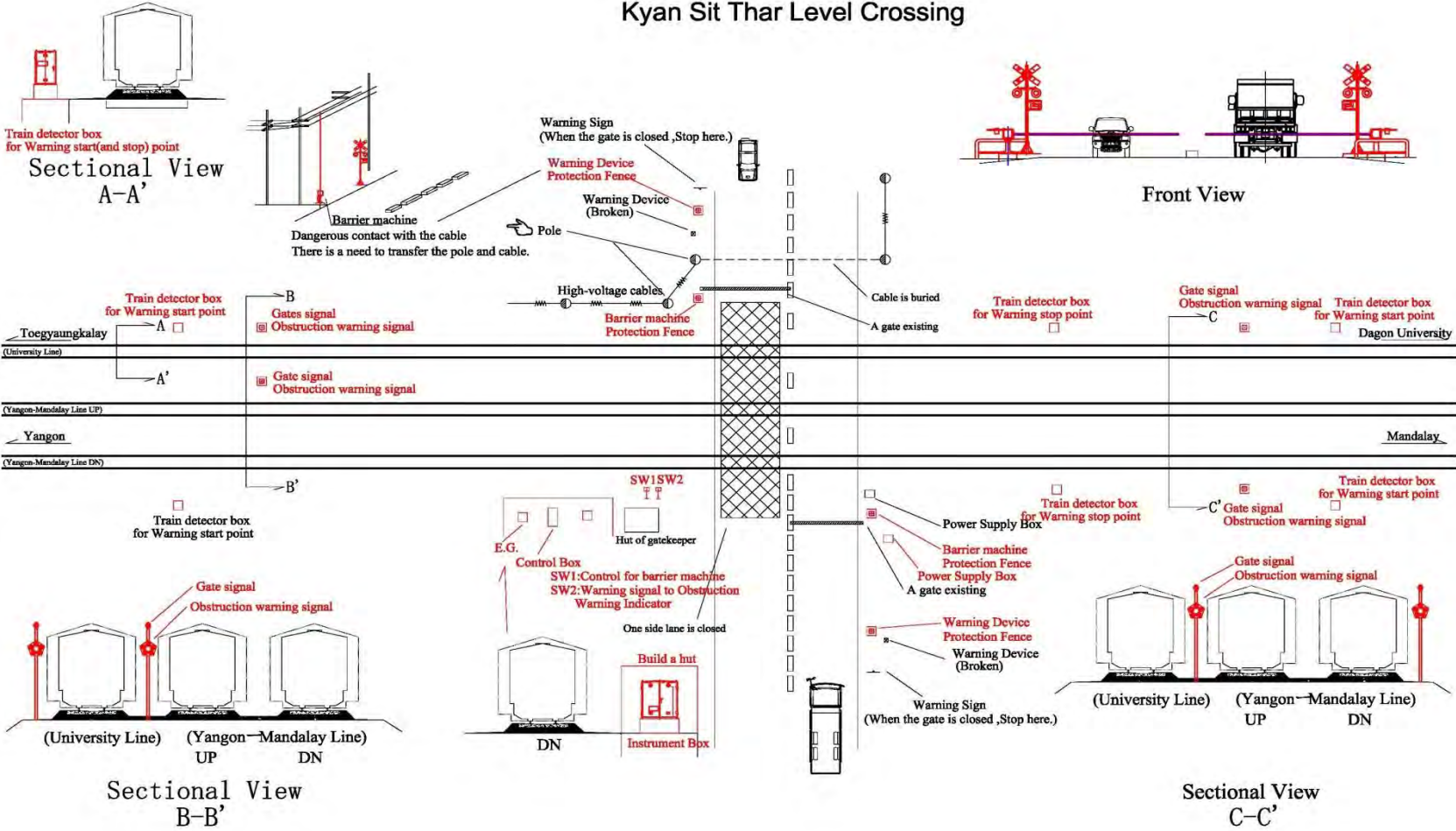
Concerning the type of generator, it must be chosen under the consideration of the consistency with the load, as well as its noise.

Table.2-10 Necessary equipment for the generator

Equipment	Specification	Unit	Quantity	Purpose of use
Diesel generator	Single-phase, 5kVA class	unit	1	Backup power at the time of blackout.

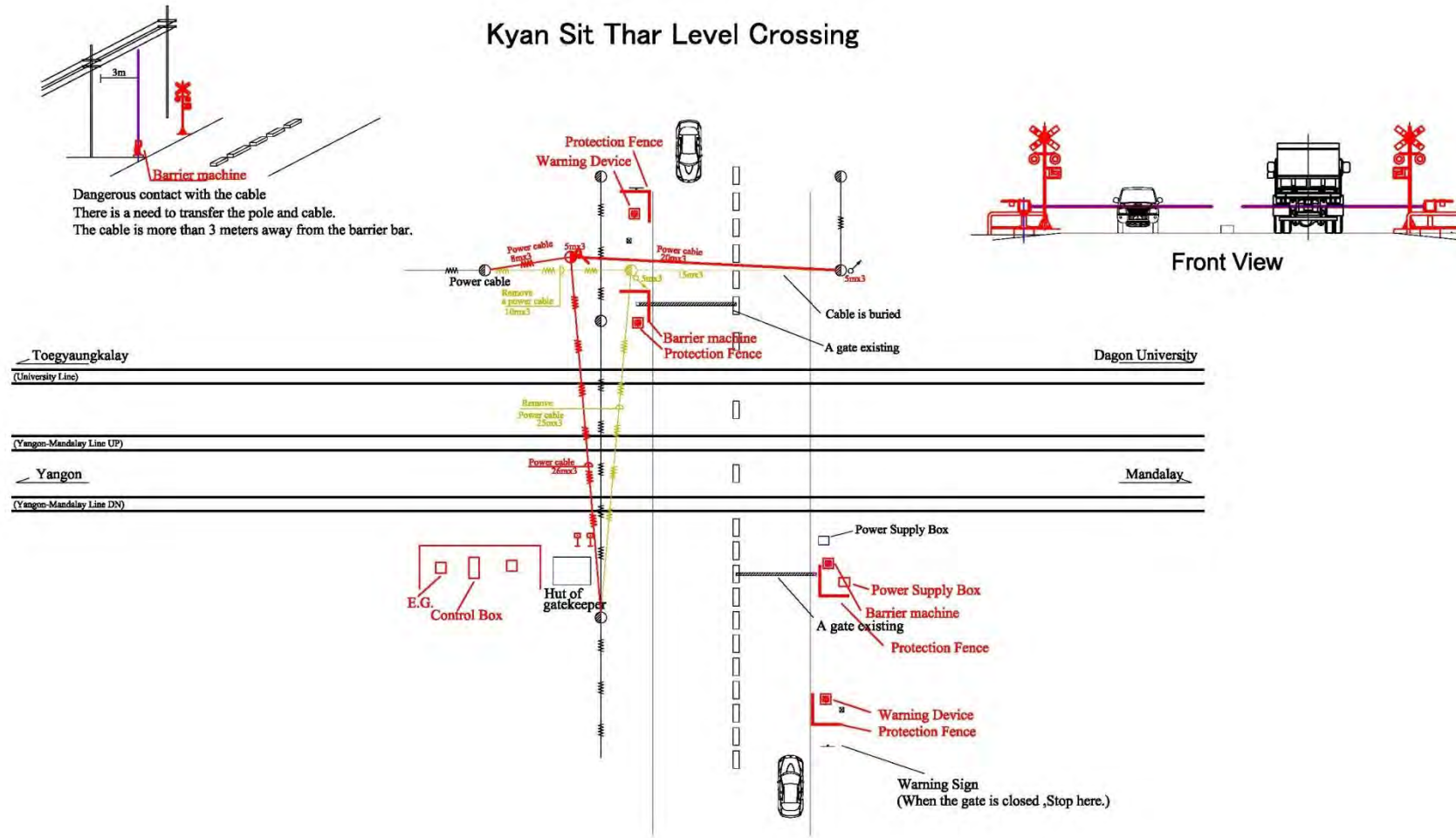
Source: The Study Team

Kyan Sit Thar Level Crossing



Source: The Study Team

Fig .2-21 Outline Design of Kyan Sit Thar Level Crossing (1)



Source: The Study Team

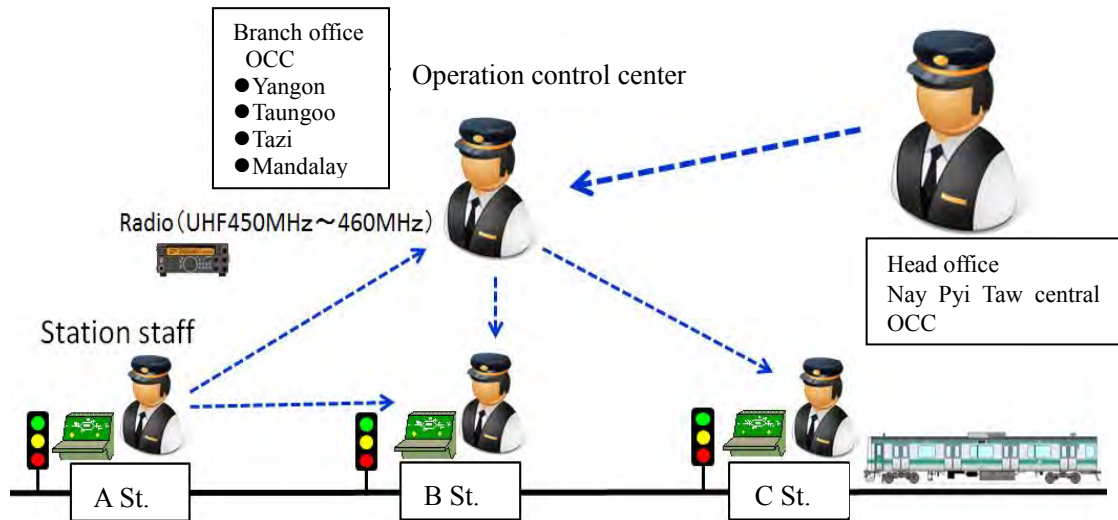
Fig .2-22 Outline Design of Kyan Sit Thar Level Crossing (2)

(3) Installation of Centralized Train Monitoring System for Yangon – Pyuntaza section

① The modernization program outline of transportation dispatcher

(a) Existing situation of Myanmar Railway Operation Control

An Operation Control Center (hereinafter OCC) is located at each of the four divisions (Yangon, Taungoo, Tazi, and Mandalay) for the Yangon – Mandalay trunk line. Each OCC communicates with the stations within the district to manage train operation. The head office train OCC at Nay Pyi Taw manages the four OCCs.



Source: The Study Team

Figure .2-23 Existing Operation Control in Myanmar Railways

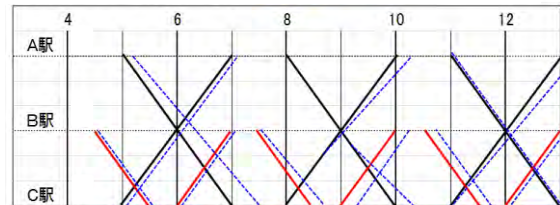
The district OCC receives the train operation plan for the day from the head office train OCC at Nay Pyi Taw, and prepares the implemented train timetable (diagram) as described in Figure.2-24. The district OCC communicates with the station to follow up the implemented train operation, and records the train arrival/departure time on the actual timetable (diagram) as shown in Figure.2-25

Implemented diagram:
Diagram (basic train+ temporary train) which was planned



Figure.2-24 Implemented train diagram

Actual diagram:
Diagram which was actually operated



Source:The Study Team

Figure.2-25 Actual train diagram

Communication between dispatchers and station masters is transmitted via UHF radio and/or telephone, which make prompt and precise transmission of information difficult. Under such conditions, it is difficult to gather information, make decisions, and direct, which are the main important roles of dispatchers. As a result, the role of the OCC is limited to just recording the actual train operation, and decisions and directions are made by the station masters.

(b) Improvement of Train Operation Control (from Station to Operation Control Center)

When train numbers increase in the future, the handling of a signal and block system at each station increases, communication with the neighboring station and/or dispatcher increases, and management of the train operation status by the dispatcher becomes even more difficult with the existing operation control method.

In addition, it is anticipated that the increase of signal and block system handling at each station results in an increase of human errors, and thus is impossible to conduct smooth and safe train operation.

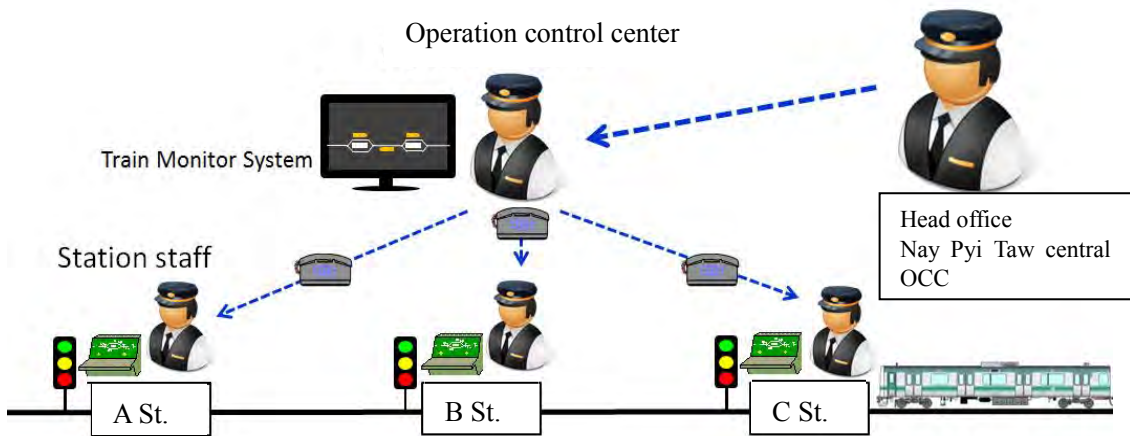
If the train frequency increases, the number of the trains affected by a single train delay increases, and the existing OCC will be incapable of handling train operation. It is likely that the number of trains increases due to increased demand, taking Myanmar's rapid economic growth into consideration. Therefore, it is crucial to change the train operation management system from the existing station-based system to centralized train operation management at the OCC. However, the transition to the proposed management system where route control is carried out in OCC will be conducted step-by-step.

To improve existing operation control, the implementation of Train Monitoring System (TMS) that provides the train operation status on time is essential. With TMS, the OCC does not need to call station masters to learn whether the train arrived/departed or not, and thus can arrange the train timetable promptly and precisely. The role of the OCC includes the following and needs to be re-arranged when the TMS is installed.

- ✓ Arrange and coordinate the timetable to operate the train as planned
- ✓ Plan special trains for temporary/seasonal demand
- ✓ Issue the investigation of disasters and accidents
- ✓ Arrange relief trains
- ✓ Understand weather conditions

The first step of operation control improvement is to install a TMS Display in the OCC

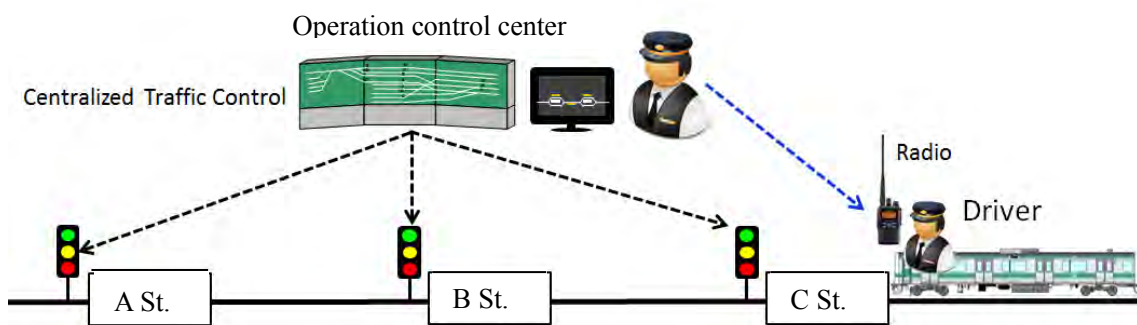
and monitor train operation status 24 hours per day. The difference from the existing system is that the station master controls the train route based on the plan and the OCC's directions, and the OCC has the authority for operation management. (Figure.2-26)



Source: The Study Team

Figure.2-26 The First Step of Operation Control Improvement

The second step is to install the Centralized Traffic Control system (CTC), which conducts route control in the station remotely from the OCC, and to install the train radio that enables direct communication between the OCC's dispatcher and train driver. The installation of the equipment is expected to further improve train operation management. (Figure.2-27)



Source: The Study Team

Figure.2-27 The Second Step of Operation Control Improvement

Introduction of TMS and circumference equipment is proposed by the study as 1st Step of modernization of train operation management.

② Centralized Train Monitoring System (TMS)

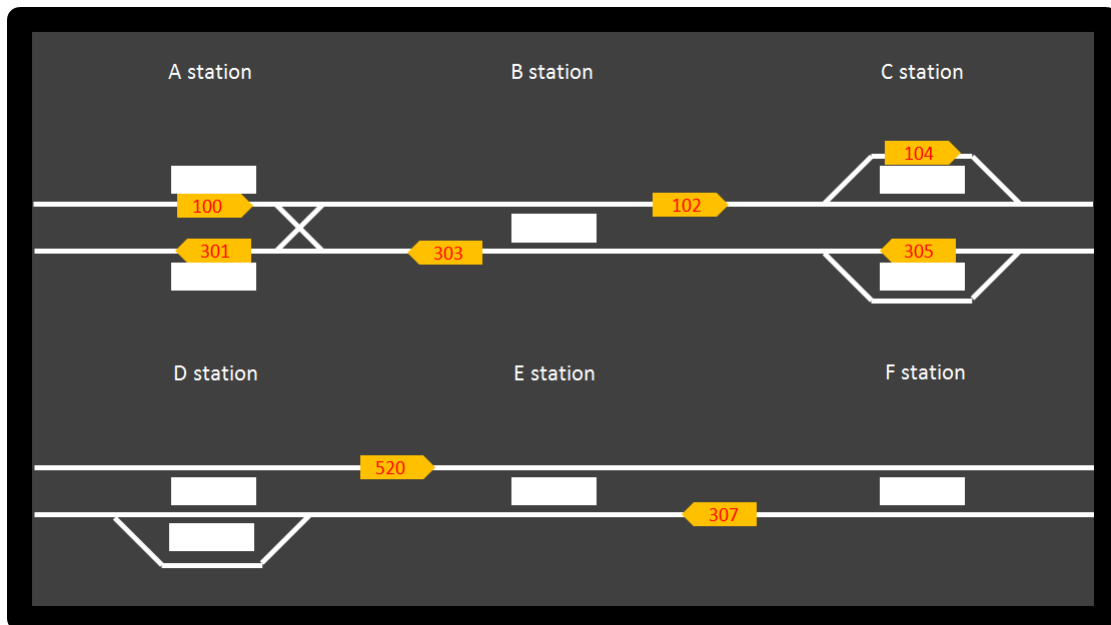
(a) Major function

The Centralized Train Monitoring System monitors train locations operating between Yangon station and Pyuntaza station. The 'central management system' and 'central transmission device' allocated in the Yangon Station signal equipment room processes the information of planned train diagrams and actual train location information from the Train Monitoring System installed in the interlocking station.

A train operation display panel is installed in Bago division OCC, which is allocated in the same place as the Yangon station signal control room. Train location and train number information are processed by the centralized management system and shown on the display.

(b) Train operation display panel

The train operation display panel shows the track arrangement of each station, train number, and train location between Yangon station and Pyuntaza station. However, train numbers of the Yangon Circular line operating in parallel with the Yangon - Mandaly trunk line from Yangon station to Toe Gyaung Kalay station will not be shown. Stations and numbers indicated on the display will be English characters and alphanumeric characters, and the train number will be a three-digit alphanumeric string.



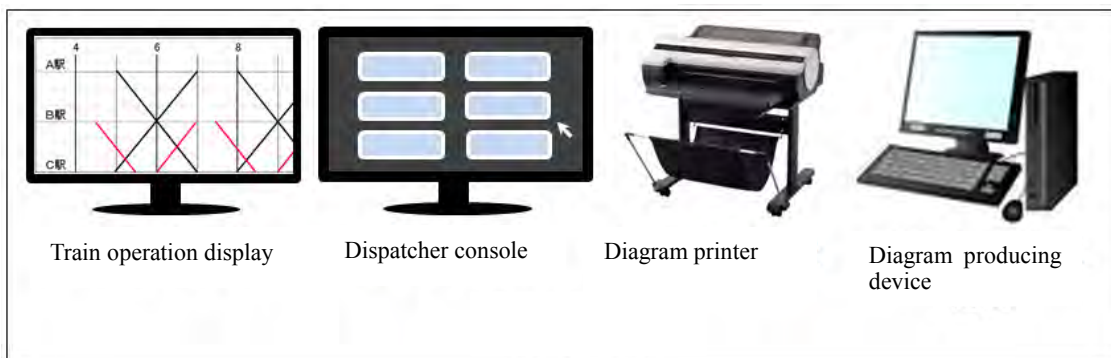
Source: The Study Team

Figure.2-28 Image of Train operation indication panel

(c) Auxiliary devices

The auxiliary devices of the train operation monitoring display includes a 'train operation display', 'dispatcher console', 'diagram printer', and 'diagram producing device'. The function of each device is as follows:

- Train operation display: Displays the planned train diagram and the operation record
- Dispatcher console: Input device for train order change, special train planning and execution, and changing the train number
- Diagram printer: Prints the planned diagram and actual train operation record
- Diagram producing device: Input the planned train operation record



Source: The Study Team

Figure.2-28 Auxiliary device of TMS

(d) The other devices

A 'Direct connect telephone', between the OCC and stations, and 'Simultaneous instruction transmission equipment' for announcing important operation information to all stations at once, are prepared to facilitate the transmission of the dispatcher's directions to the signal control center at each station. Among these, "direct connect telephone" is a telephone only for instructions and the transportation instructions prepared in each station by exclusive use, and fixes to be able to perform the required telephone call between a station and instructions immediately.

'Simultaneous instruction transmission equipment' utilizes the 'TID station console' installed in each station. Moreover, the following contents are told to each station by instruction paper for train operation or operation notice card all at once.

- ✓ Arrange and coordinate the timetable to operate the train as are planned
- ✓ Plan the special train for the temporary/seasonal demand
- ✓ Suspended of train operation

- ✓ Indicate the investigation of disasters and accidents
- ✓ Arrange the relief train
- ✓ Understand the weather condition

Furthermore, a check at each station is managed by Bago division OCC. The important information in connection with operation is transmitted certainly. Train operation display panel installed in Nay Pyi Taw central OCC shows the train operation information shown on the display located in the Bago division OCC.

③ Train Diagram Planning

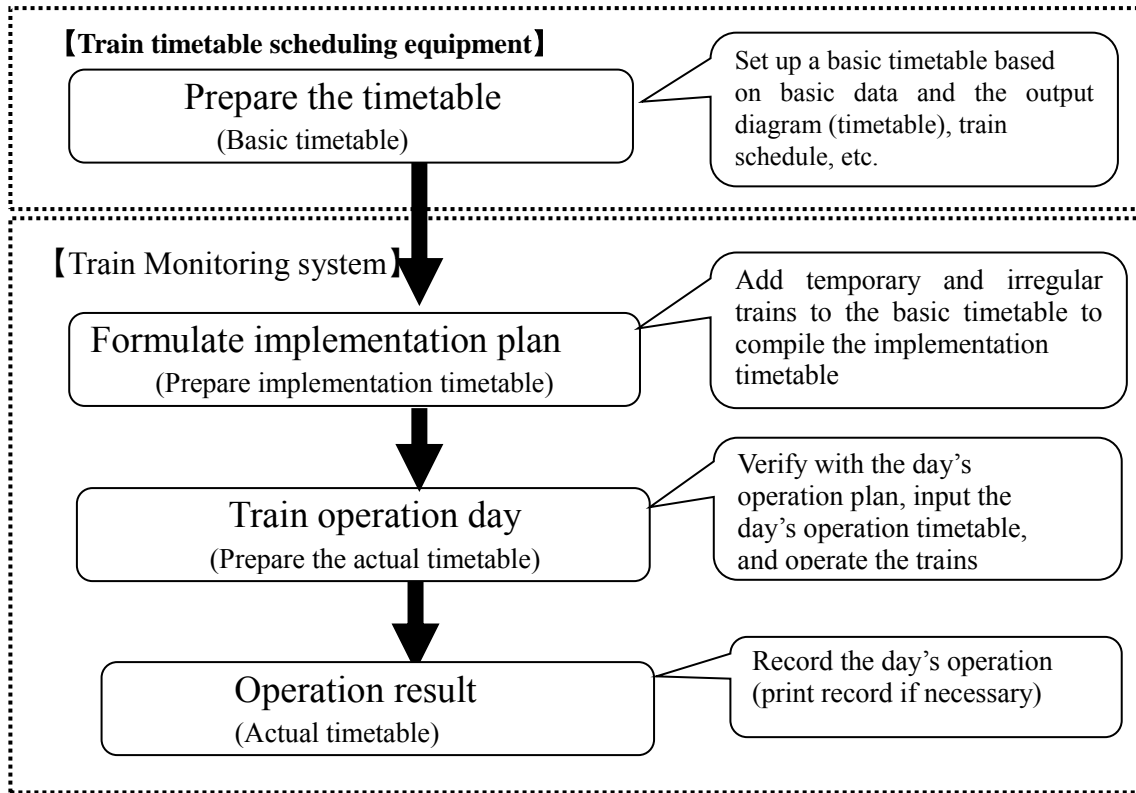
(a) Input operation of the train diagram

Regular train diagrams are organized based on regular running time and train headways. Regular train, seasonal train, and special train timetables are described on this regular train diagram.

The train timetable for the day is produced on the basis of the regular train diagram by confirming whether seasonal trains and special trains are planned or not. On the day of operation, the operation plan is checked, approved, and replaced at a certain time of the day. The operation record will be printed out if necessary.

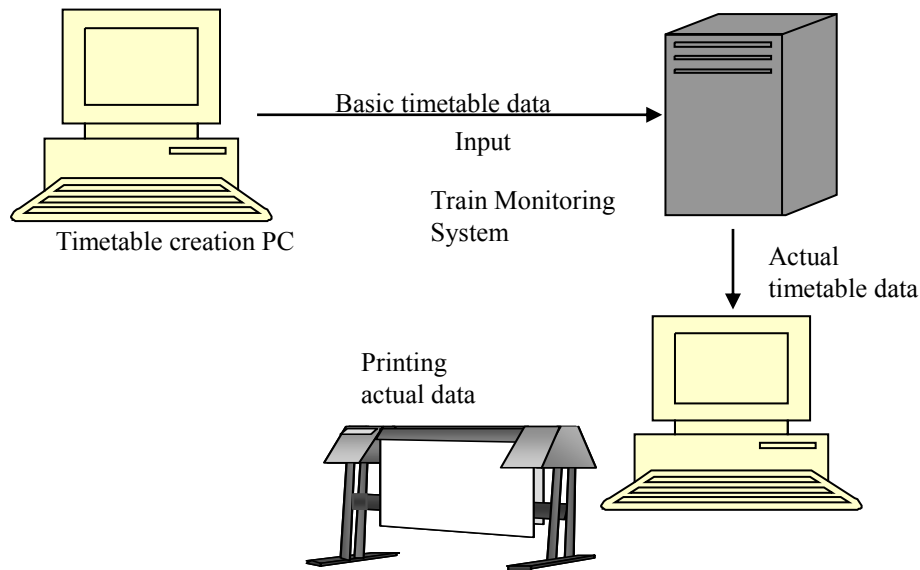
Actual train passage time is automatically measured by TMS. It records by an transportation dispatcher simultaneously. Thus, operation record is created on the day. Operation record is printed as a recording result of timetable on the day.

Figure.2-30 explains the flow from the regular diagram plan to the train operation record. Figure.2-31 explains the hardware configuration of the Train Timetable Scheduling System.



Source: The Study Team

Figure.2-30 Workflow of the Train Timetable Scheduling System



Source: The Study Team

Figure.2-31 Hardware configuration of the Train Timetable Scheduling System

(b) Types of train operation diagrams

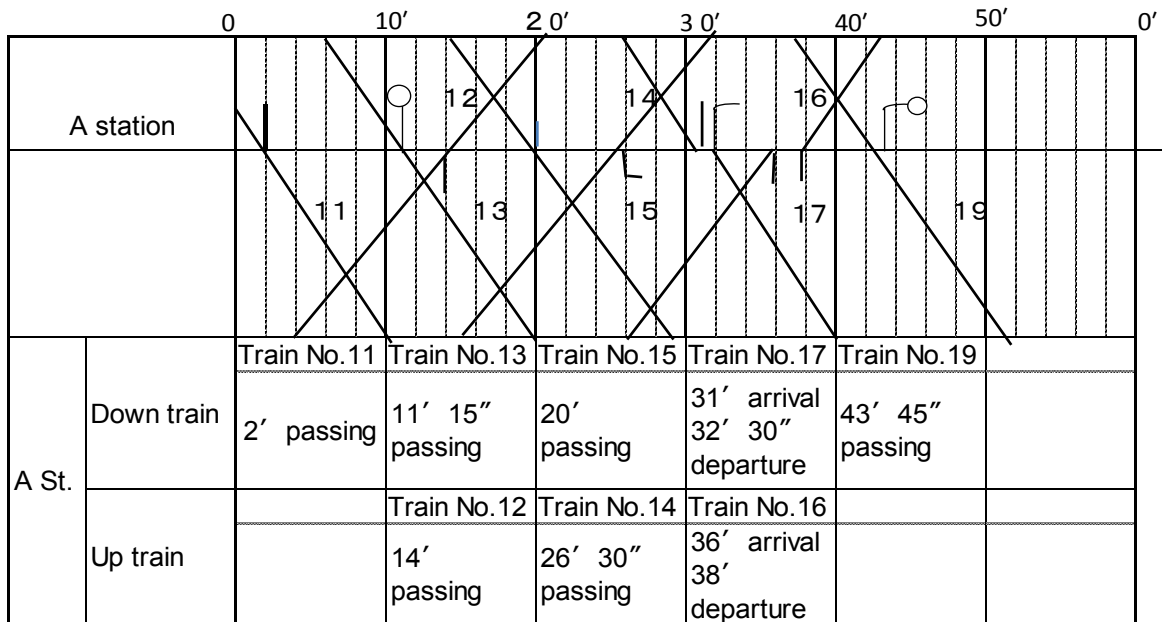
There are several types of train operation diagrams by purpose of use, shown in Table. 2-11. For the MR train monitoring system, introduction of a two-minute scale diagram is planned this time.

Figure.2-32 shows the indication symbols and an example of the two-minute scale diagram.

Table.2-11 Types and purpose of use of train diagrams

Types	Time scale	Unit of time	Purpose of use (Japan example)
2-minute scale train diagram	2 minutes	15 seconds	Operation plan, train adjustment of Japan Railway (JR) lines including HSR and local private co. lines.
1-minute scale train diagram	1 minute	10 seconds	Operation plan, train adjustment of commuting lines of the big city in JR and major private co.
1-hour scale train diagram	1 hour	1 hour	Outline operation plan of JR and through operation plan between each JR company

Source: The Study Team



Source: The Study Team

Figure.2-32 Viewpoint of a two-minute diagram

④ Equipment plan

In the implementation of this operation, the details of operation management with the MR side in the Bago division OCC were discussed and set as indicated in After Discussion 3-2). Moreover, concerning the role of the future Bago division OCC, the basic policy was checked in order to urge an increase in efficiency and modernization of operation and was set as indicated in After Discussion 3-3). To display train position, selection of the required equipment for each station and each division OCC, the transmission method to the optical conveying device of each station, the monitor's installation location, etc. were investigated. Moreover, the state of electric power supply of each station and the maintenance condition of the required power equipment were also investigated for the stable operation of the TMS equipment at each station.

In addition, when introducing TMS equipment through this research, it will be on the premise of using optical cables constructed in 2010 by support from India. For this reason, it is necessary to judge whether the use of Japanese TMS equipment is possible using an established optical cable. We investigated based on the confirmation of measurement results. As a result, the study team determined to use an optical cable as a transmission path for the TMS equipment. Use of four optical cable lines has been agreed upon with MR as a TMS transmission dedicated line between Yangon and Pyuntaza. Moreover, use of 2-core optical

cables was agreed upon with MR as a communication transmission line between Yangon and Nay Pyi Taw. This is for using it as the direct telephone set and an operation indication device transmission line to the Nay Pyi Taw central OCC.

The interlocking device which manages the route of a train has obtained support from foreign countries, various kinds of things were introduced, and introductory construction is being performed. In particular, the introductory construction of a Solid-State Interlocking system (SSI) is performed in 6 stations from Ladaungkan station to Payatonesu station with support from India, and the beginning of its use is aimed for the near future.

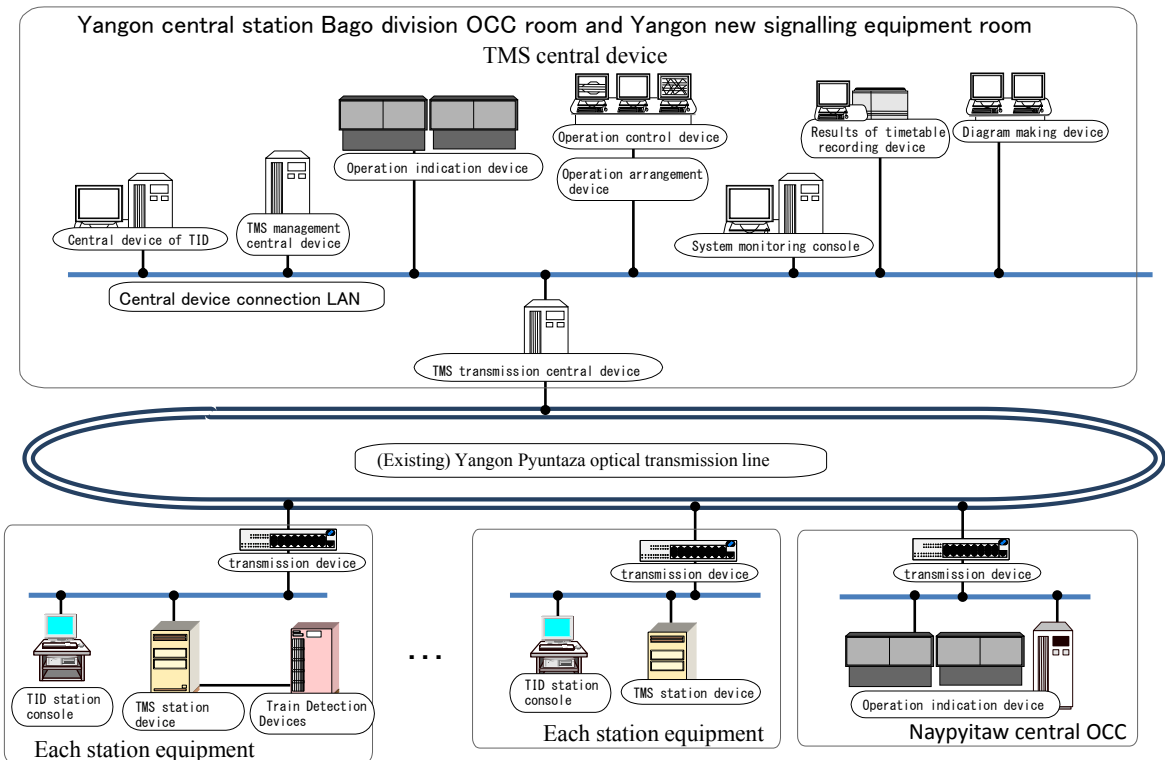
Table.2-12 List of interlocking devices between Yangon and Pyuntaza station

Sr. No	StationName	Type of Interlocking	Block working	Interlocking Manufacturer	Report
1	Yangon	E(1950)	AB	England(WestingHouse)	
2	PazunDaung	R(1970)	AB	Germany(Siemens)	
3	Malwagon	R(1996)	AB	Germany(Siemens)	
4	Thingangyun	R(1998)	AB	Japan/MR	
5	Togyauunggale	R(2000)		Korea(LG)	
6	Ywathagyi	R		Japan/MR	
7	Ladaung Kan	K		(MR)	SSI Under Construction (India)
8	Darbain	K		(MR)	SSI Under Construction (India)
9	HtoneGyi	K		(MR)	SSI Under Construction (India)
10	Kyauk Tan	K		(MR)	SSI Under Construction (India)
11	Tarwa	K		(MR)	SSI Under Construction (India)
12	Payatonesu	K		(MR)	SSI Under Construction (India)
13	Bago	M(1940)		England(Saxby&Farmers)	
14	Shwehle	R(2000)		China	
15	Payagai	R(2000)		China	
16	Pyinpongyi	R(2000)		China	
17	Kadok	R(2000)		China	
18	PaungDawThi	R(2000)		China	
19	EincheLayse	K		(MR)	
20	DaikU	R(2000)		China	
21	Pyuntaza	M(1940)		England(Saxby&Farmers)	

Source: The Study Team

The necessary train position is retrieved from the interlocking device of these countries, and the concrete information acquisition method was investigated to see if information could be displayed on TMS equipment. As a result, each station between Yangon and Ywathagyi detects train positions using the conditions of an interlocking device, because these stations can use a track circuit. At other stations, the train detecting device for TMS equipment is built, and train positions are acquired. The train detecting device for TMS equipment is installed simultaneously with the TMS transmission apparatus.

The equipment provided as TMS based on the information above is shown below.



Source: The Study Team

Figure.2-33 Train monitoring system between configuration plan

The TMS central device is installed in the Bago division OCC of Yangon central Station. This device performs operation indication and train timetable creation, and serves as a future train control system.

The composition of a TMS central apparatus is as follows.

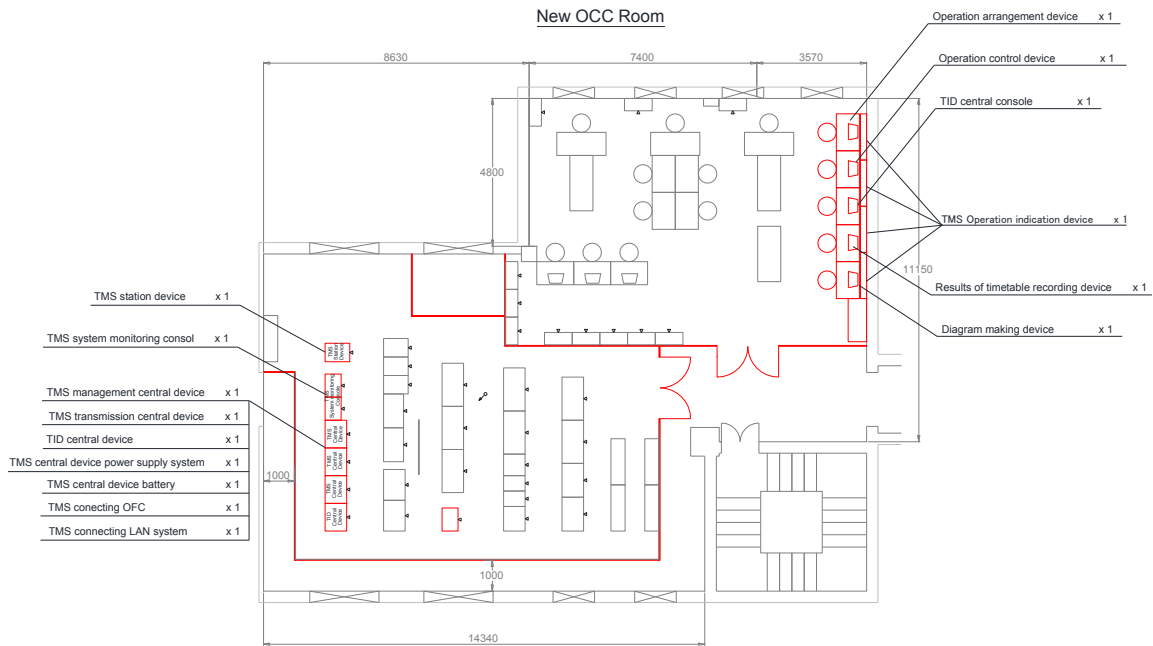
-) TMS management central equipment
-) TMS transmission central equipment
-) TID central equipment
-) Operation indication device (including visual display panel)
-) Operation indication/arrangement console
-) Command operation/control console
-) Diagram preparation equipment
-) Result-of-schedule recording/output equipment
-) System monitoring console

An "operation indicator" shall be prepared in "Bago division OCC" which will be installed in the same place as the Yangon station signal cabin, and is made as equipment that can display the train position information collected by the TMS station equipment of each station. The operation indicator shall not be a giant display, but a combination of multiple large-sized televisions, and is installed with a compact and legible indicator. Simultaneously, the indication state of the train shown on this "operation indicator" is also displayed at the central OCC of Nay Pyi Taw. This will collect train operation information to the Nay Pyi Taw central OCC in future, and assumes the introduction of equipment which can recognize trains across a whole line. In order to transmit the display information of this "operation indicator" to Nay Pyi Taw, the new circuit used by the relay station shall be prepared.

In the Bago division OCC, it is important to appropriately grasp this train position indication and to supervise operation diagrams and directions of change, etc. The "instruction console", which can change the train number and train order, and input special trains, and the "operation display table", which displays a diagram of the day, are prepared in the instruction table of the Bago division OCC. Moreover, the display screen of an operation indicator is constructed as equipment with which an instruction member can acquire detailed information on hand such as train numbers, so that it can be displayed with the operation display table or an instruction console. This prepares equipment and a system of efficient train operation management.

Moreover, in order to create a daily diagram based on a basic diagram, a "diagram listing device" and a "track record diagram printer" which prints a track record diagram of the day shall be prepared. The existing daily train operation is changed into the operation management system and modernization should be attained.

What performs these displays and operation is installed in the Bago division OCC, and is operated by the OCC operator. Other apparatuses and an electric power supply unit are installed in a new signal equipment room.



Source: The Study Team

Figure.2-34 Equipment layout of Bago division OCC room in Yangon central station

TMS station equipment is installed in each station with the signal handling in a precinct, and train positions are collected. There is an optical terminal box of an established optical cable in each station with an interlocking device, and the transmission path composition for train position acquisition is easy. Moreover, since centralization of signal route control is assumed in the future, TMS station equipment is installed in each station. Because there is no available optical cable in Eimshaylayse station, the existing cable under the ground is dug, a new junction is made, and a new optical cable is laid. The optical fiber cable is laid from the OFC room to each TMS station device at 20 stations between Pazundaung station and Pyuntaza Station.

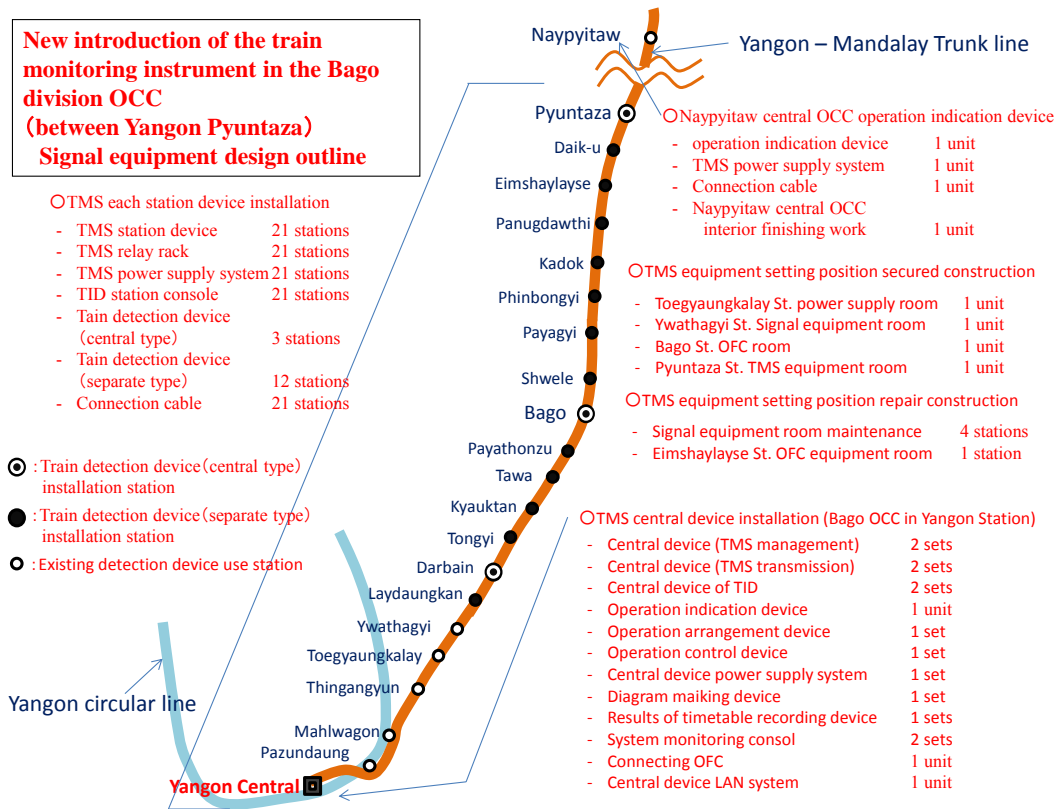
TMS station equipment is constituted by the relay part which collects information, the process division which processes it, and a transmission part that connects to an optical transmission path and transmits and receives information. Information collection from a train detecting device or an interlocking device is performed through a signal relay. Transmission of signal route control information, etc. will be performed through a signal relay in the future. However, Yangon central Station performs transmission and reception of information using a serial interface in order to simultaneously prepare an electronic interlocking device. TMS station equipment is installed in the existing signal equipment room and an OFC room. Some stations have insufficient space for an equipment compartment. Such stations diverts extension and other open rooms of equipment compartments to some other purpose. Construction of equipment compartments is carried out in Toegyaungkalay station, Ywathagyi station, Bago station,

Pyuntaza station, and the Nay Pyi Taw central OCC. Moreover, the inner roof of each signal equipment room in Payagyi station, Phinbongyi station, Kadok station, and Panugdawthi station is repaired.

Each station between Laydaungkan station and Pyuntaza station does not operate a train detection device, or a present train detection device is not installed. A train detecting device is newly installed in each of these stations. A train detection part is prepared on both ends of each station. It detects whether a train enters or leaves the station, and loads this information into TMS equipment. It indicates whether a train is detected in a station or between stations in a TMS precinct.

The train position in a TMS precinct is displayed on a TMS operation indication device through these equipment. On the other hand, it is necessary to check the position of a nearby train also at each station. In order to check a train position at each station, a Traffic Information Display console (TID) is prepared. This TID console also gives notice of operation information, including operation of a train, time change, order change, etc. to each station. It is connected with TMS station equipment, and the TID console transmits and receives information. An exclusive laptop computer is used for the TID console. It is handled as an apparatus involved with operation handling, and restricts handlers like a signal lever.

The basic composition of TMS equipment was defined as mentioned above, and the required parts for installation were investigated. The construction table of the TMS introduction examination range is shown in Figure.2-35



Source: The Study Team

Figure.2-35 TMS introduction range and construction contents between Yangon to Pyuntaza station

TMS equipment which had each role as mentioned above is scheduled to be installed. Although equipment improvement is important, in order to perform modernistic train operation control mainly on division OCC, handling of a Bago division OCC traffic dispatcher is also important. The method of the train operation control based on traffic dispatcher using TMS equipment needs to carry out the handling which fully trained and ripened. Moreover, the train operation control based on traffic dispatcher must be introduced into each division OCC from now on, and must unify method of the train operation control. It is necessary to train constantly the traffic dispatcher member which can operate TMS equipment, and to increase it. For the reason, TMS training equipment is newly installed. This training equipment carries out the same operation as the TMS equipment of Bago OCC. If there is TMS training equipment, even if it will not use the equipment which influences train operation of Bago division OCC, operation training of TMS equipment can be performed. Installation of TMS training equipment contributes to effective practical use of TMS equipment, and expansion of the further modernization.

With regard to the communication facilities, the devices which can transmit TMS information data as well as voice information, are installed between the Bago division OCC in Yangon central station and the central OCC in Nay Pyi Taw station.

At Yangon central station, the optical fiber cable is laid from the OFC (Optical Fiber Cable) room to the TMS central device. Since more rapid and reliable communication will be required between the OCC transport commander in Bago division and the stationmasters, a direct connect telephone is also installed so that the OCC transport commander can transmit information immediately to each station.

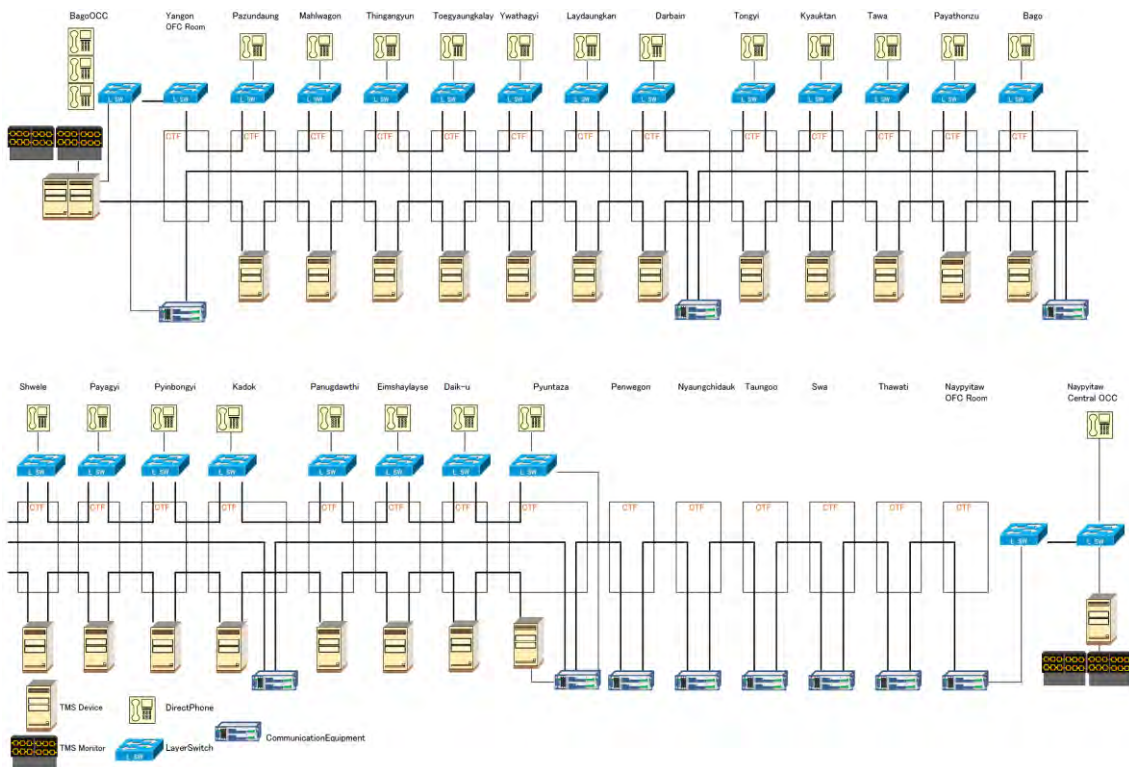
The optical fiber cable is laid from the OFC room to each TMS station device at 20 stations between Pazundaung station and Pyuntaza Station. The direct telephone set and the device which can transmit voice to the OFC room are installed in each stationmaster's office. At Nay Pyi Taw station, the optical fiber cable is laid from the transmission device in the OFC room to the Nay Pyi Taw central OCC so that the TMS information data is displayed at the Nay Pyi Taw central OCC. The TMS monitor and the direct telephone are also installed at the Nay Pyi Taw central OCC.

As for the section from Yangon central station to Nay Pyi Taw station, the communication equipment is installed for the purpose of multiplex transmission of TMS information and direct telephone information between Yangon central station and Pyuntaza station. Since the total distance from Yangon to Nay Pyi Taw is about 375 km, the communication equipment for information transmission is installed in nine intermediate stations, namely Darbain, Bago, Kadok, Pyuntaza, Penwegon, Nyaungchidauk, Taungoo, Swa, Thawati and Nay Pyi Taw station. Backup equipment is also installed at both Yangon central station and Nay Pyi Taw station.

With regard to the direct telephone which is installed in all stations between Yangon central station and Pyuntaza station, it is an IP (Internet Protocol) type telephone and the layer switch, applicable to IP telephones, is also installed in all stations. Backup equipment is also installed in both Yangon central station and Nay Pyi Taw station.

Since there is no available optical cable in Eimshaylayse station, the existing cable under the ground is dug, a new junction is made, and a new optical cable is laid. The OFC equipment room as well as its related necessary equipment, including cable termination frame, are also installed.

Some measuring instruments will be installed in the related-divisions due to maintenance for telecommunications equipment.



Source: The Study Team

Figure.2-36 The communication equipment system diagram for TMS

About the power supply of TMS, Yangon central station and Pazundaung station's TMS equipment use electric power from the new electric power room in Yangon central station.

Mahlwagon and Toegyaungkalay stations receive city electric power and engine generator power, signal equipment receive power from existing power sources. (Case 1)

Thingangyun and Ywathagyi stations receive city electric power and backup electric power from Mahlwagon and Toegyaungkalay station. Existing step-down transformers do have not enough allowance, so new transformers are added. (Case 2)

Laydaungkan, Darbain, Tongyi, Kyauktan, Tawa, and Payathonzu station's TMS equipment receive existing city electric power or newly installed city electric power, and are equipped with backup power source installed by the SSI project, so signal equipment receive power from existing power sources. (Case 1)

Bago, Payagyi, Pyinbongyi, Kadok, Paungdawthi, and Daik-u station's TMS equipment receive existing city electric power or newly installed generator power as backup. A new generator is installed outside the station building. (Case 3)

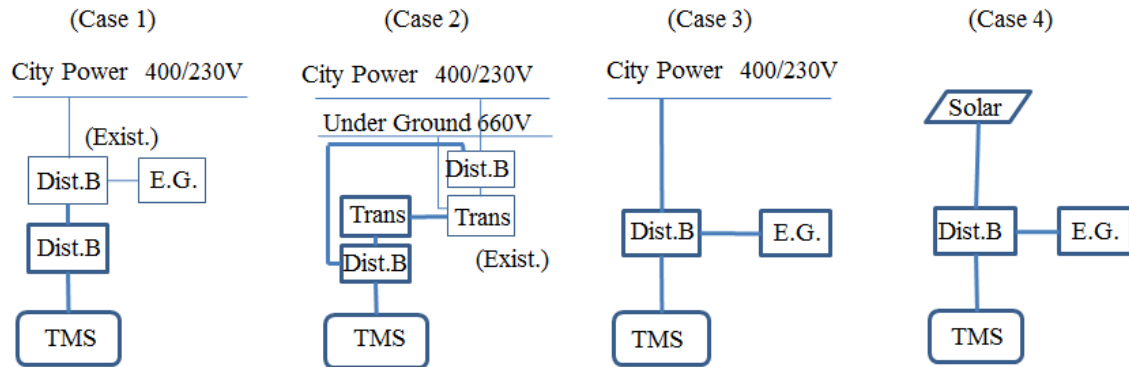
Pyuntaza station's TMS equipment receives existing city electric power or newly installed generator power as backup. A generator is installed in the station main building with exhaust pipe. (Case 3)

Shwele and Eimshaylayse stations have no city electric power, so solar power generators provide electric power. A diesel generator operates when the charge level of batteries drop. A new generator is installed outside the station building. (Case 4)

Penwegon, Nyaungchidauk, Taungoo, Swa, and Thawati station's telecommunication equipment slightly increase power consumption, so existing optical communication equipment supplies electric power.

Nay Pyi Taw station's TMS equipment uses city electric power and generators as backup. But surplus generator power is not enough, so a new generator is installed in the electric power room with exhaust pipe. (Case 3)

In cases where an engine generator is newly installed, power distribution wires and drop wires are repaired or increased to reduce voltage drop.



Source: The Study Team

Figure.2-37 Outline of TMS Power Source

The list of the necessary equipment for TMS equipment from Yangon central station to Nay Pyi Taw station is shown in Table.2-13

Table.2-13 TMS Component Plan

Equipment	Composition equipment	Unit	Qty	Commentary
Train Monitoring System (TMS) central device	TMS management central equipment	set	2	
	TMS transmission central equipment	set	2	
	TID central equipment	set	2	
	Operation indication device (including visual display panel)	set	1	

Equipment	Composition equipment	Unit	Qty	Commentary
	Operation indication/arrangement console	set	1	complementarity
	Command operation/control console	set	1	
	Diagram preparation equipment	set	1	
	Result-of-schedule recording/output equipment	set	1	
	System monitoring console	set	2	
	TMS central device power supply system	set	1	
TMS station device	TMS station equipment	set	21	
	Repeater relay rack	set	21	
	Power supply system for TMS	set	21	
	TID station console	set	21	
Nay Pyi Taw central OCC operation indication device for TMS	Operation indication device for Nay Pyi Taw (including visual display panel)	set	1	
	Power supply system for Nay Pyi Taw central OCC	set	1	
Tain detection device (central type) for Bago station	Central train location identification equipment	set	1	
	Axle detection sensor	set	24	
	Counter/relay device box	set	24	
	Sensor connecting cable	set	1	
Tain detection device (central type) for Pyuntaza station	Central train location identification equipment	set	1	
	Axle detection sensor	set	21	
	Counter/relay device box	set	21	
	Sensor connecting cable	set	1	
Tain detection device (central type) for Darbain station	Central train location identification equipment	set	1	
	Axle detection sensor	set	11	
	Counter/relay device box	set	11	
	Sensor connecting cable	set	1	

Equipment	Composition equipment	Unit	Qty	Commentary
Train detection device (separate type) for Eimshaylayse station	Point-type train detection equipment	set	6	
	Cable connecting detection equipment	km	2	
	Power supply for detection equipment	set	2	
Train detection device (separate type) for other station	Point-type train detection equipment	set	44	
	Cable connecting detection equipment	km	22	
	Power supply for detection equipment	set	22	

Source: The Study Team

The list of the necessary equipment for the communication facilities from Yangon central station to Nay Pyi Taw station is shown in Table.2-14

Table.2-14 Main equipment plan of the centralized train monitoring system
(Telecommunication equipment)

Equipment	Specification	Unit	Quantity	Purpose of use
Long distance communication equipment	Transmission capacity: more than 1Gbps Number of cores: single core two-way optical communication Optical fiber cable: SMF (ITU-T G.652 standards) Input voltage: DC-48V	set	13	Long distance data transmission between Yangon and Nay Pyi Taw
Layer switch	Port: 1000BASE-SX/SX2/LX/BX/LH/T 2 or more 10BASE-T/100BASE-TX 4 or more Number of cores: single core two-way optical communication Optical fiber cable: SMF (ITU-T G.652 standards) Input voltage: AC200-240V and DC48V	set	27	Direct telephone communication
Optical cable termination frame	Configuration: Splice + Connector Connection capacity: 24 connections	set	22	Optical cable termination
Direct telephone	To enable targeting of all telephones, a specific group of telephones, or a specific terminal, and also function as both simultaneous broadcasting and two-way communication	set	25	Communication with OCC

Source: The Study Team

Engine generator should match signal equipment and the generated noise should be considered. The list of the necessary equipment for the electric power supply system from Yangon central station to Nay Pyi Taw station is shown in Table.2-15

Table.2.15 Power Supply for TMS of Component Plan

Equipment Name	Main Specification	Unit	Qty	Commentary
Diesel Engine Generator	Single-phase 200V 10kVA class	Set	2	Emergency power in case of power outage
Diesel Engine Generator	Single-phase 200V 5kVA class	Set	8	Emergency power in case of power outage
Solar Power Generator	3 kW class	Set	2	Electric power source
Transformer	Single-phase 660V:230V 5 kVA	Set	2	
Electric Wire	Cross-linked polyethylene insulated vinyl sheath cable and others	m	1,458	
Distribution Board	Various kinds	Set	22	

Source: The Study Taem

2-2-3 Outline Design Drawing

The following is the three of Outline design drawing.

- Concentrated Electronic Interlocking System at Yangon Central Station and Pazundaung Station
- Automated level crossing alarm facilities at the Kyan Sir Thar Level Crossing located between Toegyaungkalay Station and Ywathagyi Station
- Centralized Train Monitoring System in the section of Bago Division OCC which have jurisdiction from Yangon Central Station to Pyuntaza Station

i) Centralized Electronic Interlocking System including Yangon Central,Pazundaung Drawings List (1)

For reference

Drawing Number	TITLE	Scale	Drawing Number	TITLE	Scale
BD1-01-01	Installation of the centralized Electric interlocking system including Yangon central, Pazundaung - Drawings List (1)	N/S	BD1-06-01	Signalling power supply diagram Yangon central station	N/S
BD1-01-02	Installation of the centralized Electric interlocking system including Yangon central, Pazundaung - Drawings List (2)	N/S	BD1-06-02	Signalling power supply diagram Pazundaung station	N/S
BD1-02-01	Yangon central station interlocking diagram (1) Yangon - West	N/S	BD1-07-01	Yangon central station new signal equipment room Equipments arrangement plan	1:100
BD1-02-02	Yangon central station interlocking diagram (2) Yangon - East	N/S	BD1-07-02	Pazundaung station new signal equipment house Equipments arrangement plan (1)	1:40
BD1-02-03	Yangon central station interlocking diagram (3) Pazundaung	N/S	BD1-07-03	Pazundaung station new signal equipment house Equipments arrangement plan (2)	1:40
BD1-02-04	Signalling equipment quantity list	N/S	BD1-08-01	Yangon central station New signal cables & New signal equipment boxes arrangement plan	N/S
BD1-03-01	Yangon central station Interlocking table (1)	N/S	BD1-08-02	Pazundaung station New signal cables & New signal equipment boxes arrangement plan	N/S
BD1-03-02	Yangon central station Interlocking table (2)	N/S	BD1-09-01	Concrete chipping Yangon central station Plathome 1	1:300
BD1-03-03	Yangon central station Interlocking table (3)	N/S	BD1-09-02	Working drawing Undergrounding wiring method (1)	1:30
BD1-03-04	Yangon central station Interlocking table (4)	N/S	BD1-09-03	Working drawing Undergrounding wiring method (2)	1:30
BD1-03-05	Yangon central station Interlocking table (5)	N/S	BD1-10-01	Yangon central station Cable-duct lower image drawing	1:100
BD1-03-06	Yangon central station Interlocking table (C)	N/S	BD1-11-01	Electric point machine installation drawing 8# turnout	1:30
BD1-03-07	Yangon central station Interlocking table (7)	N/S	BD1-11-02	Electric point machine installation drawing 12# turnout	1:30
BD1-03-08	Yangon central station Interlocking table (E)	N/S	BD1-11-03	Electric (L-11) machine installation drawing Elevation - 0mm raised	1:30
BD1-03-09	Yangon central station Interlocking table (5)	N/S	BD1-11-04	Electric point machine installation drawing Elevation - 200mm raised	1:30
BD1-03-10	Yangon central station Interlocking table (10)	N/S	BD1-11-05	Electric point machine installation drawing Elevation - Double track part of Yangon	1:30
BD1-03-11	Yangon central station Interlocking table (11)	N/S	BD1-11-06	Electric point machine installation drawing Elevation - 300mm raised	1:30
BD1-03-12	Yangon central station Interlocking table (12)	N/S	BD1-11-07	Outline drawing Colour light signal (Type3-1, 2-1, 1-1, LED30V)	1:10
BD1-03-13	Yangon central station Interlocking table (13)	N/S	BD1-11-08	Outline drawing Rcute indicator 3 routes type	1:10
BD1-04-01	Pazundaung station Interlocking table (1)	N/S	BD1-11-09	Outline drawing Rcute indicator number type	1:10
BD1-04-02	Pazundaung station Interlocking table (2)	N/S	BD1-11-10	Outline drawing Electric shunting signal LED type (1)	1:5
BD1-04-03	Pazundaung station Interlocking table (3)	N/S	BD1-11-11	Outline drawing Electric shunting signal LED type (2)	1:5
BD1-05-01	Installation of the centralized Electric interlocking system including Yangon central, Pazundaung - System diagram	N/S	BD1-11-12	Outline drawing Rcute indicator 3 routes type for shunting	1:6

NOTES:
1.
2.

LEGEND

CLIENT:



CONSULTANTS:
Consortium of JIC and OC



DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central,Pazundaung

SCALE:

Non scale

TITLE:

Drawings List (1)

DRAWING NUMBER

BD1-01-01

i) Centralized Electronic Interlocking System including Yangon Central,Pazundaung Drawings List (2)

For reference

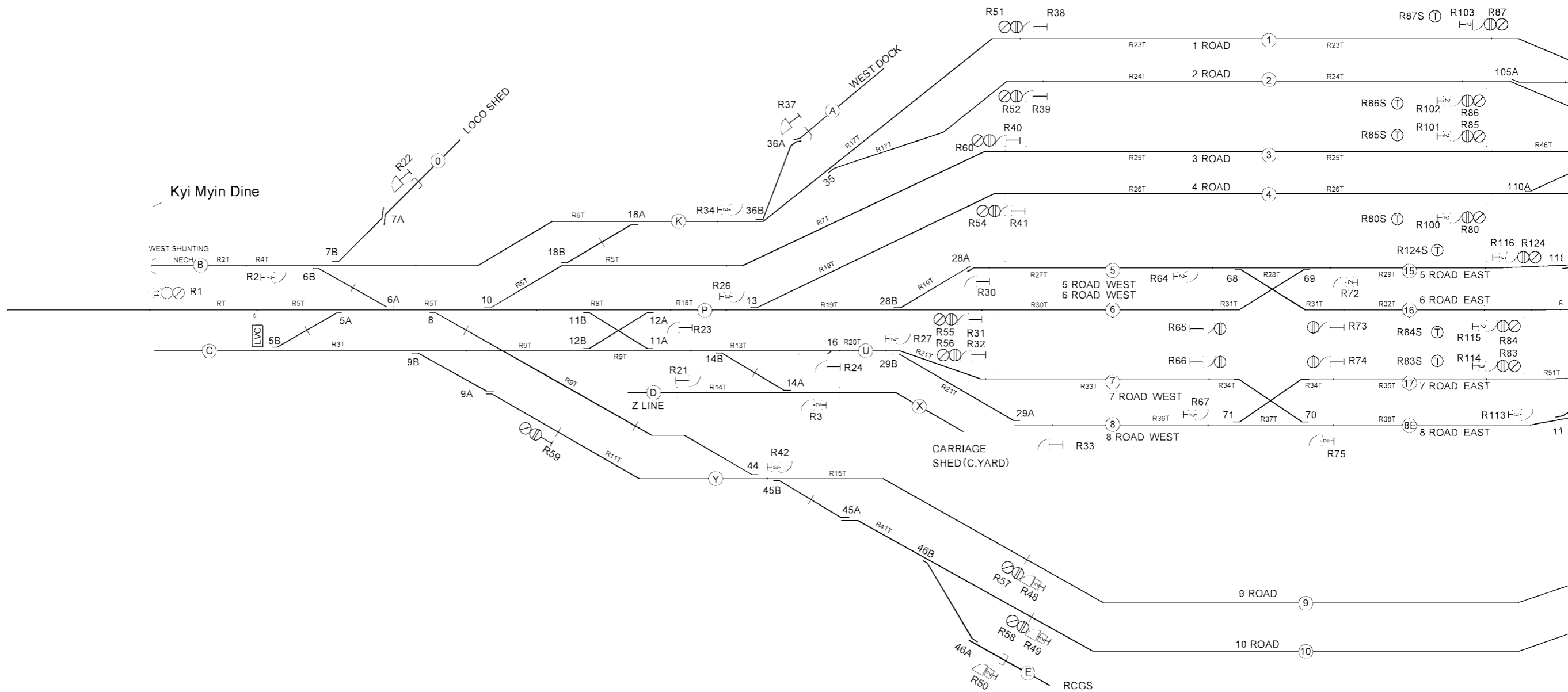
Drawing Number	TITLE	Scale	Drawing Number	TITLE	Scale
ED1-11-13	Outline drawing Route indicator number type for shunting	1:6			
ED1-12-01	Yangon central station and Pazundaung station Fcwer cable diagram (1/3)	1:3000			
ED1-12-02	Yangon central station and Pazundaung station Fcwer cable diagram (2/3)	1:3000			
ED1-12-03	Yangon central station and Pazundaung station Fcwer cable diagram (3/3)	1:3000			
ED1-13-01	Yangon Layout drawing	1:400			
ED1-14-01	Foundation drawing For type 2 signal equipment box	1:20			
ED1-14-02	Foundation drawing For type 3A signal equipment box	1:20			
ED1-15-01	Member need to be strengthening at Yangon central station	N/S			

78

NOTES: 1. 2.			CLIENT:  Japan International Cooperation Agency		CONSULTANTS: Consortium of JIC and OC.   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.		DATE: MARCH 2014		PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment	
LEGEND			THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY						i) Centralized Electronic Interlocking System including Yangon Central,Pazundaung	
									SCALE: Non scale	
									DRAWING NUMBER BD1-01-02	

YANGON CENTRAL STATION INTERLOCKING

West East



For reference

NOTES:

- The distance from the home signal to the LVC board is 600 ft.
-

LEGEND

Main signal - 2 aspects		Last Vehicle Clearance	
Main signal - 3 aspects		Shunt Limit Board	
Shunting signal		Railway switch	
Indicator			
'Free shunt' indicator			

CLIENT:

CONSULTANTS:
Consortium of JIC and OC

DATE:

MARCH 2014

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station interlocking diagram (1)
Yangon - West

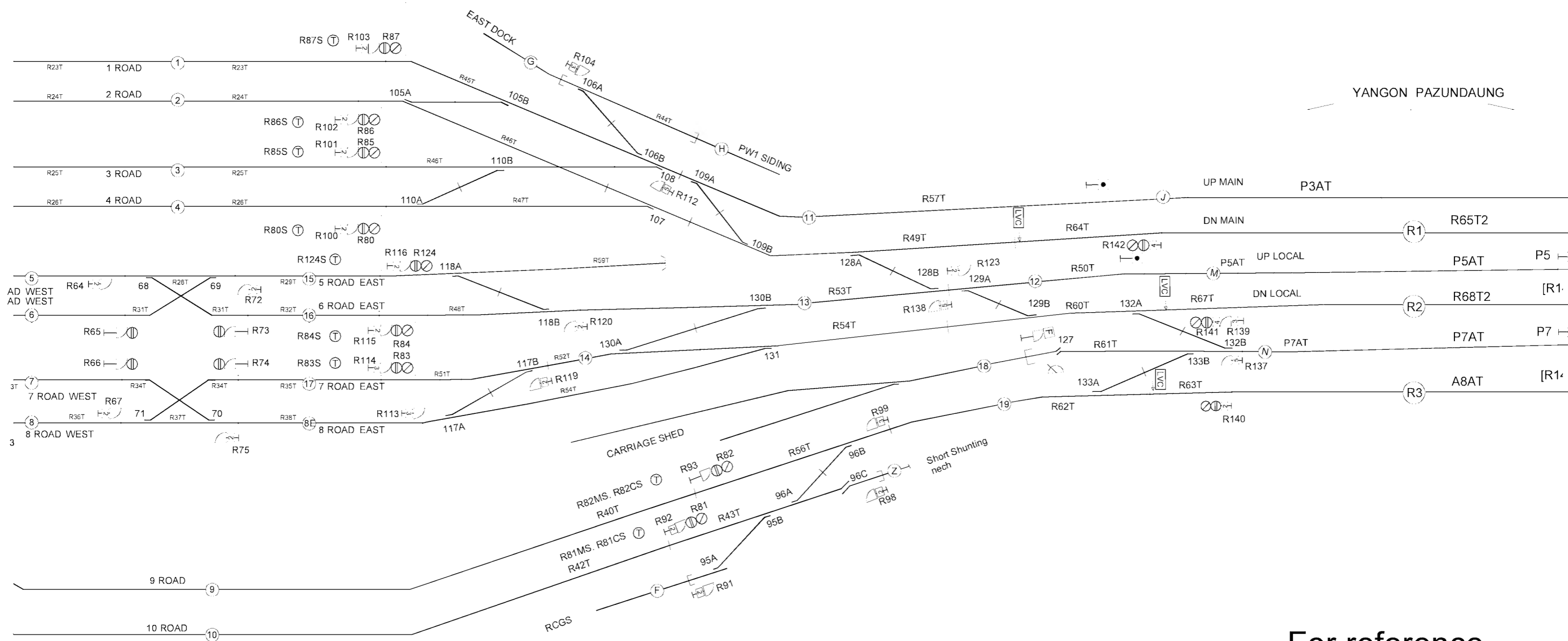
DRAWING NUMBER
BD1-02-01



THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

YANGON CENTRAL STATION INTERLOCKING

West East



YANGON PAZUNDAUNG

For reference

NOTES:

- The distance from the home signal to the LVC board is 600 ft.
-

LEGEND

Main signal - 2 aspects		Last Vehicle Clearance	LVC
Main signal - 3 aspects		Shunt Limit Board	
Shunting signal		Railway switch	
Indicator			
'Free shunt' indicator			

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

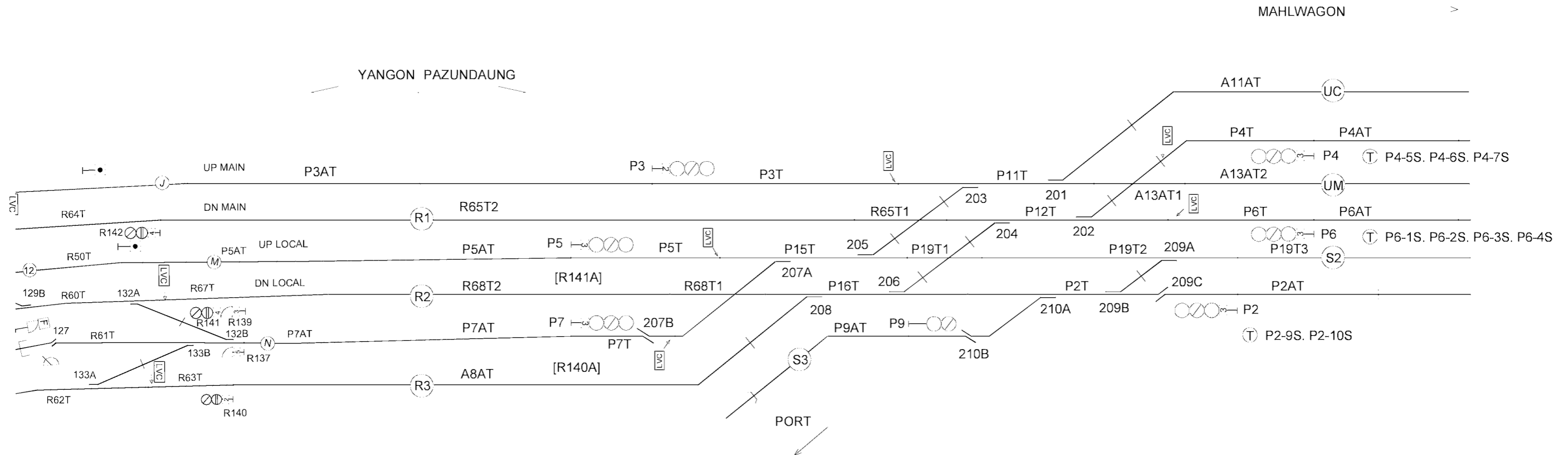
TITLE:

Yangon central station interlocking diagram (2)
Yangon - East

DRAWING NUMBER

BD1-02-02

PAZUNDAUNG STATION INTERLOCKING



For reference

NOTES:

- The distance from the home signal to the LVC board is 600 ft.
-

LEGEND

Main signal - 2 aspects		Last Vehicle Clearance	LVC
Main signal - 3 aspects		Shunt Limit Board	
Shunting signal		Railway switch	
Indicator			
'Free shunt' indicator			

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station interlocking diagram (3)
Pazundaung

DRAWING NUMBER BD1-02-03

Signalling equipment quantity list

	Yangon central station											Pazundaung station					
	Track circuit		Home signal	Starting signal	Shunting signal		Route indicator Type: Number	Route indicator Type: 3 routes	Route indicator for shunting Type: Number	Route indicator for shunting Type: 3 routes	Point machine			Track circuit	Home signal	Route indicator Type: 3 routes	Point machine
1	RT	R35T	R1	R51	R2	R91	R141	R140	R1	R3	5A	46A	128A	P2T	P2	P2	201
2	R2T	R36T	R140	R52	R3	R92	R142		R2	R26	5B	46B	128B	P2AT	P3	P3	202
3	R3T	R37T	R141	R60	R21	R93			R112	R27	6A	68A*	129A	P3T	P4	P4	203
4	R4T	R38T	R142	R54	R22	R98			R137	R34	6B	68B	129B	P3AT	P5	P5	204
5	R5T	R40T		R55	R23	R99			R138	R42	7A	69A	130A	P4T	P6	P6	205
6	R6T	R41T		R56	R24	R100				R48	7B	69B*	130B	P4AT	P7	P7	206
7	R7T	R42T		R57	R26	R101				R49	8	70A	131	P5T	P9		207A
8	R8T	R43T		R58	R27	R102				R50	9A	70B*	132A	P5AT			207B
9	R9T	R44T		R59	R30	R103				R64	9B	71A*	132B	P6T			208
10	R11T	R45T		R87	R31	R104				R67	10	71B	133A	P6AT			209A
11	R13T	R46T		R86	R32	R112				R72	11A	95A	133B	P7T			209B
12	R14T	R47T		R85	R33	R113				R75	11B	95B		P7AT			209C
13	R15T	R48T		R80	R34	R114				R91	12A	96A		P9AT			210A
14	R17T	R49T		R124	R37	R115				R92	12B	96B		P11T			210B
15	R18T	R50T		R84	R38	R116				R98	13	96C		P12T			
16	R19T	R51T		R83	R39	R119				R99	14A	105A		P15T			
17	R20T	R52T		R82	R40	R120				R100	14B	105B		P16T			
18	R21T	R53T		R81	R41	R121				R101	16	106A		P19T1			
19	R23T	R54T			R42	R123				R102	18A	106B		P19T2			
20	R24T	R56T			R48	R137				R103	18B	107		P19T3			
21	R25T	R57T			R49	R138				R104	28A	108		R65T1			
22	R26T	R60T			R50	R139				R113	28B	109A		R68T1			
23	R27T	R61T			R64					R114	29A	109B		A8AT			
24	R28T	R62T			R65					R115	29B	110A		A11T			
25	R29T	R63T			R66					R116	35	110B		A11AT			
26	R30T	R64T			R67					R119	36A	117A		A12T			
27	R31T	R65T2			R72					R120	36B	117B		A13T			
28	R32T	R67T			R73					R123	44	118A		A13AT1			
29	R33T	R68T2			R74					R139	45A	118B		A13AT2			
30	R34T				R75						45B	127					

*Proposal of the out of service equipment

For reference

NOTES: 1. 2.	CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment
				i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung
LEGEND		SCALE: Non scale		TITLE: Signalling equipment quantity list
		DRAWING NUMBER: BD1-02-04		

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Home signal	Kyi Myin Dine - 1 ROAD	R1	1	5 6 7 8 10 18 36 35 105 106 108 109	R112 R103	RT R5T R6T R17T R23T R45T	(RT)(R5T)(R6T)(R17T)	ART	90sec	R34	
Home signal	Kyi Myin Dine - 2 ROAD	R1	2	5 6 7 8 10 18 36 35 105 106 107 108 109	R112 R102	RT R5T R6T R17T R24T R45T R46T	(RT)(R5T)(R6T)(R17T)	ART	90sec	R34	
Home signal	Kyi Myin Dine - 3 ROAD	R1	3	5 6 8 10 18 110 107 108 109	R112 R101	RT R5T R7T R25T R45T R46T	(RT)(R5T)(R7T)	ART	90sec		
Home signal	Kyi Myin Dine - 4 ROAD	R1	4	5 6 8 10 11 12 13 28 110 107 108 109	R112 R100	RT R5T R8T R19T R18T R26T R47T R46T R45T	(RT)(R5T)(R8T)(R18T)(R19T)	ART	90sec	R26	
Home signal	Kyi Myin Dine - 5 ROAD EAST	R1	15	5 6 8 10 11 12 13 28 68 69 118		RT R5T R8T R18T R19T R27T R28T R29T R59T	(RT)(R5T)(R8T)(R18T)(R19T) (R28T)(R27T)	ART	90sec	R26 R64	
Home signal	Kyi Myin Dine - 6 ROAD EAST	R1	16	5 6 8 10 11 12 13 28 68 69 118 130	R120(R138 or 128)	RT R5T R8T R18T R19T R27T R28T R31T R32T R48T R53T	(RT)(R5T)(R8T)(R18T)(R19T) (R27T)(R28T)(R31T)	ART	90sec	R26 R64	
Home signal	Kyi Myin Dine - 6 ROAD WAST	R1	6	5 6 8 10 11 12 13 28 68 69 118	R120 R72 R65	RT R5T R8T R18T R19T R30T R31T R28T R29T	(RT)(R5T)(R8T)(R18T)(R19T)	ART	90sec	R26	
Home signal	Kyi Myin Dine - 7 ROAD EAST	R1	17	5 6 8 10 11 12 14 16 29 70 71 117 131 130	R119 R114	RT R5T R8T R9T R13T R20T R21T R36T R37T R34T R35T R51T R52T R54T	(RT)(R5T)(R8T R9T)(R13T) (R20T)(R21T)(R33T) (R34T)	ART	90sec	R27 R67	
Home signal	Kyi Myin Dine - 7 ROAD WAST	R1	7	5 6 8 10 11 12 14 16 29 70 71 117	R119 R75 R66	RT R5T R8T R9T R13T R20T R21T R33T R34T R37T R38T	(RT)(R5T)(R8T R9T)(R13T) (R20T)(R21T)	ART	90sec	R27	
Home signal	Kyi Myin Dine - 9 ROAD	R1	9	5 6 8 9 44 45 96	R99 R93	RT R5T R8T R9T R11T R15T R40T R56T R62T	(RT)(R5T R9T)(R11T)(R15T)	ART	90sec	R42	
Home signal	Kyi Myin Dine - 10 ROAD	R1	10	5 6 8 9 44 45 46 95 96	R98	RT R5T R9T R11T R15T R41T R42T R43T	(RT)(R5T R9T)(R11T)(R15T) (R41T)	ART	90sec	R42	
Home signal	Pazundaung - 9 ROAD	R140	9	133 96 44 45		R63T R62T R56T R40T R15T R11T	(R63T)(R62T)(R56T)	[A8AT]	90sec	R99	
Home signal	Pazundaung - 10 ROAD	R140	10	133 96 95 46 45		R63T R62T R56T R43T R42T R41T	(R63T)(R62T)(R56T R43T)	[A8AT]	90sec	R99	
Home signal	DL LOCAL - 6 ROAD WAST	R141	6	132 129 128 130 118 69 13 28	R116 R123 R65 R26	R67T R60T R50T R53T R48T R29T R28T R31T R30T R19T	(R67T)(R60T R50T)(R53T)(R48T) (R29T)(R28T)(R31T)	[A68T2]	90sec	R138 R120 R72	
Home signal	DL LOCAL - 6 ROAD EAST	R141	16	132 129 128 130 118 68 28	R115 R123 R64	R67T R60T R50T R53T R48T R32T R31T R28T R27T	(R67T)(R60T R50T)(R53T)(R48T)	[A68T2]	90sec	R138 R120	
Home signal	DL LOCAL - 7 ROAD WAST	R141	7	132 129 131 117 70 29 16	R113 R66 R27	R67T R60T R54T R38T R37T R34T R33T R21T R20T	(R67T)(R60T)(R54T)(R52T) (R51T)(R38T)(R37T R34T)	[A68T2]	90sec	R75	

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (1)

DRAWING NUMBER

BD1-03-01

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Home signal	DL LOCAL - 7 ROAD EAST	R141	17	132 129 131 130 117 (71) 29	R114 R67	R67T R60T R54T R52T R51T R35T R34T R37T R36T	(R67T)(R60T)(R54T)(R52T)(R51T)	[A68T2]	90sec	R119	
Home signal	DN MAIN - 1 ROAD	R142	1	128 (109) 108 106 105 35 36	R34	R64T R49T R57T R45T R23T R17T	(R64T)(R49T R57T)(R45T)	[A65T2]	90sec	R112	
Home signal	DN MAIN - 2 ROAD	R142	2	128 109 107 105 (35) 36	R34	R64T R49T R47T R46T R24T R17T	(R64T)(R49T)(R47T R46T)	[A65T2]	90sec		
Home signal	DN MAIN - 3 ROAD	R142	3	128 (109) (107) (108) 110	(R1 or 10 or 18) (R2 or 6 or 10 or 18)	R64T R49T R57T R45T R46T R25T R7T	(R64T)(R49T)(R47T R46T)	[A65T2]	90sec	R112	
Home signal	DN MAIN - 4 ROAD	R142	4	128 109 (107) 108 110 (13)	R26	R64T R49T R47T R26T R19T	(R46T)(R49T)(R47T)	[A65T2]	90sec		
Starting signal	1 ROAD - Kyi Myin Dine	R51	C	(5) 6 (7) 8 (10) (18) 35 36	R34 R87 R103	R17T R6T R5T R3T R1T	(R17T)(R6T)(R5T)(R3T)	R23T	90sec		
Starting signal	2 ROAD - Kyi Myin Dine	R52	C	(5) 6 (7) 8 (10) (18) (35) 36	R34 R86 R102	R17T R6T R5T R3T R1T	(R17T)(R6T)(R5T)(R3T)	R24T	90sec		
Starting signal	3 ROAD - Kyi Myin Dine	R60	C	(5) 6 8 (10) 18	R40 R85 R101	R7T R5T R3T R1T	(R7T)(R5T)(R3T)	R25T	90sec		
Starting signal	4 ROAD - Kyi Myin Dine	R54	C	5 8 9 (10) 11 (12) (13) 28	R41 R80 R100 R26	R19T R18T R9T R8T R3T R1T	(R19T)(R18T R9T R8T)(R3T)	R26T	90sec	R23	
Starting signal	6 ROAD WEST - Kyi Myin Dine	R55	C	5 8 9 (10) 11 (12) 13 28	R31 R65 R26	R19T R18T R8T R9T R3T R1T	(R19T)(R18T R9T R8T)(R3T)	R30T	90sec	R23	
Starting signal	7 ROAD WEST - Kyi Myin Dine	R56	C	5 8 (9) 11 12 14 (16) 29	R27 R32 R66	R21T R20T R13T R9T R3T R1T	(R21T)(R20T)(R13T)(R9T)(R3T)	R33T	90sec	R24	
Starting signal	9 ROAD - Kyi Myin Dine	R57	C	5 8 (9) 44 45	R42	R15T R11T	(R15T)(R11T)	R59	90sec	R59	
Starting signal	10 ROAD - Kyi Myin Dine	R58	C	5 8 (9) 44 (45) 46	R42	R41T R15T R11T	(R41T)(R15T)(R11T)	R59	90sec	R59	
Starting signal	R11T - Kyi Myin Dine	R59	C	5 8 (9) 44	R42 R48 R49 R50	R3T R1T	(R3T)		90sec		
Starting signal	1 ROAD - UP MAIN	R87	J	105 106 108 109	R112 R103 R38 R51	R45T R57T [P3AT]	(R45T)(R57T)	R23T	90sec		
Starting signal	2 ROAD - UP MAIN	R86	J	(105) 106 (107) 108 109	R112 R102 R39 R52	R46T R45T R57T [P3AT]	(R46T)(R45T)(R57T)	R24T	90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station Interlocking table (2)

DRAWING NUMBER

BD1-03-02

For reference

YANGON CENTRAL STATION INTERLOCKING

Route	Number	Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Starting signal 3 ROAD - UP MAIN	R85 J	106 (107) (108) 109 110 105	R112 R101 R40 R60	R46T R45T R57T [P3AT]	(R46T R45T)(R57T)	R25T 90sec		
Starting signal 4 ROAD - UP MAIN	R80 J	(107) (108) 109 (110) 105 106	R112 R100 R54 R41	R47T R46T R45T R57T [P3AT]	(R47T R46T)(R45T)(R57T)	R26T 90sec		
Starting signal 5 ROAD - UP LOCAL	R124 M	(118) 130 128 129	R138 R120 R116 R72	R59T R48T R53T R50T [P5AT]	(R59T R48T)(R53T)(R50T)	R29T 90sec	R123	
Starting signal 6 ROAD EAST - UP LOCAL	R84 M	118 130 128 129	R138 R120 R115 R73	R48T R53T R50T [P5AT]	(R48T)(R53T)(R50T)	R32T 90sec	R123	
Starting signal 7 ROAD EAST - UP LOCAL	R83 M	117 (130) 128 129 (131)	R138 R119 R114 R74	R51T R52T R53T R50T [P5AT]	(R51T)(R52T R53T)(R50T)	R35T 90sec	R123	
Starting signal 9 ROAD - PAZUNDAUNG	R82 N	96 132 (133)	R99 R137 R93 R48 R57	R56T R62T R61T [P7AT]	(R56T)(R62T R61T)	R40T 90sec		
Starting signal 10 ROAD - PAZUNDAUNG	R81 N	(95) 96 132 (133)	R99 R137 R92 R49 R58	R43T R56T R62T R61T [P7AT]	(R43T R56T)(R62T R61T)	R42T 90sec		
Shunting signal WEST SHUNTING NECH - LOCO SHED	R2 0	(6) 7	R22		(R4T)	R2T 90sec		
Shunting signal WEST SHUNTING NECH - R6T	R2 K	6 7 10	R37 R38 R39		(R4T)(R6T)	R2T 90sec	R34	
Shunting signal WEST SHUNTING NECH - 3 ROAD	R2 3	(6) 7 8 (10) 18	R25(R112 or 108)		(R4T R5T)(R7T)	R2T 90sec		
Shunting signal WEST SHUNTING NECH - R18T	R2 P	(6) 7 8 10 11 12	R23 R30 R31 R41		(R4T R5T)(R8T)(R18T)	R2T 90sec	R26	
Shunting signal WEST SHUNTING NECH - R20T	R2 U	(6) 7 8 10 (11) 12 14 16	R24 R32 R33		(R4T R5T)(R8T R9T) (R13T R20T)	R2T 90sec	R27	
Shunting signal WEST SHUNTING NECH - CARRIAGE SHED	R2 X	(6) 7 8 10 (11) 12 (14)	R3		(R4T R5T) (R8T R9T)(R13T R14T)	R2T 90sec		
Shunting signal WEST SHUNTING NECH - R11T	R2 Y	(6) 7 (8) 9 (44)	R48(R49 R50 or 45)		(R4T R5T)(R9T)(R11T)	R2T 90sec	R42	
Shunting signal CARRIAGE SHED - WEST SHUNTING NECH	R3 B	(6) 7 8 10 (11) (14)	R2		(R14T R13T)(R9T R8T)(R5T R4T)	— 90sec		
Shunting signal CARRIAGE SHED - LINE Z	R3 D	14	R21		(R14T)	— 90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (3)

DRAWING NUMBER

BD1-03-03

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	LINE Z - CARRIAGE SHED	R21	X	14	R3		(R14T)	—	90sec		
Shunting signal	LOCO SHED - WEST SHUNTING NECH	R22	B	6 7	R2		(R4T)	—	90sec		
Shunting signal	R18T - WEST SHUNTING NECH	R23	B	6 8 10 11 12	R2		(R8T)(R5T R4T)	R18T	90sec		
Shunting signal	R20T - WEST SHUNTING NECH	R24	B	6 8 10 11 12 14 16	R2		(R13T)(R9T R8T)(R5T R4T)	R20T	90sec		
Shunting signal	R18T - 4 ROAD	R26	4	13 28	R23 R41(R142 or 107)		(R19T)	R18T	90sec		
Shunting signal	R18T - 5 ROAD WEST	R26	5	13 28	R30 R73(R72 or 69)		(R19T)	R18T	90sec		
Shunting signal	R18T - 6 ROAD WEST	R26	6	13 28	R31 (R72 or 69)		(R19T)	R18T	90sec		
Shunting signal	R20T - 7 ROAD WEST	R27	7	29	R32 (R75 or 70)		(R21T)	R20T	90sec		
Shunting signal	R20T - 8 ROAD WEST	R27	8	29	R33 R74 (R75 or 70)		(R21T)	R20T	90sec		
Shunting signal	5 ROAD WEST - R18T	R30	P	13 28	R26		(R19T)	R27T	90sec		
Shunting signal	6 ROAD WEST - R18T	R31	P	13 28	R26		(R19T)	R30T	90sec		
Shunting signal	7 ROAD WEST - R20T	R32	U	29	R27		(R21T)	R33T	90sec		
Shunting signal	8 ROAD WEST - R20T	R33	U	29	R27		(R21T)	R36T	90sec		
Shunting signal	R6T - WEST DOCK	R34	A	36	R37		(R17T)	R6T	90sec		
Shunting signal	R6T - 1 ROAD	R34	1	36 35	R38 (R112 or 105 or 106 or 108)		(R17T)	R6T	90sec		
Shunting signal	R6T - 2 ROAD	R34	2	36 35	R39 (R112 or 105 or 106 or 108)		(R17T)	R6T	90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



CONSULTANTS:

Consortium of JIC and OC



DATE:

MARCH 2014

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (4)

DRAWING NUMBER

BD1-03-04

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	WEST DOCK - WEST SHUNTING NECH	R37	B	6 7 18 36	R34 R2		(R17T)(R6T)(R4T)	—	90sec		
Shunting signal	1 ROAD - WEST SHUNTING NECH	R38	B	6 7 18 35 36	R34 R2		(R17T)(R6T)(R4T)	R23T	90sec		
Shunting signal	2 ROAD - WEST SHUNTING NECH	R39	B	6 7 18 (35) 36	R34 R2		(R17T)(R6T)(R4T)	R24T	90sec		
Shunting signal	3 ROAD - WEST SHUNTING NECH	R40	B	(6) 7 8 (10) 18	R2		(R7T)(R5T R4T)	R25T	90sec		
Shunting signal	4ROAD - R18T	R41	P	(13)28	R26		(R19T)	R26T	90sec		
Shunting signal	R11T - 9 ROAD	R42	9	45	R48 R57 (R99 or 96)		(R15T)	R11T	90sec		
Shunting signal	R11T - 10 ROAD	R42	10	(45)46	R49 R58 (R98 or 95) (R99 or 96 or 95)		(R15T)(R41T)	R11T	90sec		
Shunting signal	R11T - RCGS	R42	E	(45) (46)	R50		(R15T)(R41T)	R11T	90sec		
Shunting signal	9 ROAD - R11T	R48	Y	44 45	R59 R42		(R15T)	R40T	90sec		
Shunting signal	9 ROAD - WEST SHUNTING NECH	R48	B	(6) 7 (8) (9) (15) 44 45	R42 R2		(R15T)(R11T)(R9T)(R5T R4T)	R40T	90sec		
Shunting signal	10 ROAD - R11T	R49	Y	46 (45) 44	R59 R42		(R41T)(R15T)	R42T	90sec		
Shunting signal	10 ROAD - WEST SHUNTING NECH	R49	B	(6) 7 (8) (9) 15 (44) (45) 46	R42 R2		(R41T)(R11T)(R15T)(R9T) (R5T R4T)	R42T	90sec		
Shunting signal	RCGS - R11T	R50	Y	(46) (45) (44)	R59 R42		(R41T)(R15T)	—	90sec		
Shunting signal	RCGS - WEST SHUNTING NECH	R50	B	(6) 7 (8) (44) (45) (46)	R42 R2		(R41T)(R11T)(R15T)(R9T) (R5T R4T)	—	90sec		
Shunting signal	5 ROAD WEST - 5 ROAD EAST	R64	15	68 69	R72 (R120 or 118)		(R28T)	R27T	90sec		
Shunting signal	5 ROAD WEST - 6 ROAD EAST	R64	16	(68) 69	R73 (R120 or 118)		(R28T R31T)	R27T	90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station Interlocking table (5)

DRAWING NUMBER

BD1-03-05

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	6 ROAD WEST - 5 ROAD EAST	R65	15	69 68	R72 (R120 or 118)		(R31T R28T)	R30T	90sec		
Shunting signal	7 ROAD WEST - 8 ROAD EAST	R66	8E	70 71 131	R75(R119 or 117)		(R34T R37T)	R33T	90sec		
Shunting signal	8 ROAD WEST - 7 ROAD EAST	R67	17	70 71	R74 (R119 or 117)		(R37T R34T)	R36T	90sec		
Shunting signal	8 ROAD WEST - 8 ROAD EAST	R67	8E	70 71	R75 (R119 or 117)		(R37T)	R36T	90sec		
Shunting signal	5 ROAD EAST - 6 ROAD WEST	R72	6	68 69	R65 (R26 or 13)		(R28T R31T)	R29T	90sec		
Shunting signal	5 ROAD EAST - 5 ROAD WEST	R72	5	68 69	R64 (R26 or 28)		(R28T)	R29T	90sec		
Shunting signal	6 ROAD EAST - 5 ROAD WEST	R73	5	68 69	R64 (R26 or 28)		(R31T R28T)	R32T	90sec		
Shunting signal	7 ROAD EAST - 8 ROAD WEST	R74	8	71 70	R67 (R29 or 27)		(R34T R37T)	R35T	90sec		
Shunting signal	8 ROAD EAST - 7 ROAD WEST	R75	7	70 71	R66 (R27 or 29)		(R37T R34T)	R38T	90sec		
Shunting signal	8 ROAD EAST - 8 ROAD WEST	R75	8	70 71	R67 (R27 or 29)		(R37T)	R38T	90sec		
Shunting signal	RCGS - SHORT SHUNTING NECH	R91	Z	95 96	R98		(R43T)	—	90sec		
Shunting signal	RCGS - PAZUNDAUNG	R91	N	95 96 138 132	R99 R137		(R43T R56T)(R62T R61T)	—	90sec		
Shunting signal	10 ROAD - SHORT SHUNTING NECH	R92	Z	96 95	R98		(R43T)	R42T	90sec		
Shunting signal	10 ROAD - PAZUNDAUNG	R92	N	95 96 133 132	R99 R137		(R43T R56T)(R62T R61T)	R42T	90sec		
Shunting signal	9 ROAD - PAZUNDAUNG	R93	N	96 133 132	R99 R137		(R56T)(R62T R61T)	R40T	90sec		
Shunting signal	SHORT SHUNTING NECH - RCGS	R98	F	95 96	R91 (R42 or 46 or 45)		(R43T)	—	90sec		

NOTES:
1.
2.

LEGEND

CLIENT:



CONSULTANTS:
Consortium of JIC and OC



DATE:

MARCH 2014

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (6)

DRAWING NUMBER

BD1-03-06

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	SHORT SHUNTING NECH - 10 ROAD	R98	10	95 96	R92 (R42 or 46 or 45)		(R43T)	—	90sec		
Shunting signal	R62T - RCGS	R99	F	(95) (96)	R91(R42 or 46 or 45)		(R56T R43T)	R62T	90sec		
Shunting signal	R62T - 10 ROAD	R99	10	95 (96)	R92 (R42 or 46 or 45)		(R56T R43T)	R62T	90sec		
Shunting signal	R62T - 9 ROAD	R99	9	96	R93 (R42 or 45)		(R56T)	R62T	90sec		
Shunting signal	4ROAD - R57T	R100	11	(107) (105) 109 (110) 128 105 106	R112 R142 R80		(R47T R46T R45T)	R26T	90sec		
Shunting signal	4ROAD - R50T	R100	12	(107) 109 110 (128)	R138		(R47T)(R49T R53T)	R26T	90sec	R123	
Shunting signal	3ROAD - R57T	R101	11	105 106 107 108 109 110	R112 R85		(R46T R45T)	R25T	90sec		
Shunting signal	3ROAD - R50T	R101	12	105 106 (107) (108) (109) 110 (128)	R112 R138		(R46T)(R49T R53T)(R57T)	R25T	90sec	R123	
Shunting signal	2ROAD - R57T	R102	11	(105) 106 (107) 108 109	R112 R86		(R46T R45T)	R24T	90sec		
Shunting signal	2ROAD - R50T	R102	12	105 107 108 109 (128)	R138		(R46T)(R49T R53T)	R24T	90sec	R123	
Shunting signal	1ROAD - R57T	R103	11	105 106 108 109	R112 R87		(R45T)	R23T	90sec		
Shunting signal	1ROAD - R50T	R103	12	105 106 108 (109) (128)	R138 R112		(R45T)(R57T R49T R53T)	R23T	90sec	R123	
Shunting signal	EAST DOCK - PWI SIDING	R104	H	106			(R44T)	—	90sec		
Shunting signal	EAST DOCK - R57T	R104	11	(106) 105 108 109	R112		(R45T)	—	90sec		
Shunting signal	EAST DOCK - R50T	R104	12	105 (106) 108 (109) (128)	R112 R138		(R44T R45T)(R57T R49T R53T)	—	90sec	R123	
Shunting signal	R57T - EAST DOCK	R112	G	105 (106) 108	R104		(R45T R44T)	R57T	90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station Interlocking table (7)

DRAWING NUMBER

BD1-03-07

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	R57T-1ROAD	R112	1	105 106 108	R103 R87 (R34 or 36)		(R45T)	R57T	90sec		
Shunting signal	R57T-2ROAD	R112	2	105 106 108 107	R102 R86 (R34 or 35)		(R45T R46T)	R57T	90sec		
Shunting signal	R57T-3ROAD	R112	3	105 106 107 108 110	R101 R85 (R1 or 10)		(R45T R46T)	R57T	90sec		
Shunting signal	R57T-4ROAD	R112	4	105 106 107 108 110	R100 R80 (R26 or 13)		(R45T R46T R47T)	R57T	90sec		
Shunting signal	8 ROAD EAST - R50T	R113	12	117 130 128 129	R119 R138		(R54T R51T)(R52T R53T)	R38T	90sec	R123	
Shunting signal	8 ROAD EAST - R52T	R113	14	117 130 128	R119 R138		(R54T R51T)	R38T	90sec		
Shunting signal	8 ROAD EAST - PAZUNDAUNG	R113	N	117 131 129 132	R137		(R54)(R60T R61T)	R38T	90sec		
Shunting signal	7 ROAD EAST - R52T	R114	14	117 130 128 131	R119 R138		(R51T)	R35T	90sec		
Shunting signal	7 ROAD EAST - R50T	R114	12	117 130 128 129 131	R119 R138		(R51T)(R52T R53T)	R35T	90sec	R123	
Shunting signal	7 ROAD EAST - PAZUNDAUNG	R114	N	117 130 131 129 132	R137		(R51T)(R52T R54T)(R60T R61T)	R35T	90sec		
Shunting signal	6ROAD EAST - R53T	R115	13	118 130 128	R120 R138		(R48T)	R32T	90sec		
Shunting signal	6ROAD EAST - R50T	R115	12	118 130 128 129	R120 R138		(R48T)(R53T)	R32T	90sec	R123	
Shunting signal	5ROAD EAST - R53T	R116	13	118 130 128	R120 R138		(R59T)(R48T)	R29T	90sec		
Shunting signal	5ROAD EAST - R50T	R116	12	118 130 128	R120 R138		(R59T R48T)(R53T)	R29T	90sec	R123	
Shunting signal	R52T - 7 ROAD EAST	R119	17	117	R114 R83 (R67 or 71)		(R51T)	R53T	90sec		
Shunting signal	R52T - 8ROAD EAST	R119	F	117	R113 R66 (R67 or 71)		(R51T R54T)	R53T	90sec		

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (8)

DRAWING NUMBER

BD1-03-08

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Shunting signal	R53T - 5 ROAD EAST	R120	15	5 6 7 8 10 18 (118)	R116 R124 R65 (R64 or 68)		(R48T)(R59T)	R53T	90sec		
Shunting signal	R53T - 6 ROAD EAST	R120	16	118	R115 R84 (R64 or 68)		(R48T)	R53T	90sec		
Shunting signal	CARRIAGE SHED -PAZUNDAUNG	R121	N	(127)132 133	R137		(R61T)	-	90sec		
Shunting signal	CARRIAGE SHED -PAZUNDAUNG	R121F	N	(127)132 133	R137		(R61T)	-	90sec		
Shunting signal	R53T-R50T	R123	12	129	R138		(R50T)	R53T	90sec		
Shunting signal	R53T -PAZUNDAUNG	R123	N	(129)(132)	R138 R137		(R50T R60T R61T)	R53T	90sec		
Shunting signal	PAZUNDAUNG-R50T	R137	12	(132)(129)133 127	R123		(R61T R60T R50T)	[P7AT]	90sec	R138	
Shunting signal	PAZUNDAUNG-R52T	R137	14	(132)129 133 131 130 127	R114 R113		(R61T R60T) (R54T R52T)	[P7AT]	90sec	R119	
Shunting signal	PAZUNDAUNG R53T - 8 ROAD EAST	R137	8E	(132)133 129 (131) 117 127	R113 R66 (R67 or 71)		(R61T R60T) (R54T R52T)	[P7AT]	90sec		
Shunting signal	PAZUNDAUNG- CARRIAGE SHED	R137	18	132 133 (127)	R121 R121F		(R61T)	[P7AT]	90sec		
Shunting signal	PAZUNDAUNG-R62T	R137	19	132 (133)127	R98 (R92 or 96) (R91 or 95 or 96)		(R61T R62T)	[P7AT]	90sec	R99	
Shunting signal	R50T-R57T	R138	11	(128)(109)	R123		(R53T R49T R57T)	R50T	90sec	R112	
Shunting signal	R50T-2ROAD	R138	2	(128)109 107 105	R123		(R53T R49T)(R47T R46T)	R50T	90sec		
Shunting signal	R50T-4ROAD	R138	4	(128)109 (107)110	R123		(R53T R49T)(R47T)	R50T	90sec		
Shunting signal	R50T-R53T	R138	16	128 130	R123		(R53T)	R50T	90sec	R120	
Shunting signal	R50T-R52T	R138	18	128 (131)(130)	R123		(R53T R52T)	R50T	90sec	R119	

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants
for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR
USED WITHOUT THE WRITTEN PERMISSION
FROM JAPAN INTERNATIONAL COOPERATION
AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (9)

DRAWING
NUMBER

BD1-03-09

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Shunting signal	DN LOCAL-R50T	R139	12	129 132	R123					
Shunting signal	DN LOCAL-R52T	R139	14	129 132 131 130						
Shunting signal	DN LOCAL-R50T	R139	8E	132 129 131 117						
Point	Dual	5				R3T R5T				
Point	Dual	6				R4T R5T				
Point	Dual	7				R4T				
Point		8				R5T				
Point	Dual	9				R3T				
Point		10				R5T				
Point	Dual	11				R8T R9T				
Point	Dual	12				R8T R9T				
Point		13				R19T				
Point	Dual	14				R13T R14T				
Point		16				R13T				
Point	Dual	18				R5T R6T				
Point	Dual	28				R19T				

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (10)

DRAWING NUMBER

BD1-03-10

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number	Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Point	Dual	29			R21T				
Point		35			R17T				
Point	Dual	[36]			R17T				
Point		44			R11T				
Point	Dual	45			R15T R41T				
Point	Dual	46			R41T				
Point		68			R28T R31T				
Point		69			R28T R31T				
Point		70			R34T R37T				
Point		71			R34T R37T				
Point	Dual	95			R43T				
Point	Triple	96			R43T R56T				
Point	Dual	105			R45T R46T				
Point	Dual	106			R44T R45T				
Point		107			R47T				
Point		108			R45T				

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants
for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR
USED WITHOUT THE WRITTEN PERMISSION
FROM JAPAN INTERNATIONAL COOPERATION
AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (11)

DRAWING
NUMBER

BD1-03-11

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number	Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Point	Dual	109			R49T R57T				
Point	Dual	110			R46T R47T				
Point	Dual	117			R51T R54T				
Point	Dual	118			R48T R59T				
Point		[127]			R61T				
Point	Dual	128			R49T R53T				
Point	Dual	129			R50T R60T				
Point	Dual	130			R52T R53T				
Point		131			R54T				
Point	Dual	132			R460 R61T				
Point	Dual	133			R61T R62T				
Request Routs	FOR 1 ROAD	R87S							R87J[P3UM]
Request Routs	FOR 2 ROAD	R86S							R86J[P3UM]
Request Routs	FOR 3 ROAD	R85S						R138 R120 R72	R85J[P3UM]
Request Routs	FOR 4 ROAD	R80S						R138 R120	R80J[P3UM]
Request Routs	FOR 5 ROAD	R124S						R75	R124M[P5UC]

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants
for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR
USED WITHOUT THE WRITTEN PERMISSION
FROM JAPAN INTERNATIONAL COOPERATION
AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station
Interlocking table (12)

DRAWING
NUMBER

BD1-03-12

For reference

YANGON CENTRAL STATION INTERLOCKING

Route		Number	Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Request Routs	FOR 6 ROAD	R84S							R84M[P5UC]
Request Routs	FOR 7 ROAD	R83S							R83M[P5UC]
Request Routs	FOR 8 ROAD	R82MS							R82N[P7UM]
Request Routs	FOR 9 ROAD	R82MC							R82N[P7UC]
Request Routs	FOR 10 ROAD	R81MS							R81N[P7UM]
Request Routs	FOR 10 ROAD	R81MC							R81N[P7UC]

95

NOTES:
1.
2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Yangon central station Interlocking table (13)

DRAWING NUMBER

BD1-03-13

For reference

PAZUNDAUNG STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Home signal	Yangon - Mahlwagon	P3	UC	203 205 (201)	P5UC P7UC P11UC P12UC P13UC	P3T P11T A11AT	(P3T)(P11T)	[P3AT]	90sec		
Home signal	Yangon - Mahlwagon	P3	UM	203 205 201 202	P5UC P5UM P7UC P7UM P4R1 P4R2 P4R3 P6R1 P6R2 P6R3	P3T P11T A13AT1 A13AT2	(P3T)(P11T)(A13AT1)	[P3AT]	90sec		
Home signal	Yangon - Mahlwagon	P5	UC	207 (203) (205) (201)	P3UC P3UM P7UC P7UM P7S2 P4R1 P4R2 P4R3 P6R1 P6R2 P6R3	P5T P15T R65T1 P11T	(P5T)(P15T)(R65T1)(P11T)	[P5AT]	90sec		
Home signal	Yangon - Mahlwagon	P5	UM	207 (203) (205) 201 202	P3UC P3UM P7UC P7UM P7S2 P4R1 P4R2 P4R3 P6R1 P6R2 P6R3	P5T P15T R65T1 P11T A13AT1 A13AT2	(P5T)(P15T)(R65T1)(P11T)(A13AT1)	[P5AT]	90sec		
Home signal	Yangon - SID2	P5	S2	207 203 205 204 206 209	P7UC P7UM P7S2 P9S2 P4R2 P4R3 P6R2 P6R3	P5T P15T P19T1 P19T2 P19T3	(P5T)(P15T)(P19T1)(P19T2)	[P5AT]	90sec		
Home signal	Yangon - Mahlwagon	P7	UC	(207) (208) (203) (205) (201)	P3UC P3UM P5UC P5UM P5S2 P2R2 P2R3 P4R1 P4R2 P4R3 P6R1 P6R2 P6R3	P7T R68T1 P15T R65T1 P11T A11AT	(P7T)(R68T1)(P15T)(R65T1)(P11T)	[P7AT]	90sec		
Home signal	Yangon - Mahlwagon	P7	UM	(207) (208) (203) (205) 201 202	P3UC P3UM P5UC P5UM P5S2 P2R2 P2R3 P4R1 P4R2 P4R3 P6R1 P6R2 P6R3	P7T R68T1 P15T R65T1 P11T A13AT1 A13AT2	(P7T)(R68T1)(P15T)(R65T1)(P11T)(A13AT1)	[P7AT]	90sec		
Home signal	Yangon - SID2	P7	S2	(207) (208) 203 205 204 206 209	P5UC P5UM P5S2 P9S2 P4R2 P4R3 P6R2 P6R3	P7T R68T1 P15T P19T1 P19T2 P19T3	(P7T)(R68T1)(P15T)(P19T1)(P19T2)	[P7AT]	90sec		
Home signal	SID3 - SID2	P9	S2	(209) (210)	P5S2 P7S2 P2R2 P2R3 P2S3	P2T P19T2 P19T3	(P2T)(P19T2)	P9AT	90sec		
Home signal	SID2 - Yangon	P2	R2	209 210 204 206 208 207	P7UC P7UM P7S2 P9S2 P4R2 P4R3 P6R2 P6R3	P2T P16T R68T1 R68T2	(P2T)(P16T)(R68T1)	P2AT	90sec		
Home signal	SID2 - Yangon	P2	R3	209 (210) 204 206 206	P9S2 P4R3 P6R3	P2T P16T A8AT	(P2T)(P16T)	P2AT	90sec		
Home signal	SID2 - SID3	P2	S3	209 (210)	P9S2	P2T P9AT	(P2T)	P2AT	90sec		
Home signal	Mahlwagon - Yangon	P4	R1	(202) (201) 204 206 203 205	P3UM P5UC P5UM P7UC P7UM P6R1	P4T A13AT1 P12T R65T1 R65T2	(P4T)(A13AT1)(P12T)(R65T1)	P4AT	90sec		
Home signal	Mahlwagon - Yangon	P4	R2	(202) (201) (204) (206) 208 207	P3UM P5UM P5S2 P7UC P7UM P7S2 P6R1 P6R2 P6R3 P2R2 P2R3	P4T A13AT1 P12T P19T1 P16T R68T1 R68T2	(P4T)(A13AT1)(P12T)(P19T1)(P16T)(R68T1)	P4AT	90sec		
Home signal	Mahlwagon - Yangon	P4	R3	(202) (201) (208) (204) (206)	P3UM P5UM P5S2 P7UC P7UM P7S2 P6R1 P6R2 P6R3 P2R2 P2R3	P4T A13AT1 P12T P19T1 P16T A8AT	(P4T)(A13AT1)(P12T)(P19T1)(P16T)	P4AT	90sec		
Home signal	Mahlwagon - Yangon	P6	R1	202 204 206 203 205	P5UC P5UM P7UC P7UM P4R1 P4R2 P4R3	P6T P12T R65T1 R65T2	(P6T)(P12T)(R65T1)	P6AT	90sec		

NOTES

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Pazundaung station Interlocking table (1)

DRAWING NUMBER

BD1-04-01

For reference

PAZUNDAUNG STATION INTERLOCKING

Route		Number		Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock		Released by	Route control
Home signal	Mahlwagon - Yangon	P6	R2	202 (204) (206) 208 207	P5UM P5S2 P7UC P7UM P7S2 P4R1 P4R2 P4R3 P2R2 P2R3	P6T P12T P19T1 P16T R68T1 R68T2	(P6T)(P12T)(P19T1)(P16T)(R68T1)	P6AT	90sec		
Home signal	Mahlwagon - Yangon	P6	R3	202 (204) (206) (208)	P5S2 P7S2 P4R1 P4R2 P4R3 P2R2 P2R3	P6T P12T P19T1 P16T A8AT	(P6T)(P12T)(P19T1)(P16T)	P6AT	90sec		
Point		201 (11)				P11T					
Point		202 (12)				P12T					
Point		203 (13)				P11T					
Point		204 (14)				P12T					
Point		205 (15)				P15T					
Point		206 (16)				P16T					
Point	Dual	207 (17)				P15T R68T1 P7T					
Point		208 (18)				P16T					
Point	Triple	209 (19)				P19T2 P2T					
Point	Dual	210 (20)				P2T					
Request Route	FROM DN LOCAL TO YANGON 5 ROAD	P4-5S									P4R2[R141-15]
Request Route	FROM DN LOCAL TO YANGON 6 ROAD	P4-6S									P4R2[R141-16]
Request Route	FROM DN LOCAL TO YANGON 7 ROAD	P4-7S									P4R2[R141-17]
Request Route	FROM DN MAIN TO YANGON 1 ROAD	P6-1S									P6R1[R142-1]

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Pazundaung station
Interlocking table (2)

DRAWING NUMBER

BD1-04-02

For reference

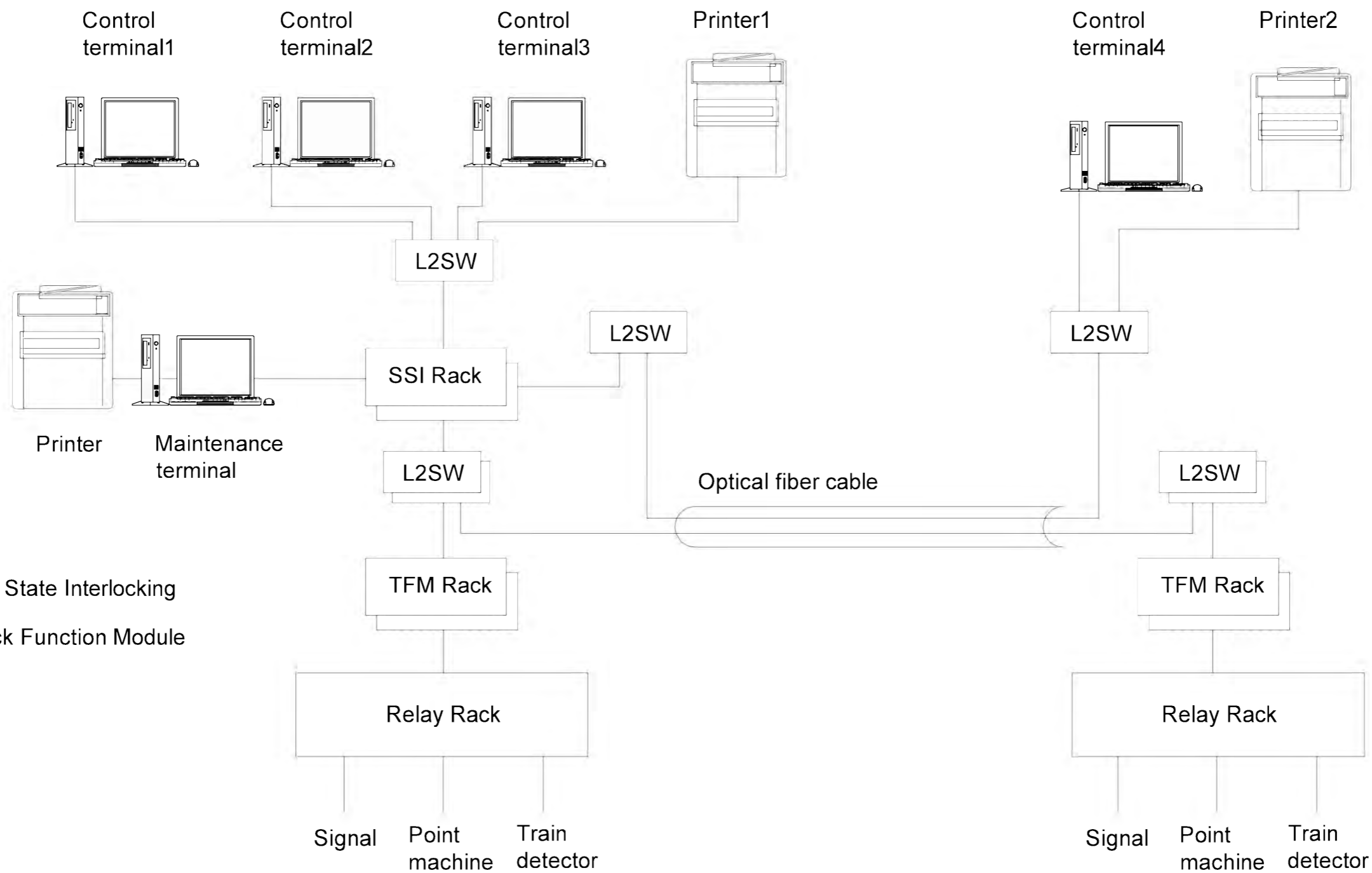
PAZUNDAUNG STATION INTERLOCKING

Route		Number	Point locking for route setting	Signal locking for route setting	Track for signal control	Track for route locking	Approach lock	Released by	Route control
Request Route	FROM DN MAIN TO YANGON 2 ROAD	P6-2S							P6R1[R142-2]
Request Route	FROM DN MAIN TO YANGON 3 ROAD	P6-3S							P6R1[R142-3]
Request Route	FROM DN MAIN TO YANGON 4 ROAD	P6-4S							P6R1[R142-4]
Request Route	FROM FACTORY TO YANGON 9 ROAD	P2-9S							P2R3[R140-9]
Request Route	FROM FACTORY TO YANGON 10 ROAD	P2-10S							P2R3[R140-10]

<p>NOTES:</p> <ol style="list-style-type: none"> 	<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>	<p>SCALE:</p> <p>Non scale</p>	<p>TITLE:</p> <p>Pazundaung station Interlocking table (3)</p>
					<p>DRAWING NUMBER</p> <p>BD1-04-03</p>	

Yangon central station

Pazundaung station

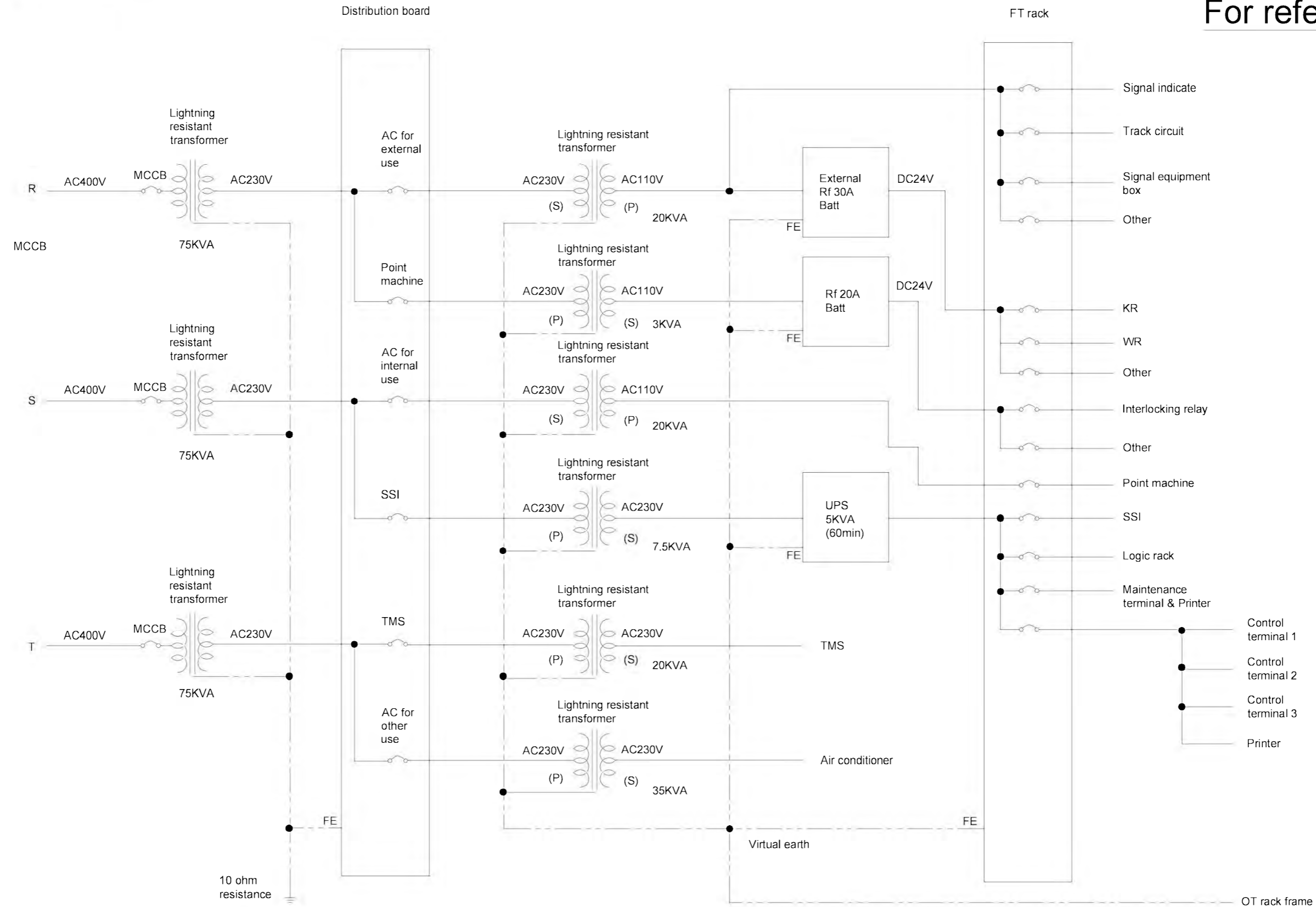


SSI : Solid State Interlocking
TFM : Track Function Module

For reference

<p>NOTES:</p> <ol style="list-style-type: none"> 1. 2. 	<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p>
				<p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>
<p>LEGEND</p>		<p>SCALE:</p> <p>Non scale</p>		<p>TITLE:</p> <p>Centralized Electronic Interlocking System diagram</p>
				<p>DRAWING NUMBER</p> <p>BD1-05-01</p>

For reference



NOTES:
1.
2.

LEGEND

Earth wire	Earthing	Frame earthing	FE
	MCCB or NFB		

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

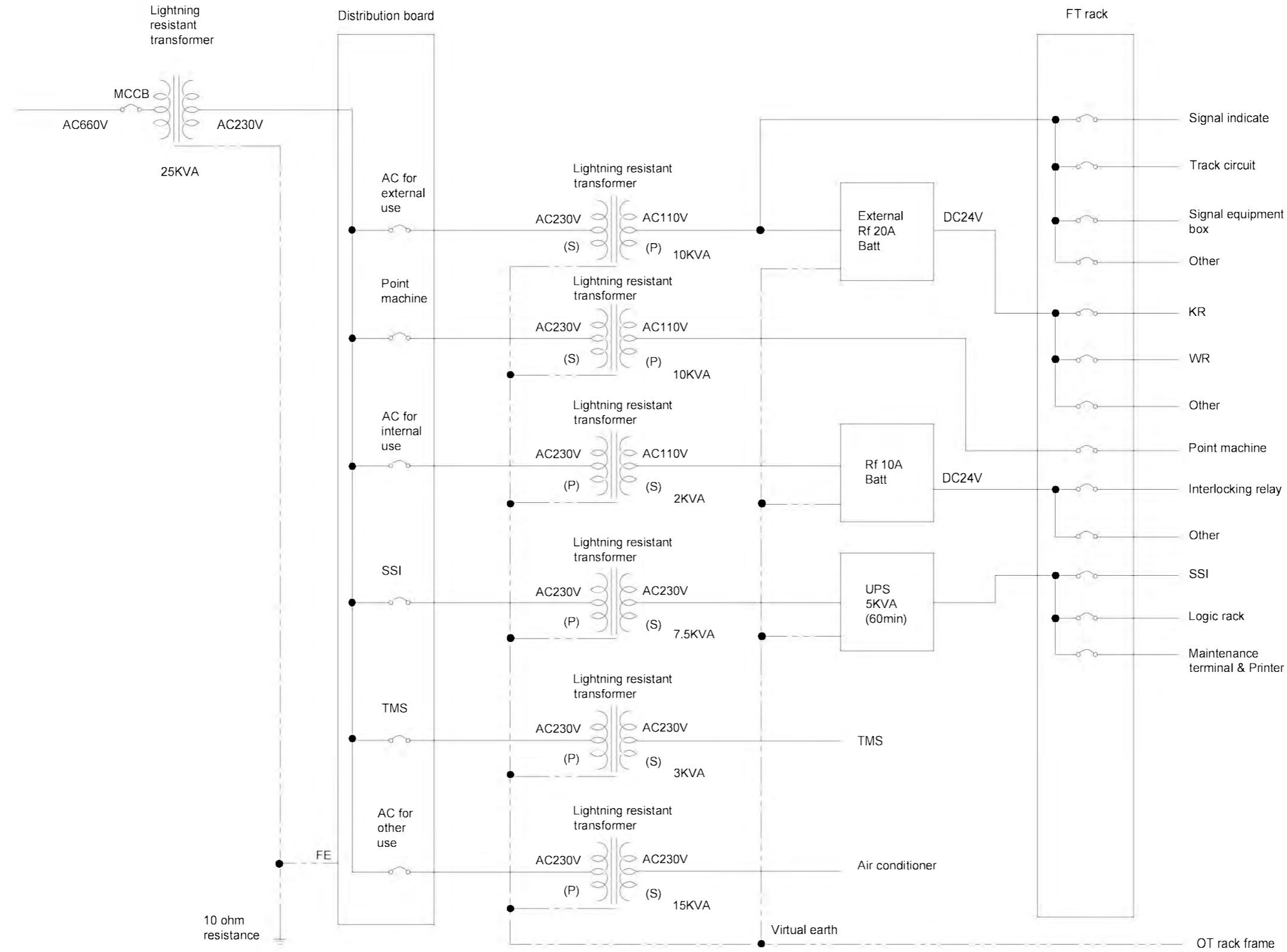
TITLE:

Signalling power supply drawing
Yangon central station

DRAWING NUMBER

BD1-06-01

For reference



NOTES:
1.
2.

LEGEND

Earth wire	Earthing	Frame earthing	FE
	MCCB or NFB		

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Signalling power supply drawing
Pazundaung

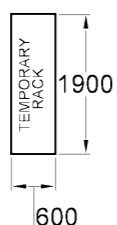
DRAWING NUMBER

BD1-06-02

YANGON CENTRAL STATION

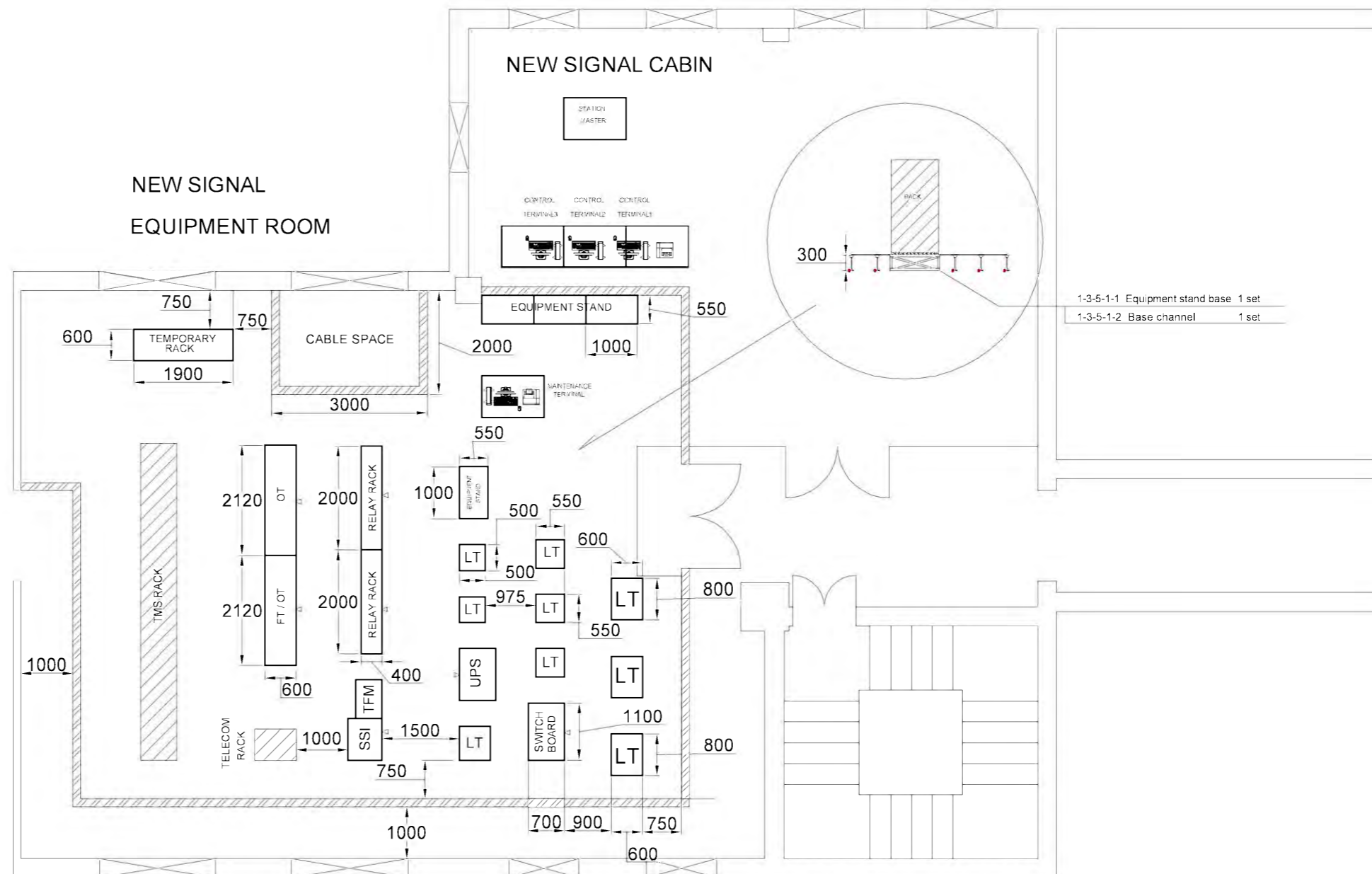
SIGNAL TOWER

EXISTING SIGNAL
EQUIPMENT ROOM



	QTY	
1-1-1-1 Solid state interlocking rack	1	Set
1-1-2-1 Train detect rack	1	Set
1-1-3-1 Relay rack	1	Set
1-1-3-2 FT rack	1	Set
1-1-3-3 OT rack	1	Set
1-1-3-4 Equipment stand	1	Set
1-1-3-5 Temporary rack	1	Set
1-1-4-1 LT for power receive	3	Unit
1-1-4-2 Switch board for Signalling	1	Unit
1-1-4-3 LT for power supply	1	Set
1-1-4-4 Rectifier	1	Set
1-1-4-5 UPS	1	Unit

MAIN BUILDING



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:100

TITLE:

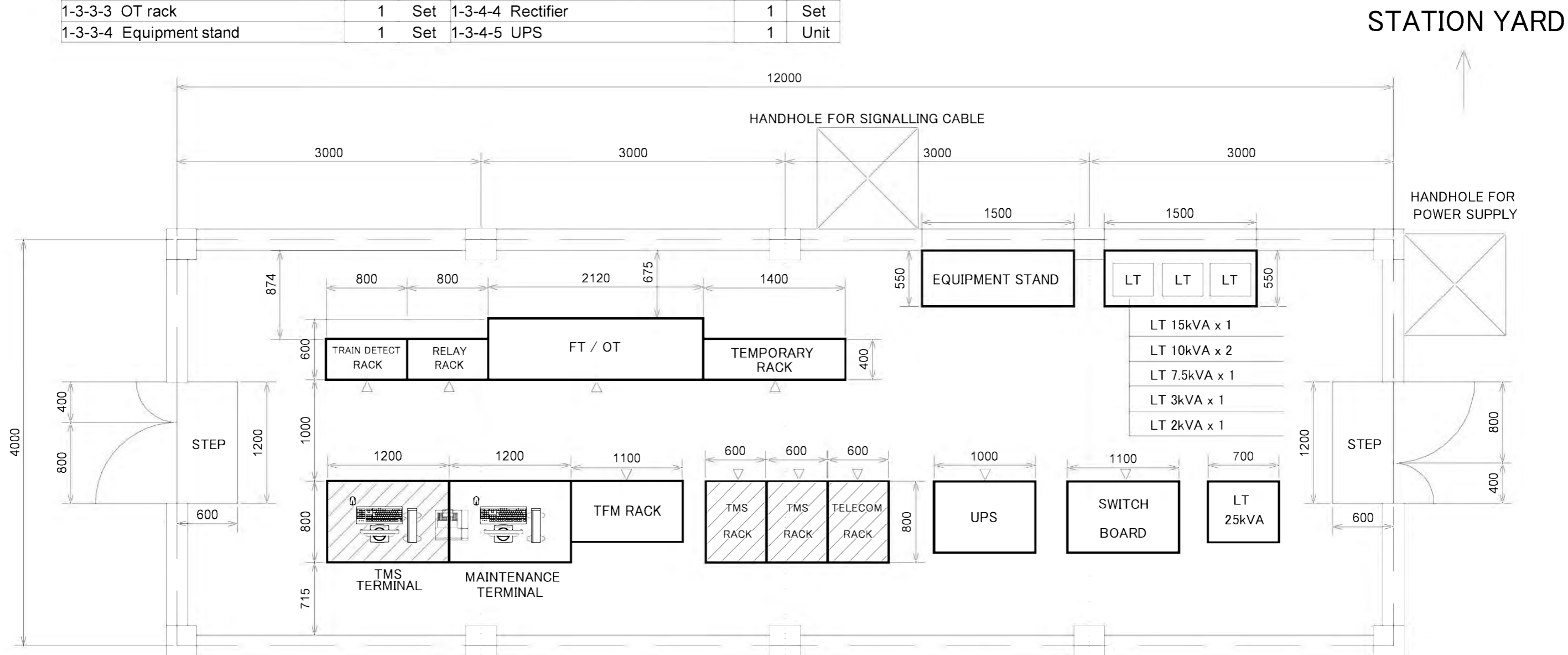
Yangon central station new signal equipment room Equipments arrangement plan

DRAWING NUMBER

BD1-07-01

PAZUNDAUNG STATION NEW SIGNAL EQUIPMENT HOUSE

1-3-1-1 Solid state interlocking rack	1	Set	1-3-3-5 Temporary rack	1	Set
1-3-2-1 Train detect rack	1	Set	1-3-4-1 LT for power receive	1	Unit
1-3-3-1 Relay rack	1	Set	1-3-4-2 Switch board for Signalling	1	Unit
1-3-3-2 FT rack	1	Set	1-3-4-3 LT for power supply	1	Set
1-3-3-3 OT rack	1	Set	1-3-4-4 Rectifier	1	Set
1-3-3-4 Equipment stand	1	Set	1-3-4-5 UPS	1	Unit



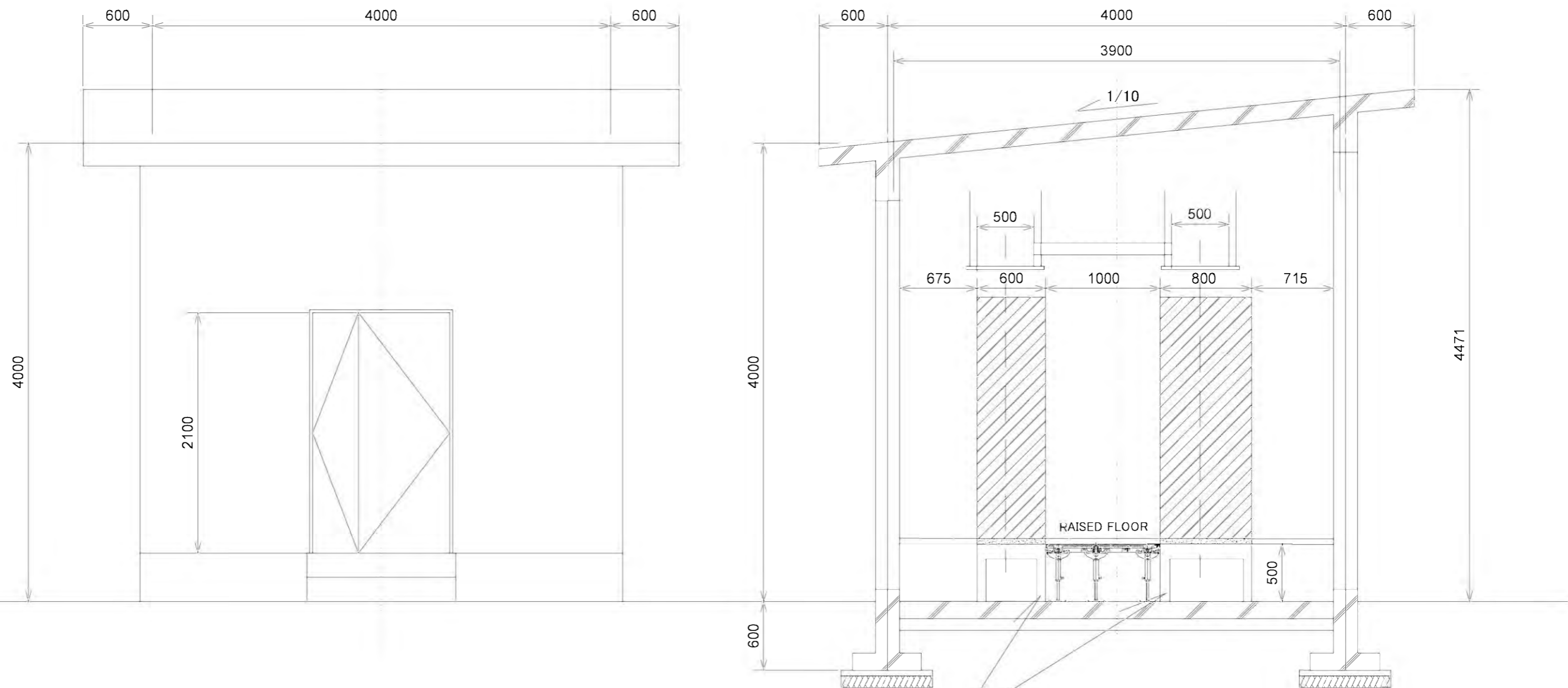
STATION YARD

For reference

<p>NOTES:</p> <ol style="list-style-type: none"> 	<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p>	
				<p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>	
<p>LEGEND</p>		<p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>		<p>DRAWING NUMBER</p> <p>BD1-07-02</p>	

103

PAZUNDAUNG STATION NEW SIGNAL EQUIPMENT HOUSE



- 1-3-5-1 Equipment stand base 1 set
- 1-3-5-2 Base channel 1 set

For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:40

TITLE:

Pazundaung station new signal equipment house
Equipments arrange plan

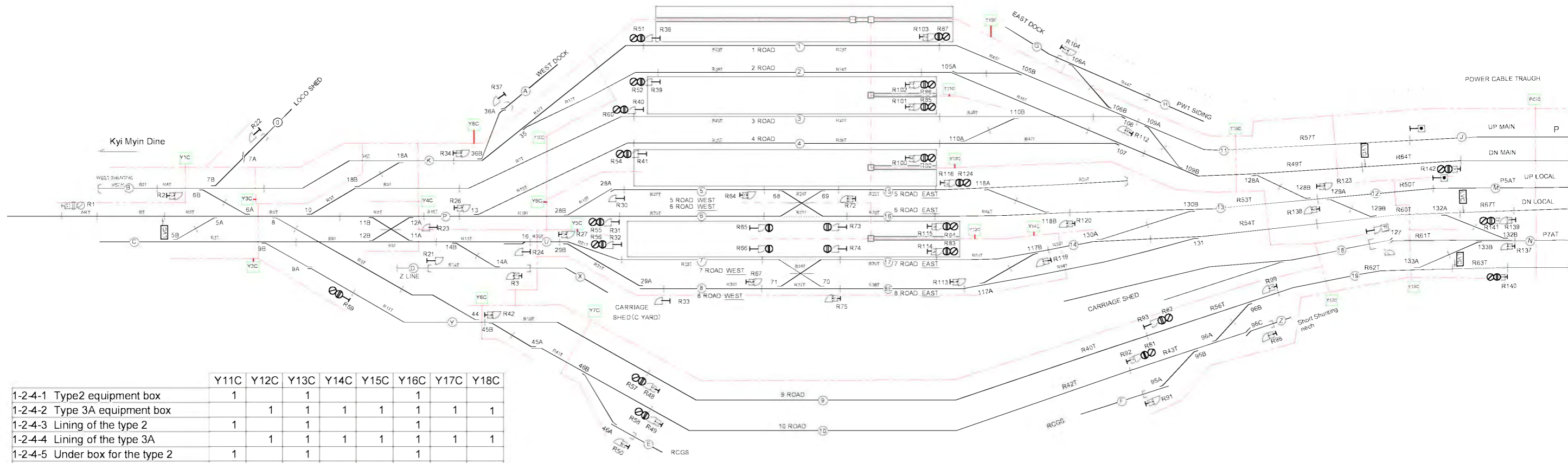
DRAWING NUMBER

BD1-07-03

YANGON CENTRAL STATION

MSH

	Y1C	Y2C	Y3C	Y4C	Y5C	Y6C	Y7C	Y8C	Y9C	Y10C
1-2-4-1 Type2 equipment box		1	1	1	1	1	1	1	1	1
1-2-4-2 Type 3A equipment box	1		1	1	1		1		1	1
1-2-4-3 Lining of the type 2		1	1	1	1	1	1	1	1	1
1-2-4-4 Lining of the type 3A	1		1	1	1		1		1	1
1-2-4-5 Under box for the type 2		1	1	1	1	1	1	1	1	1
1-2-4-6 Under box for the type 3A	1		1	1	1		1		1	1
1-2-4-9 10C wirintg terminals	16	20	18	18	49	8	18	12	14	105
1-2-3-1-1 Silicon constant-voltage Rf	1		1		1					1
1-2-3-1-2 Battery	1		1		1					1
1-2-3-1-3 Track resistor	8	5	3	2	10	5	4	1	8	5
1-2-3-1-4 Rail bond plug	32	20	12	8	40	20	12	4	32	20



	Y11C	Y12C	Y13C	Y14C	Y15C	Y16C	Y17C	Y18C
1-2-4-1 Type2 equipment box	1		1		1	1		1
1-2-4-2 Type 3A equipment box		1	1	1	1	1	1	1
1-2-4-3 Lining of the type 2	1		1		1			1
1-2-4-4 Lining of the type 3A		1	1	1	1	1	1	1
1-2-4-5 Under box for the type 2	1		1		1			1
1-2-4-6 Under box for the type 3A		1	1	1	1	1	1	1
1-2-4-9 10C wirintg terminals	11	25	26	24	16	19	20	26
1-2-3-1-1 Silicon constant-voltage Rf	1		1	1	1	1	1	1
1-2-3-1-2 Battery	1		1	1	1	1	1	1
1-2-3-1-3 Track resistor	4	8	13	7	8	4	7	14
1-2-3-1-4 Rail bond plug	16	32	52	28	32	16	28	56

For reference

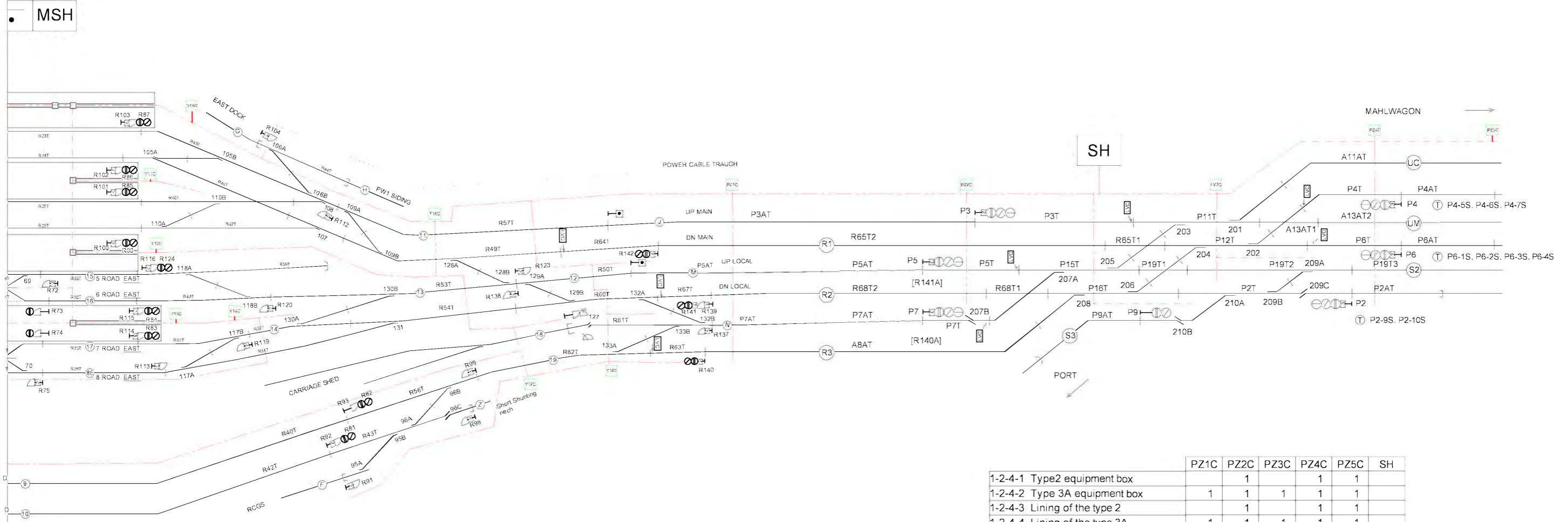
<p>NOTES:</p> <ol style="list-style-type: none"> 	<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p>
				<p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>
<p>LEGEND</p> <p>Undergrounding wiring</p> <p>Inside cable rack</p> <p>Inside cable duct</p> <p>Equipment box</p>				<p>SCALE:</p> <p>Non scale</p>
				<p>TITLE:</p> <p>Yangon central station New signal cables & equipment boxes arrangement plan</p>
				<p>DRAWING NUMBER</p> <p>BD1-08-01</p>

105

For reference

YANGON CENTRAL STATION

PAZUNDAUNG STATION



	PZ1C	PZ2C	PZ3C	PZ4C	PZ5C	SH
1-2-4-1 Type2 equipment box		1		1	1	
1-2-4-2 Type 3A equipment box	1	1	1	1	1	
1-2-4-3 Lining of the type 2		1		1	1	
1-2-4-4 Lining of the type 3A	1	1	1	1	1	
1-2-4-5 Under box for the type 2		1		1	1	
1-2-4-6 Under box for the type 3A	1	1	1	1	1	
1-2-4-9 10C wiring terminals	6	18	20	12	4	
1-2-3-1-1 Silicon constant-voltage Rf	1	1	1	1	1	2
1-2-3-1-2 Battery	1	1	1	1	1	2
1-2-3-1-3 Track resistor	6	7	9	11	6	23
1-2-3-1-4 Rail bond plug	24	28	36	44	24	92

NOTES:
1.
2.

LEGEND

Undergrounding wiring	
Inside cable rack	
Inside cable duct	
Equipment box	

CLIENT: JICA
Japan International Cooperation Agency

CONSULTANTS: Consortium of JIC and OC
JIC
Japan International Consultants for Transportation Co., Ltd.

ORICONSUL
Oriental Consultants Co., Ltd.

DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

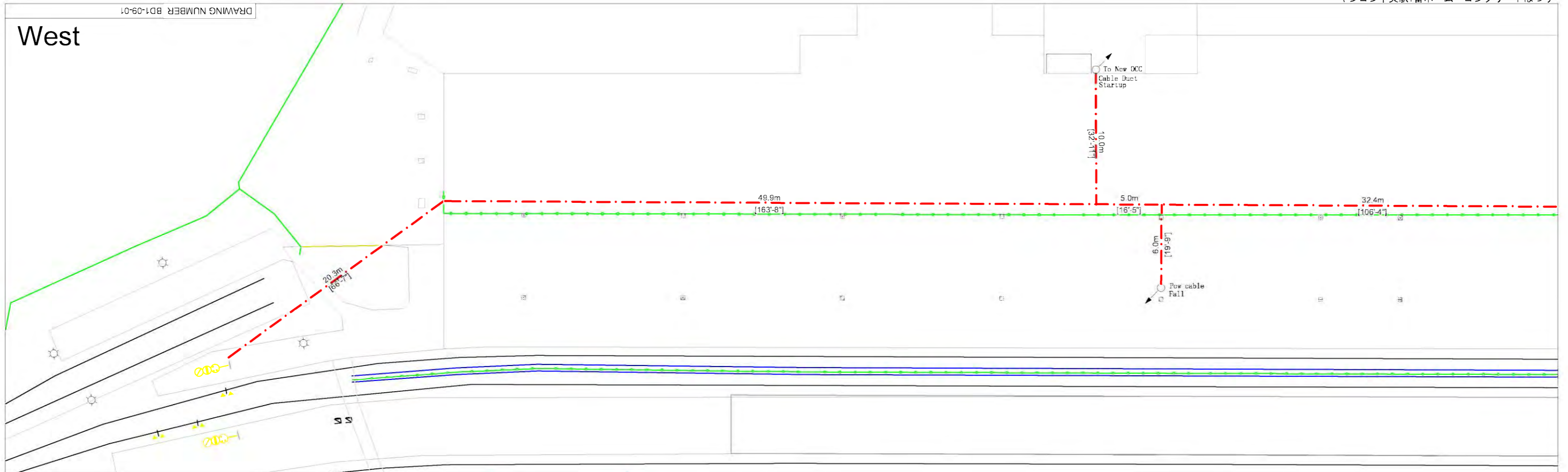
SCALE: Non scale

TITLE: Pazundaung station
New signal cables & equipment boxes arrangement plan

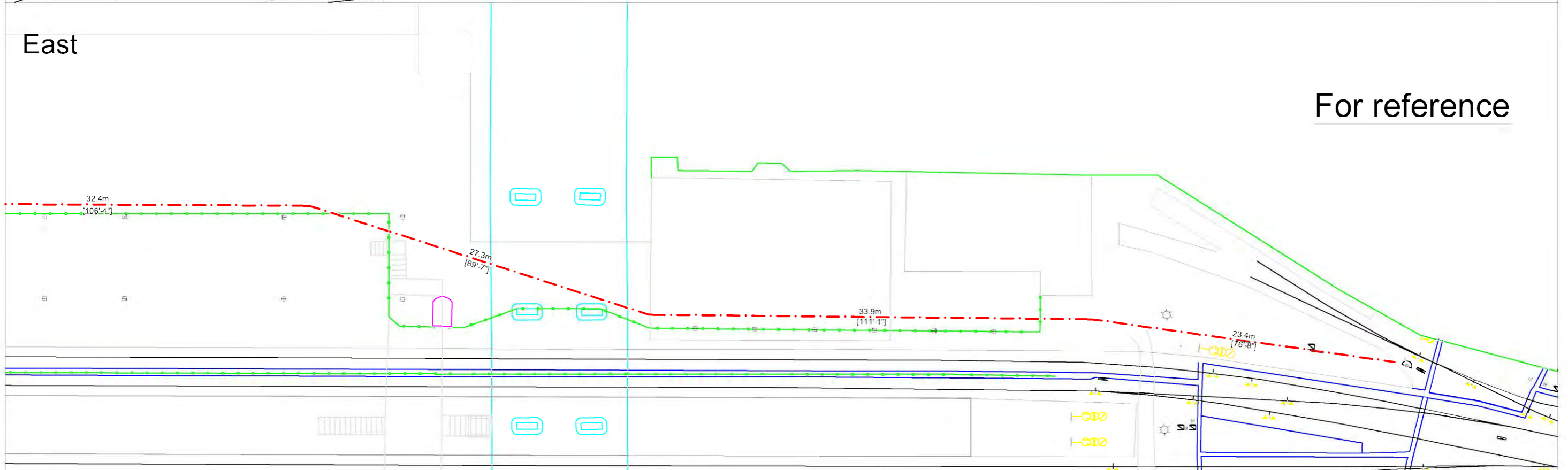
DRAWING NUMBER: BD1-08-02

106

West



East



For reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

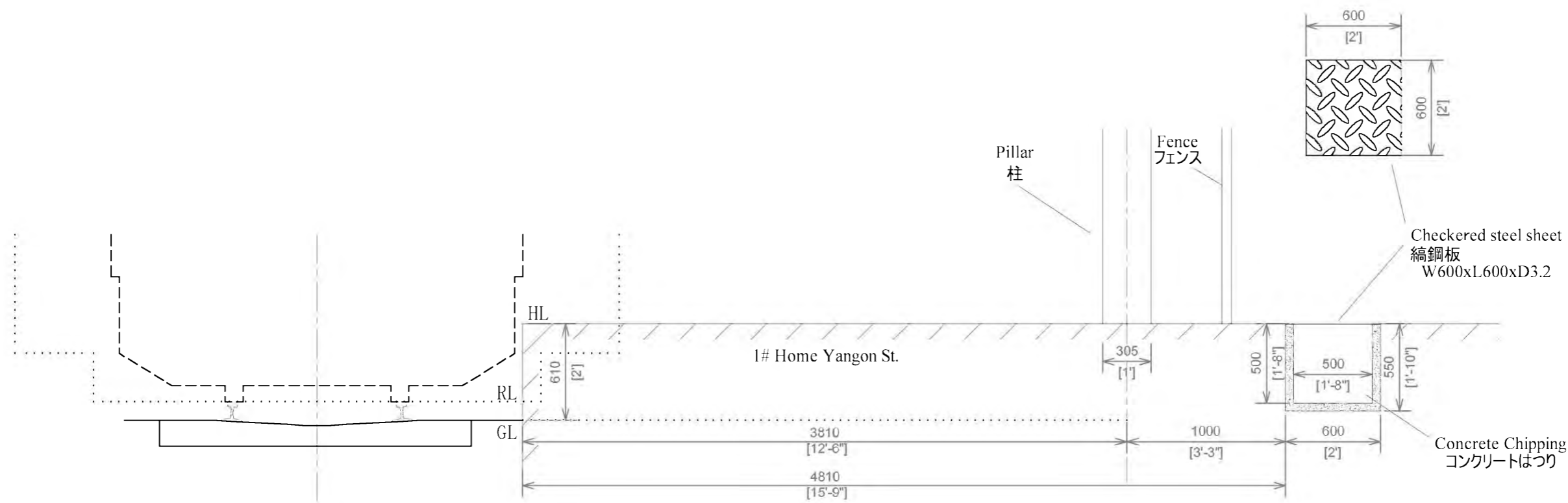
1:300

TITLE:

Concrete chipping
Yangon central station Plathome 1

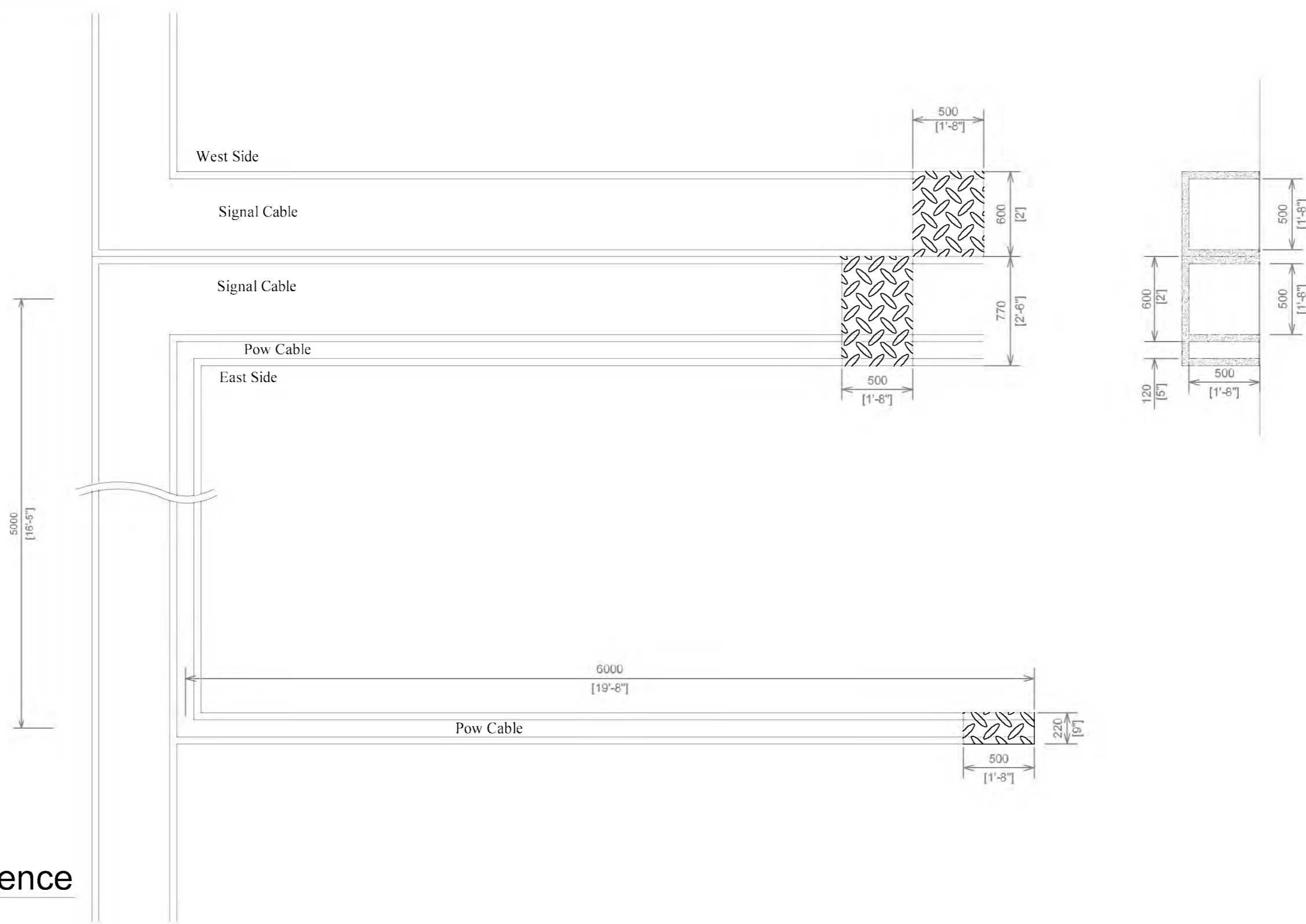
DRAWING NUMBER

BD1-09-01



For reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line	
LEGEND					SCALE: 1:30	TITLE: Working drawing Undergrounding wiring method (1)
Ceiling concealment line  Floor concealment line  Exposure Wiring  Undergrounding wiring  Overhead line 	Startup  Fall  Through  Earthing  Hand Hall 	600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP				DRAWING NUMBER BD1-09-02



For reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

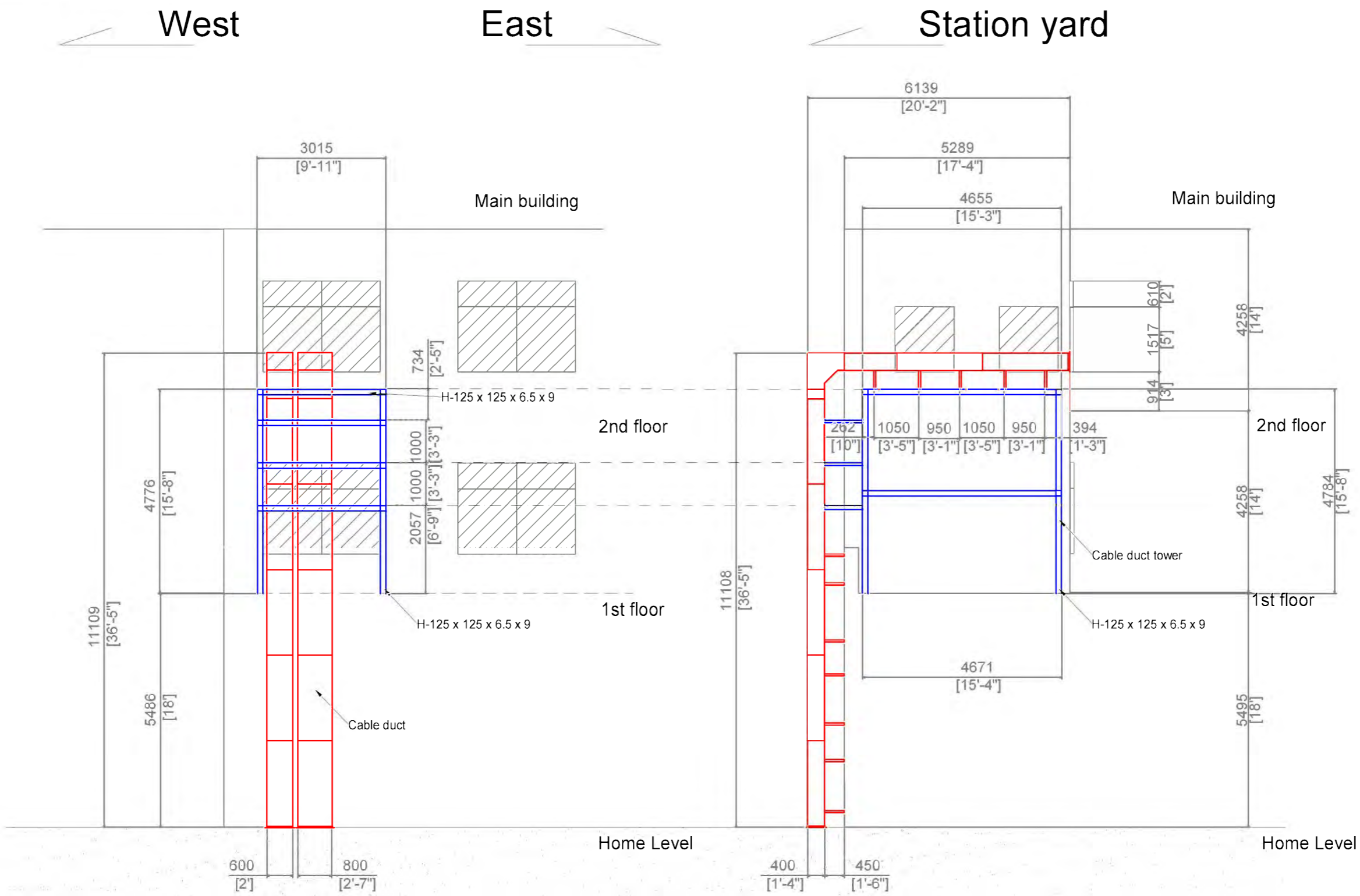
1:30

TITLE:

Working drawing
Undergrounding wiring method (2)

DRAWING NUMBER

BD1-09-03

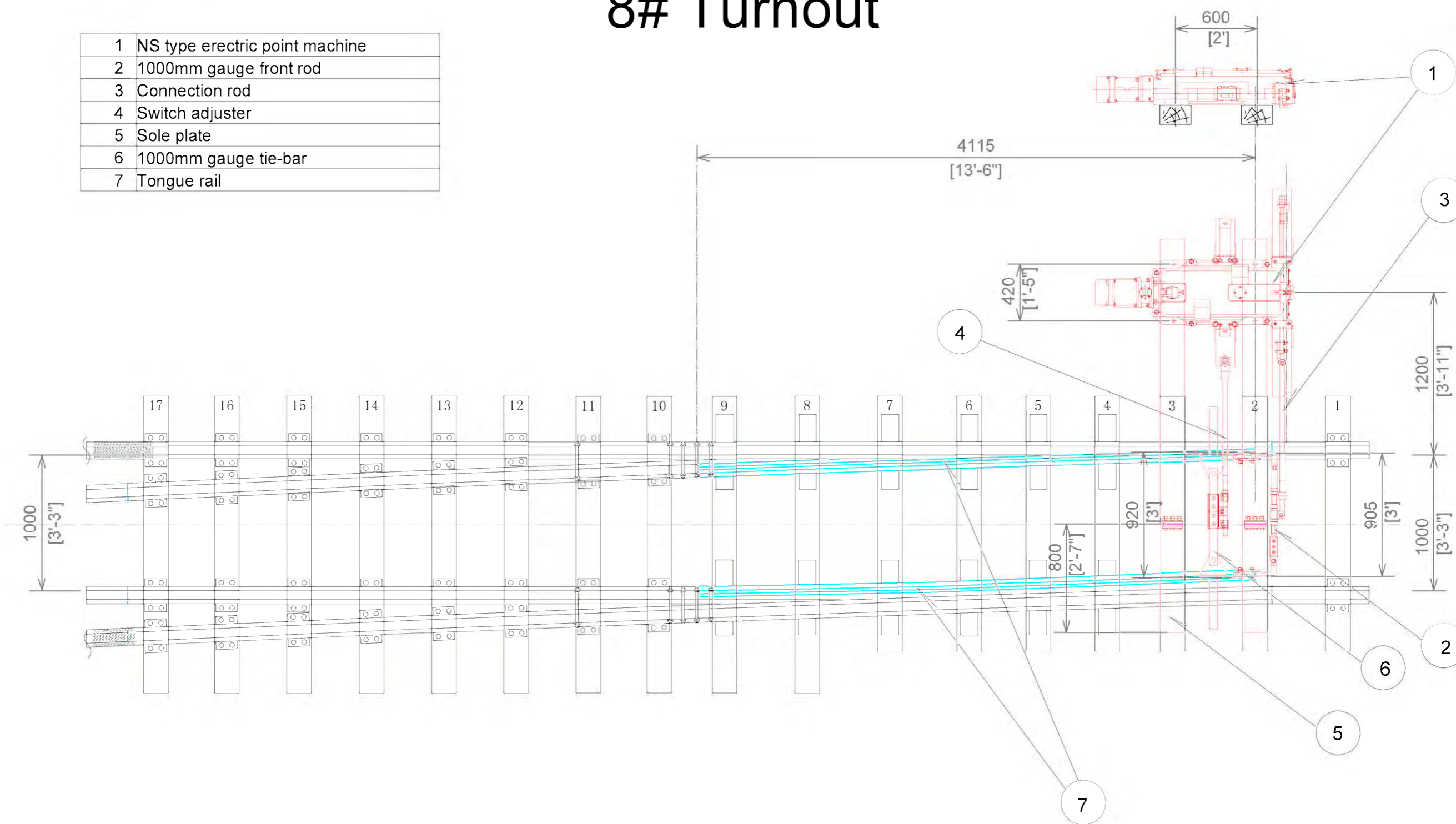


For reference

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>																				
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td></td> <td>Startup</td> <td></td> </tr> <tr> <td>Floor concealment line</td> <td></td> <td>Fall</td> <td></td> </tr> <tr> <td>Exposure Wiring</td> <td></td> <td>Through</td> <td></td> </tr> <tr> <td>Undergrounding wiring</td> <td></td> <td>Earthing</td> <td></td> </tr> <tr> <td>Pierce</td> <td></td> <td>Hand Hall</td> <td></td> </tr> </table>		Ceiling concealment line		Startup		Floor concealment line		Fall		Exposure Wiring		Through		Undergrounding wiring		Earthing		Pierce		Hand Hall					
Ceiling concealment line		Startup																							
Floor concealment line		Fall																							
Exposure Wiring		Through																							
Undergrounding wiring		Earthing																							
Pierce		Hand Hall																							
<p>DRAWING NUMBER</p> <p>BD1-10-01</p>		<p>TITLE:</p> <p>Yangon central station Cable-duct tower image drawing</p>																							

8# Turnout

1	NS type electric point machine
2	1000mm gauge front rod
3	Connection rod
4	Switch adjuster
5	Sole plate
6	1000mm gauge tie-bar
7	Tongue rail



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:30

TITLE:

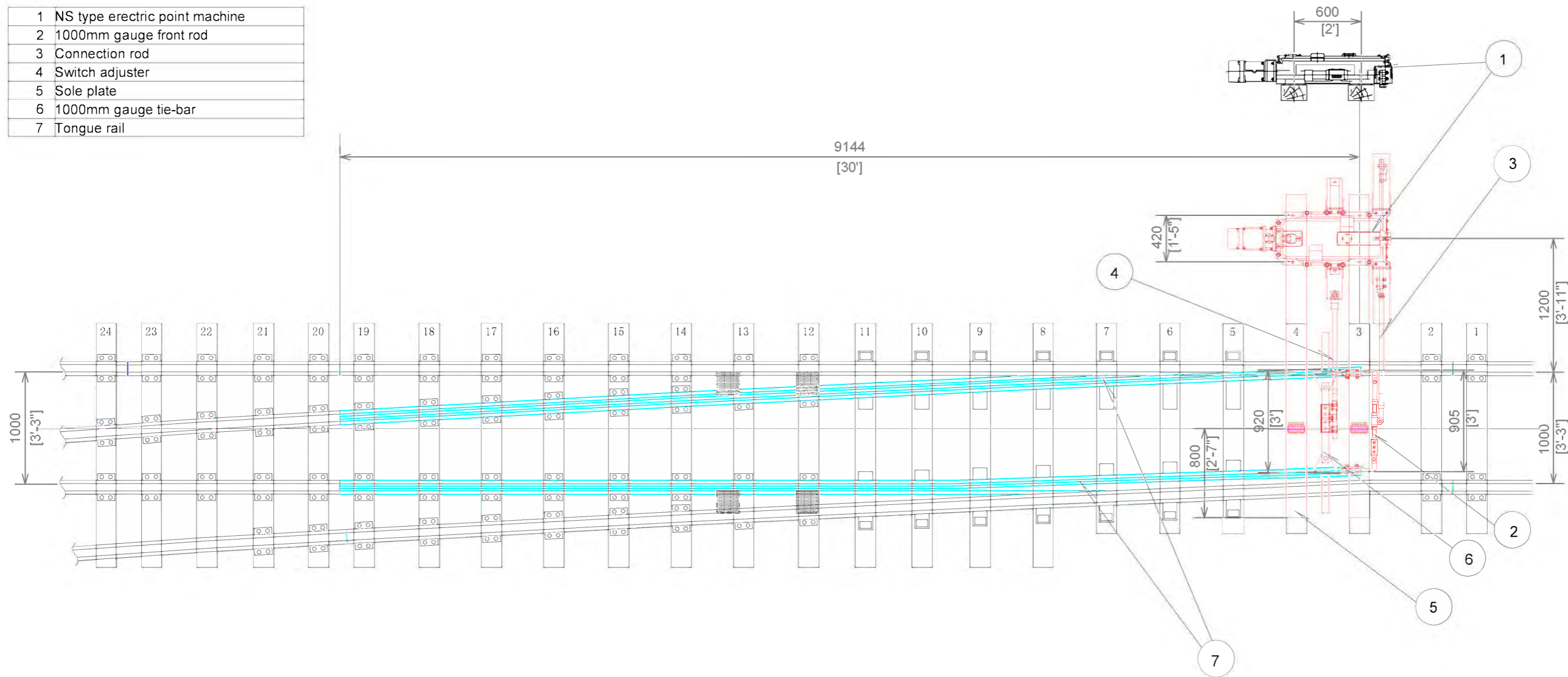
Electric point machine installation drawing
8# turnout

DRAWING NUMBER

BD1-11-01

12# Turnout

1	NS type electric point machine
2	1000mm gauge front rod
3	Connection rod
4	Switch adjuster
5	Sole plate
6	1000mm gauge tie-bar
7	Tongue rail



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

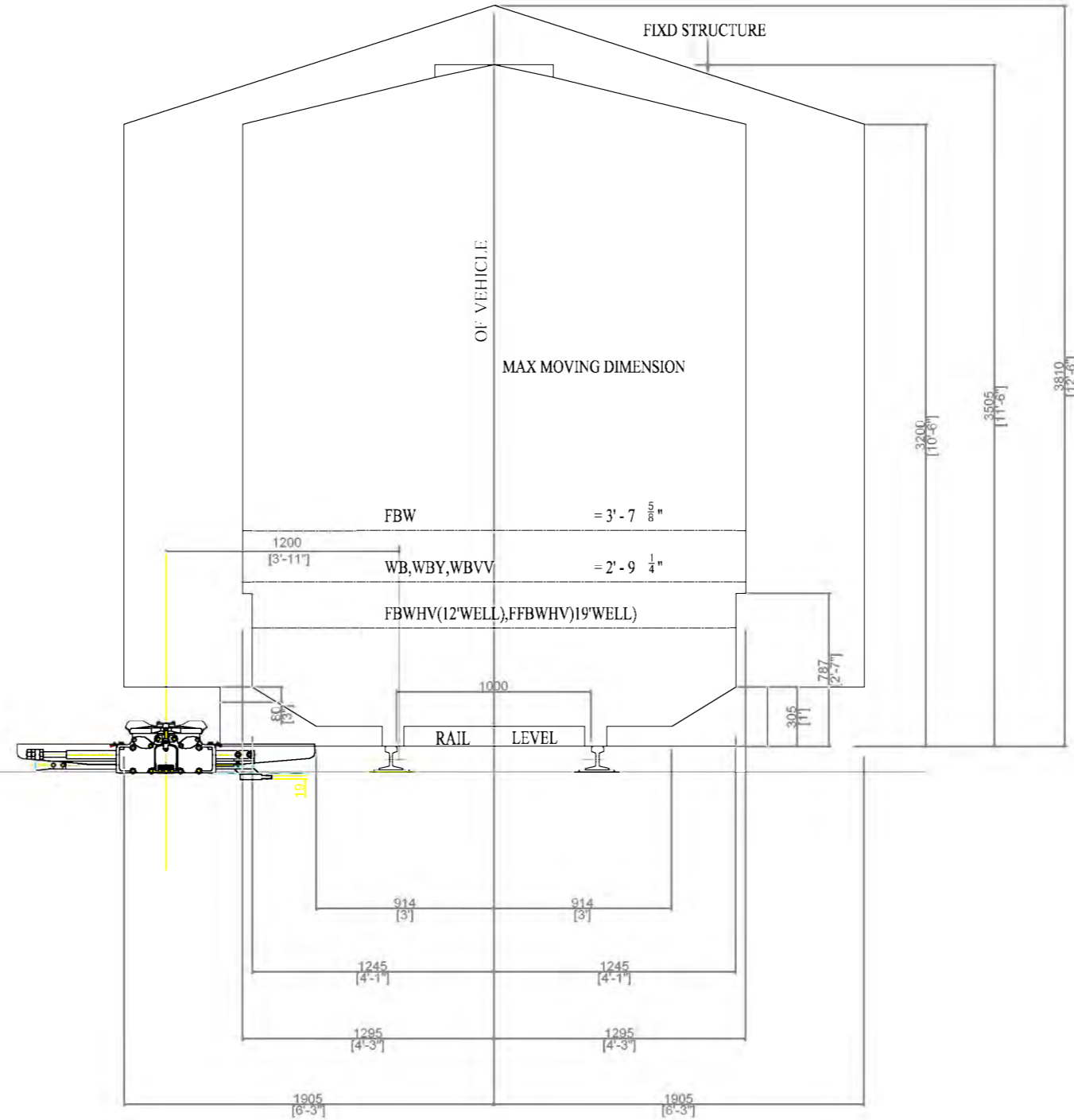
1:30

TITLE:

Electric point machine installation drawing
12# turnout

DRAWING NUMBER

BD1-11-02



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

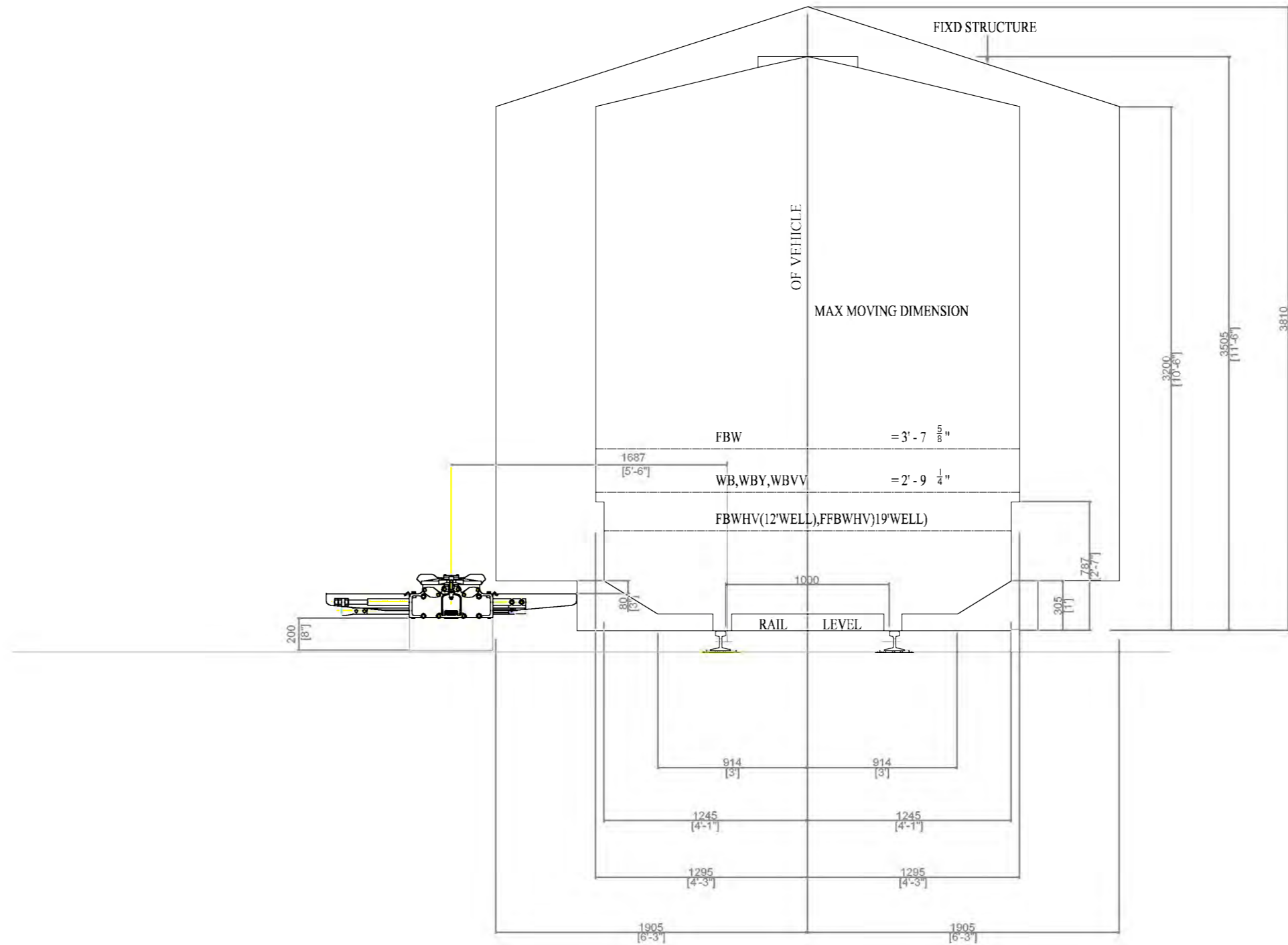
1:30

TITLE:

Electric point machine installation drawing
Elevation - 0mm raised

DRAWING NUMBER

BD1-11-03



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

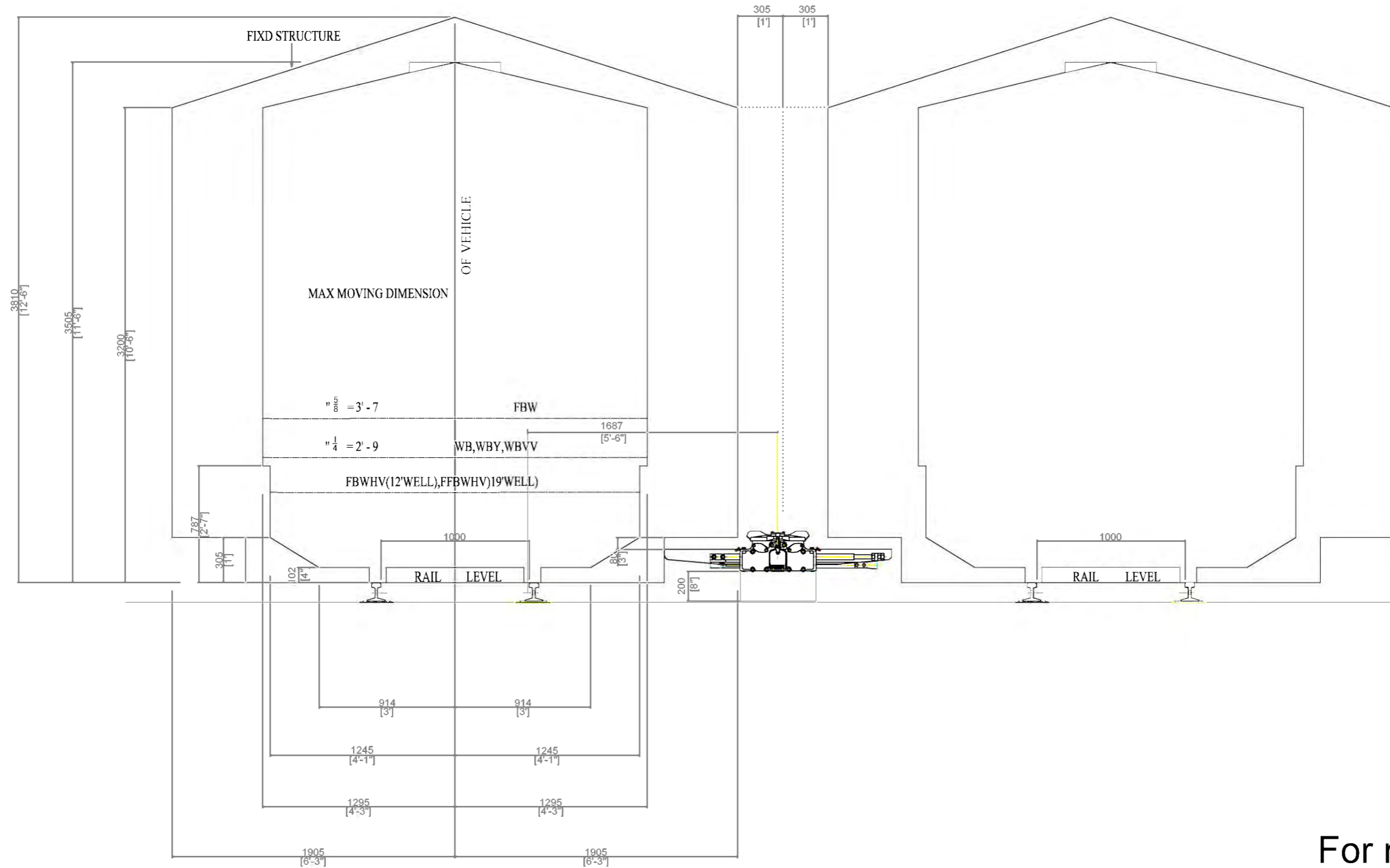
1:30

TITLE:

Electric point machine installation drawing
Elevation - 200mm raised

DRAWING NUMBER

BD1-11-04



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

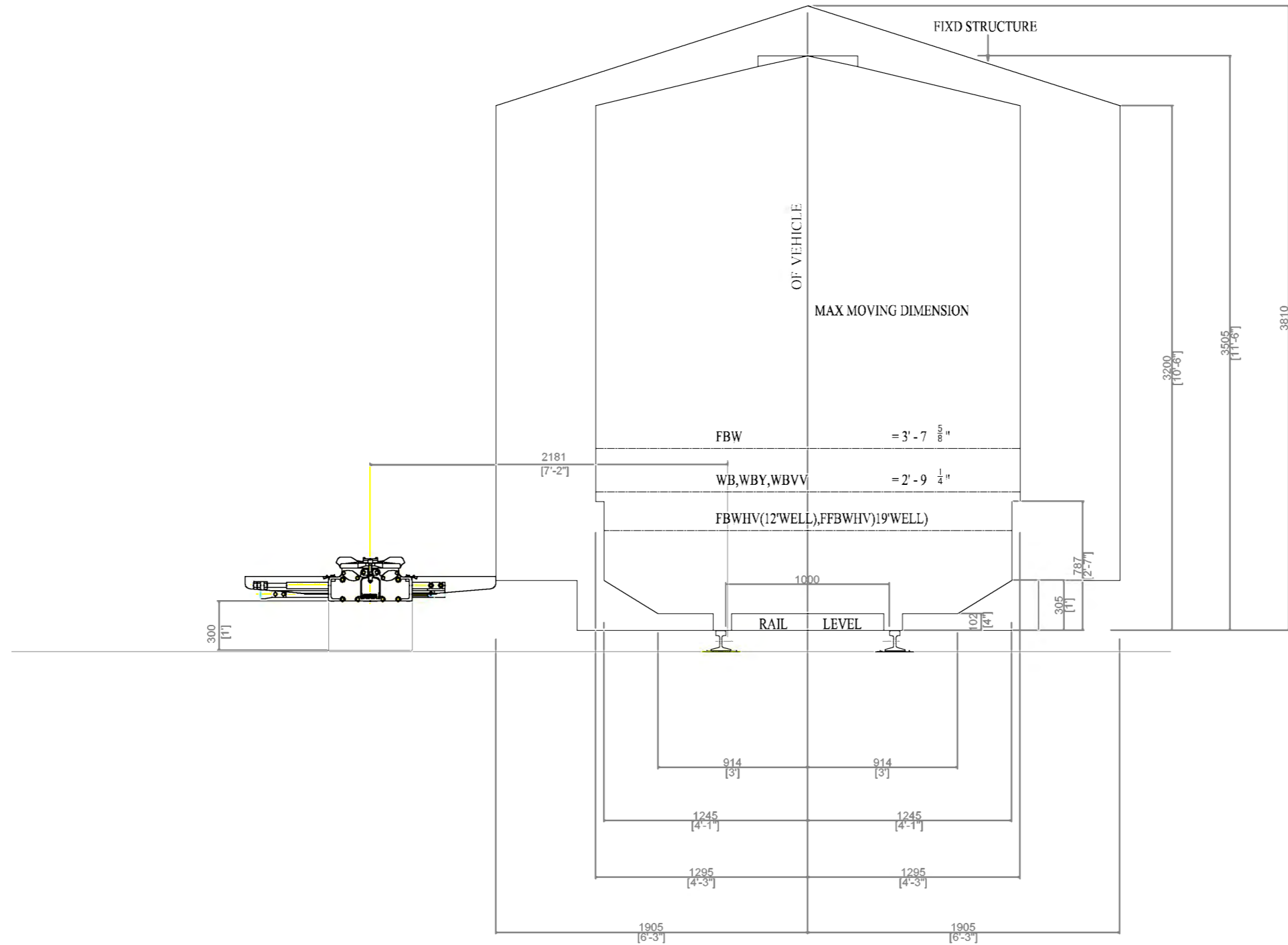
1:30

TITLE:

Electric point machine installation drawing
Elevation - Double track part of Yangon

DRAWING NUMBER

BD1-11-05



For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central,Pazundaung

SCALE:

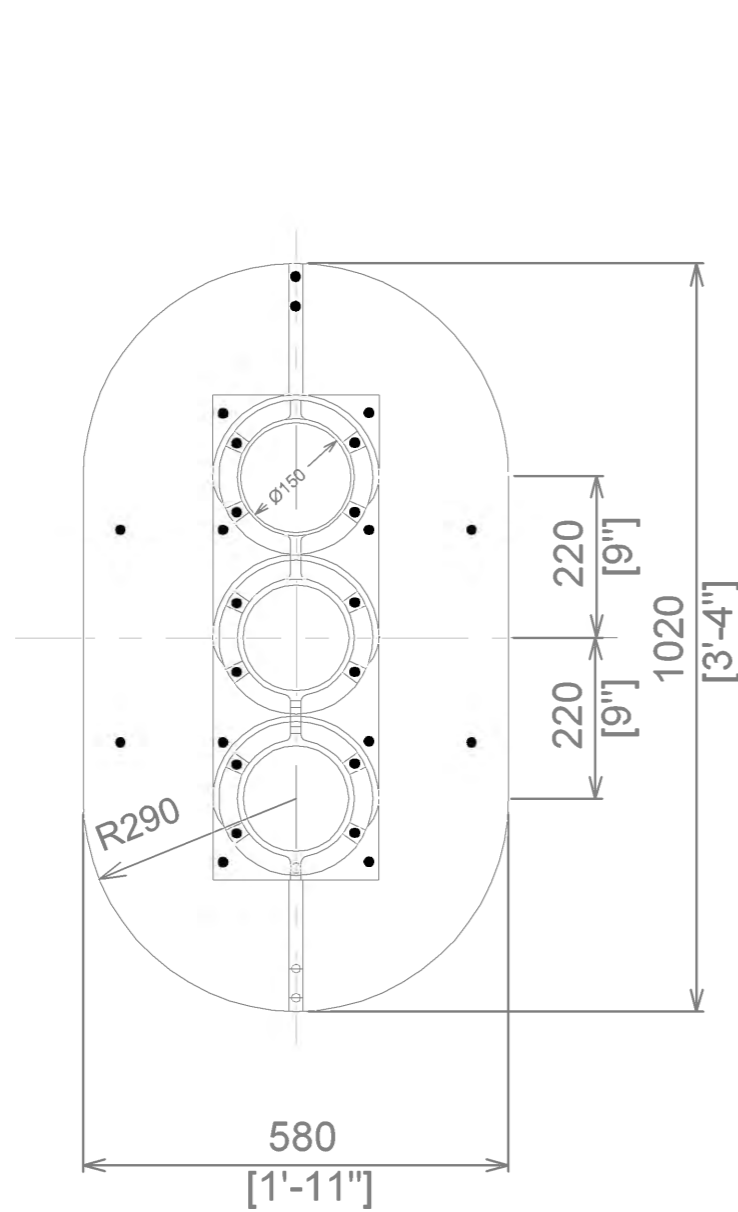
1:30

TITLE:

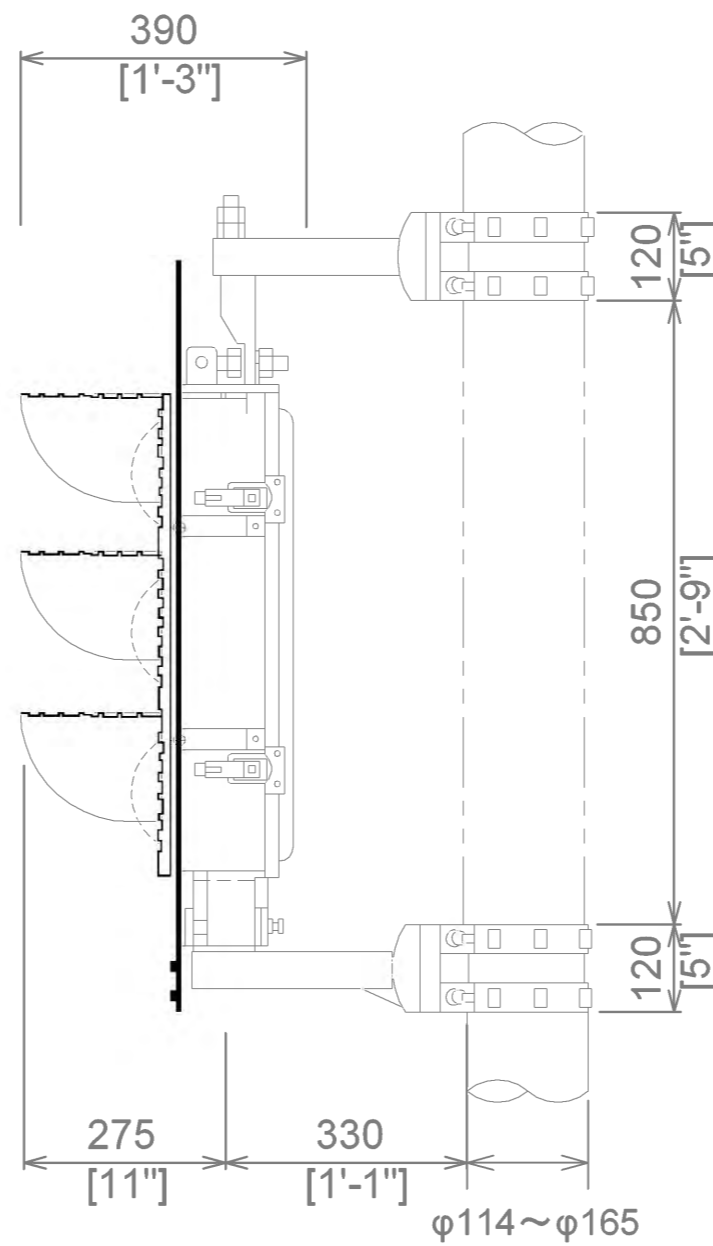
Electric point machine installation drawing
Elevation - 300mm raised

DRAWING NUMBER

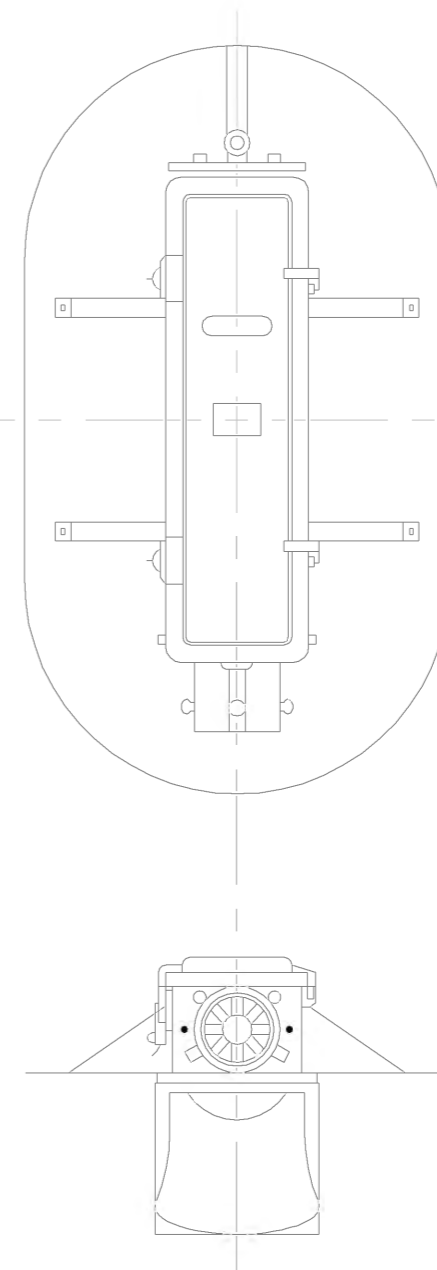
BD1-11-06



Front view



Side view



Rear view

Bottom view

For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:10

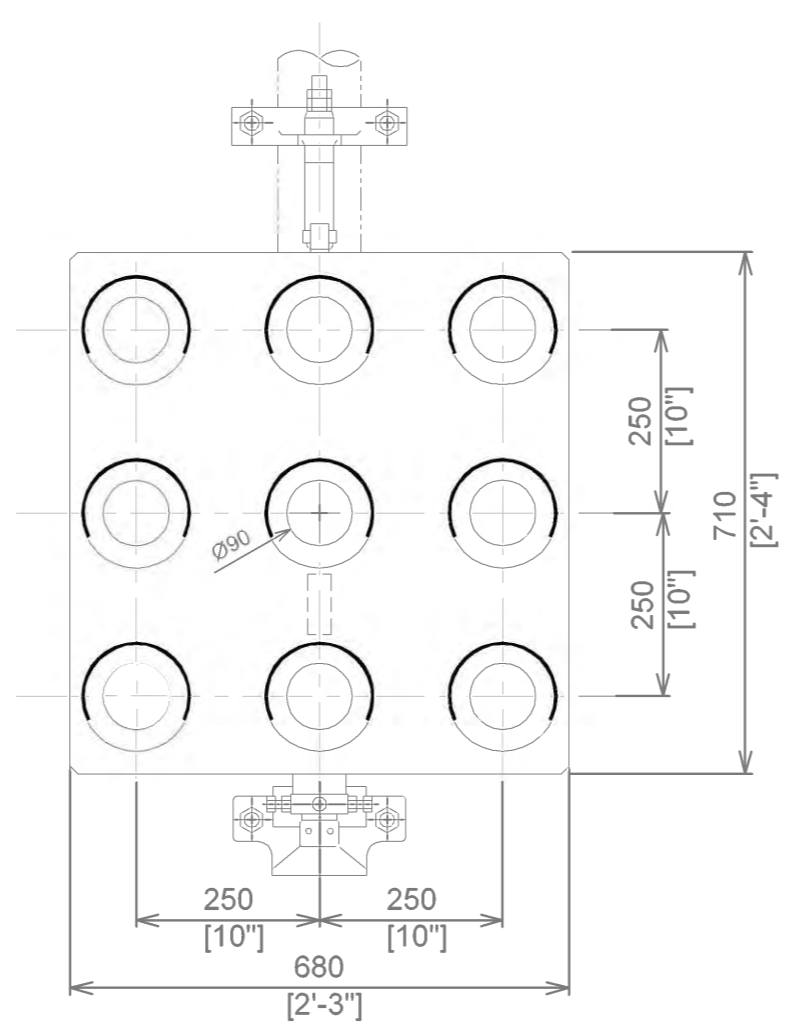
TITLE:

Outline drawing
Colour light signal (Type3-1, 2-1, 1-1, LED30V)

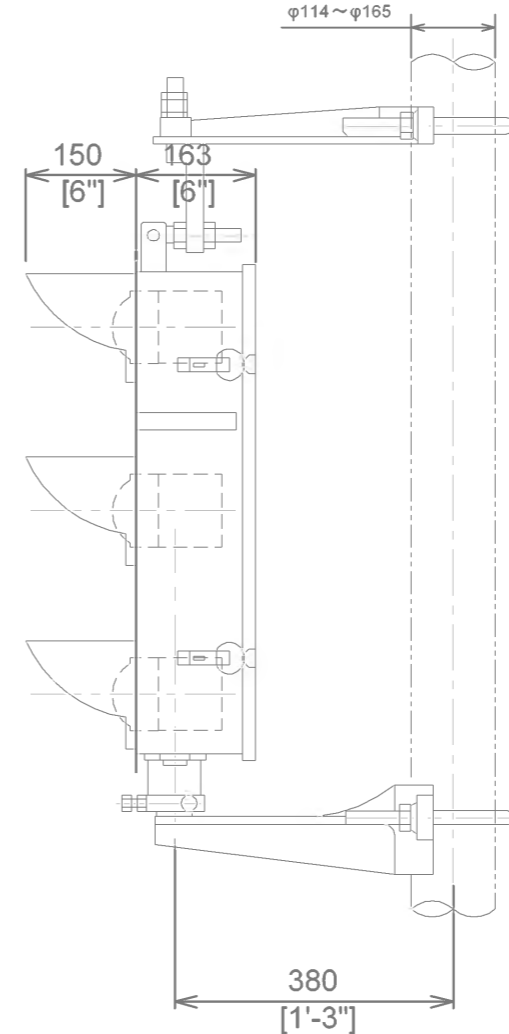
DRAWING NUMBER

BD1-11-07

For reference



Front view



Side view

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



CONSULTANTS:
Consortium of JIC and OC



DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:10

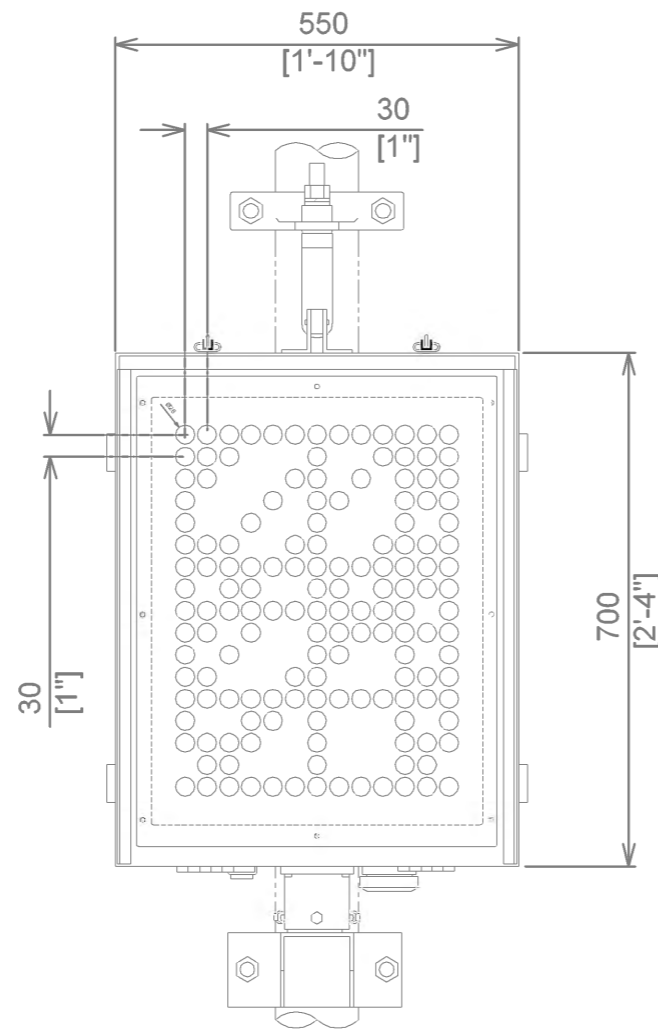
TITLE:

Outline drawing
Route indicator 3 routes type

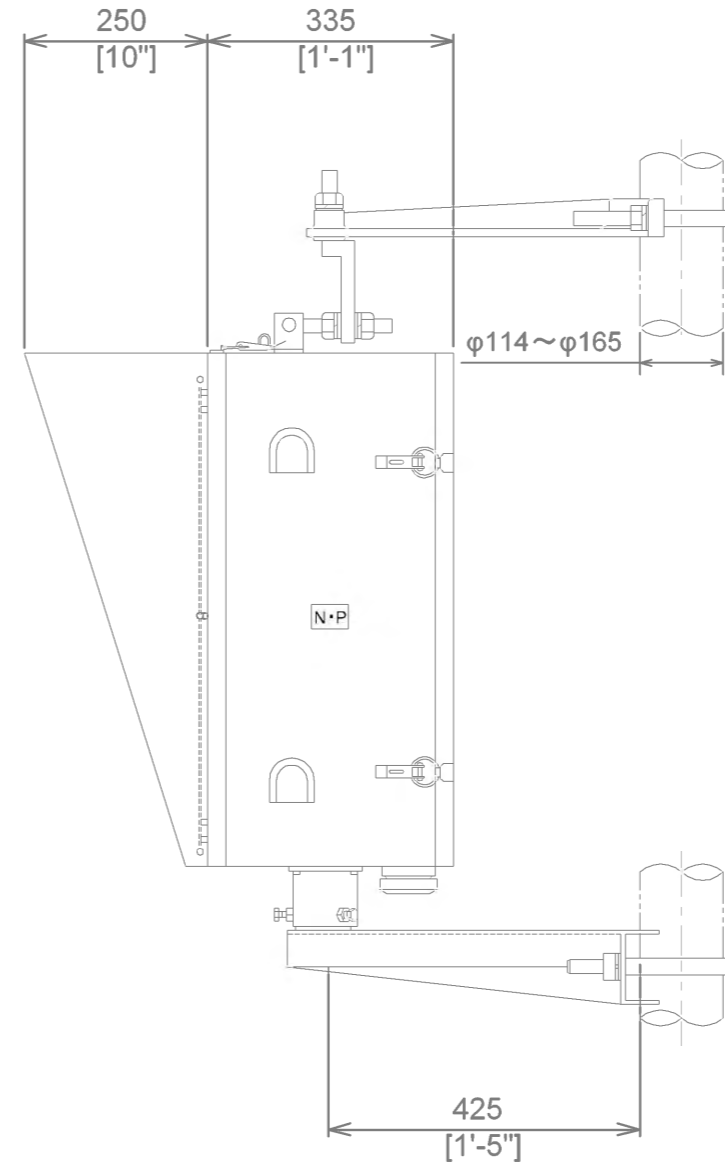
DRAWING NUMBER

BD1-11-08

For reference



Front view



Side view

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:10

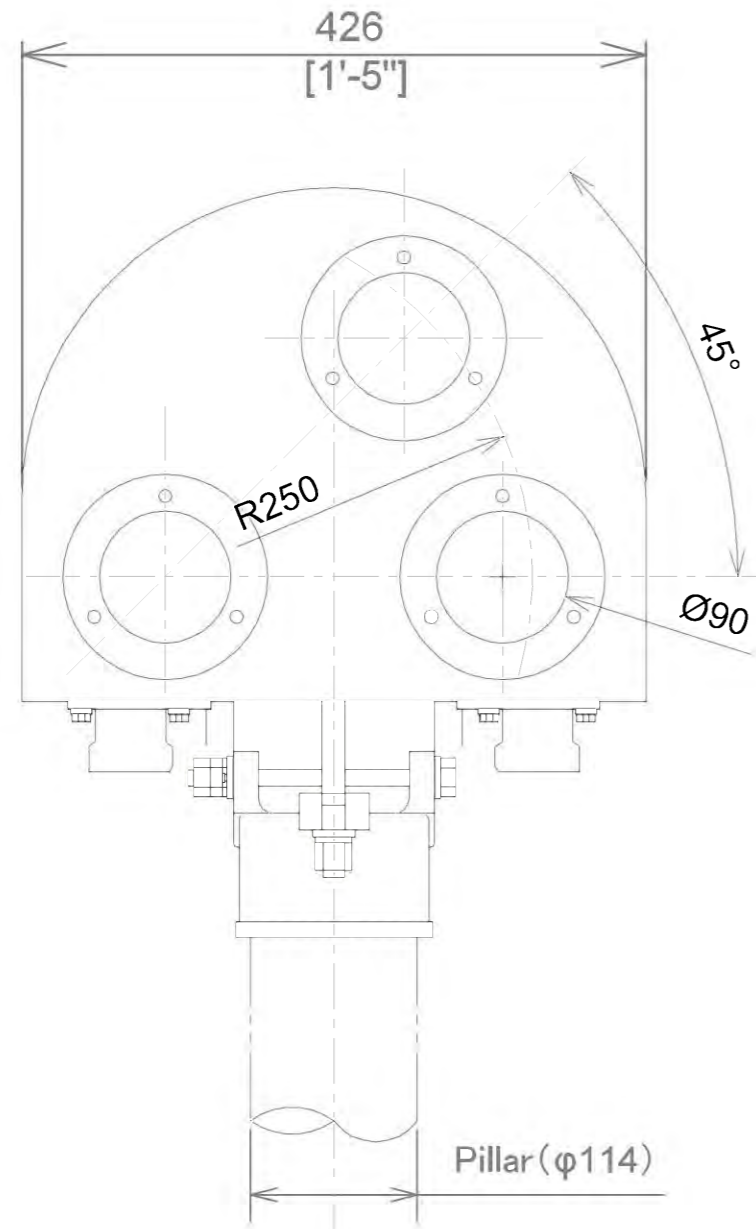
TITLE:

Outline drawing

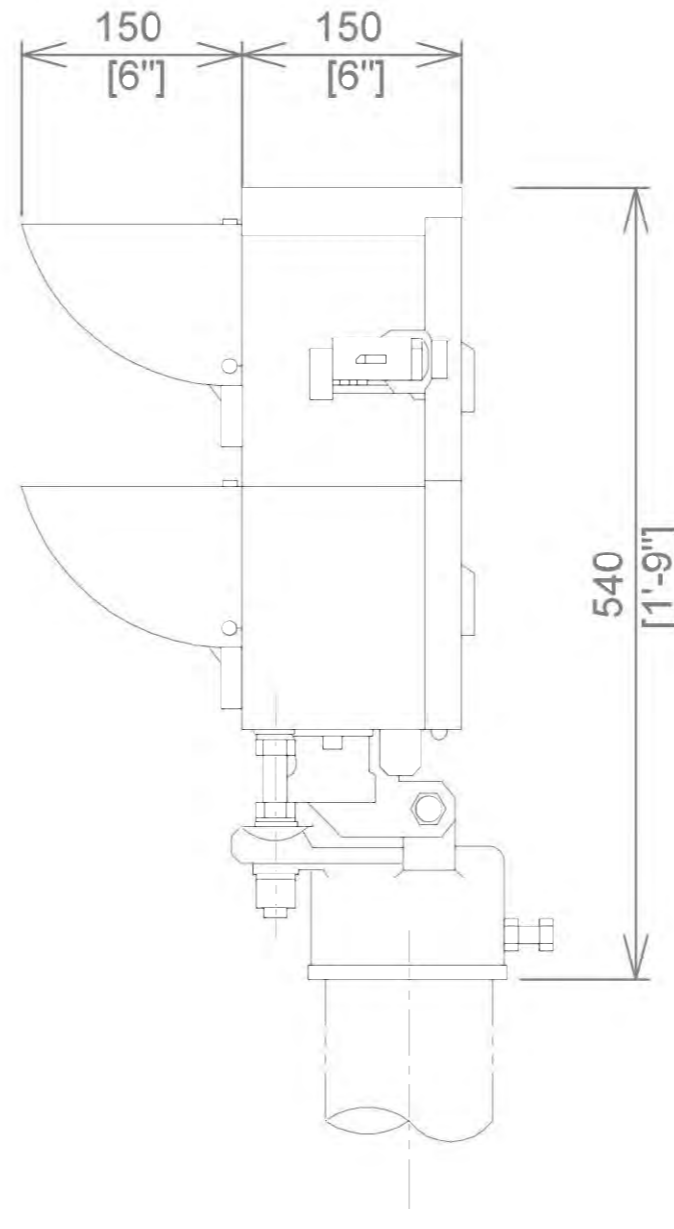
Route indicator number type

DRAWING NUMBER

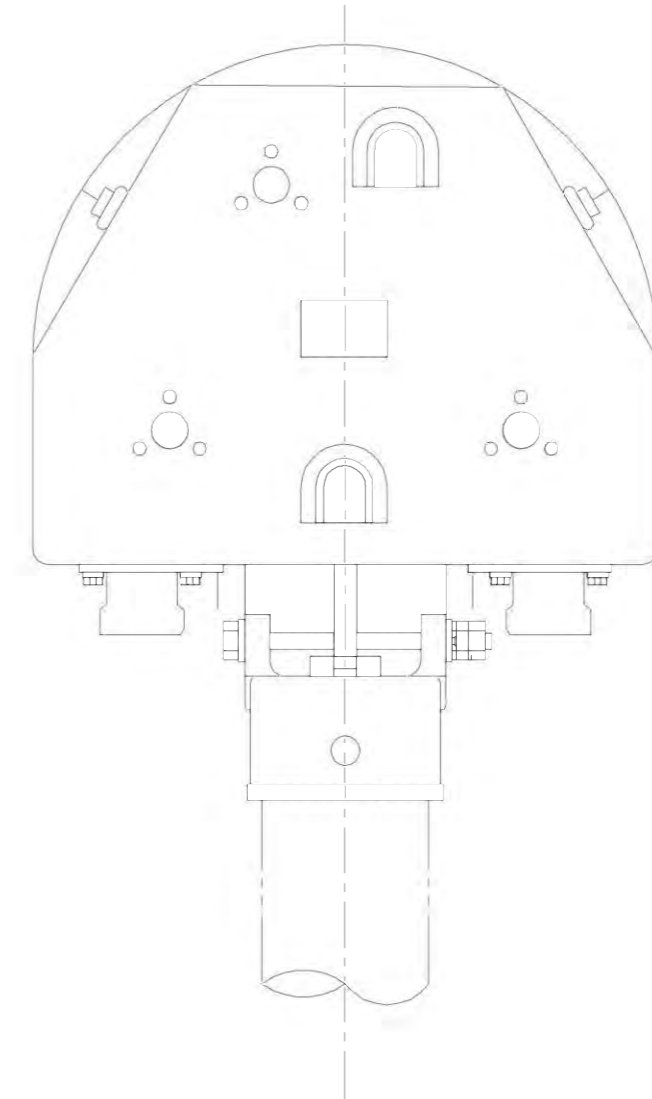
BD1-11-09



Front View



Side View



Rear View

For reference

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:5

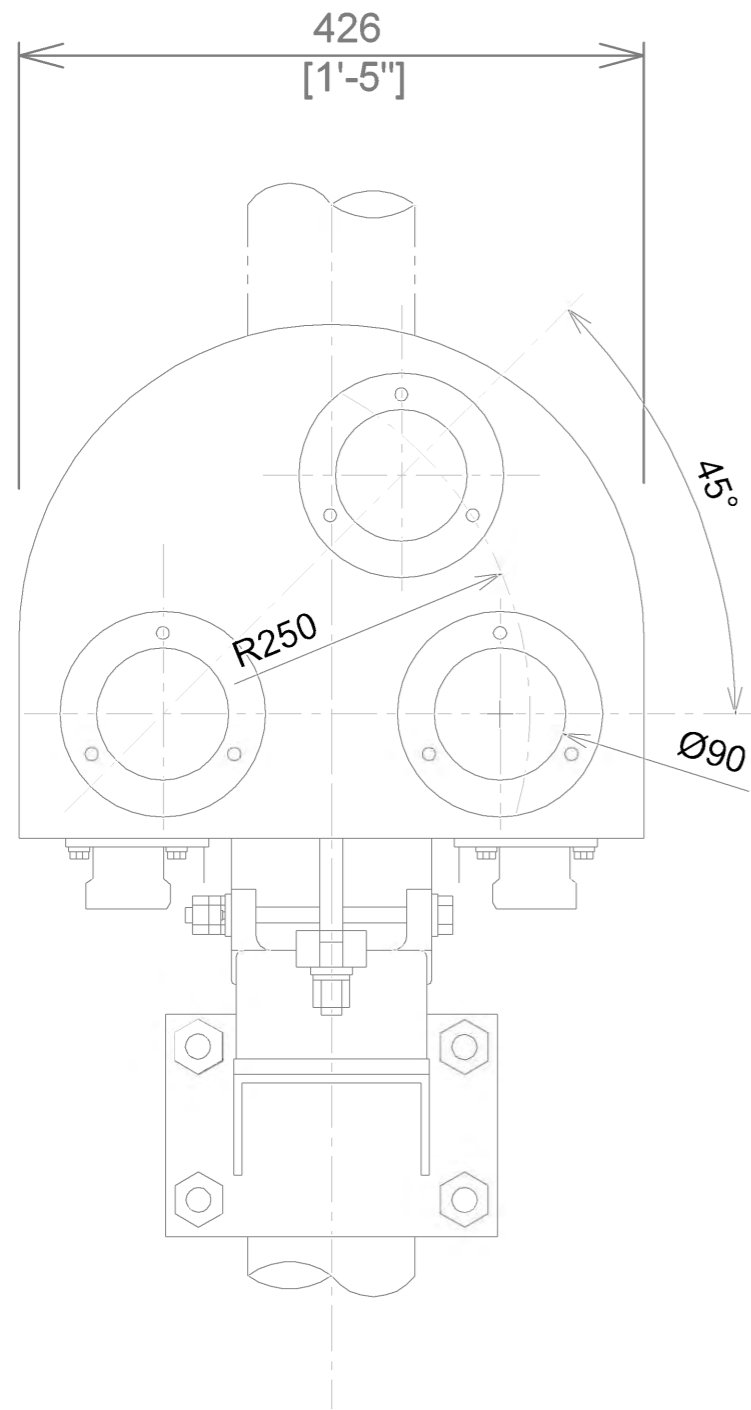
TITLE:

Outline Drawing
Electric shunting signal LED type (1)

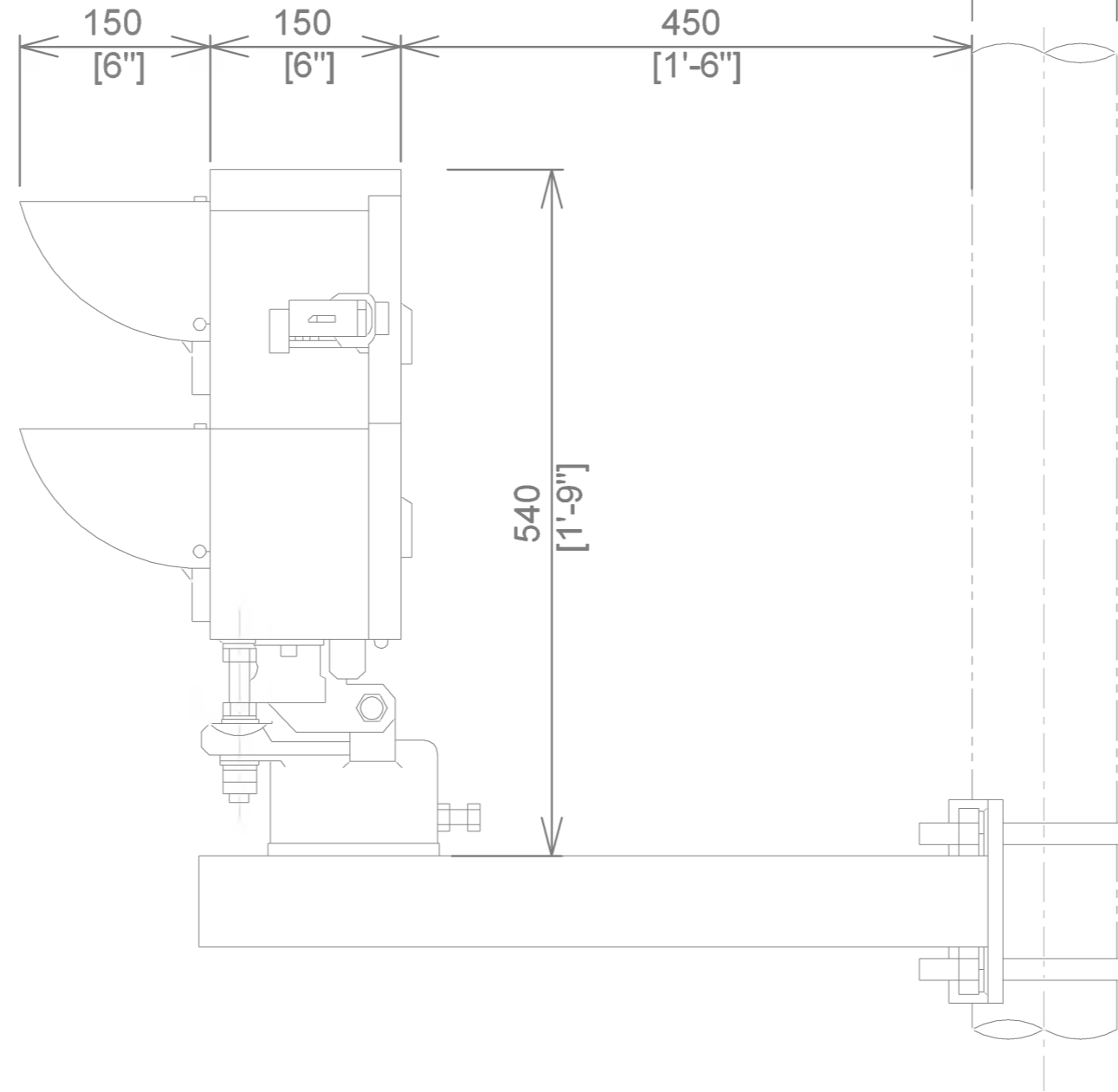
DRAWING NUMBER

BD1-11-10

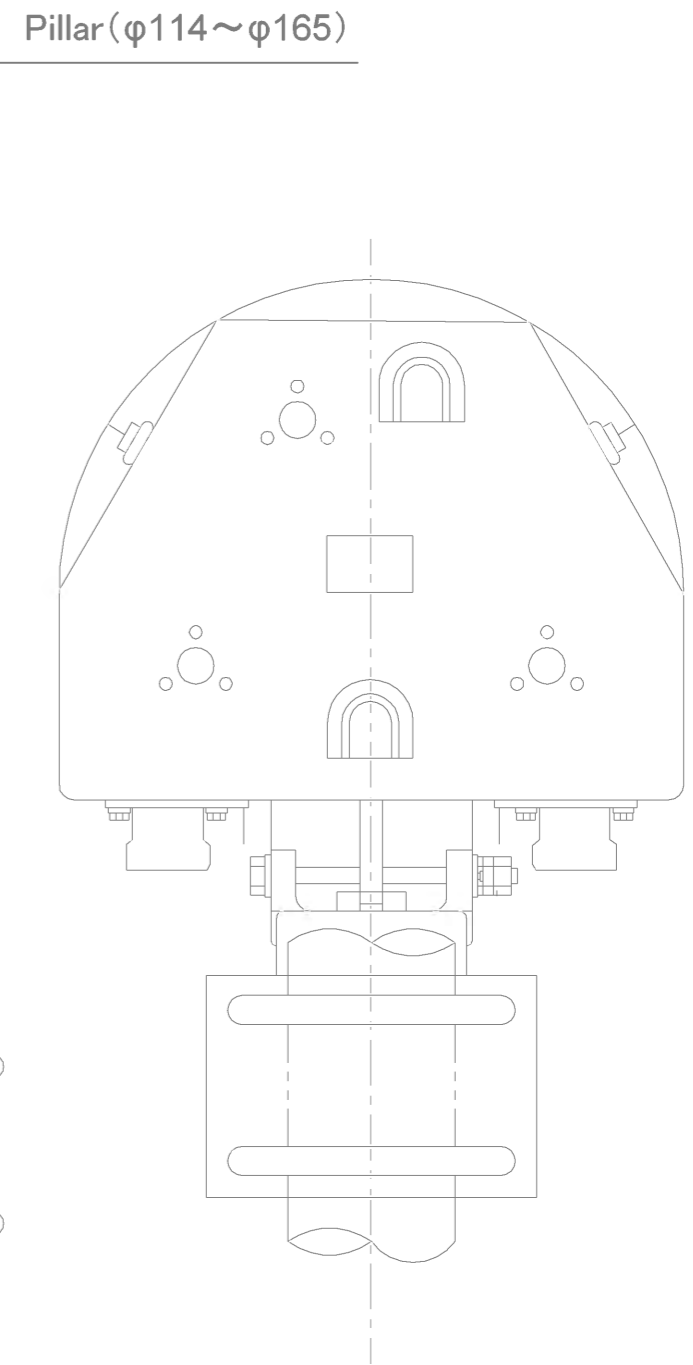
For reference



Front View



Side View



Rear View

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants
for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR
USED WITHOUT THE WRITTEN PERMISSION
FROM JAPAN INTERNATIONAL COOPERATION
AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:5

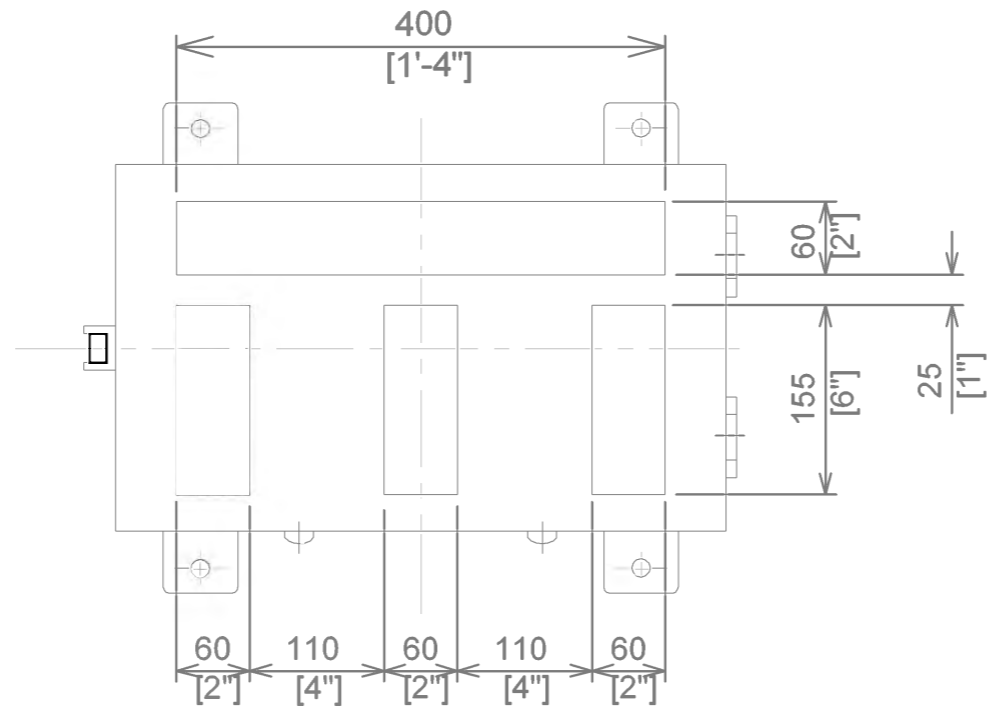
TITLE:

Outline Drawing
Electric shunting signal LED type (2)

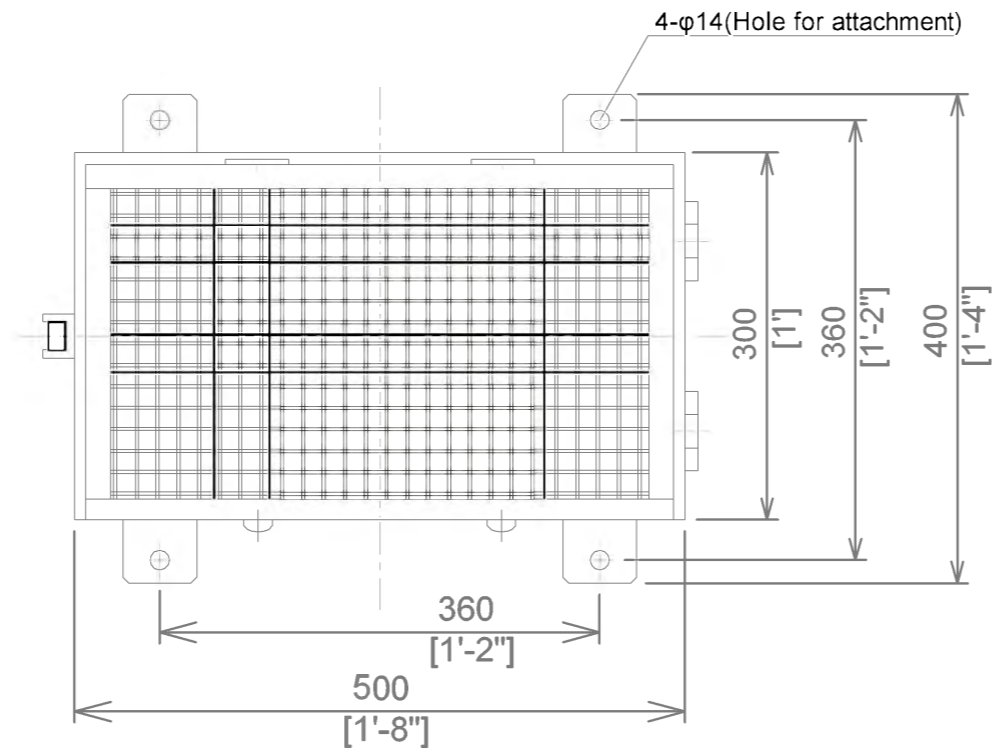
DRAWING
NUMBER

BD1-11-11

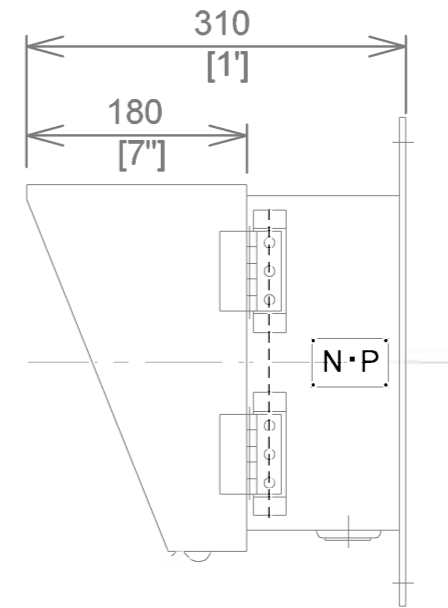
For reference



Front View without Protect cover



Front View with Protect cover



Side View

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:6

TITLE:

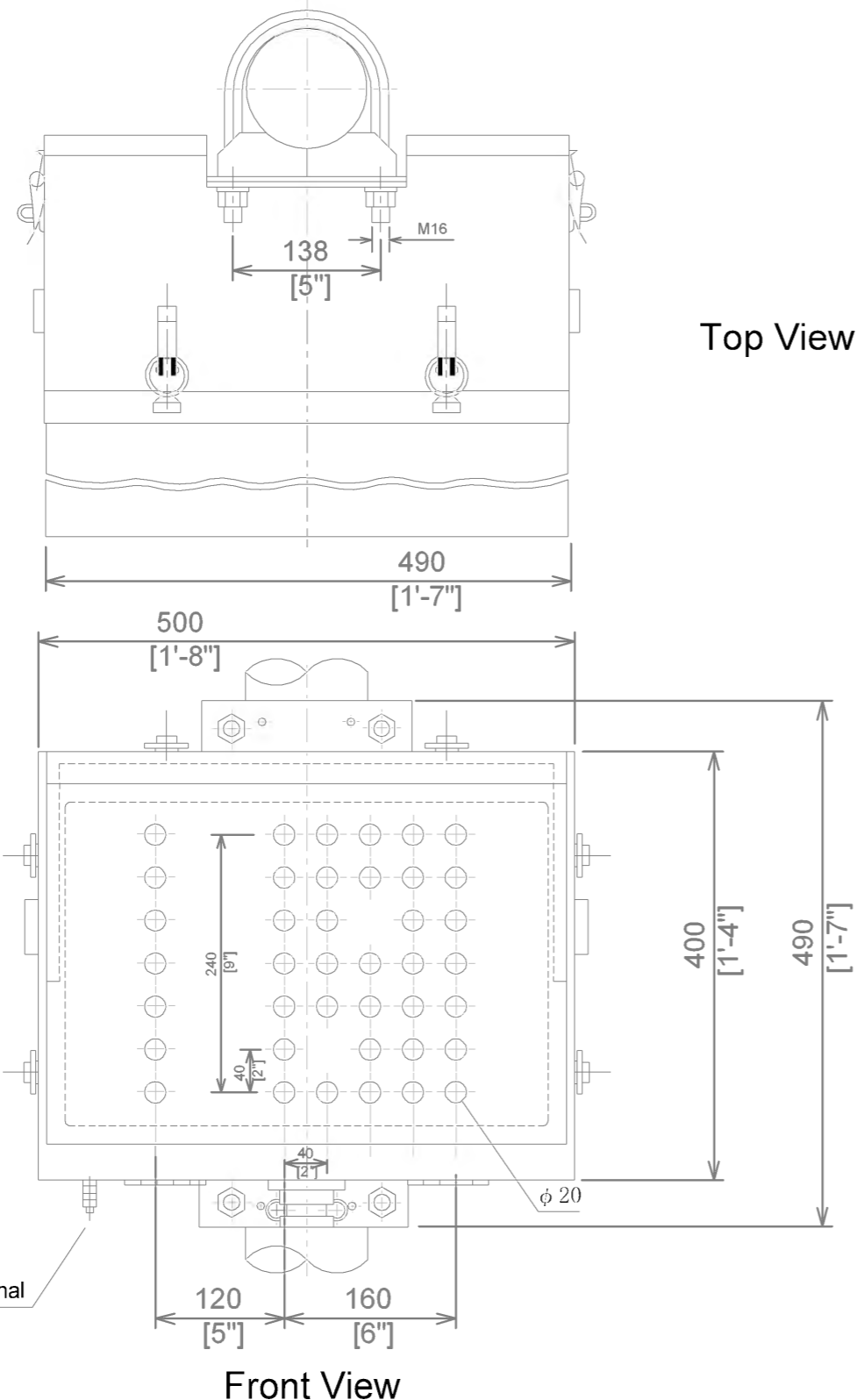
Outline drawing

Route indicator 3 routes type for shunting

DRAWING NUMBER

BD1-11-12

For reference



NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:6

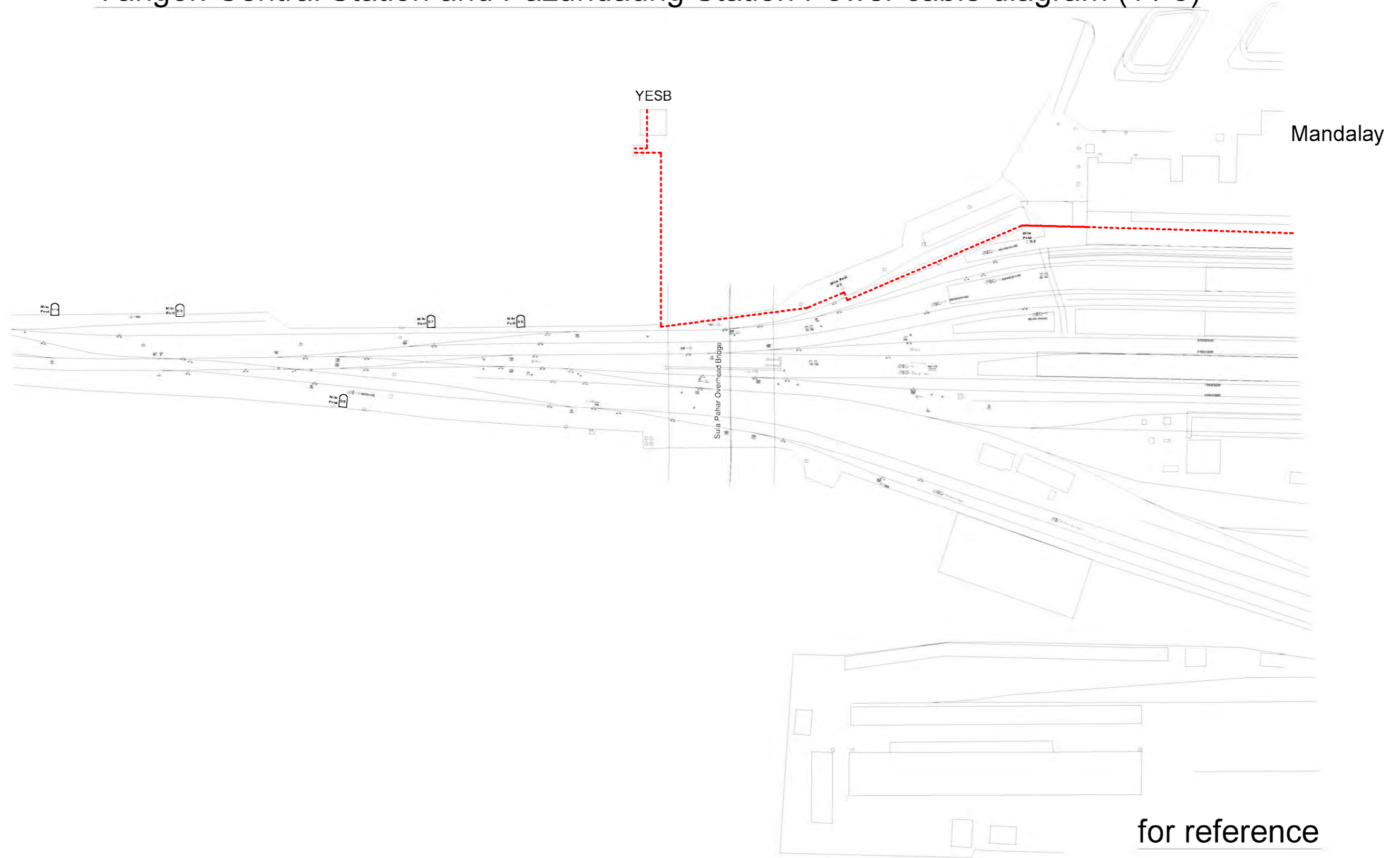
TITLE:

Outline drawing
Route indicator number type for shunting

DRAWING NUMBER

BD1-11-13

Yangon Central Station and Pazundaung Station Power cable diagram (1 / 3)



NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants
for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR
USED WITHOUT THE WRITTEN PERMISSION
FROM JAPAN INTERNATIONAL COOPERATION
AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

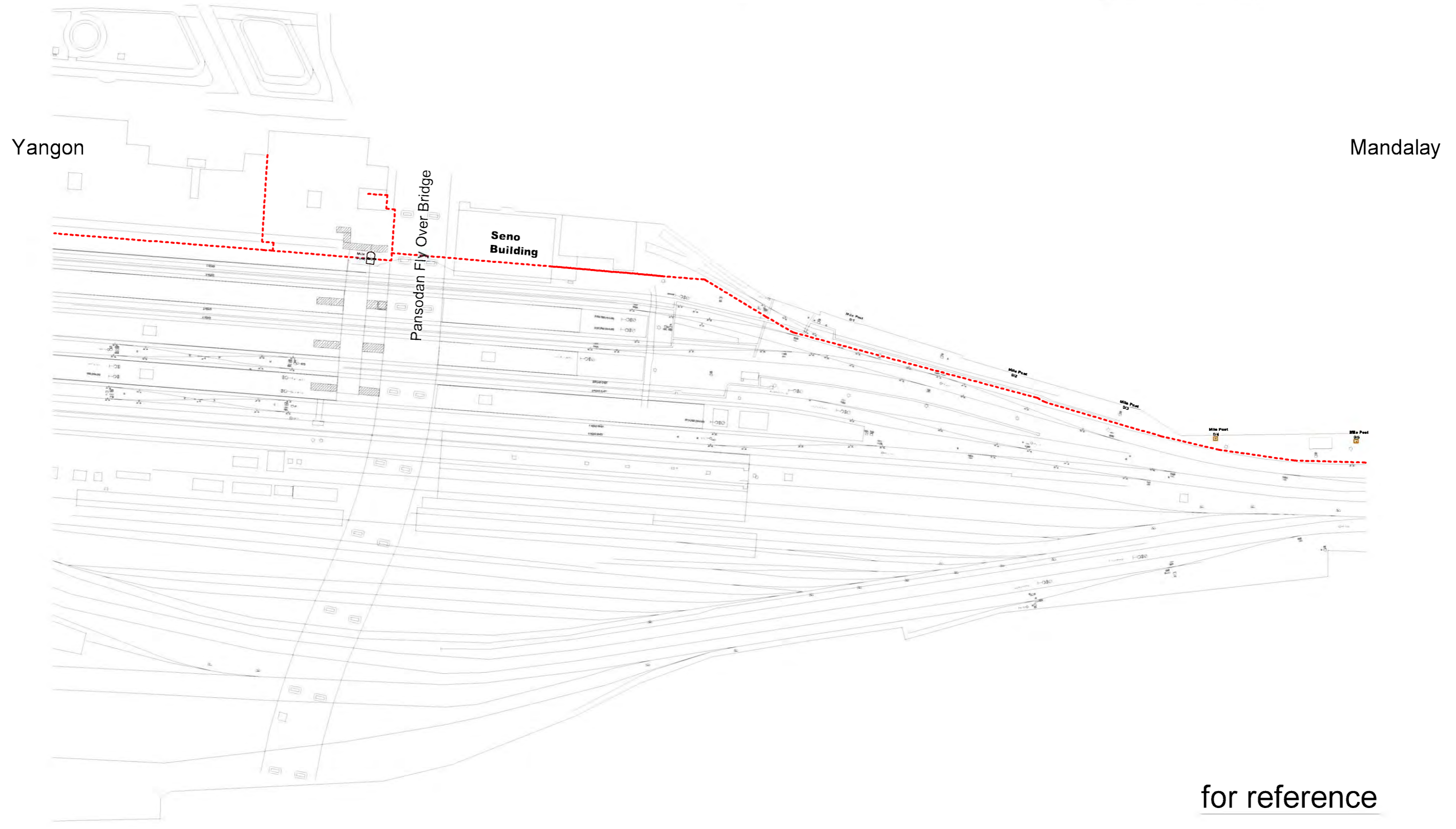
1:3000

TITLE: Yangon Central Station and Pazundaung Station
Power cable diagram (1 / 3)

DRAWING
NUMBER

BD1-12-01

Yangon Central Station and Pazundaung Station Power cable diagram (2 / 3)



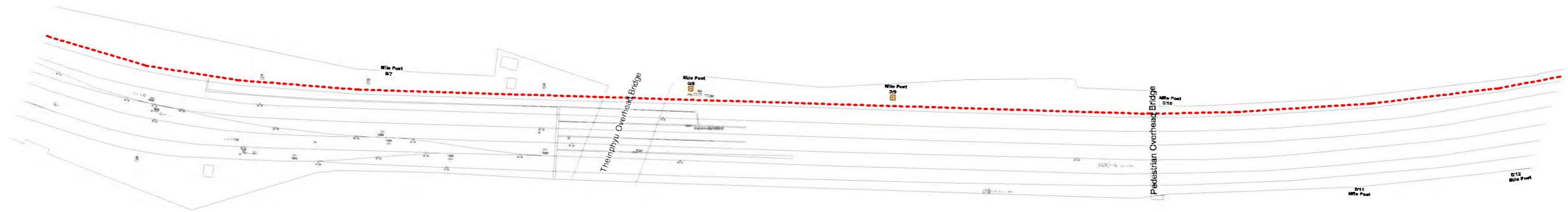
for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency		CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.		DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY		PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
LEGEND						SCALE: 1:3000		TITLE: Yangon Central Station and Pazundaung Station Power cable diagram (2 / 3)	
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP			DRAWING NUMBER BD1-12-02			

Yangon Central Station and Pazundaung Station Power cable diagram (3 / 3)

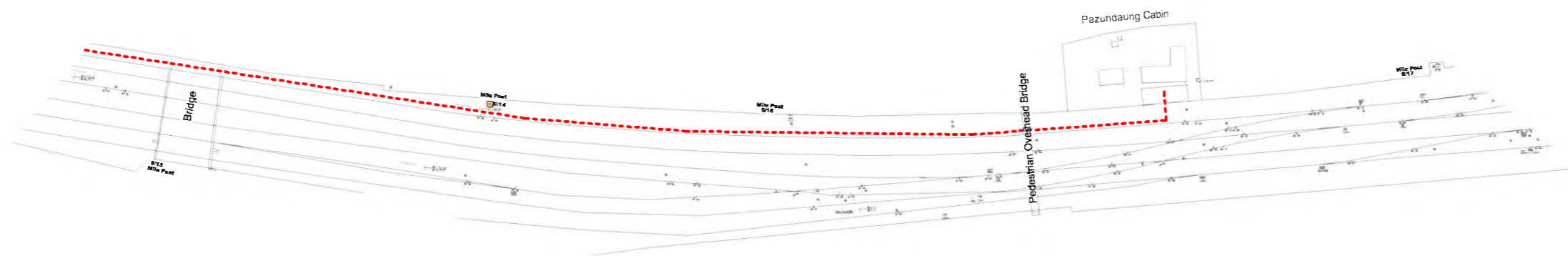
Yangon

Mandalay



Yangon

Mandalay



for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1:3000

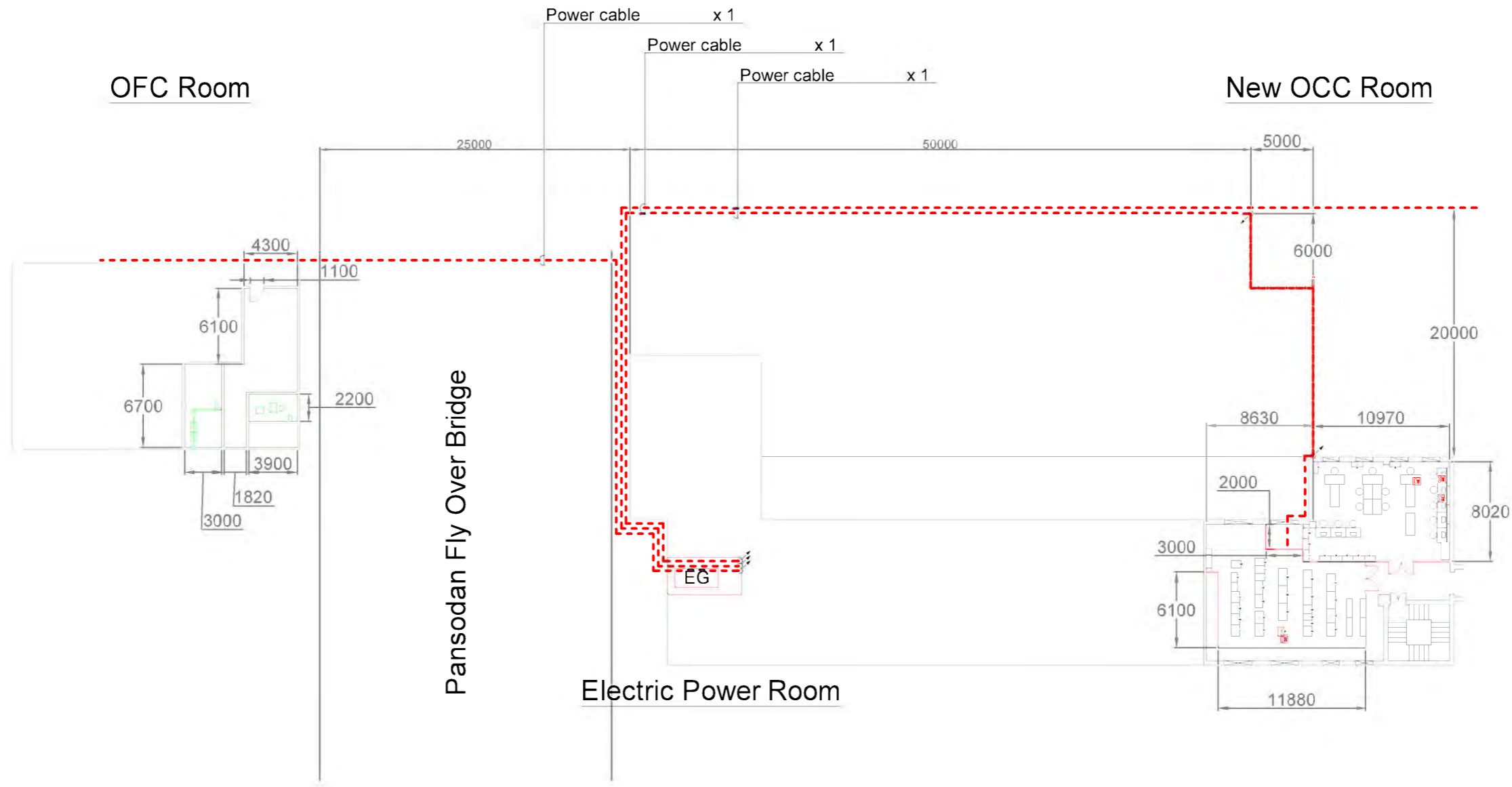
TITLE: Yangon Central Station and Pazundaung Station Power cable diagram (3 / 3)

DRAWING NUMBER

BD1-12-03

Yangon Layout drawing

Mandalay



for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1:400

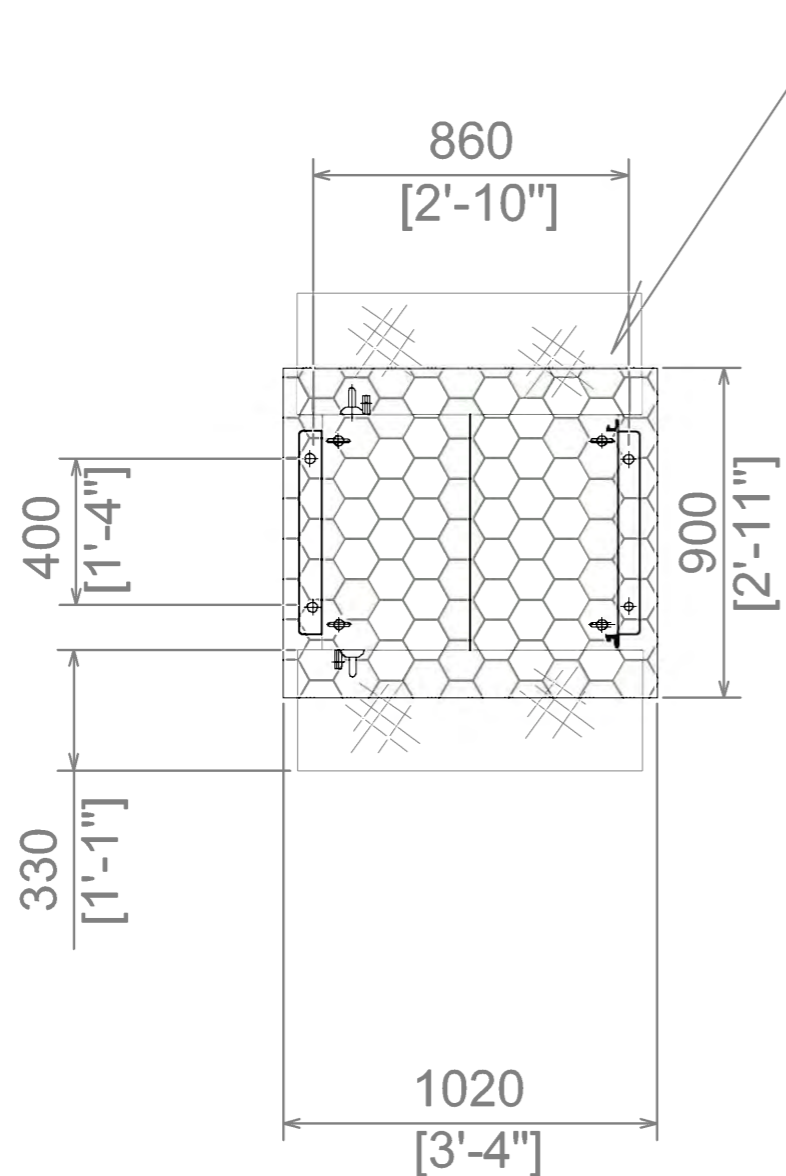
TITLE:

Yangon Layout drawing

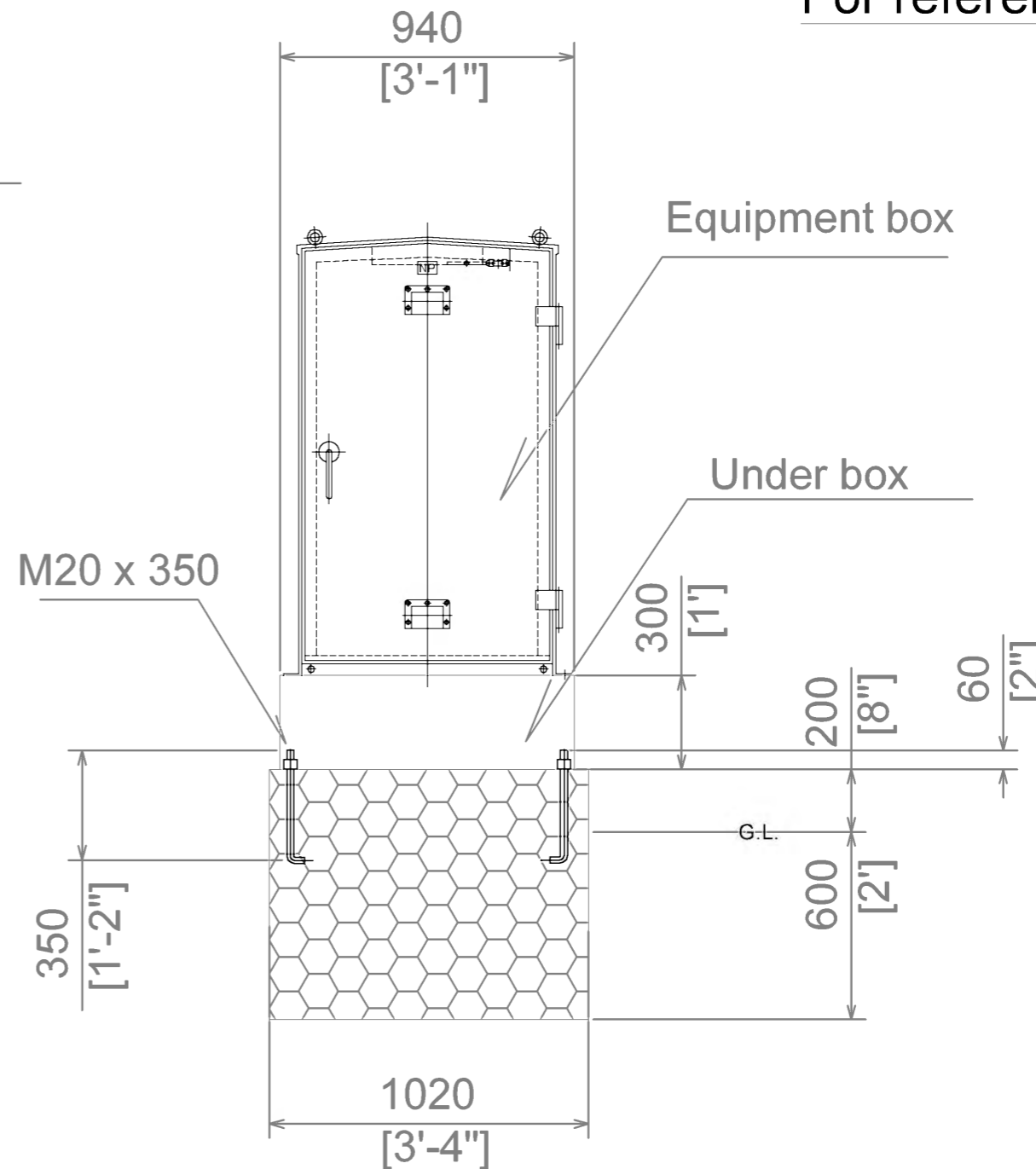
DRAWING NUMBER

BD1-13-01

For reference



Top view



Front view

NOTES:

- 1.
- 2.

LEGEND

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

1:20

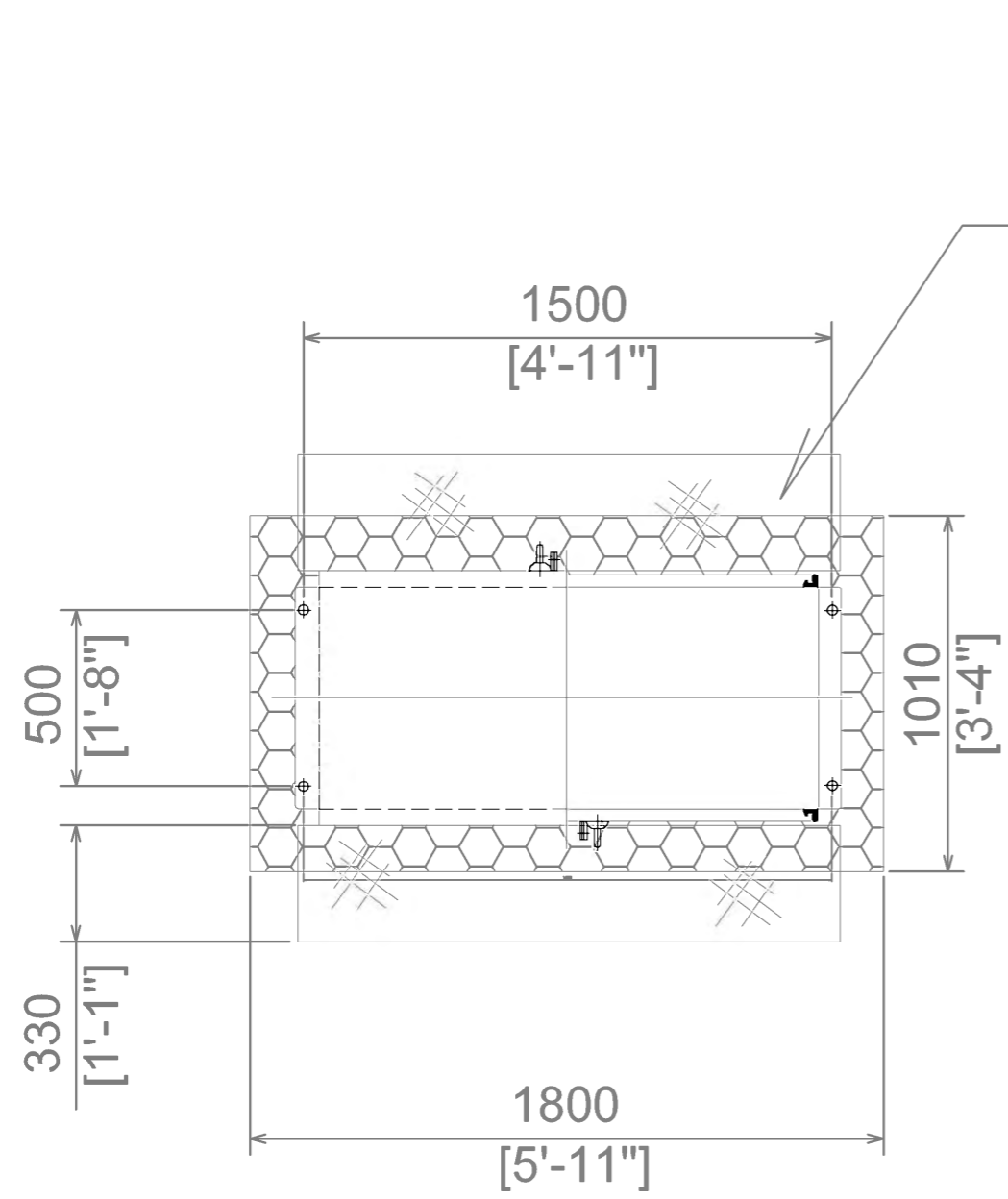
TITLE:

Foundation drawing

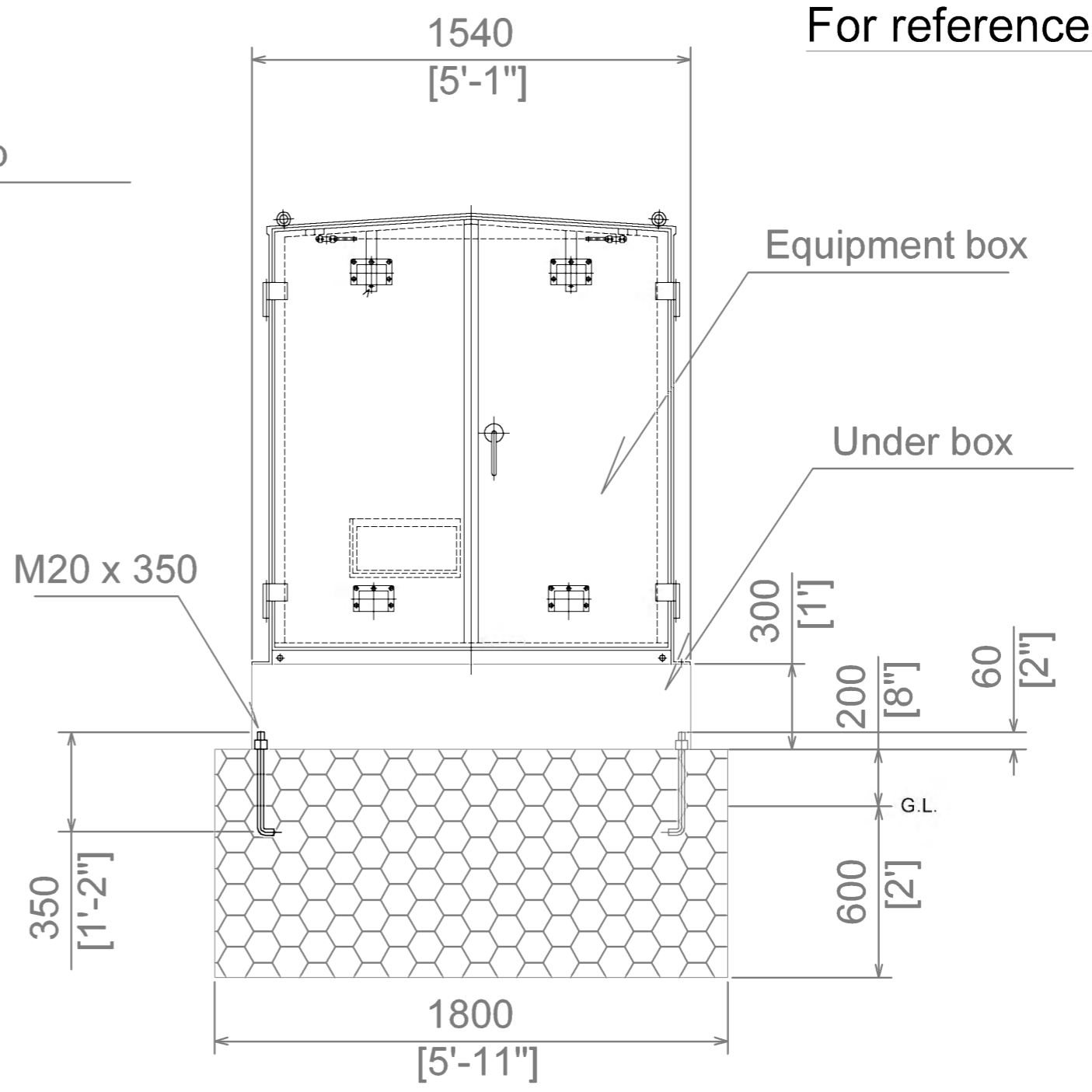
For Type 2 signal equipment box

DRAWING NUMBER

BD1-14-01



Top view

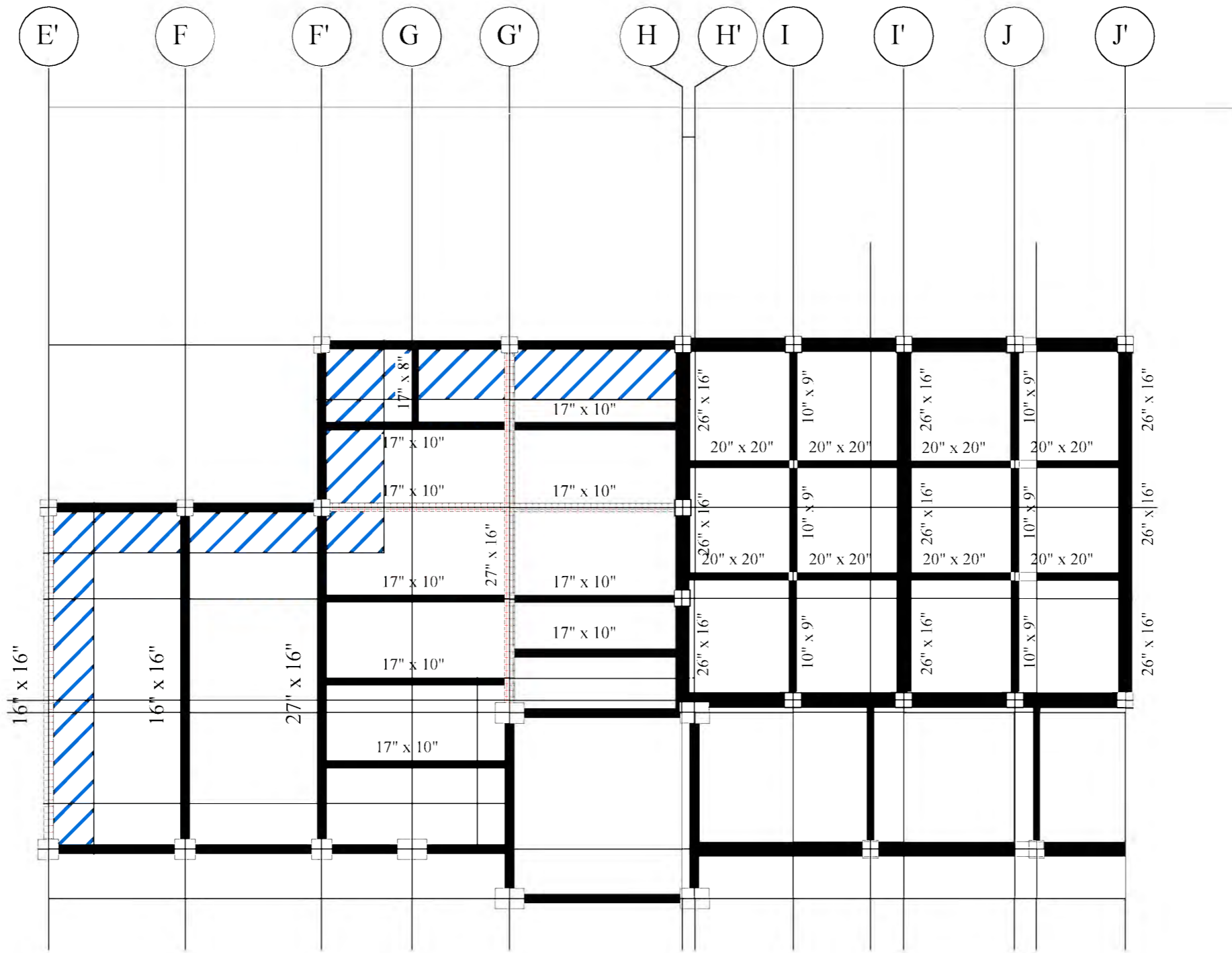


Front view

For reference

129

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung</p>	
<p>LEGEND</p>					<p>SCALE:</p> <p>1:20</p>	<p>TITLE:</p> <p>Foundation drawing For type 3A signal equipment box</p>
					<p>DRAWING NUMBER</p> <p>BD1-14-02</p>	



for reference

NOTES:

- 1.
- 2.

LEGEND

- Beam need to be strenghteing
- Slab Area need to be strenghteing



CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

i) Centralized Electronic Interlocking System including Yangon Central, Pazundaung

SCALE:

Non scale

TITLE:

Member need to be strengthening at Yangon central station

DRAWING NUMBER

BD1-15-01

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

for reference

Drawings List

Drawing Number	TITLE	Scale	Drawing Number	TITLE	Scale
BD2-00-01	Drawings List	Non scale	BD2-05-08	Outline Drawing Gate signal	1:3
BD2-01-01	Construction Site Map Kyan Sit Thar Level Crossing	Non scale	BD2-05-09	Outline Drawing Obstruction warning signal (Rotary signal type)	1:10
BD2-02-01	General Arrangement Drawing (1) Kyan Sit Thar Level Crossing	Non scale	BD2-05-10	Outline Drawing Fence	1:20
BD2-02-02	General Arrangement Drawing (2) Kyan Sit Thar Level Crossing	Non scale	BD2-06-01	Foundation Drawing For Instrument box(N-3A type)	1:20
BD2-03-01	The Level Crossing Control Diagram Kyan Sit Thar Level Crossing	Non scale	BD2-06-02	Foundation Drawing For Instrument box(N-2 type)	1:20
BD2-03-02	The Level Crossing Control Chart Kyan Sit Thar Level Crossing	Non scale	BD2-06-03	Foundation Drawing 3A Type	1:20
BD2-04-01	Facility System Drawing Kyan Sit Thar Level Crossing	Non scale	BD2-06-04	Foundation Drawing Engine Generator	1:20
BD2-04-02	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 8/9-10	1:300	BD2-06-05	Foundation Drawing Earth Retaining Plan(1)	1:100
BD2-04-03	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 8/12-13	1:300	BD2-06-06	Foundation Drawing Earth Retaining Plan(2)	1:100
BD2-04-04	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 8/21-22	1:300	BD2-06-07	Foundation Drawing Earth Retaining Plan(3)	1:100
BD2-04-05	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 9/1 (1)	1:300			
BD2-04-06	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 9/1 (2)	1:300			
BD2-04-07	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 9/1 (3)	1:300			
BD2-04-08	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 9/2-3	1:300			
BD2-04-09	Partial arrangement Drawing Toegyaungkalay- Ywathagyi 9/17	1:300			
BD2-04-10	Partial arrangement Drawing University Line 9/13-14	1:300			
BD2-05-01	Outline Drawing Instrument box(N-3A type)	1:20			
BD2-05-02	Outline Drawing Instrument box (N-2 type)	1:20			
BD2-05-03	Outline Drawing Road warning device (A type)	1:20			
BD2-05-04	Outline Drawing Crossing Warning Sign	1:30			
BD2-05-05	Outline Drawing Warning Light (LED Type)	1:5			
BD2-05-06	Outline Drawing Train Direction Indicator	1:5			
BD2-05-07	Outline Drawing Barrier machine	1:20			

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

Non scale

TITLE:

Drawings List

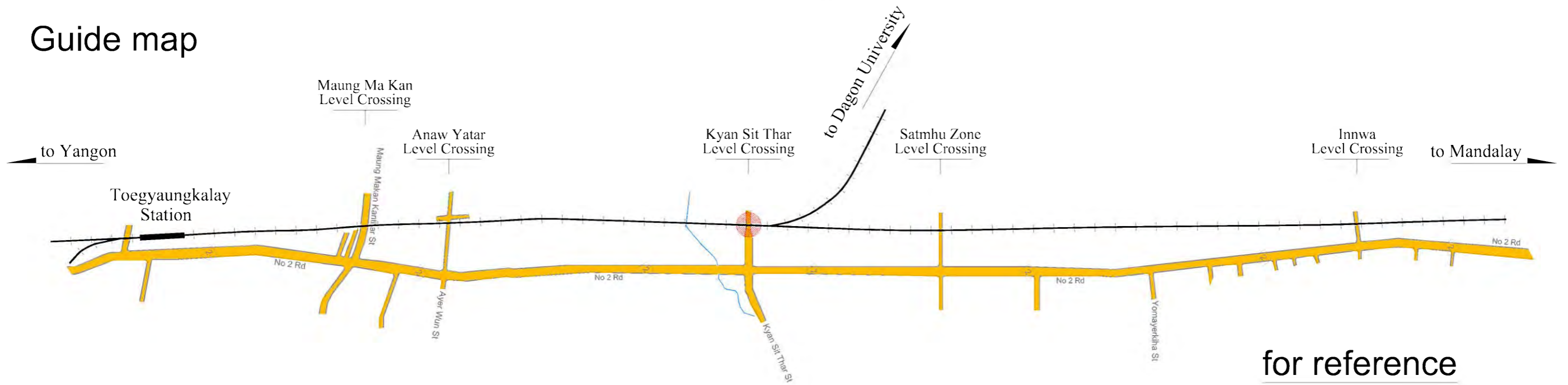
DRAWING NUMBER

BD2-00-01

Outline document

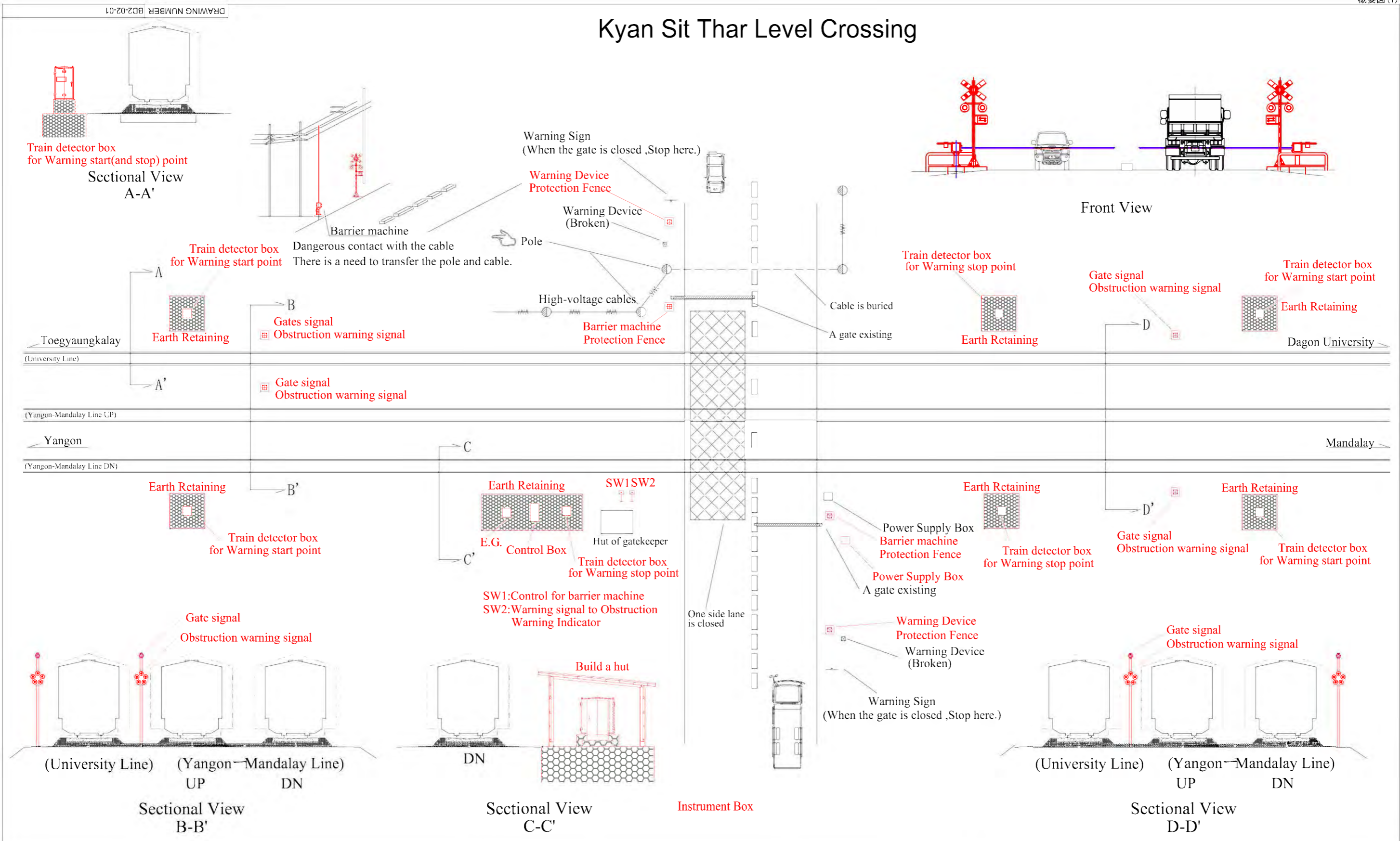
Object a. The level crossing warning device shall be installed in order to warn the passing traffic such as cars. b. The electric barrier machine shall be also introduced in order to reduce the gatekeeper's burden and shorten the gate closing time. c. At the same time, the level crossing control device, including train detector, and the Gate Signal, i.e. gate close indicator, are installed in order to control the alarm warning device and inform the train driver of the gate closing.	Outline of the work a. Install a control device for level crossing. b. Install a warning device c. Install a barrier machine d. Install a gate signal e. Install a obstruction warning signal f. Install a engine generator
Construction Site Kyan Sit Thar Level Crossing Lat.(N) 16° 53' 05".834 Long.(W) 96° 13' 56".146 From starting point 8/8 - 9/17	

Guide map



NOTES: 1. 2.	CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Comsultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND Ceiling concealment line ——— Startup Floor concealment line - - - - - Fall Exposure Wiring - - - - - Through Undergrounding wiring - · - · - Earthing Overhead line ——— Hand Hall	600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP	SCALE: Non scale	TITLE: Construction Site Map Kyan Sit Thar Level Crossing	DRAWING NUMBER BD2-01-01

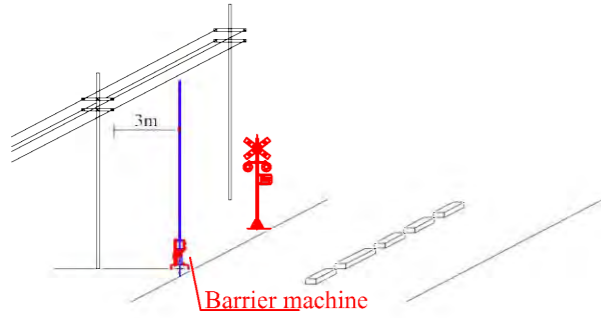
Kyan Sit Thar Level Crossing



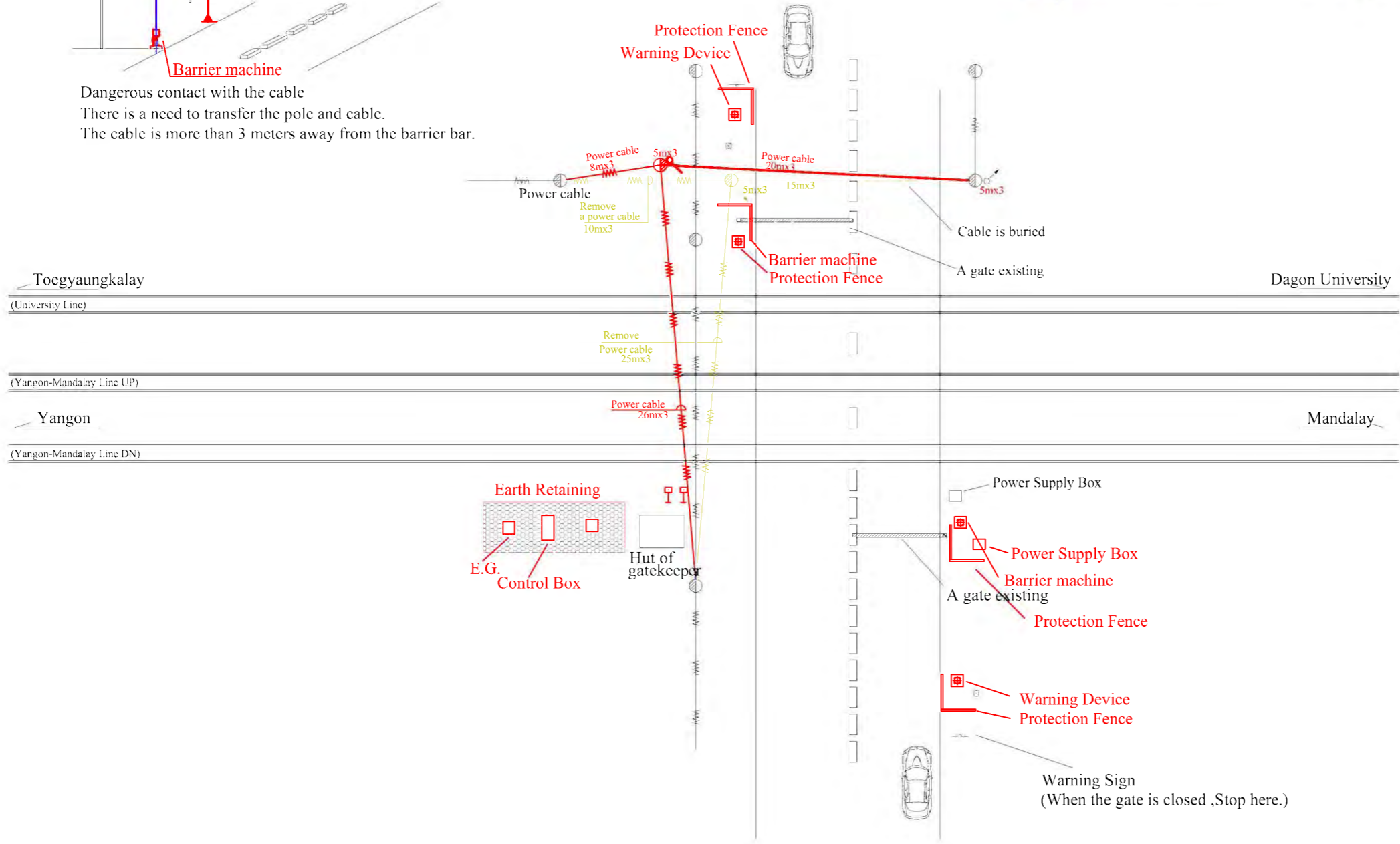
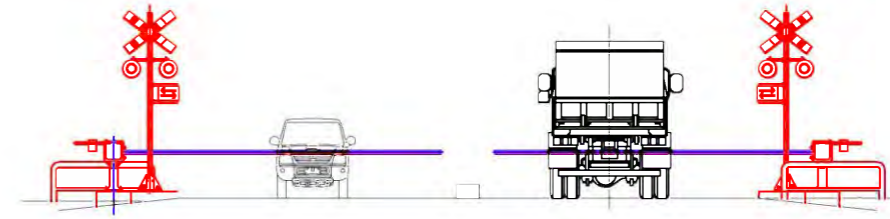
NOTES: 1. 2.		CLIENT: Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP		
DRAWING NUMBER BD2-02-01		TITLE: General Arrangement Drawing(1) Kyan Sit Thar Level Crossing			

133

Kyan Sit Thar Level Crossing



Dangerous contact with the cable
There is a need to transfer the pole and cable.
The cable is more than 3 meters away from the barrier bar.



NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

Non scale

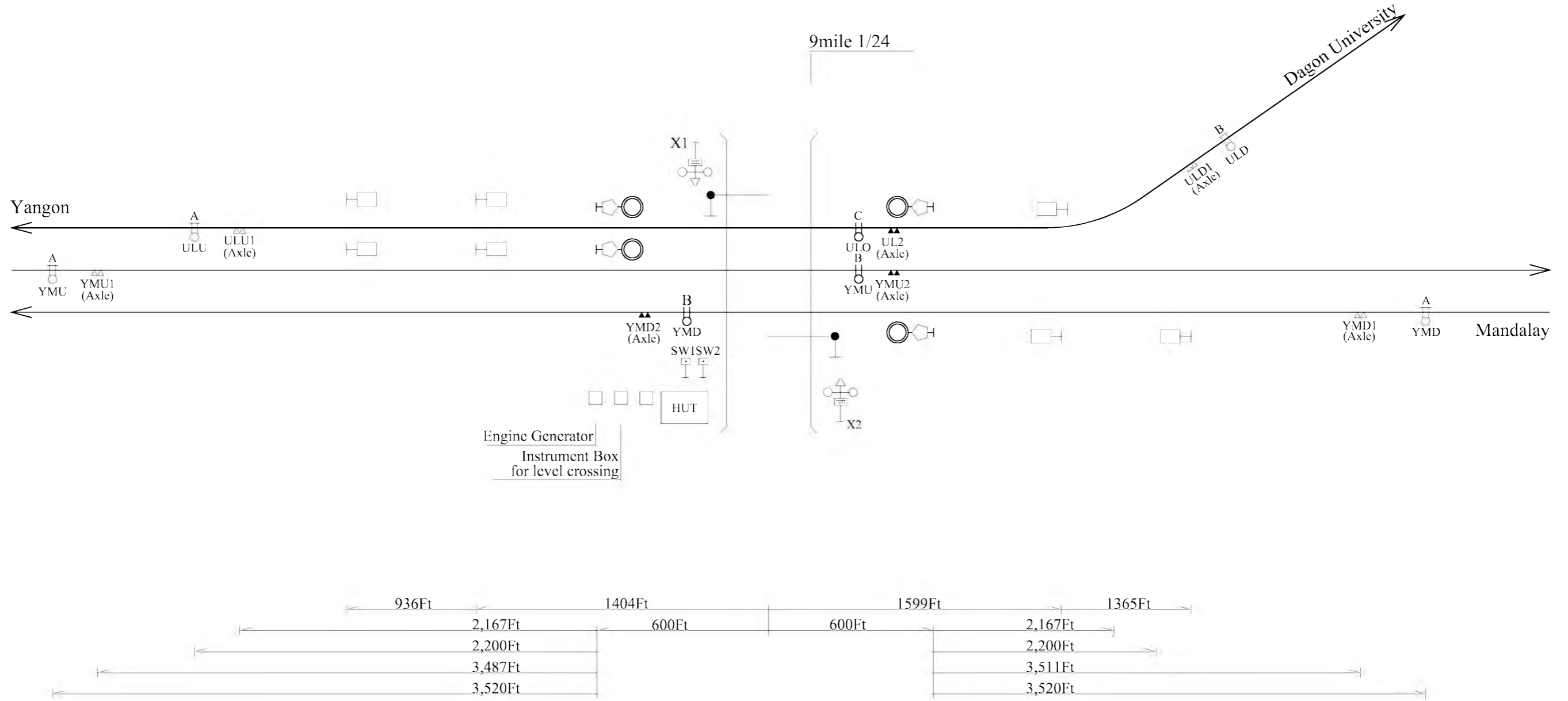
TITLE:

General Arrangement Drawing(2)
Kyan Sit Thar Level Crossing

DRAWING NUMBER

BD2-02-02

Kyan Sit Thar Level Crossing



Semi-automatic Crossing
 Length of Level Crossing=78"-0'
 Width of Level Crossing=38"-0'

for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND				SCALE: Non scale	TITLE: The Level Crossing Control Diagram Kyan Sit Thar Level Crossing
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP	DRAWING NUMBER BD2-03-01	










for reference

The level crossing control diagram

Warning Time 70s

Device Name	Alarm control sections		Alarm Control		Distance between Train Detector and Level Crossing	Speed limit	Operating Speed	Delay	Remarks	
			Alarm Start	Alarm terminates						
X1	D	1	Y-M Line	YMD-A	YMD-B	3,520+600=4,120Ft	40mph	25mph	7s	
		2	Y-M Line	YMD1	YMD2	3,487+600=4,087Ft				
		3	University Line	ULD	ULO	2,200+600=2,800Ft	25mph	10mph	25s	
		4	University Line	ULD1	UL2	2,167+600=2,767Ft				
X2	U	1	Y-M Line	YMU-A	YMU-B	3,520+600=4,120Ft	40mph	25mph	7s	
		2	Y-M Line	YMU1	YMU2	3,487+600=4,087Ft				
		3	University Line	ULU	ULO	2,200+600=2,800Ft	25mph	10mph	25s	
		4	University Line	ULU1	UL2	2,167+600=2,767Ft				

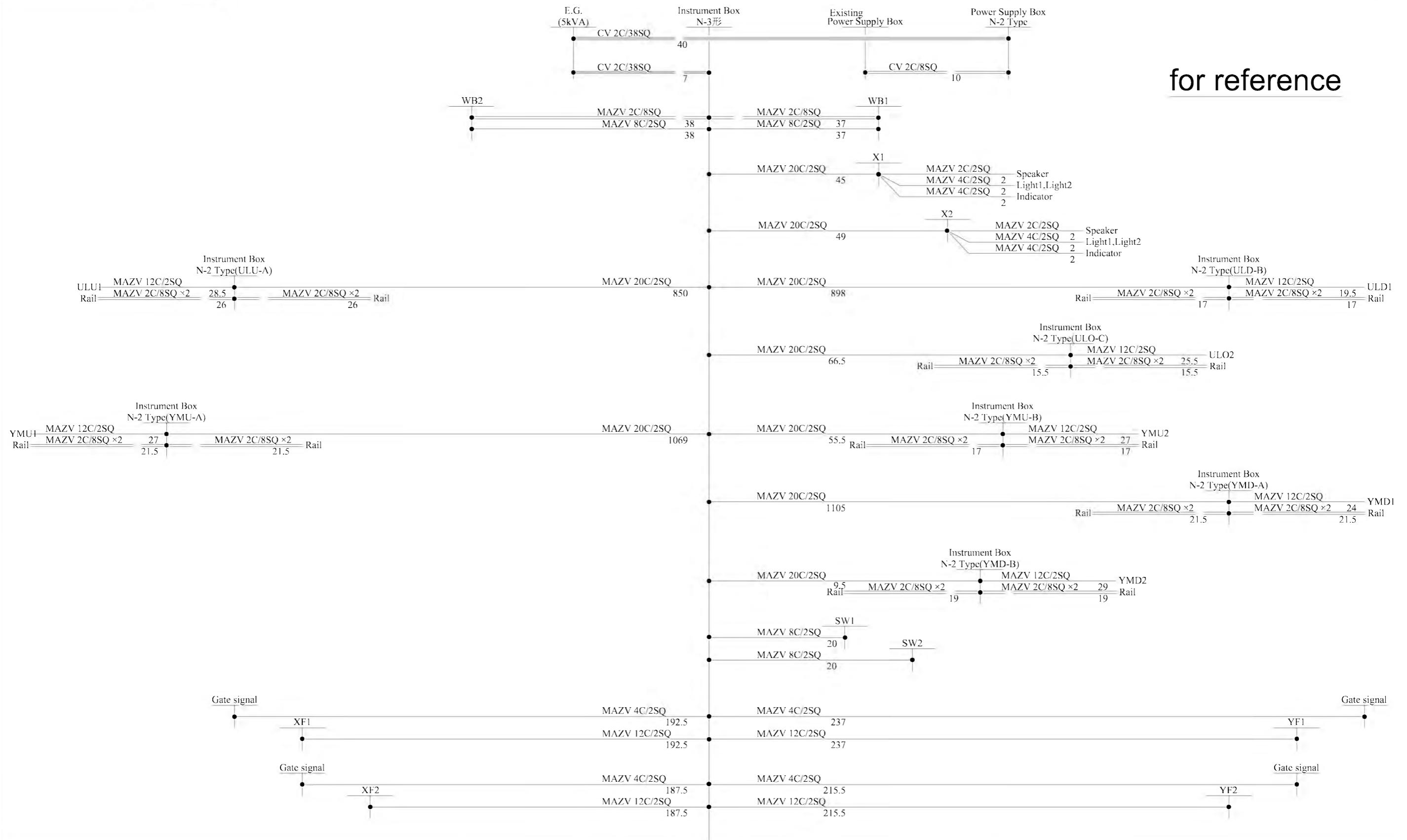
Notice

- a.  Whistle board
- b.  Obstruction warning signal
- c.  Gate signal
- d.  Train detector for Warning start point (Track circuit)
- e.  Train detector for Warning stop point (Track circuit)
- f.  Train detector for Warning start point (Axle Counter)
- g.  Train detector for Warning stop point (Axle Counter)
- h.  Control for barrier machine
- i.  Warning signal for Obstruction Warning Indicator
- j. The level crossing arrival predicting time is set to 70 seconds on the assumption that the operating speed is 40 mph.
- k. The train driver blows the alarm whistle soon after he notices the Whistle Board.

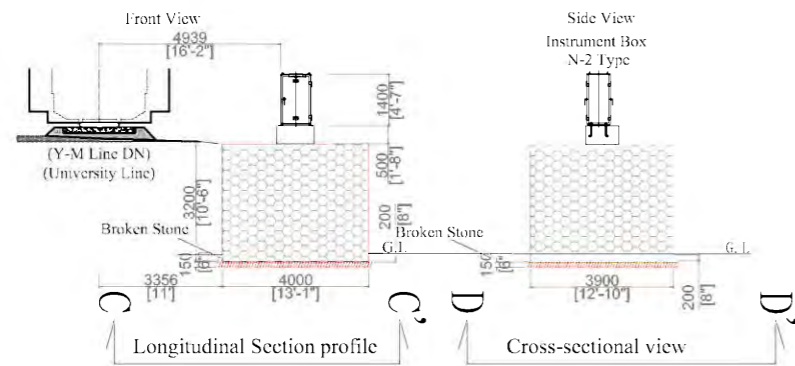
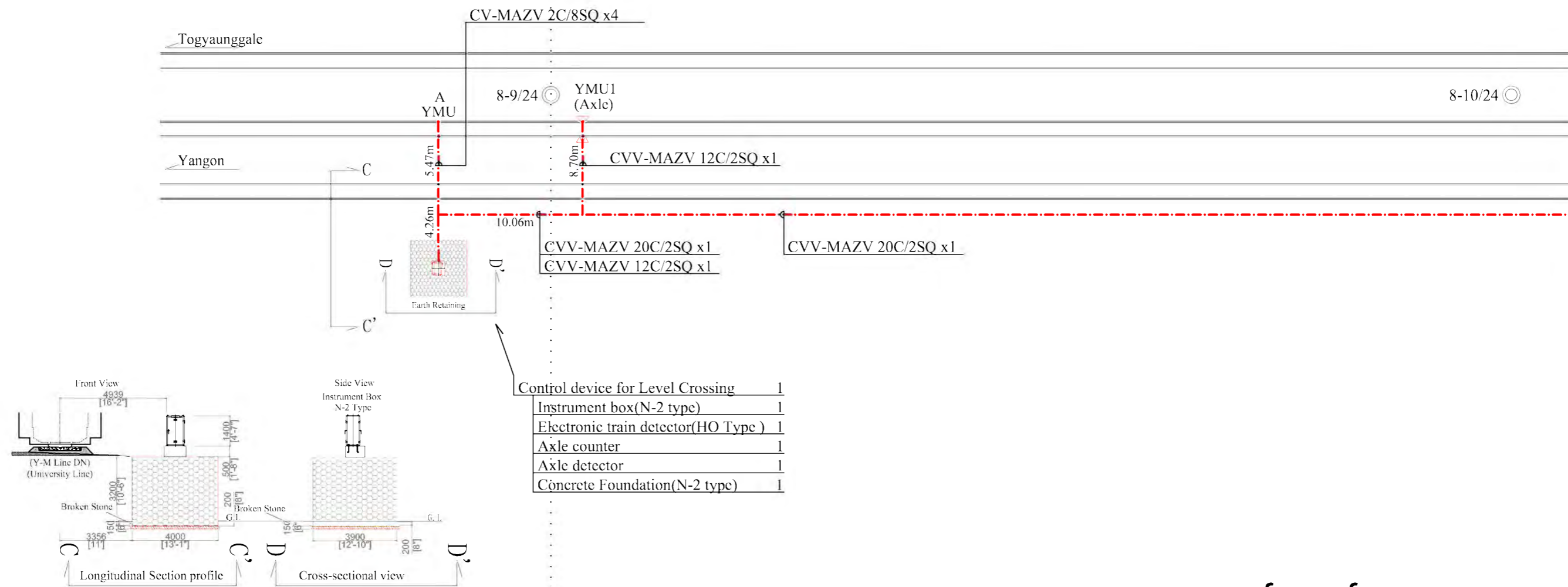
- l. Soon after the gatekeeper recognizes the alarm whistle, he handles SW1 so that the barrier bar closes the gate.
- m. The gatekeeper handles SW1 in order to close and open the level crossing gate.
- n. The Gate Signal is turned on when the gate is closed completely.
- o. The alarm terminates when the train passes through the level crossing completely.
- p. After the train passes through the level crossing completely, the gatekeeper handles the SW1 so that the barrier bar is opened.
- q. In case of emergency, the gatekeeper handles SW2 so that the Obstruction Warning Indicator is turned on.
- r. When SW2 is handled and the Obstruction Warning Indicator is turned on, the Gate Signal is turned off.

NOTES: 1. 2.	CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment
LEGEND		THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY		
Ceiling concealment line	Startup	 600V Vinyl insulation electric wire	IV	ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
Floor concealment line	Fall	 Polyethylene insulation cable	CV	
Exposure Wiring	Through	 Vinyl insulation cable for control	CVV	
Undergrounding wiring	Earthing	 Communication cable	CPEV	
Overhead line	Hand Hall	 UTP cable	UTP	
DRAWING NUMBER		BD2-03-02		
TITLE:		The Level Crossing Control Chart Kyan Sit Thar Level Crossing		

for reference



<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p> <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p> <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line</p>																				
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV	Floor concealment line	Fall	Polyethylene insulation cable	CV	Exposure Wiring	Through	Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing	Communication cable	CPEV	Overhead line	Hand Hall	UTP cable	UTP				
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV																						
Floor concealment line	Fall	Polyethylene insulation cable	CV																						
Exposure Wiring	Through	Vinyl insulation cable for control	CVV																						
Undergrounding wiring	Earthing	Communication cable	CPEV																						
Overhead line	Hand Hall	UTP cable	UTP																						
<p>DRAWING NUMBER</p> <p>BD2-04-01</p>		<p>TITLE:</p> <p>Facility System Drawing Kyan Sit Thar Level Crossing</p>																							



Enlarged View Scale=1:200

8Mi 9/24

8Mi 10/24

for reference

NOTES:
1. MAZV-Undergrounding wiring of CV or CV
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

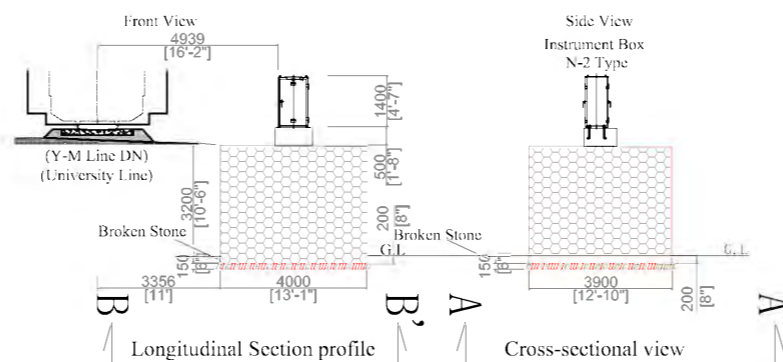
1:300

TITLE:

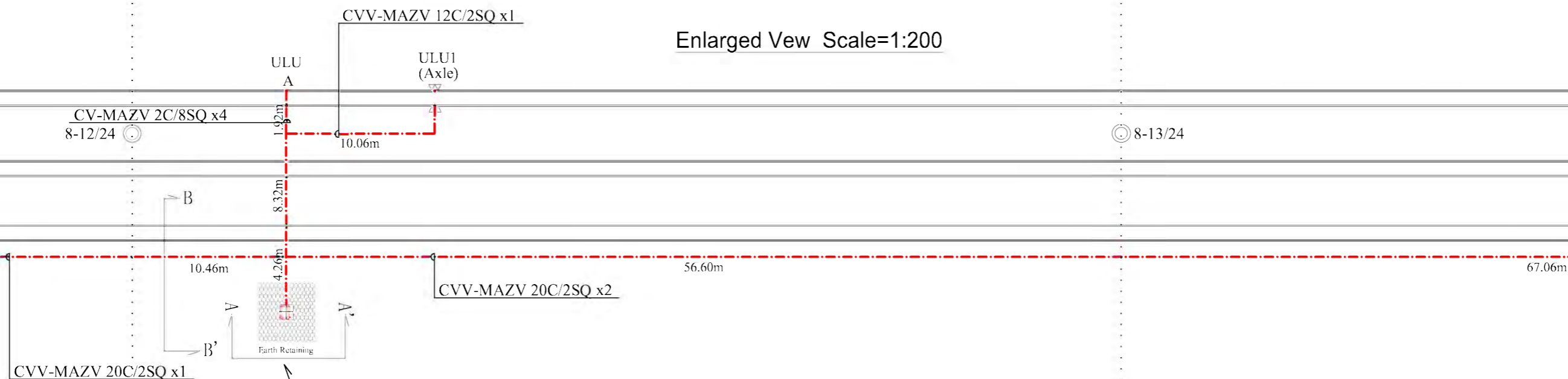
Partial arrangement Drawing
Toegyaungkalay- Ywathagyi 8/9-10

DRAWING NUMBER

BD2-04-02



Enlarged View Scale=1:200



Control device for Level Crossing	1
Instrument box(N-2 type)	1
Electronic train detector(HO Type)	1
Axle counter	1
Axle detector	1
Concrete Foundation(N-2 type)	1

for reference

8Mi 12/24

8Mi 13/24

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

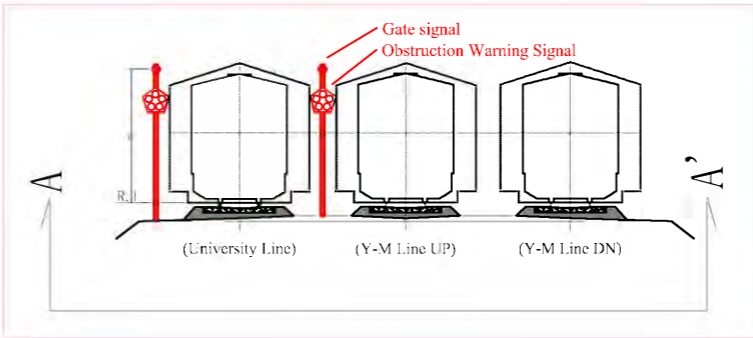
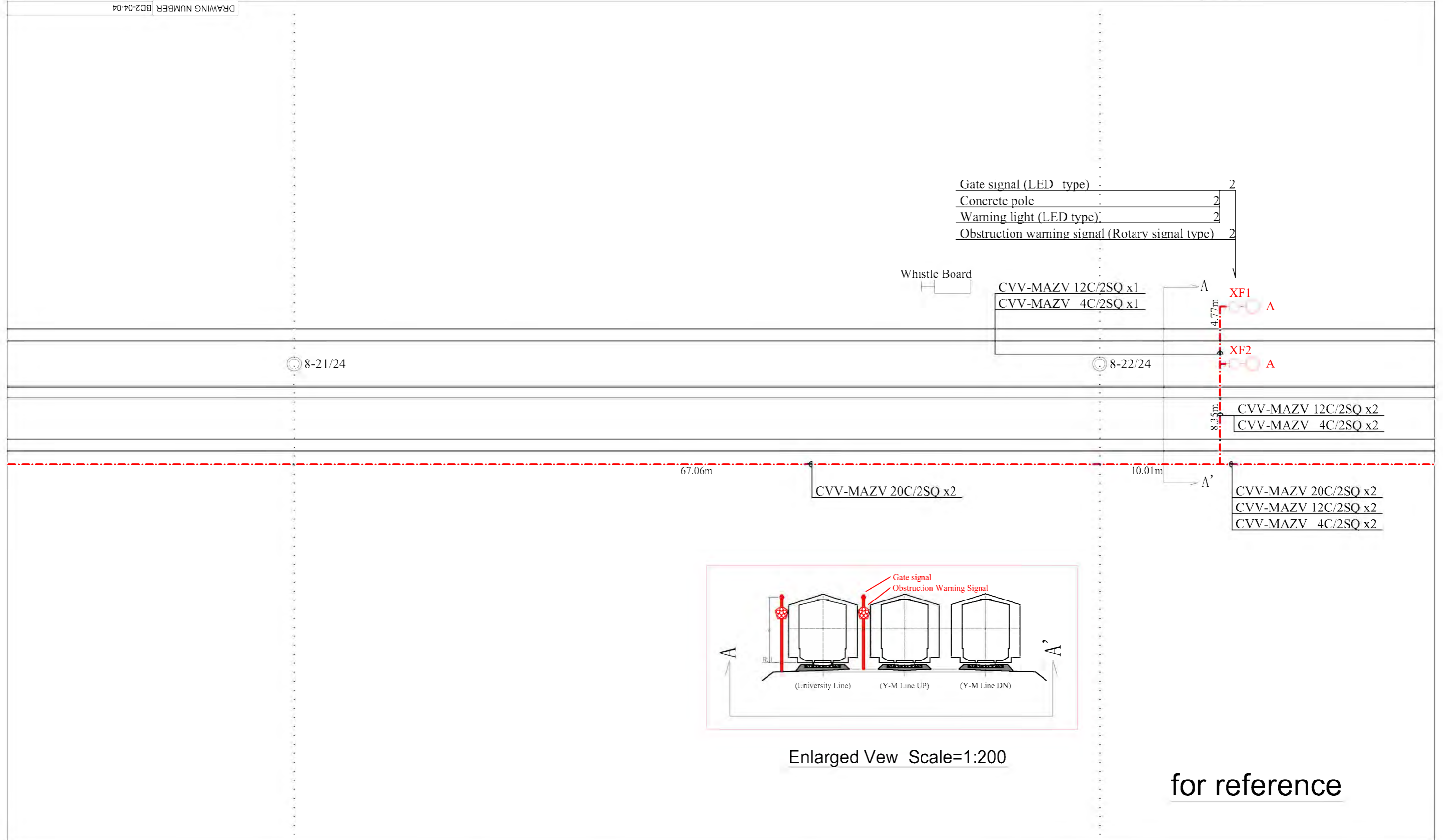
1:300

TITLE:

Partial arrangement Drawing
Toegyaukcalay- Ywathagyi 8/12-13

DRAWING NUMBER

BD2-04-03



Enlarged View Scale=1:200

for reference

140

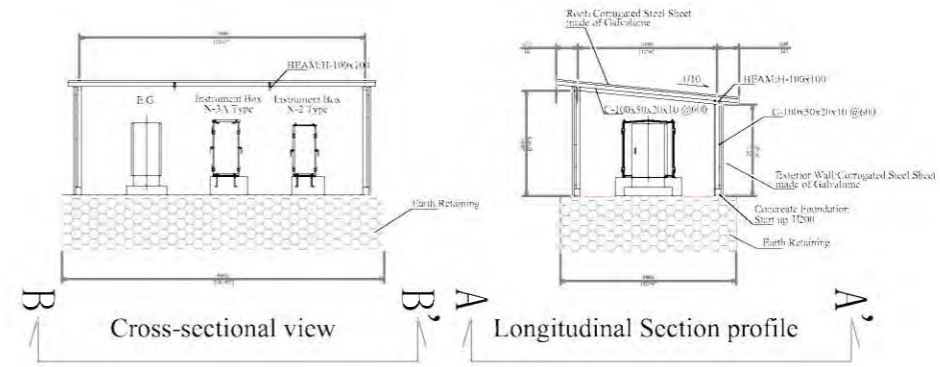
8Mi 21/24

8Mi 22/24

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line</p>																				
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV	Floor concealment line	Fall	Polyethylene insulation cable	CV	Exposure Wiring	Through	Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing	Communication cable	CPEV	Overhead line	Hand Hall	UTP cable	UTP			<p>SCALE:</p> <p>1:300</p>	<p>TITLE:</p> <p>Partial arrangement Drawing Toegyaukcalay- Ywathagyi 8/21-22</p>
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV																						
Floor concealment line	Fall	Polyethylene insulation cable	CV																						
Exposure Wiring	Through	Vinyl insulation cable for control	CVV																						
Undergrounding wiring	Earthing	Communication cable	CPEV																						
Overhead line	Hand Hall	UTP cable	UTP																						
				<p>DRAWING NUMBER</p> <p>BD2-04-04</p>																					

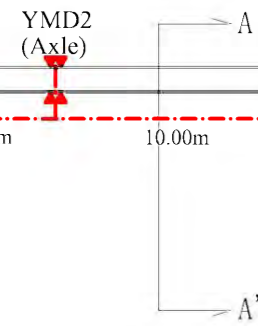
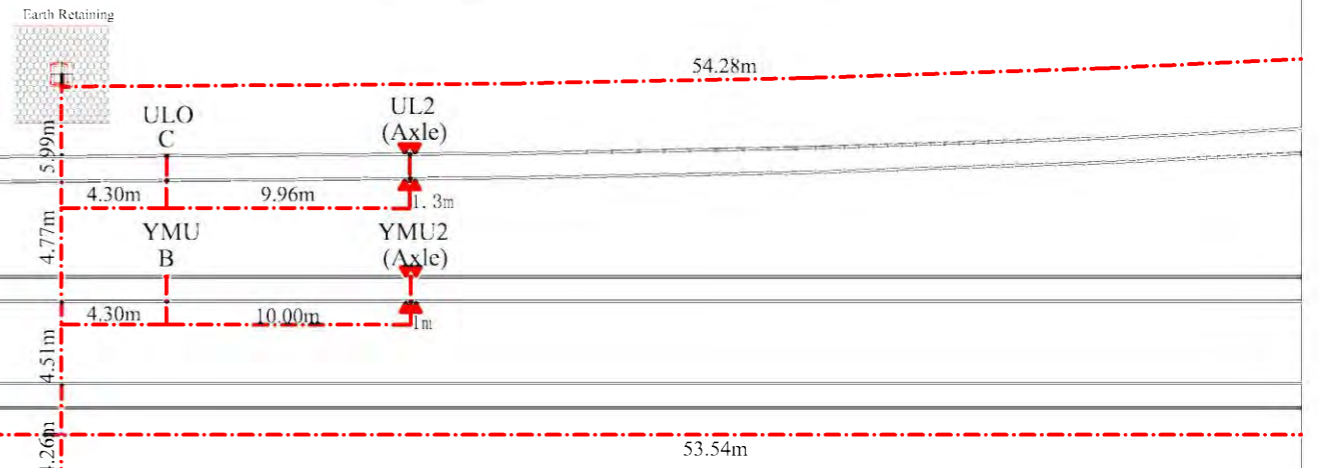
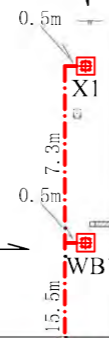
Road warning device(A type)	1
Pillar with the crossing warning sign	1
Warning light (LED type)	2
Train direction indicator	1
Concrete Foundation(3A type)	1

Control device for Level Crossing	1
Instrument box(N-2 type)	1
Electronic train detector(HC Type)	1
Axle counter	1
Axle detector	1
Concrete Foundation(N-2 type)	1



Enlarged View Scale=1:200

Electric Barrier machine	1
Crossing rod (with prevention device of rod breakage)	1
Concrete Foundation(3A type)	1

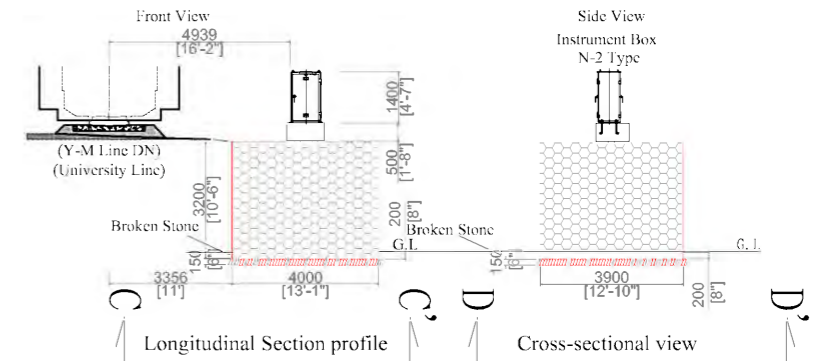


Control device for Level Crossing	1
Control device for Level Crossing	1
Instrument box(N-3 type)	1
Concrete Foundation(N-3 type)	1
Concrete Foundation(N-2 type)	1
Instrument box(N-2 type)	1
Electronic train detector(HC Type)	1
Axle counter	1
Axle detector	1
Concrete Foundation(N-2 type)	1

Control device for Level Crossing	1
Instrument box(N-2 type)	1
Electronic train detector(HC Type)	1
Axle counter	1
Axle detector	1
Concrete Foundation(N-2 type)	1

Electric Barrier machine	1
Crossing rod (with prevention device of rod breakage)	1
Concrete Foundation(3A type)	1

Road warning device(A type)	1
Pillar with the crossing warning sign	1
Warning light (LED type)	2
Train direction indicator	1
Concrete Foundation(3A type)	1



Enlarged View Scale=1:200

for reference

9Mi 1/24

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

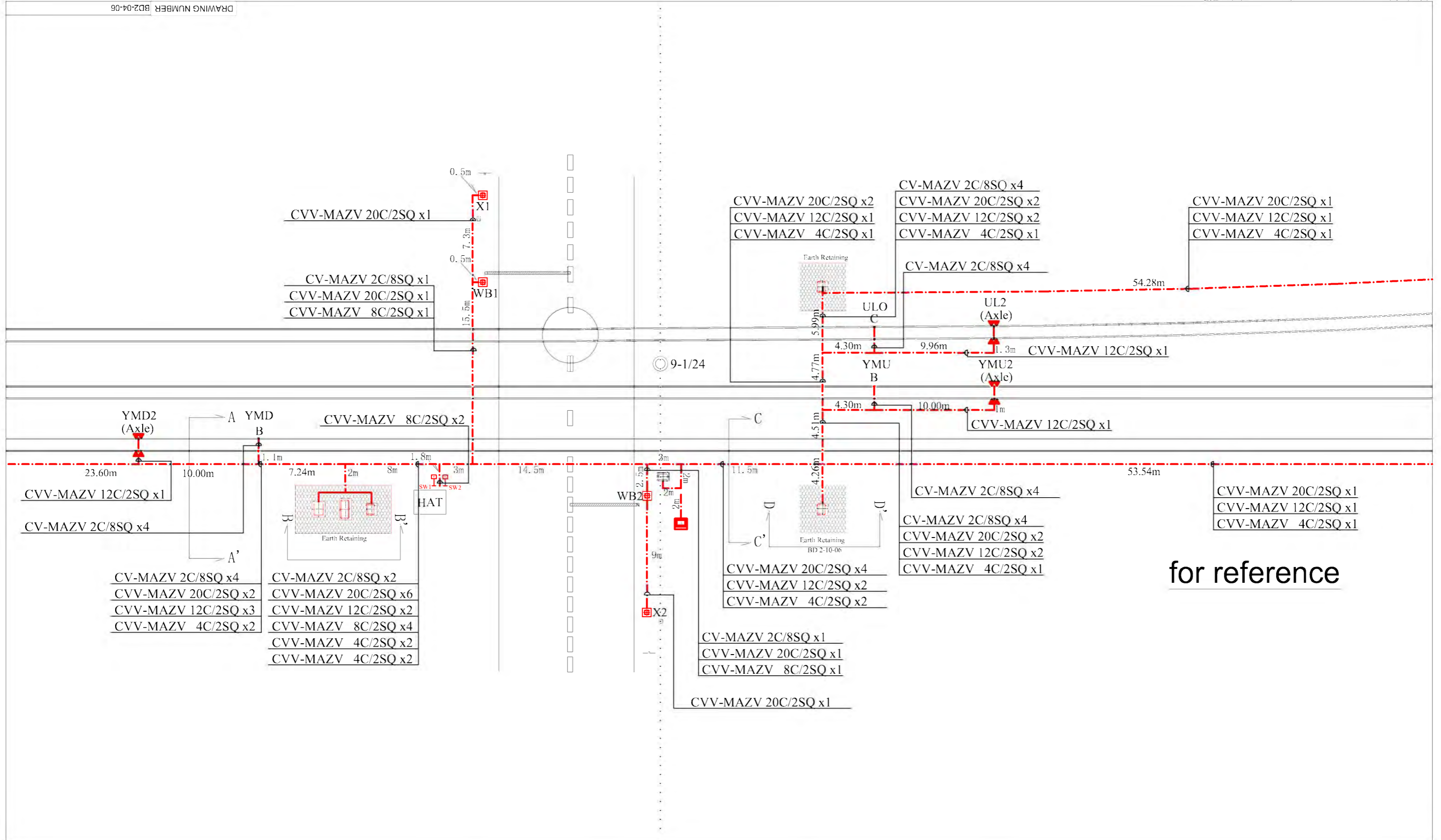
1:300

TITLE:

Partial arrangement Drawing
Toegyaukcalay- Ywathaygi 9/1 (1)

DRAWING NUMBER

BD2-04-05



for reference

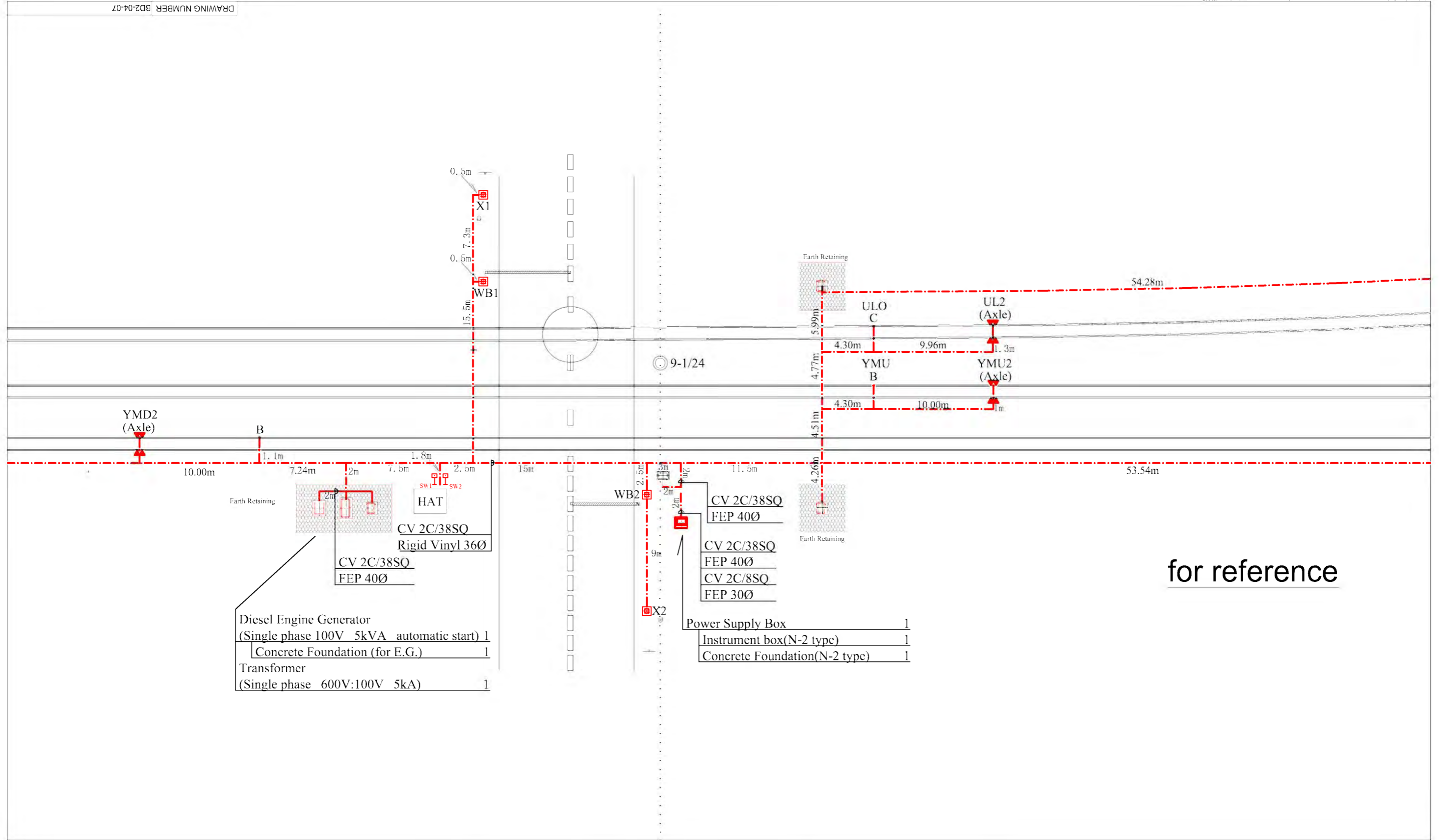
9Mi 1/24

NOTES:
1.
2.

LEGEND			
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:	CONSULTANTS:	DATE:	PROJECT:
Japan International Cooperation Agency	Consortium of JIC and OC Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	MARCH 2014	The Project for Installation of Operation Control Center System and Safety Equipment

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY			ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
SCALE:	TITLE:	DRAWING NUMBER	
1:300	Partial arrangement Drawing Toegyaukcalay- Ywathagyi 9/1 (2)	BD2-04-06	



Diesel Engine Generator (Single phase 100V 5kVA automatic start)	1
Concrete Foundation (for E.G.)	1
Transformer (Single phase 600V:100V 5kA)	1

Power Supply Box	1
Instrument box(N-2 type)	1
Concrete Foundation(N-2 type)	1

9Mi 1/24

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

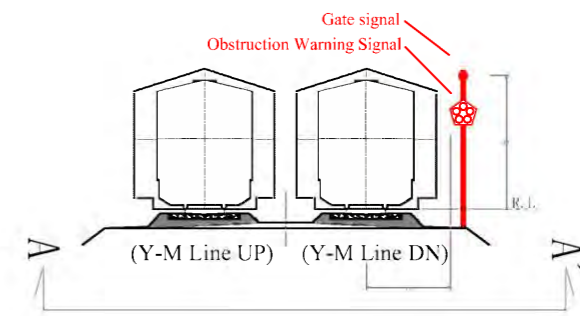
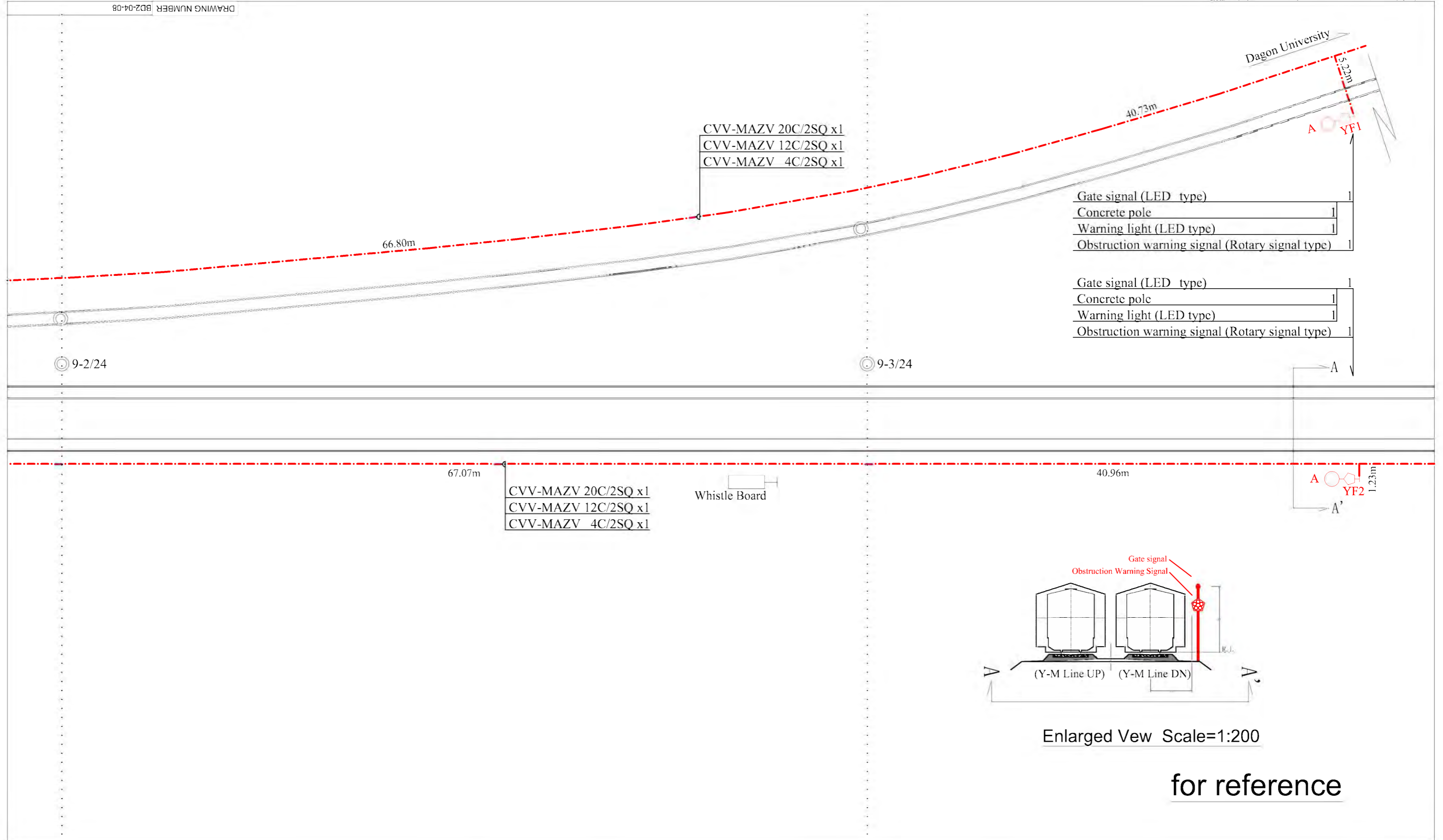
1:300

TITLE:

Partial arrangement Drawing
Toegyaukcalay- Ywathagyi 9/1 (3)

DRAWING NUMBER

BD2-04-07

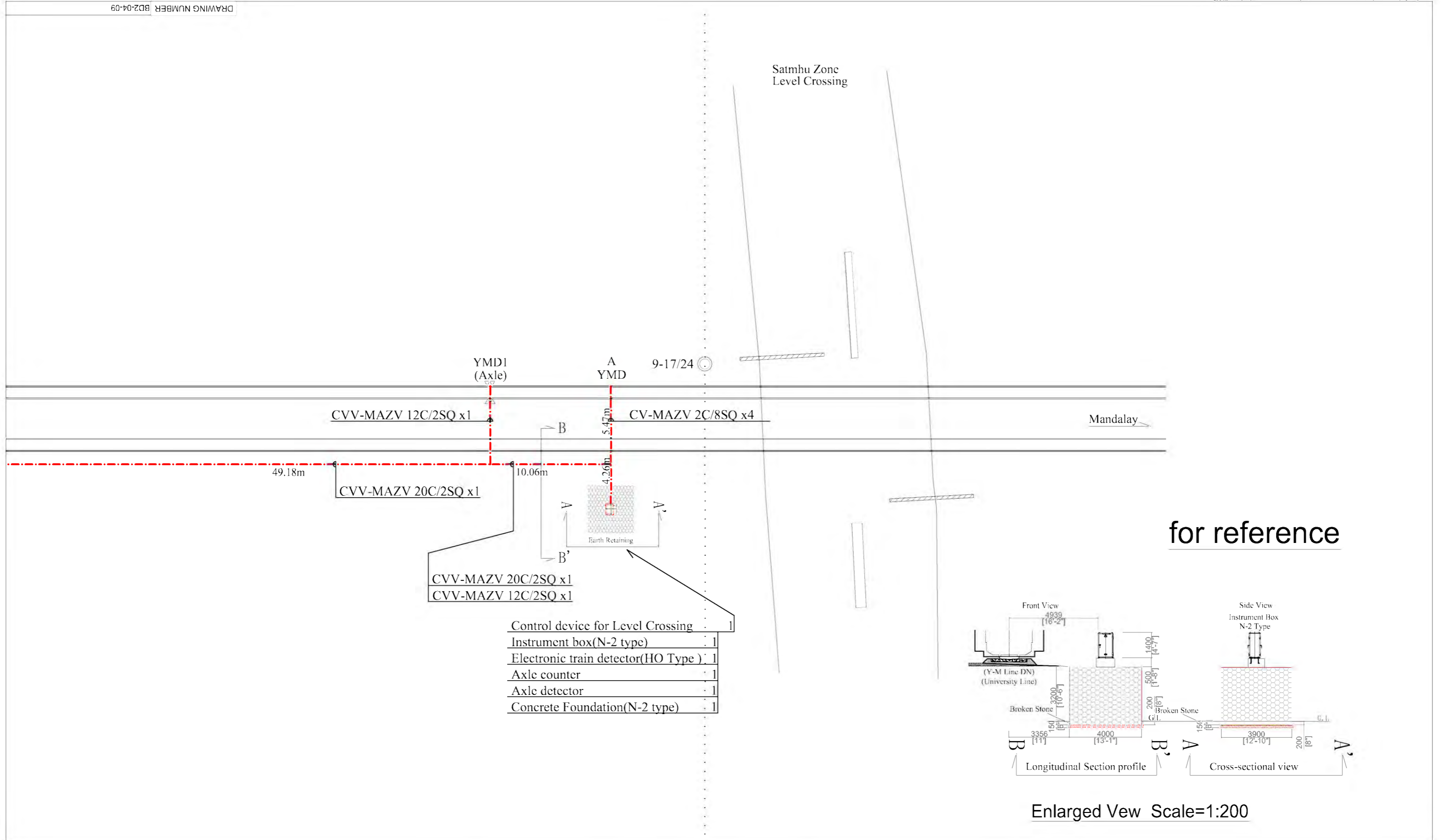


Enlarged View Scale=1:200

for reference

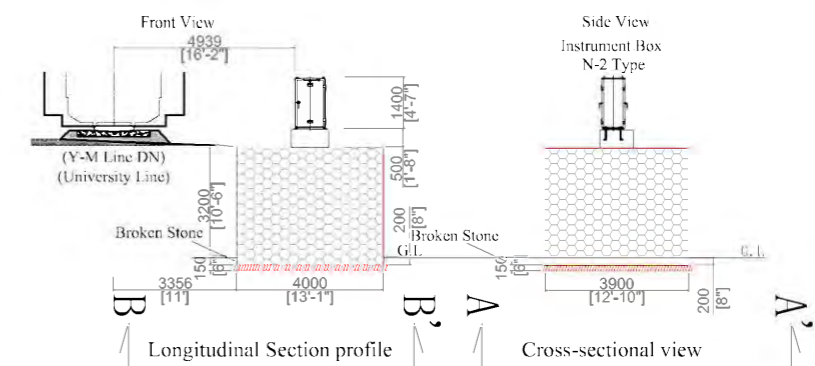
144

9Mi 2/24		9Mi 3/24			
NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND Ceiling concealment line ——— Startup Floor concealment line - - - - - Fall Exposure Wiring - - - - - Through Undergrounding wiring - · - · - Earthing Overhead line ——— Hand Hall		600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP	SCALE: 1:300	TITLE: Partial arrangement Drawing Toegyaukcalay- Ywathagyi 9/2-3	
		DRAWING NUMBER BD2-04-08			



Control device for Level Crossing	1
Instrument box(N-2 type)	1
Electronic train detector(HO Type)	1
Axle counter	1
Axle detector	1
Concrete Foundation(N-2 type)	1

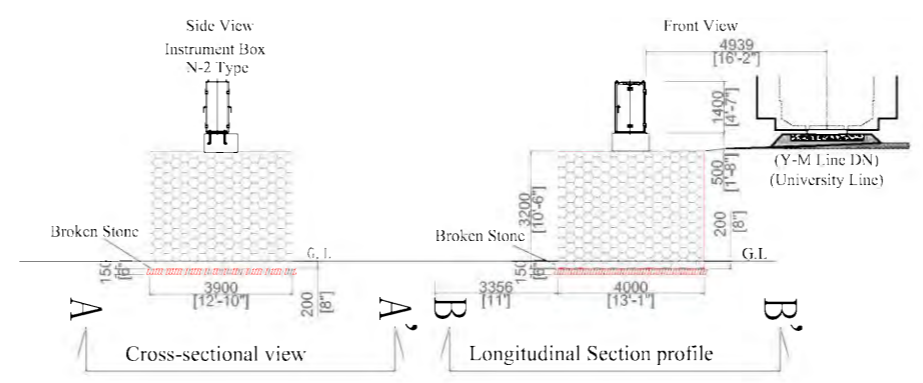
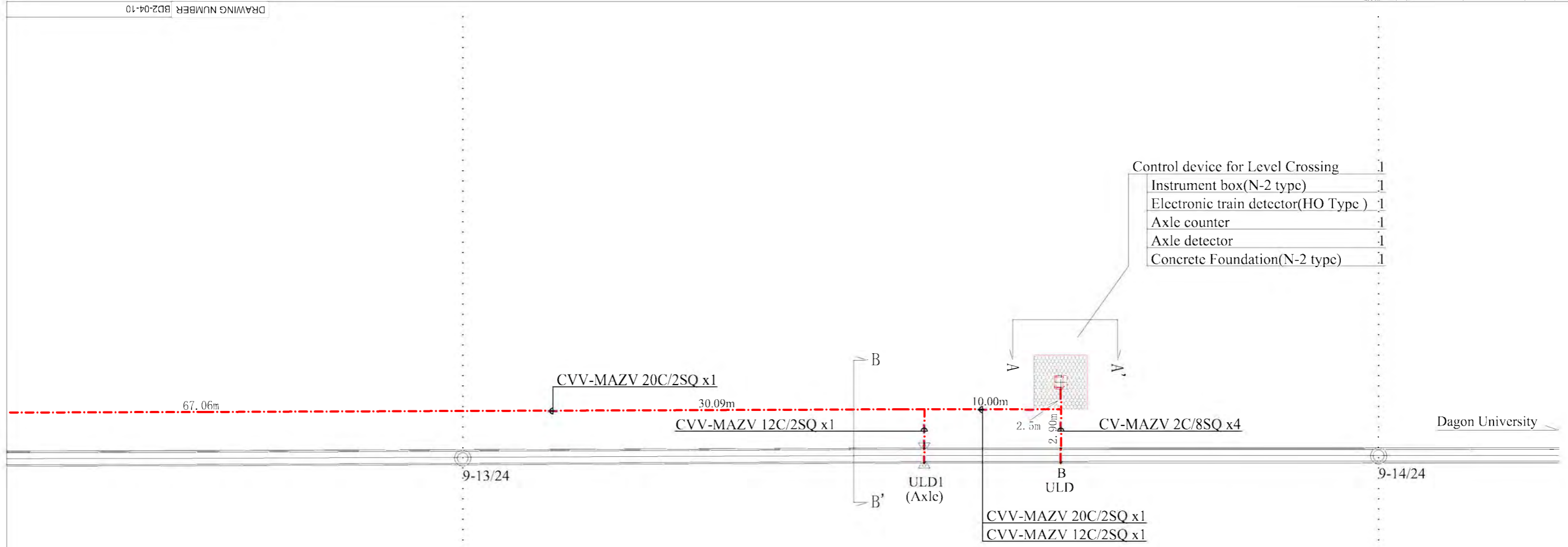
for reference



Enlarged View Scale=1:200

9Mi: 17/24

<p>NOTES:</p> <p>1.</p> <p>2.</p>	<p>CLIENT:</p> <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p> <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p>																										
				<p>ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line</p>		<p>SCALE:</p> <p>1:300</p>	<p>TITLE:</p> <p>Partial arrangement Drawing Toegyaukcalay- Ywathaygi 9/17</p>																							
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>			Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP	<p>DRAWING NUMBER</p> <p>BD2-04-09</p>		
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																										
Floor concealment line	Fall		Polyethylene insulation cable	CV																										
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																										
Undergrounding wiring	Earthing		Communication cable	CPEV																										
Overhead line	Hand Hall		UTP cable	UTP																										



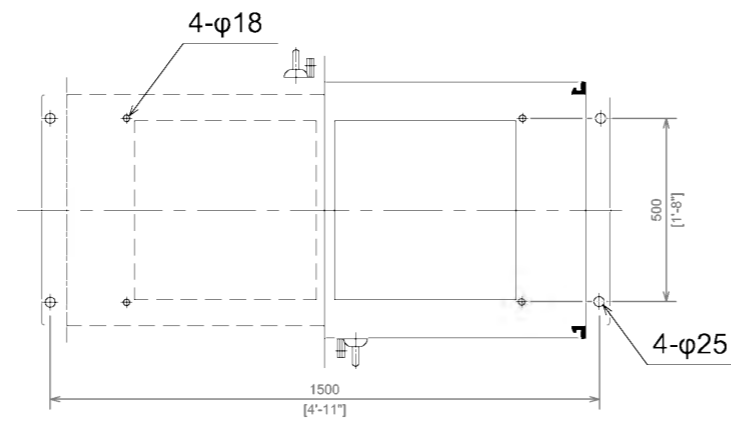
Enlarged View Scale=1:200

for reference

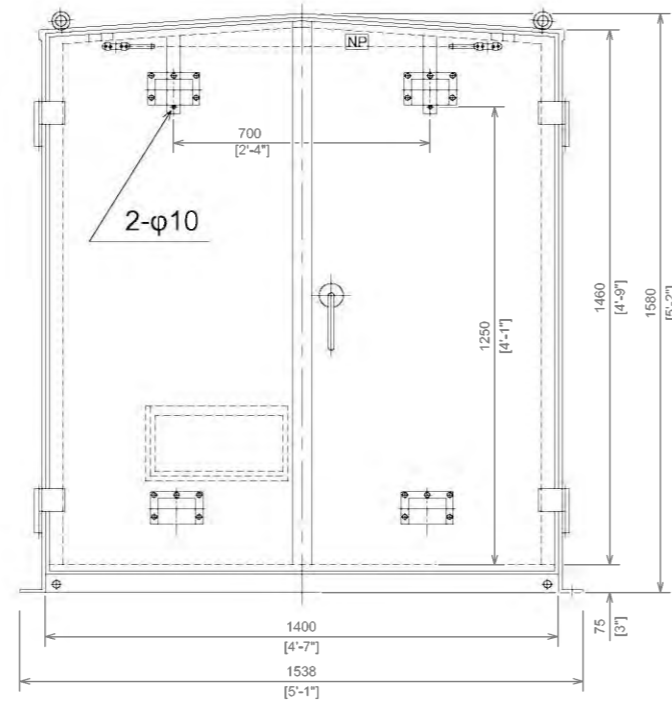
9Mi 13/24

9Mi 14/24

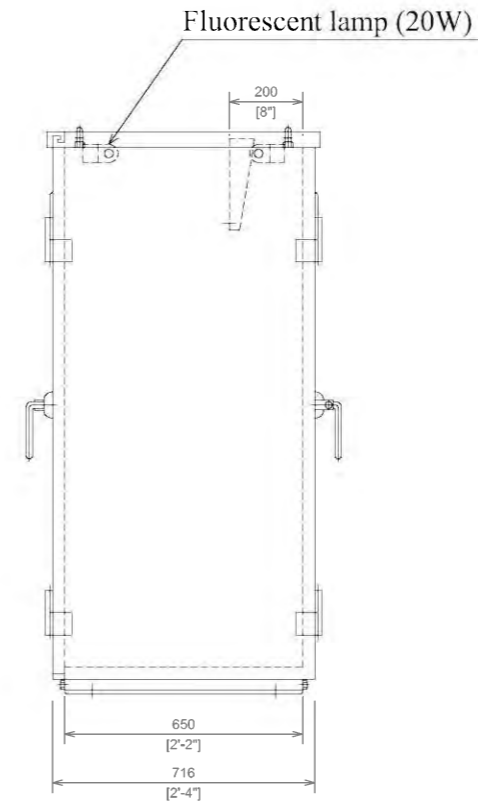
<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p> <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p> <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line</p>																				
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV	Floor concealment line	Fall	Polyethylene insulation cable	CV	Exposure Wiring	Through	Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing	Communication cable	CPEV	Overhead line	Hand Hall	UTP cable	UTP				
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV																						
Floor concealment line	Fall	Polyethylene insulation cable	CV																						
Exposure Wiring	Through	Vinyl insulation cable for control	CVV																						
Undergrounding wiring	Earthing	Communication cable	CPEV																						
Overhead line	Hand Hall	UTP cable	UTP																						
<p>DRAWING NUMBER</p> <p>BD2-04-10</p>		<p>TITLE:</p> <p>Partial arrangement Drawing University Line 9/13-14</p>																							



Top View



Front View



Side view

for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	—	Startup	⊕	600V Vinyl insulation electric wire	IV
Floor concealment line	- - -	Fall	⊖	Polyethylene insulation cable	CV
Exposure Wiring	—	Through	⊕	Vinyl insulation cable for control	CVV
Undergrounding wiring	—	Earthing	⊕	Communication cable	CPEV
Overhead line	—	Hand Hall	⊕	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

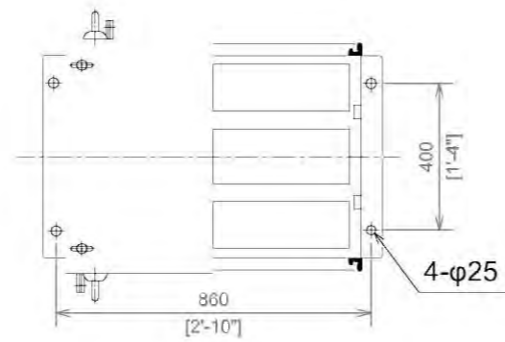
1:20

TITLE:

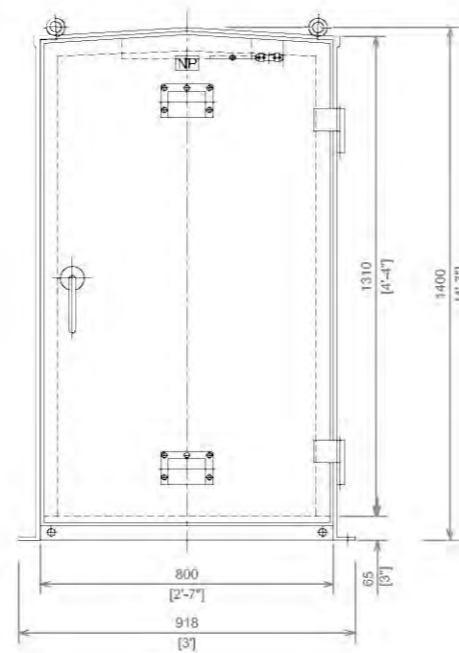
Outline Drawing
Instrument box(N-3A type)

DRAWING NUMBER

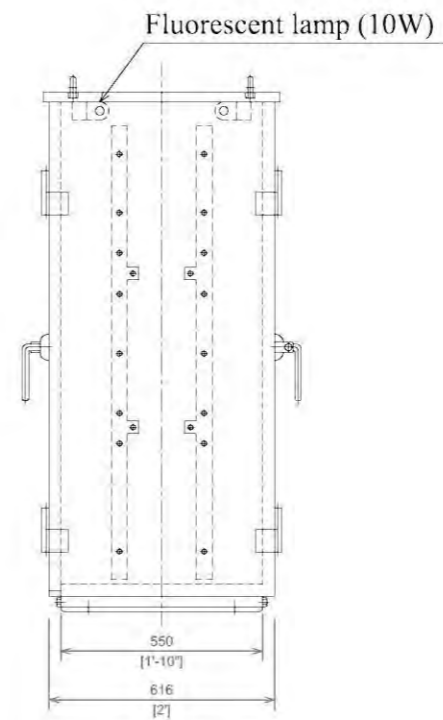
BD2-05-01



Top View



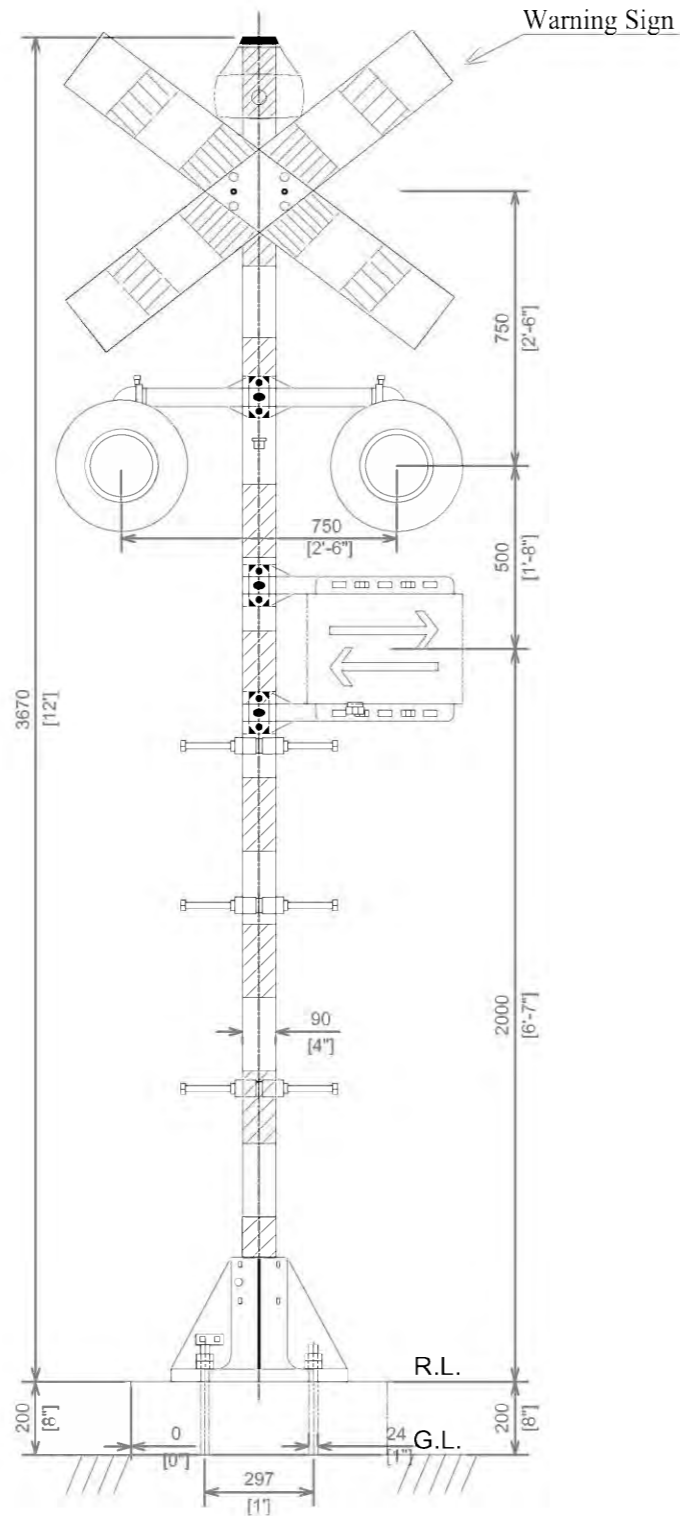
Front View



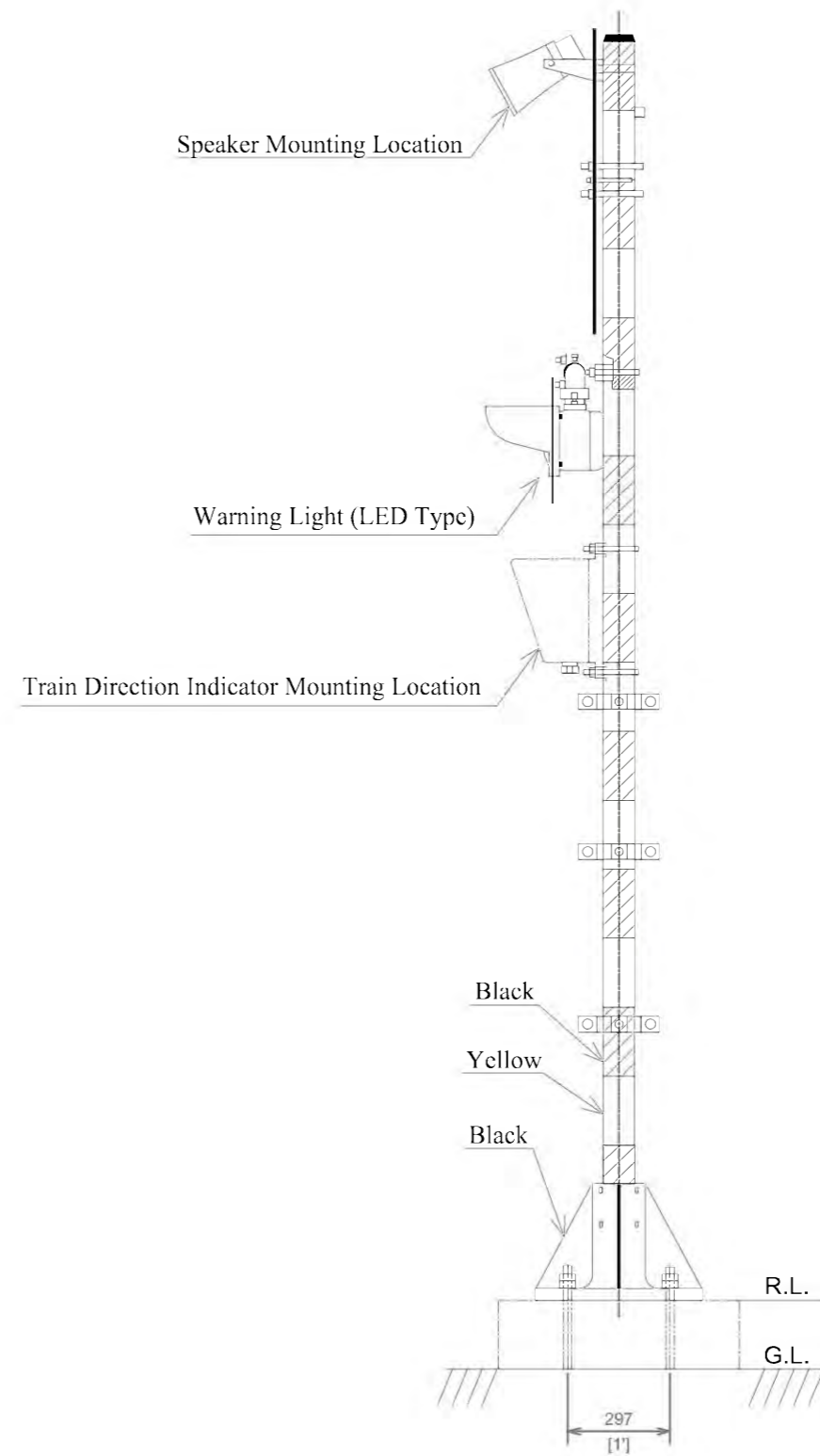
Side view

for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND Ceiling concealment line ——— Startup Floor concealment line - - - - - Fall Exposure Wiring ——— Through Undergrounding wiring ——— Earthing Overhead line ——— Hand Hall		600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP	SCALE: 1:20 TITLE: Outline Drawing Instrument box(N-2 type) DRAWING NUMBER: BD2-05-02		



Front View



Side View

for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

1:20

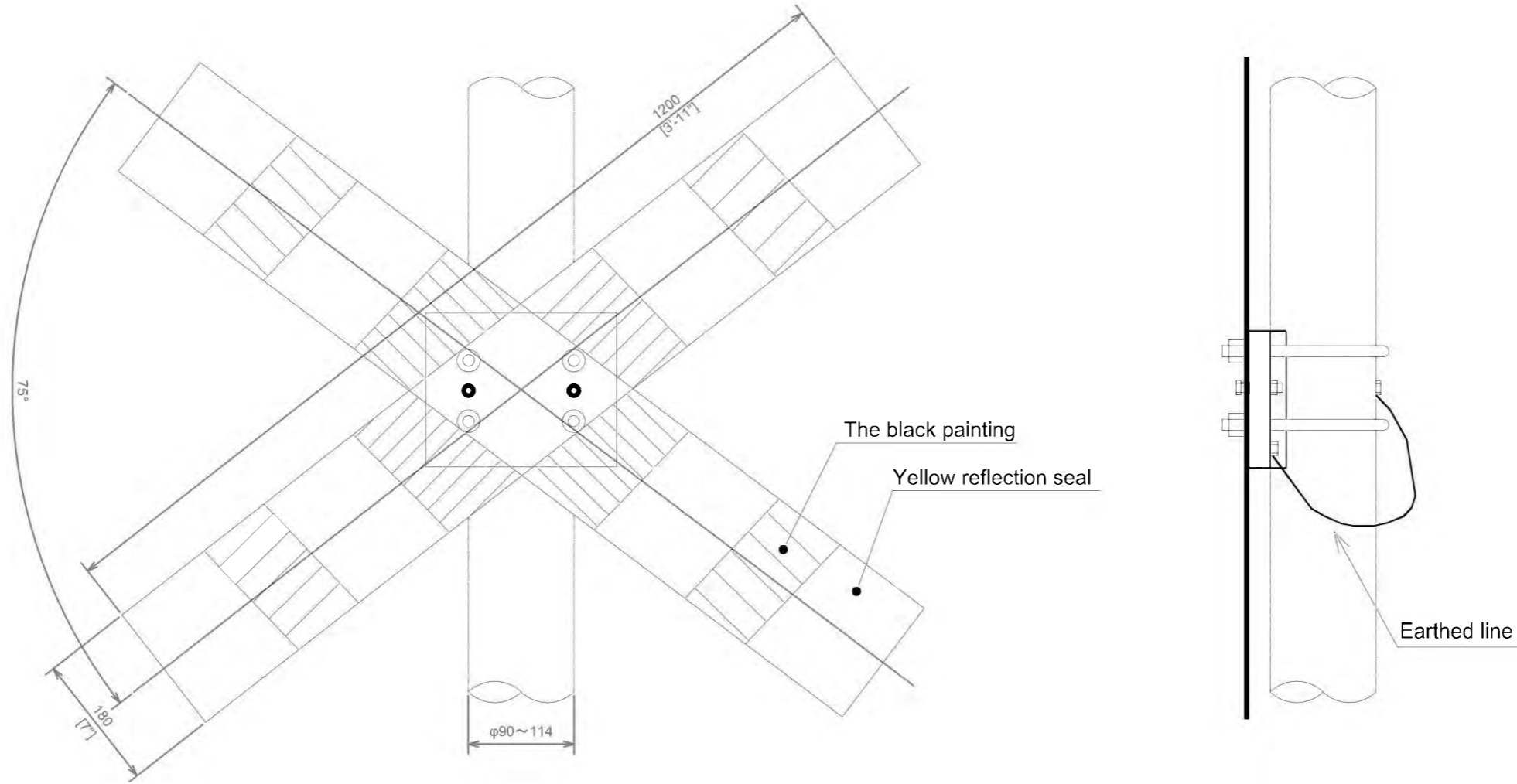
TITLE:

Outline Drawing
Road warning device (A type)

DRAWING NUMBER

BD2-05-03

Crossing Warning Sign



for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

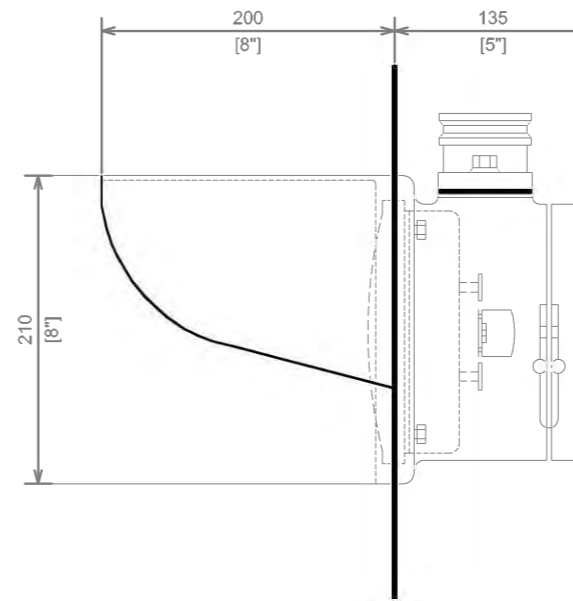
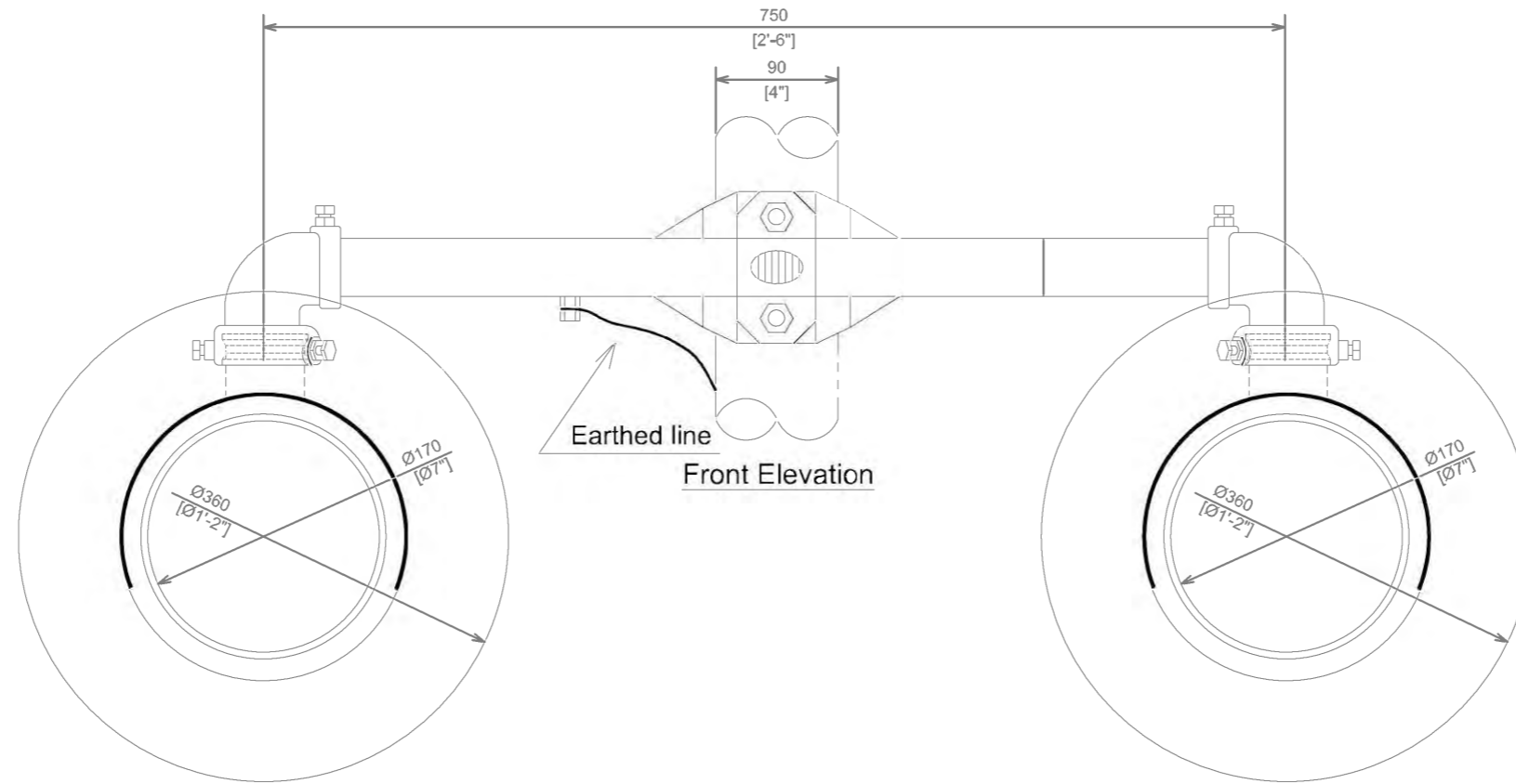
1:30

TITLE:

Outline Drawing
Crossing Warning Sign

DRAWING NUMBER

BD2-05-04



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

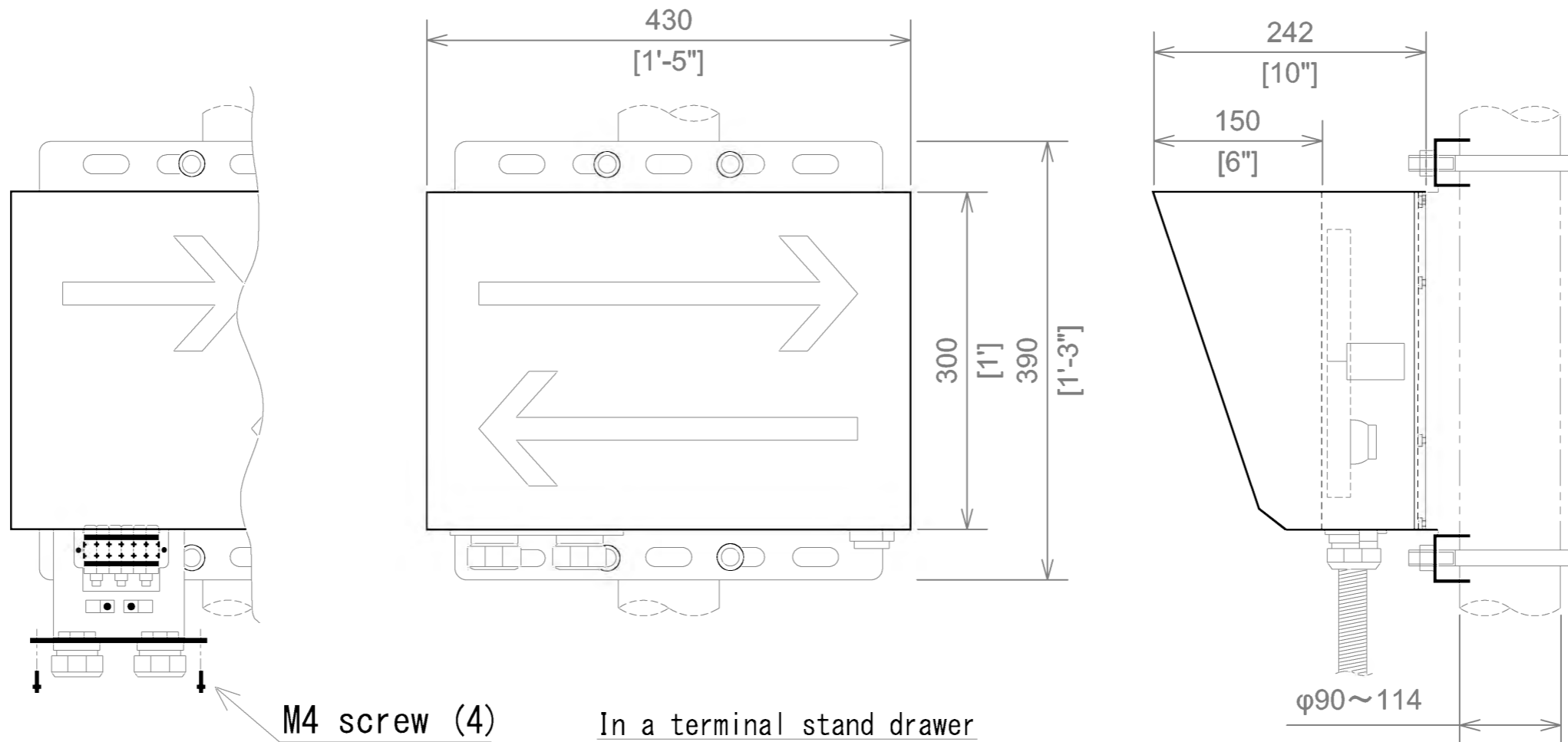
1:5

TITLE:

Outline Drawing
Warning Light (LED Type)

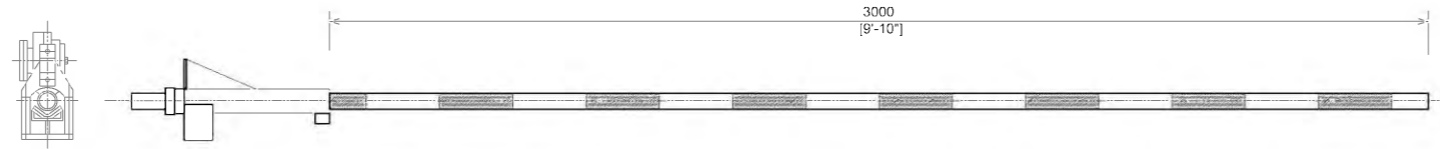
DRAWING NUMBER

BD2-05-05

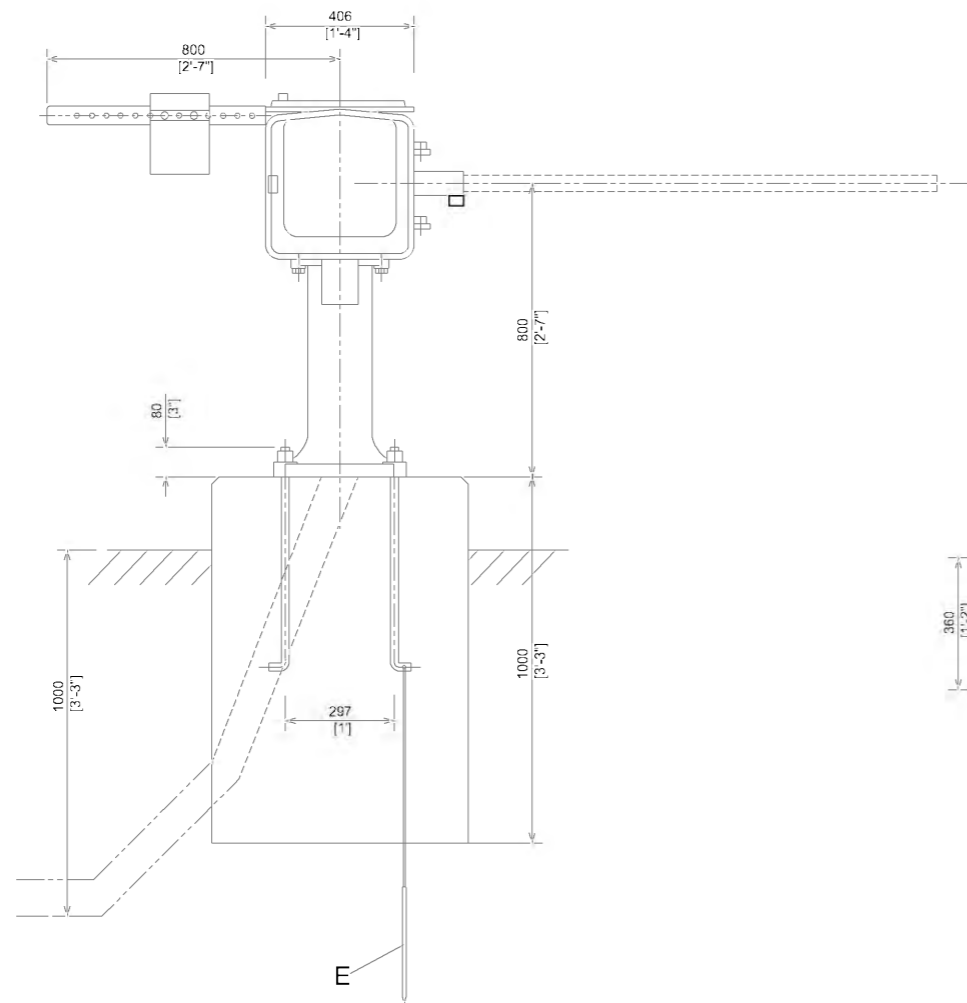


for reference

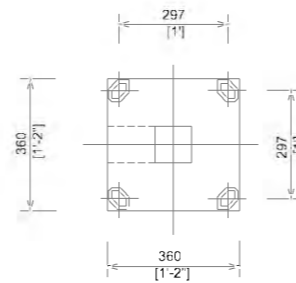
<p>NOTES:</p> <p>1.</p> <p>2.</p>		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line</p>																									
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP				
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																										
Floor concealment line	Fall		Polyethylene insulation cable	CV																										
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																										
Undergrounding wiring	Earthing		Communication cable	CPEV																										
Overhead line	Hand Hall		UTP cable	UTP																										
		<p>SCALE:</p> <p>1:5</p>	<p>TITLE:</p> <p>Outline Drawing Train Direction Indicator</p>																											
<p>DRAWING NUMBER</p> <p>BD2-05-06</p>																														



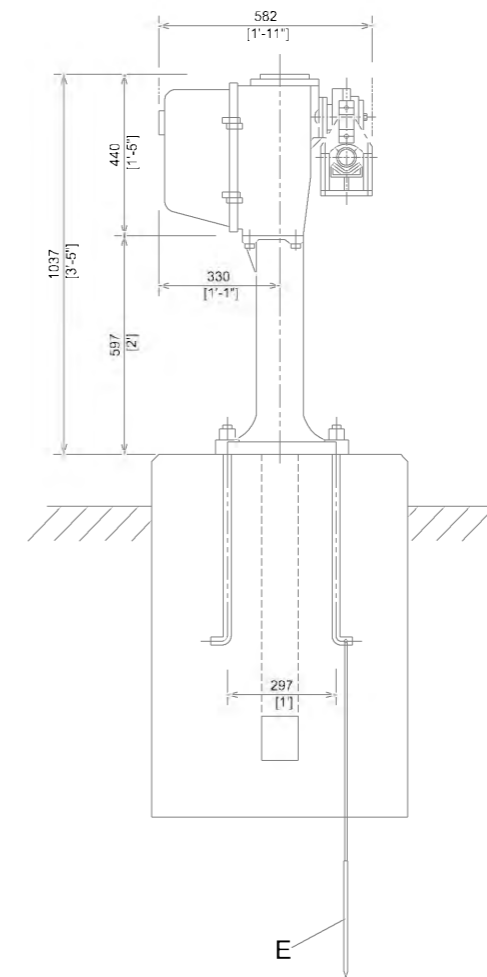
Crossing Rod (with prevention device of rod breakage) Max Length : 6m



Front View



Base of Barrier Machine



Side view

for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

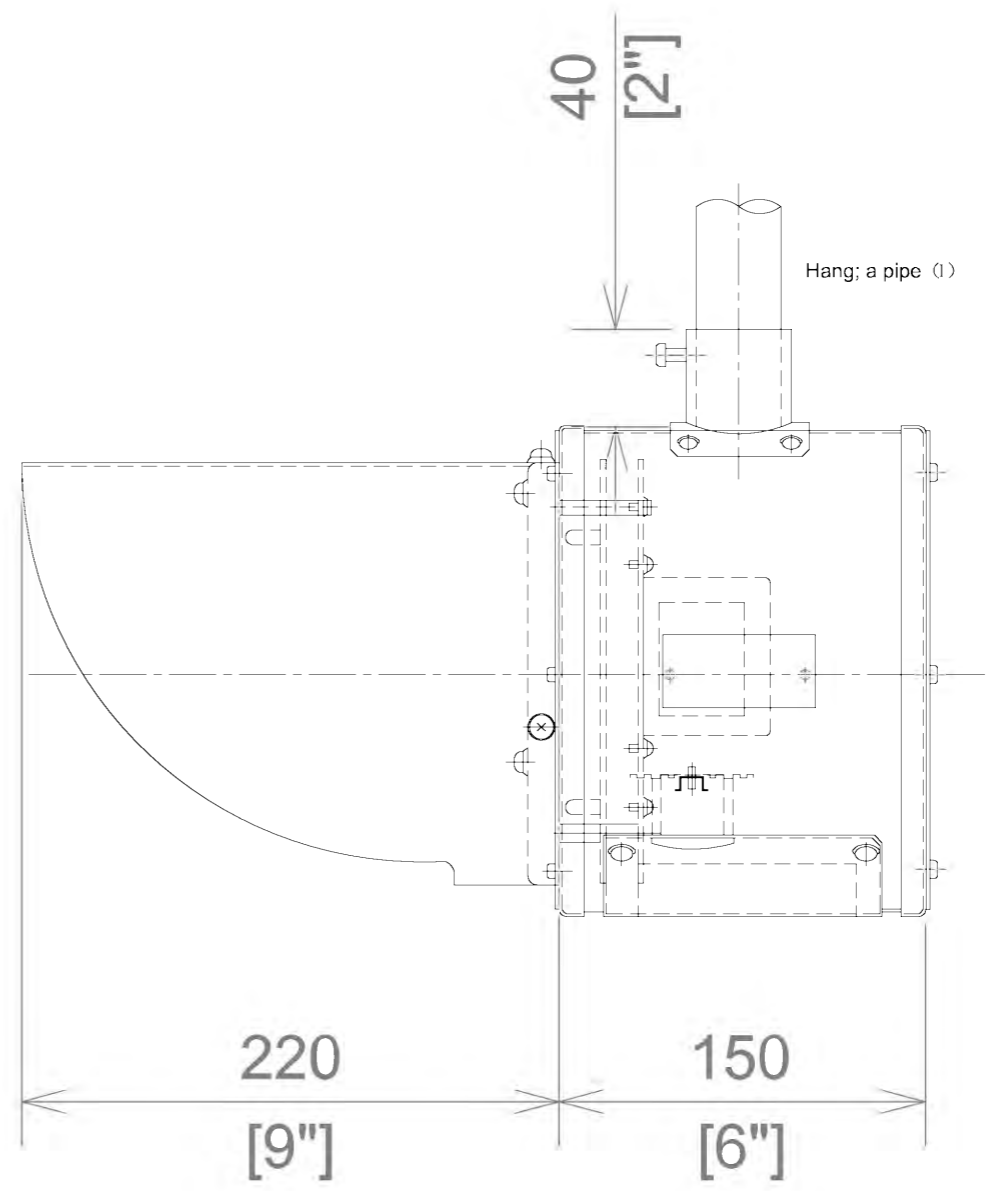
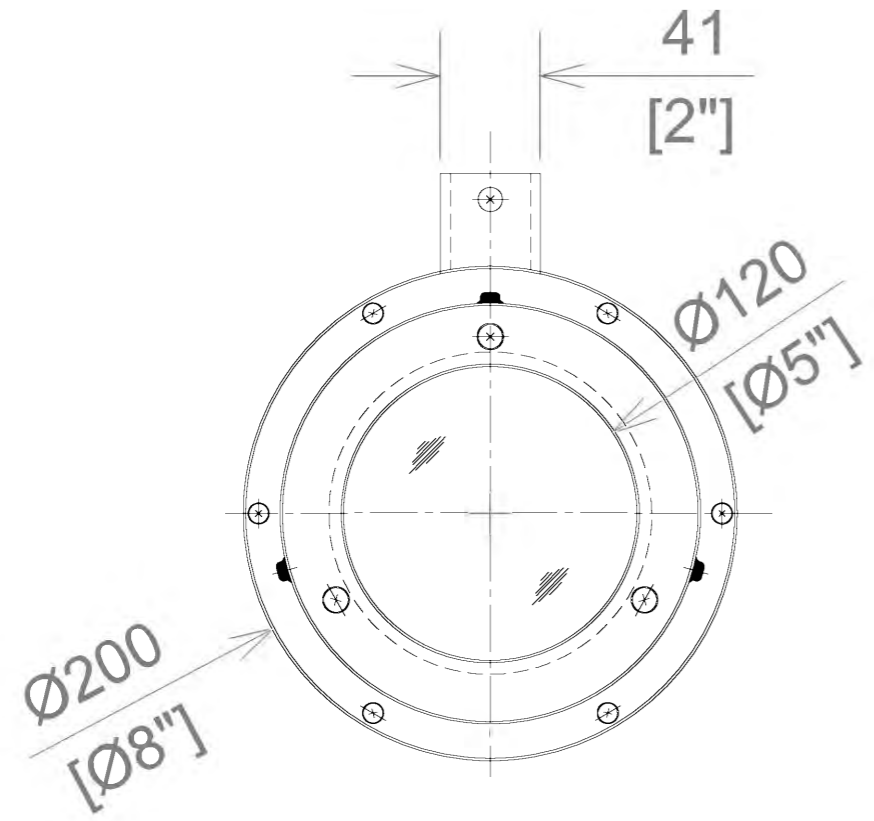
1:20

TITLE:

Outline Drawing
Barrier Machine

DRAWING NUMBER

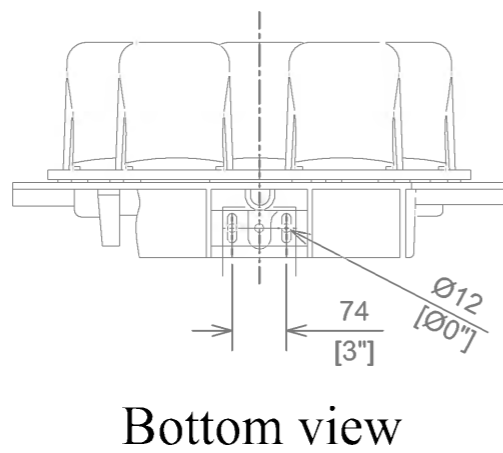
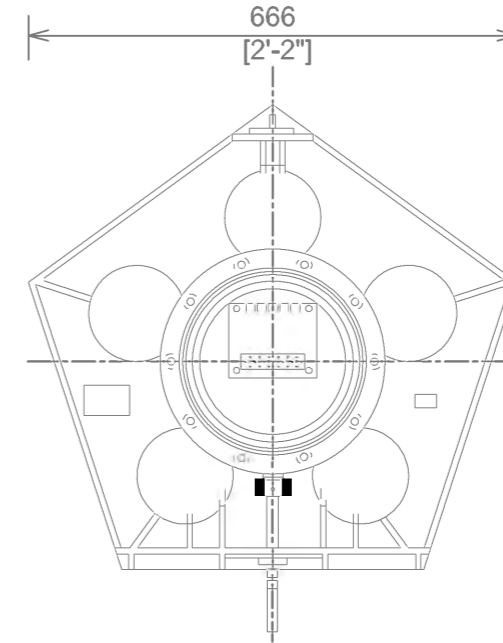
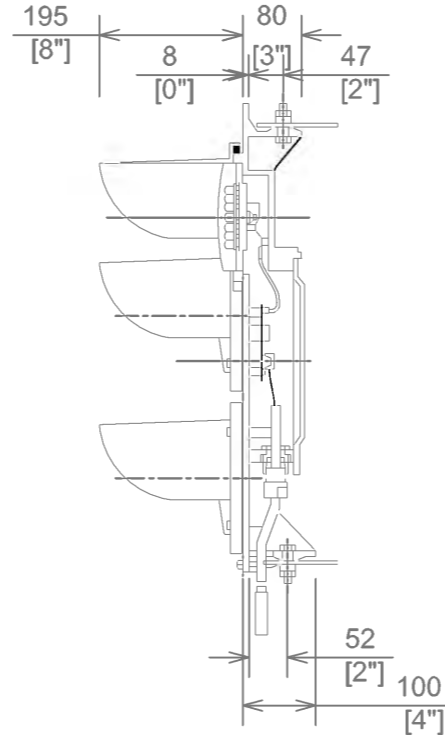
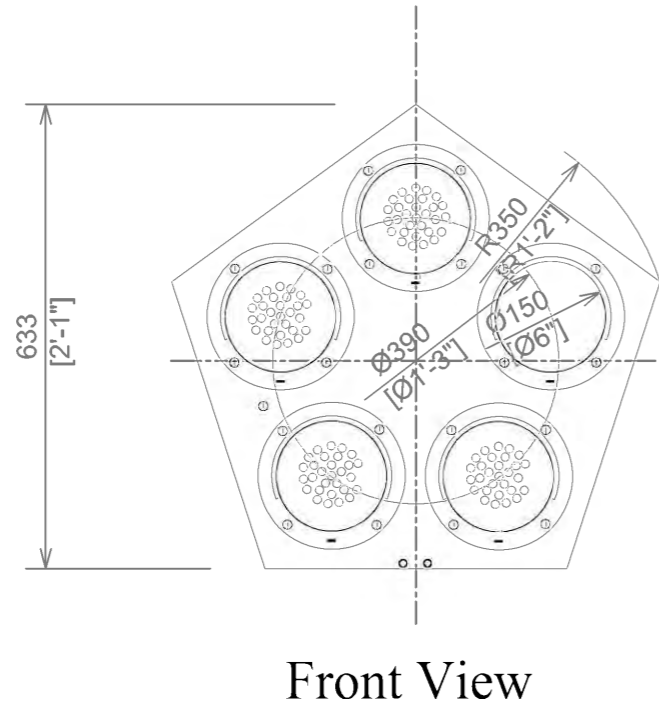
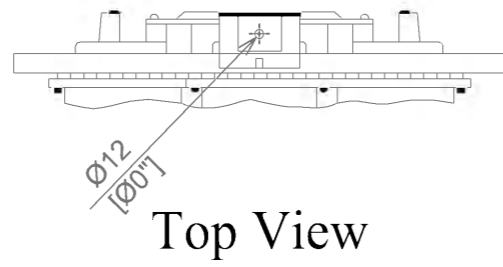
BD2-05-07



for reference

154

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
LEGEND				SCALE: 1:3	TITLE: Outline Drawing Gate signal
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - · Overhead line — — — — —	Startup Fall Through Earthing Hand Hall	600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP	DRAWING NUMBER BD2-05-08	



for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

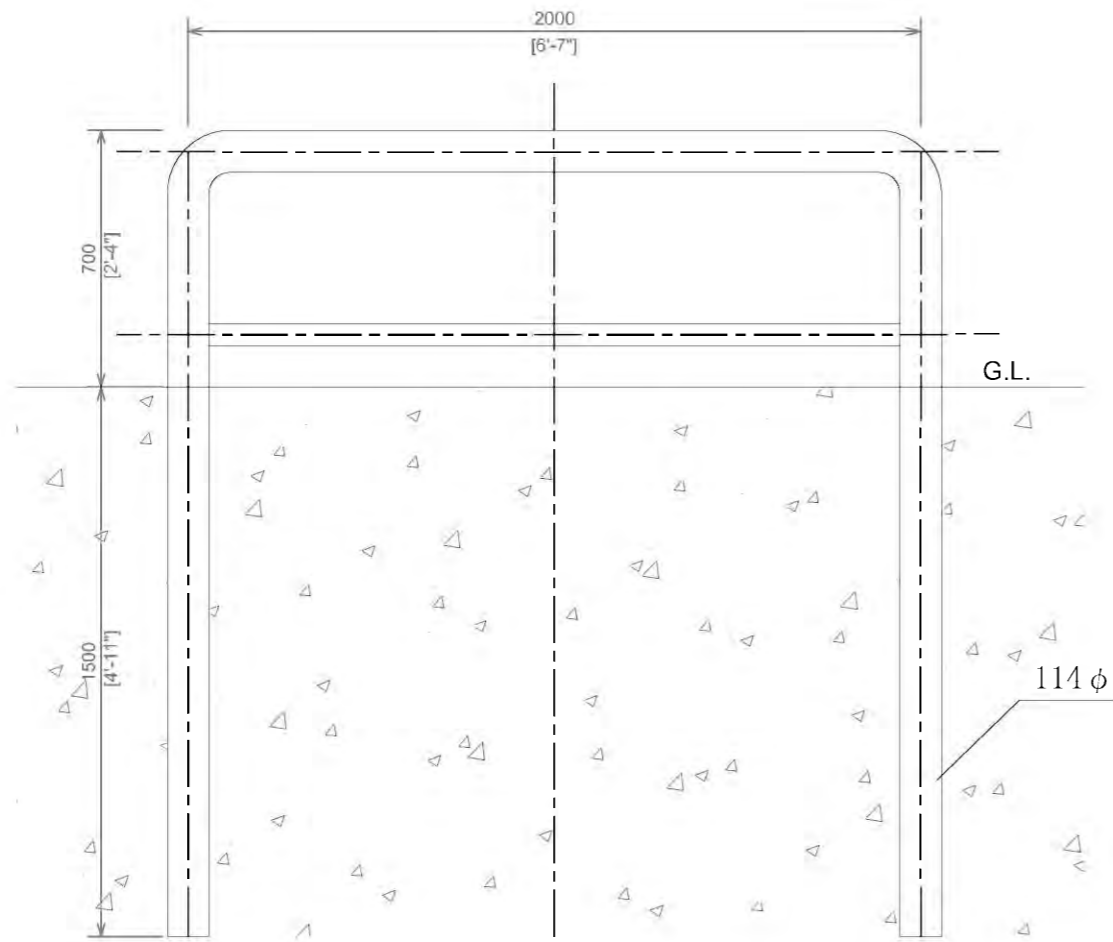
1: 10

TITLE:

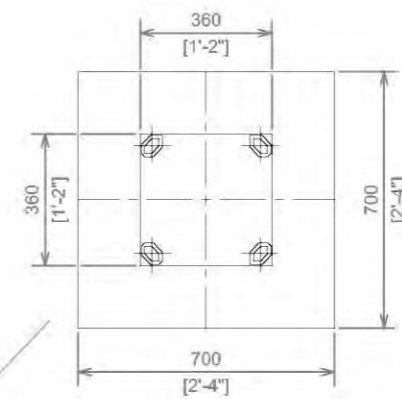
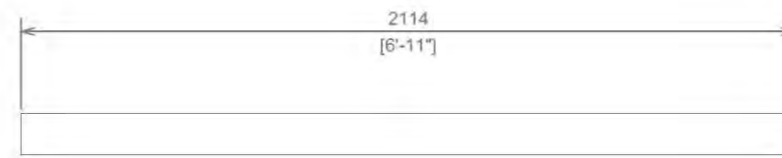
Outline Drawing
Obstruction warning signal(Rotary signal type)

DRAWING NUMBER

BD2-05-09



Front View



Barrier Machine Warning Device

Top View

for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

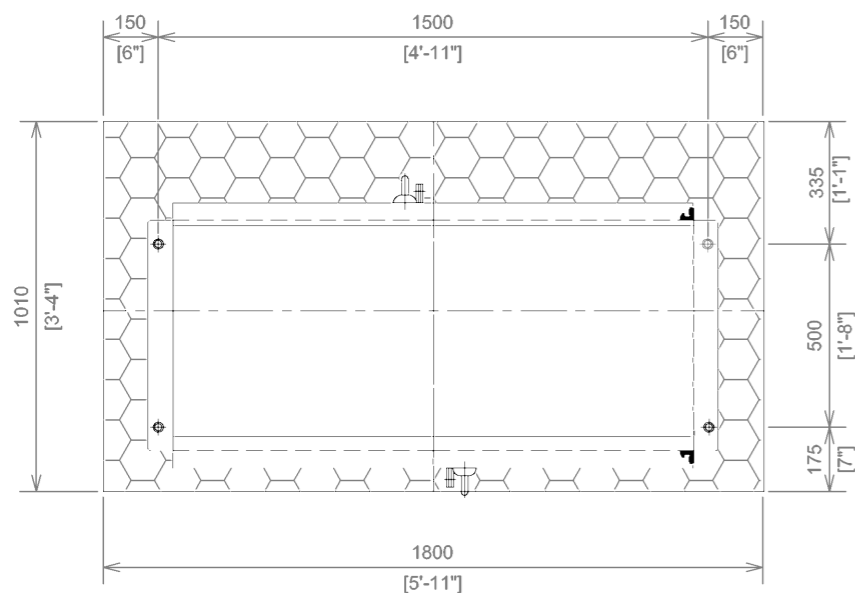
1:20

TITLE:

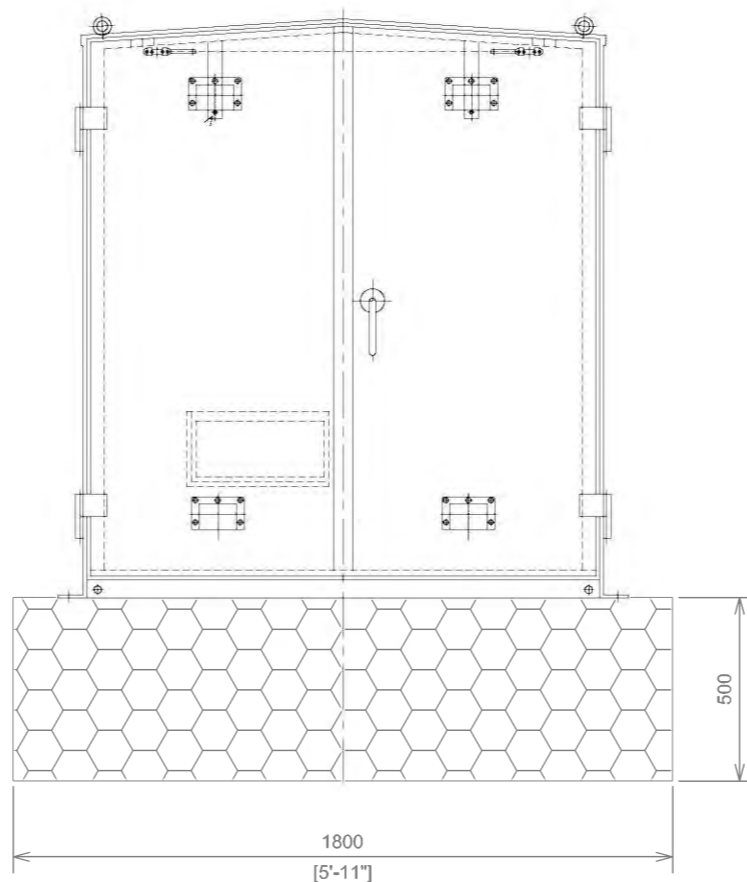
Outline Drawing
Fence

DRAWING NUMBER

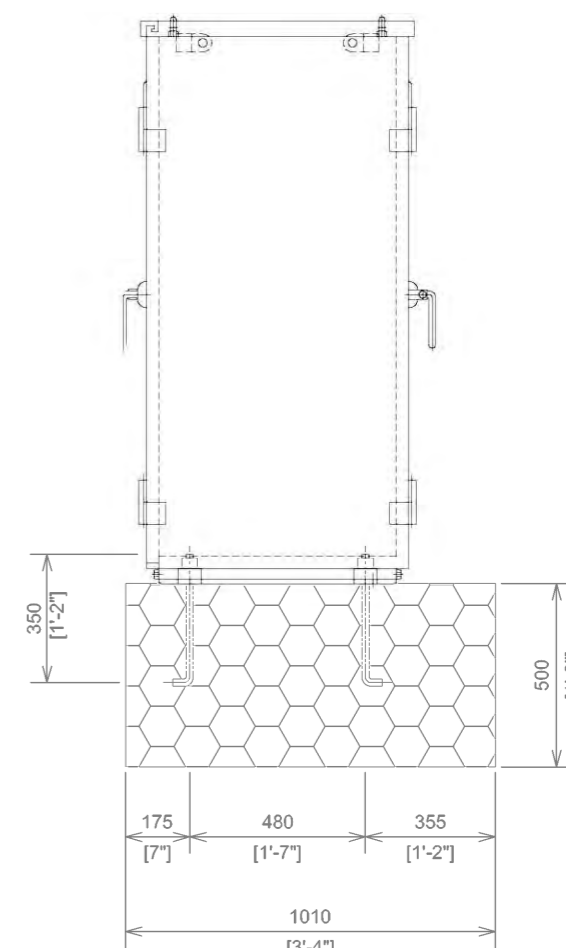
BD2-05-10



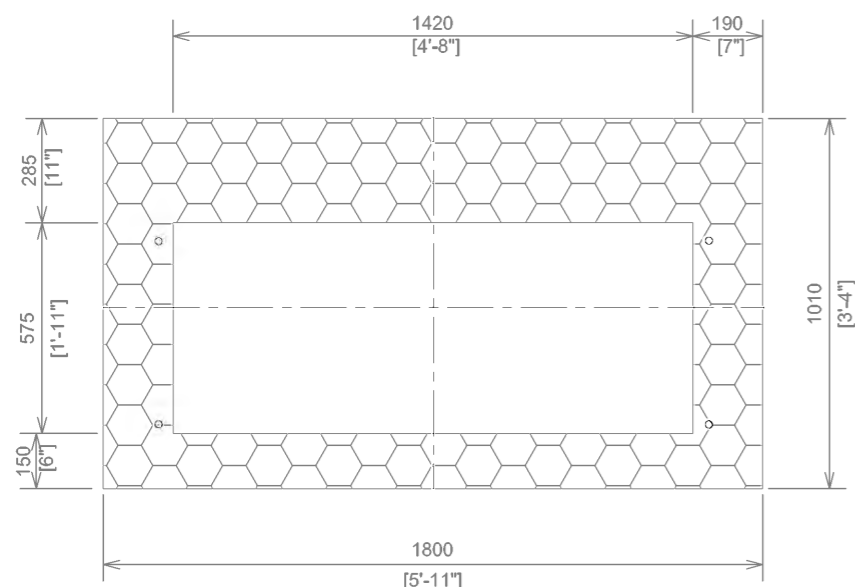
Top View



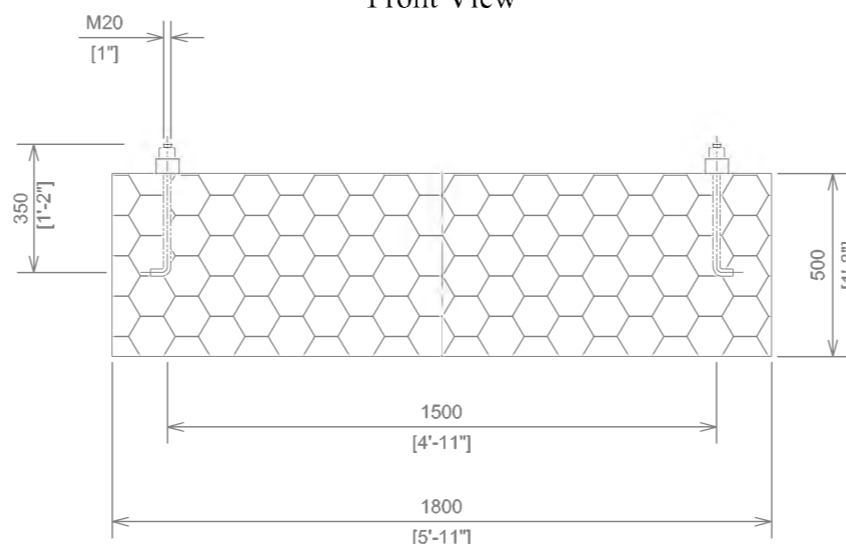
Front View



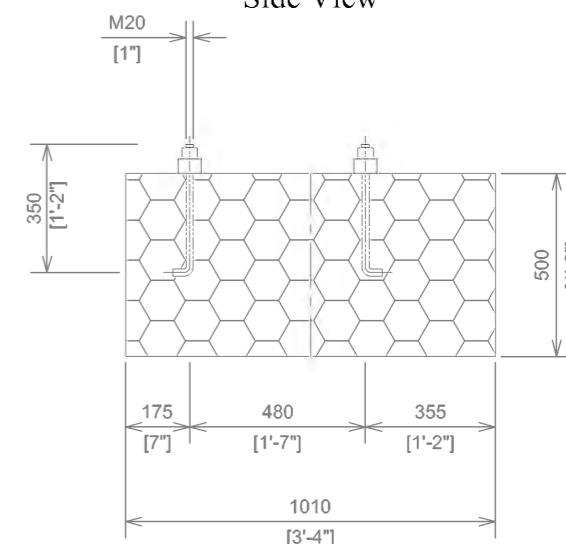
Side View



Top View



Front View



Side View

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

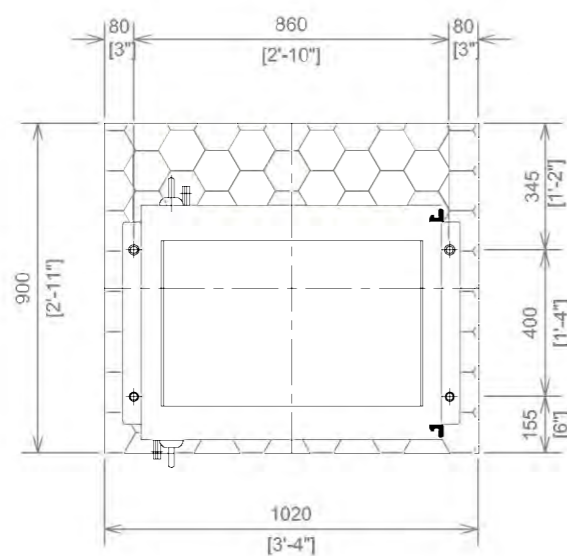
1:20

TITLE:

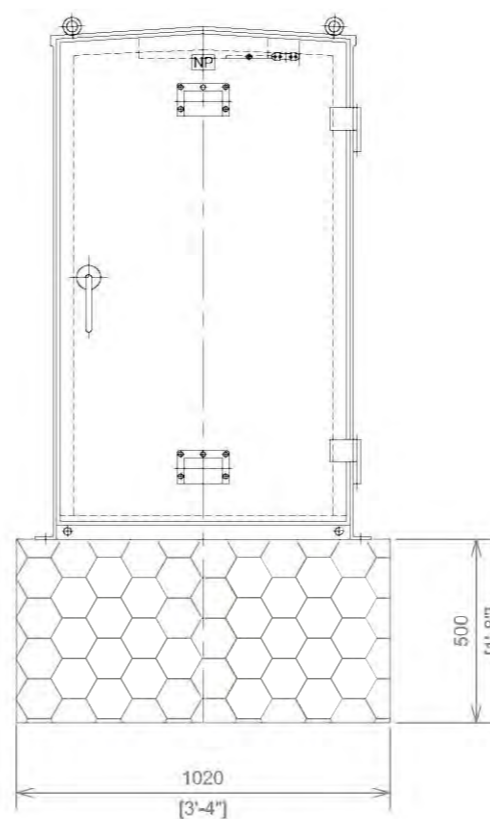
Foundation Drawing
For Instrument box(N-3A type)

DRAWING NUMBER

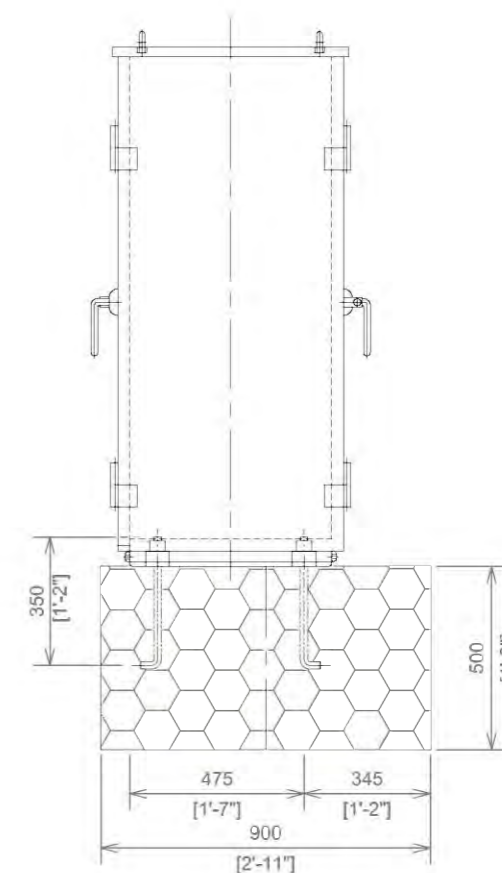
BD2-06-01



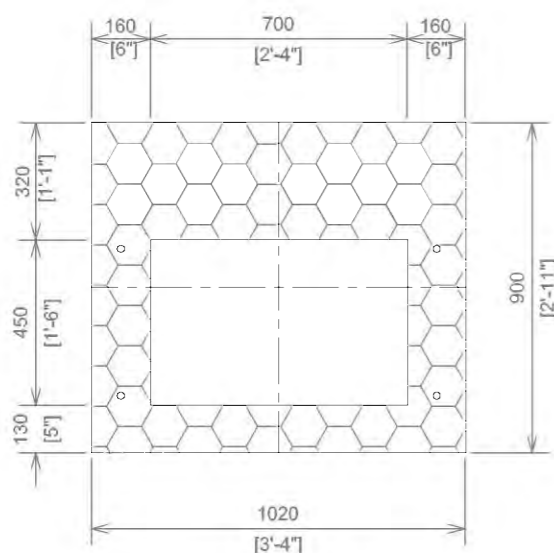
Top View



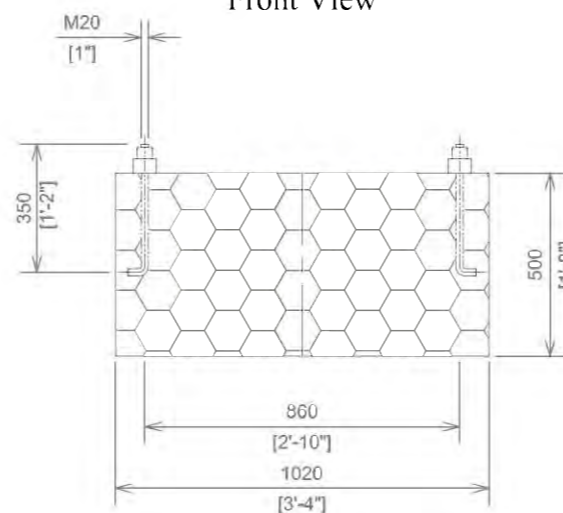
Front View



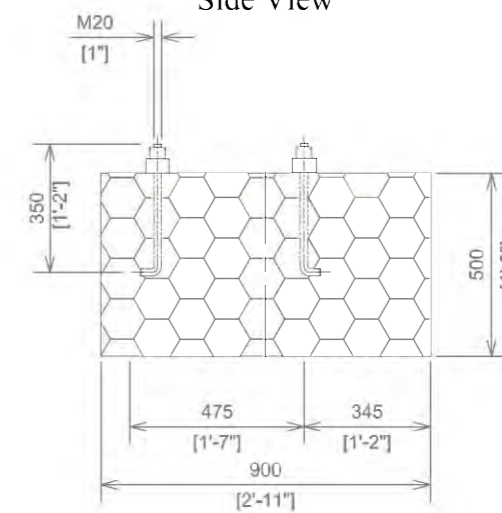
Side View



Top View



Front View



Side View

for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Start-up	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

1:20

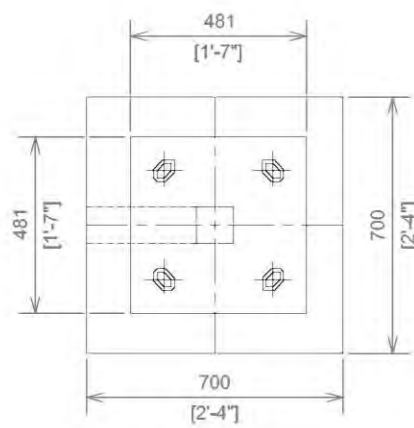
TITLE:

Foundation Drawing
For Instrument box(N-2 type)

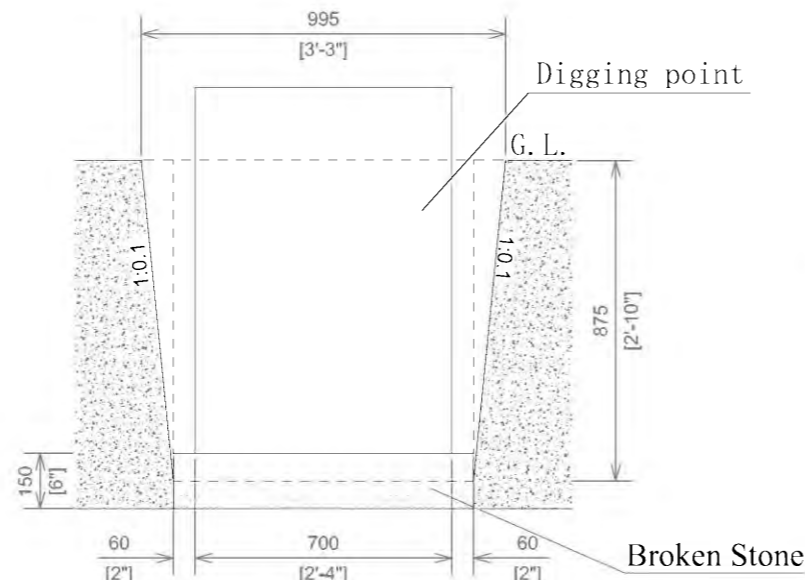
DRAWING NUMBER

BD2-06-02

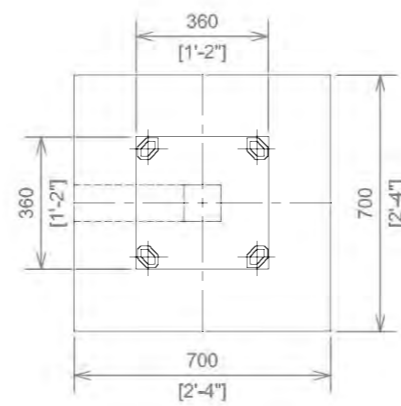
DRAWING NUMBER BD2-06-03



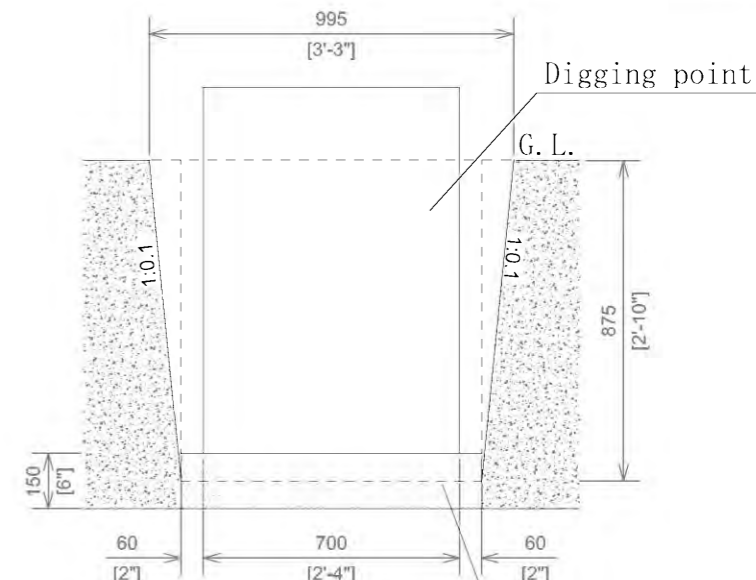
Top View



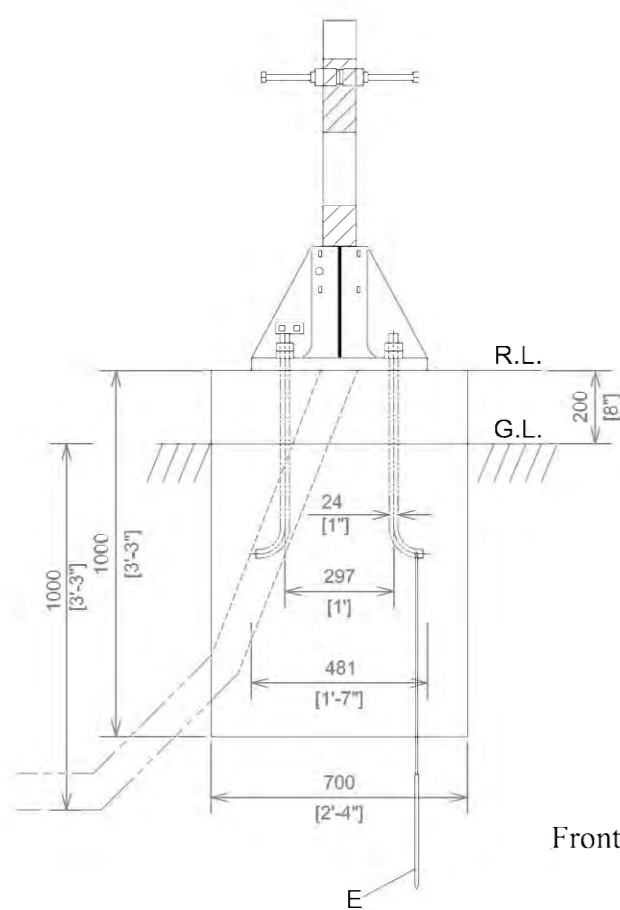
Sectional View



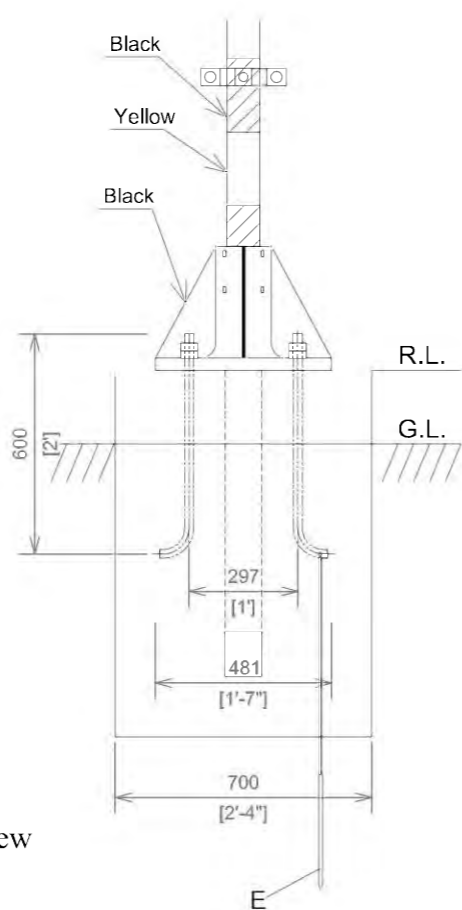
Top View



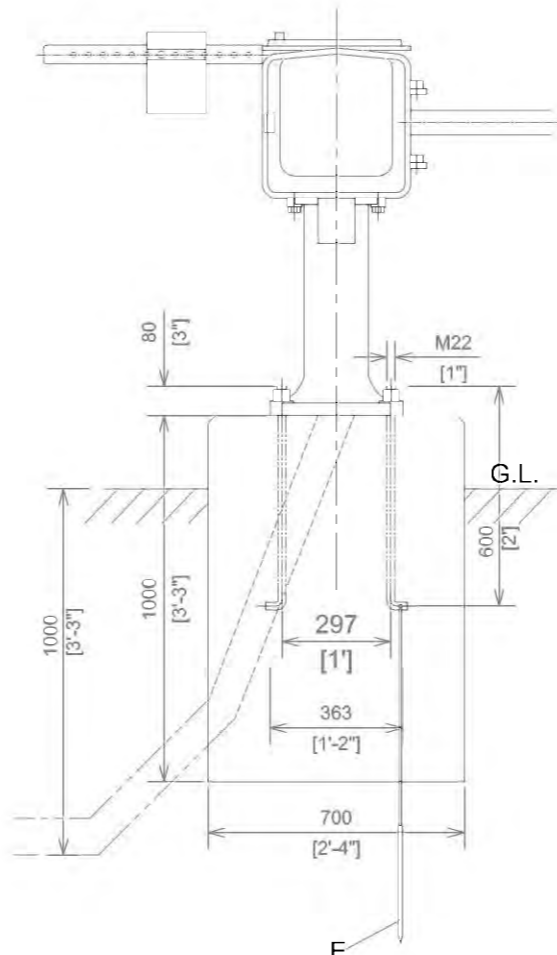
Sectional View



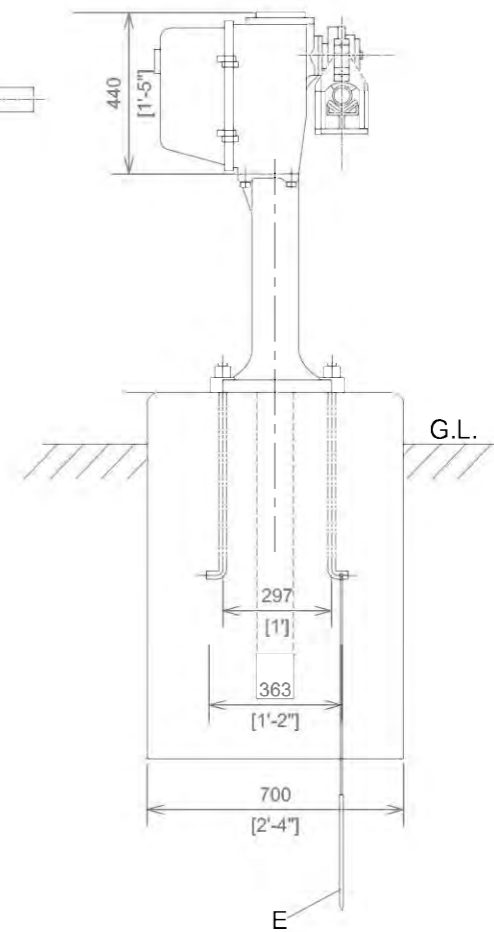
Front View



Front View



Concrete Foundation (3A Type)
For Electric Barrier Machine



Concrete Foundation (3A Type)
For Warning Device

NOTES: 1. 2.	
LEGEND	
Ceiling concealment line	Startup
Floor concealment line	Fall
Exposure Wiring	Through
Undergrounding wiring	Earthing
Overhead line	Hand Hall
600V Vinyl insulation electric wire	IV
Polyethylene insulation cable	CV
Vinyl insulation cable for control	CVV
Communication cable	CPEV
UTP cable	UTP

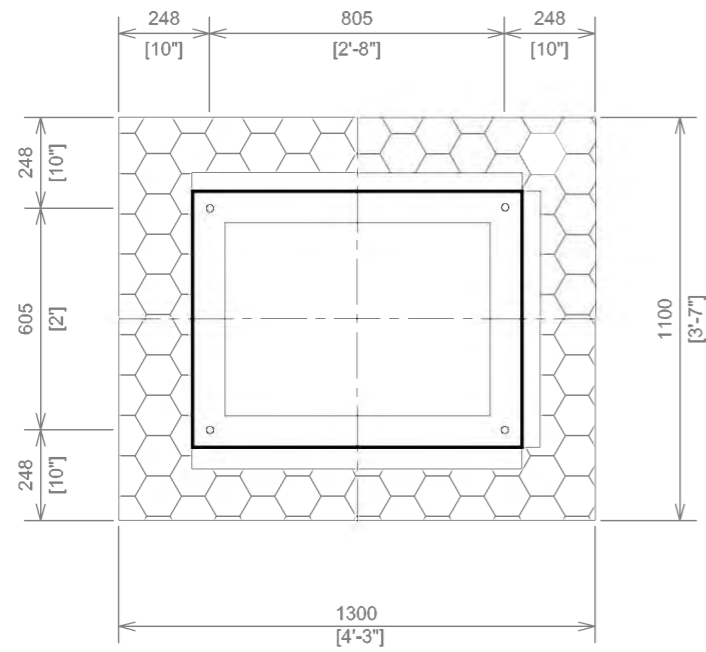
CLIENT:  Japan International Cooperation Agency

CONSULTANTS: Consortium of JIC and OC
 Japan International Consultants for Transportation Co., Ltd.
 Oriental Consultants Co., Ltd.

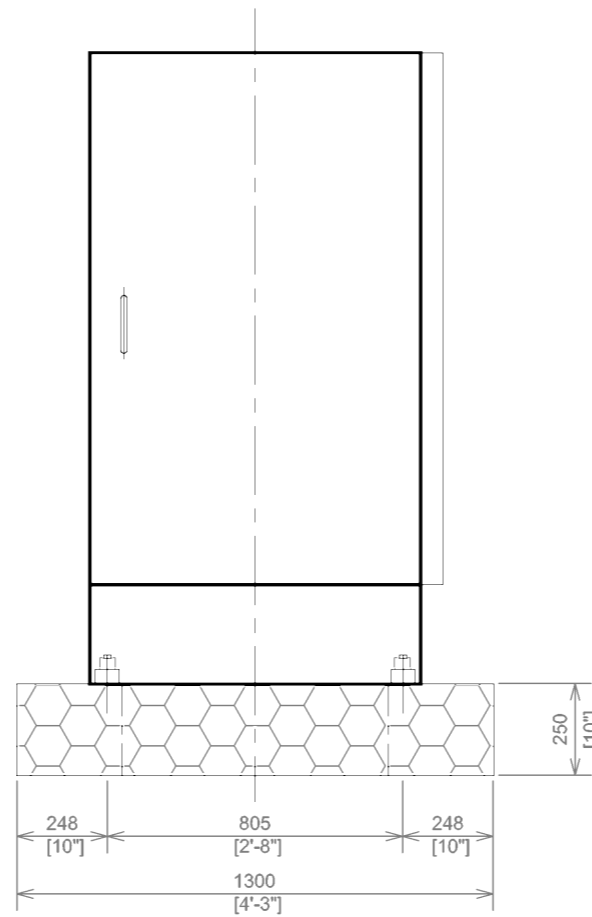
DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

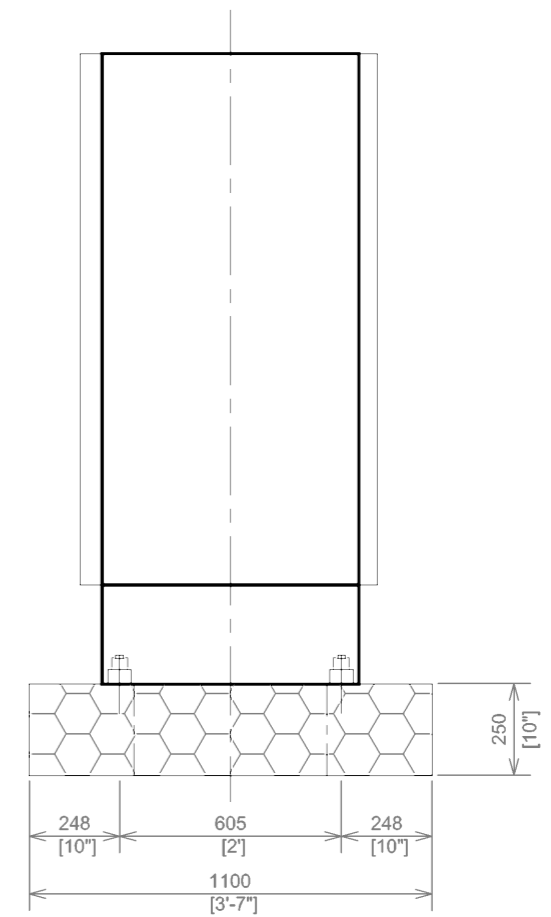
PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment	
ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line	
SCALE:	TITLE:
1:20	Foundation Drawing 3A Type
DRAWING NUMBER	BD2-06-03



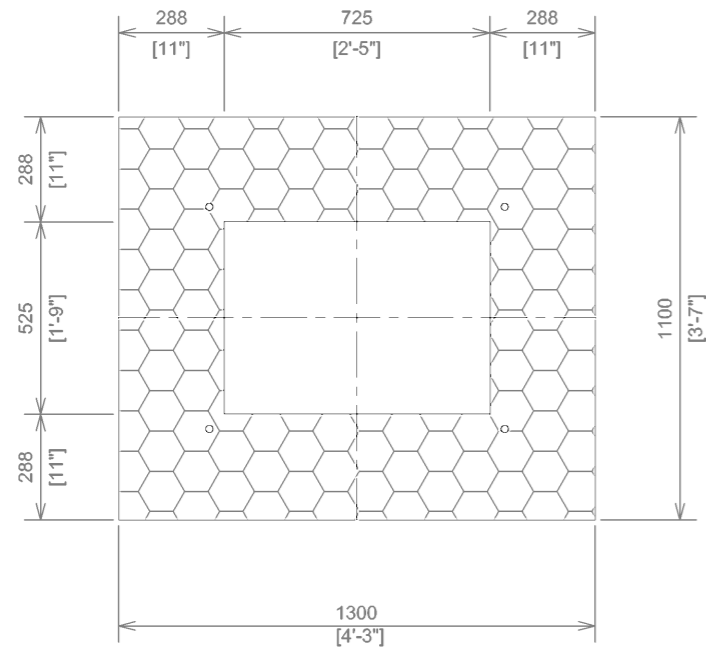
Top View



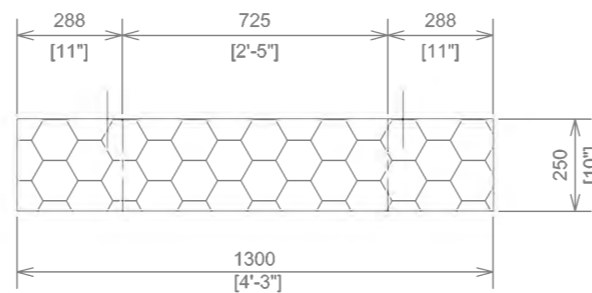
Front View



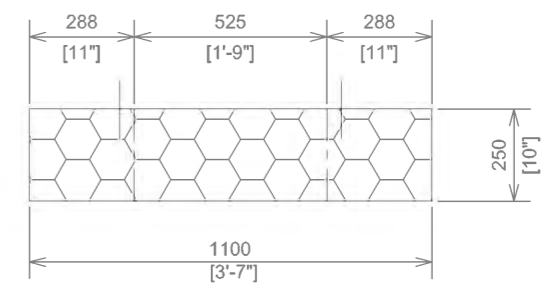
Side View



Top View



Front View



Side View

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	—	Startup	⊕	600V Vinyl insulation electric wire	IV
Floor concealment line	- - -	Fall	⊖	Polyethylene insulation cable	CV
Exposure Wiring	- · - · -	Through	⊕	Vinyl insulation cable for control	CVV
Undergrounding wiring	- · - · -	Earthing	⊕	Communication cable	CPEV
Overhead line	- - -	Hand Hall	⊕	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

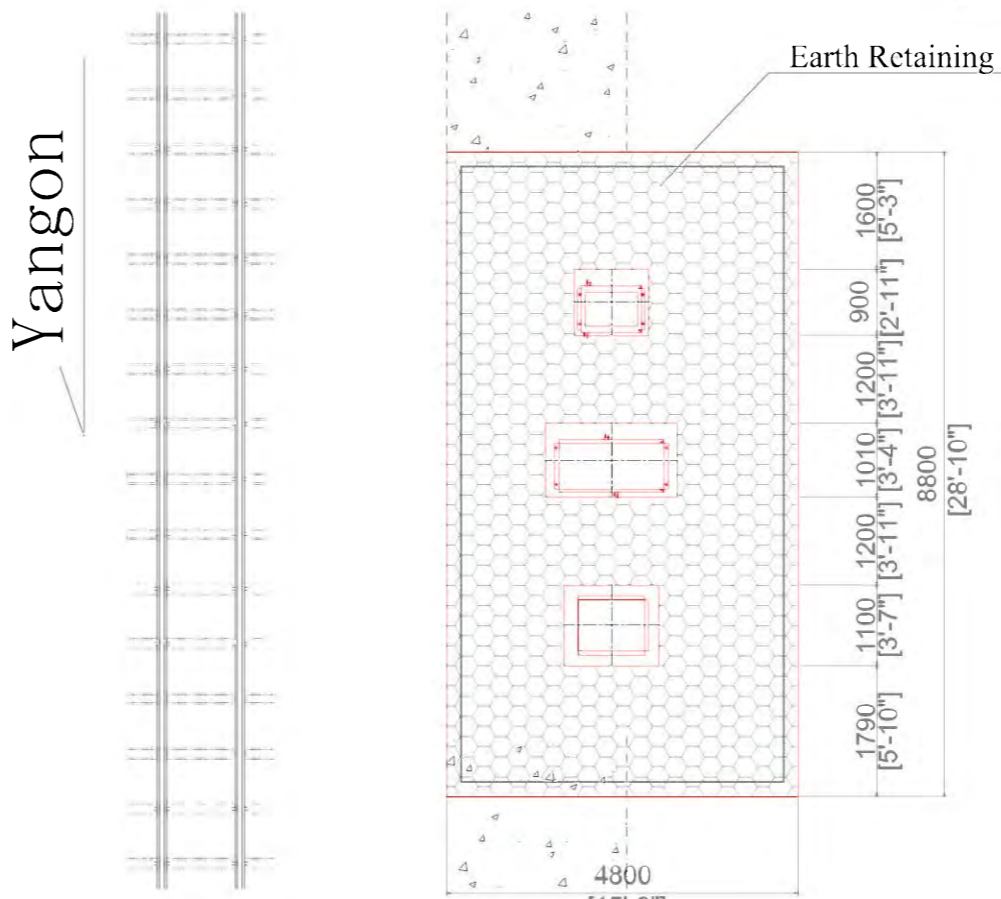
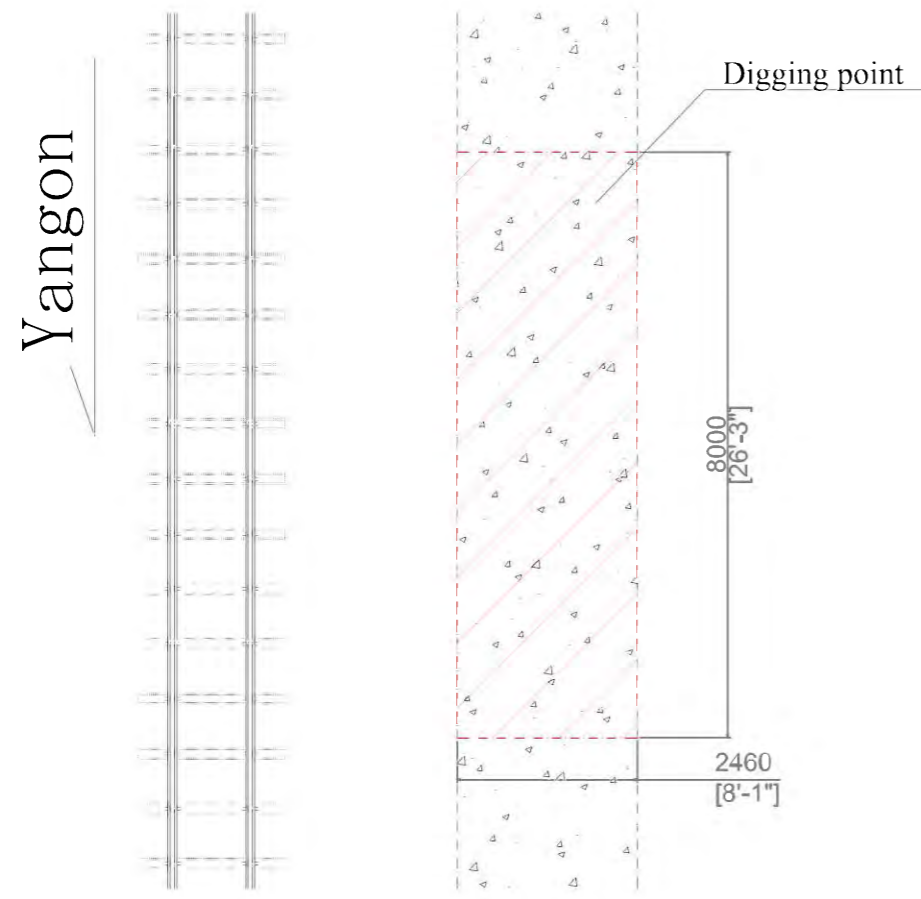
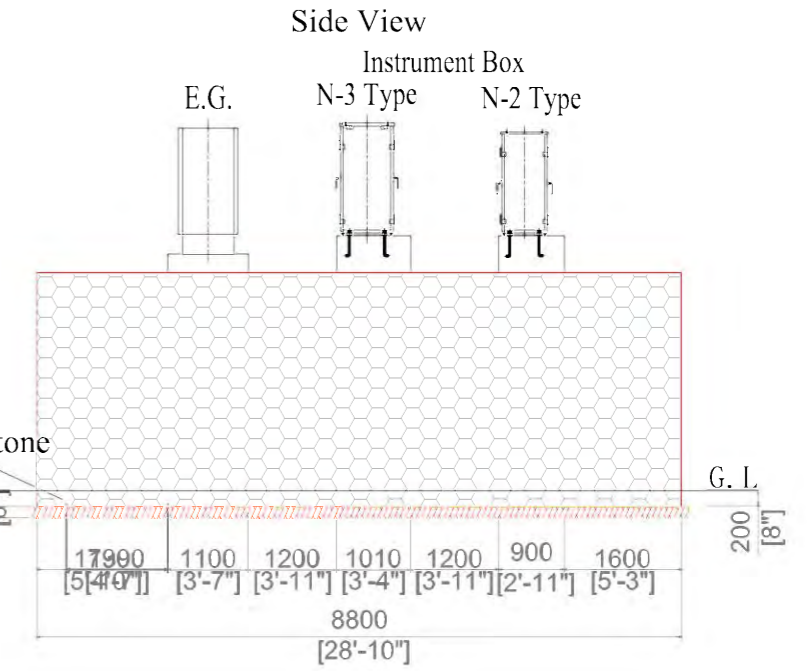
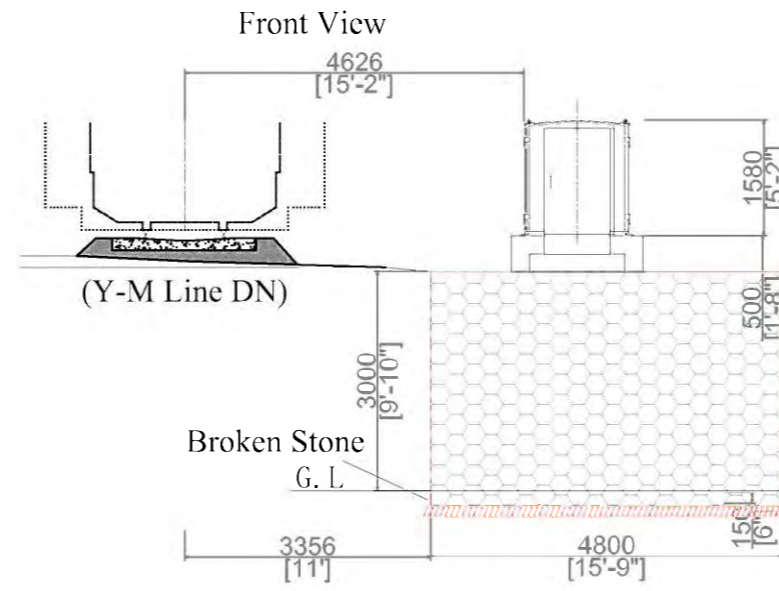
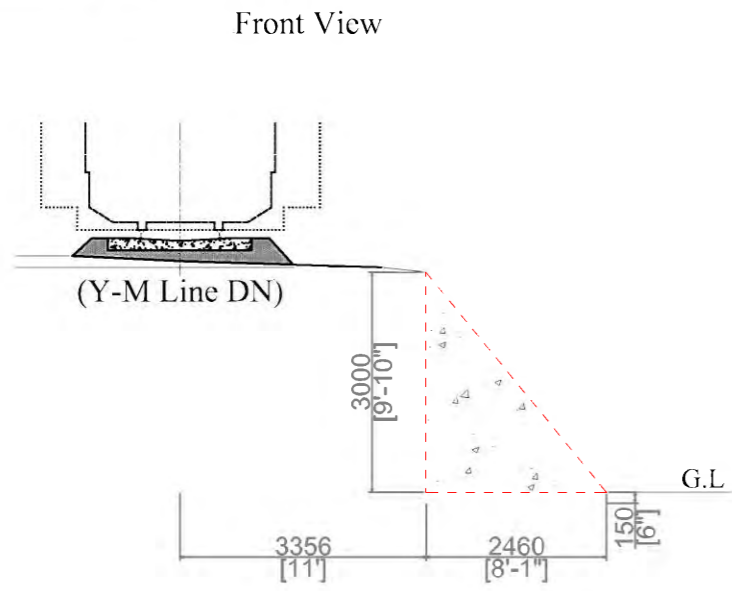
1:20

TITLE:

Foundation Drawing
Engine Generator

DRAWING NUMBER

BD2-06-04



Top View
Digging point

Top View
Earth Retaining

NOTES:
1.
2.

LEGEND			
Ceiling concealment line	—	Startup	IV
Floor concealment line	- - -	Fall	CV
Exposure Wiring	- - - -	Through	CVV
Undergrounding wiring	- · - · -	Earthing	CPEV
Overhead line	— — — —	Hand Hall	UTP
		600V Vinyl insulation electric wire	IV
		Polyethylene insulation cable	CV
		Vinyl insulation cable for control	CVV
		Communication cable	CPEV
		UTP cable	UTP

CLIENT:

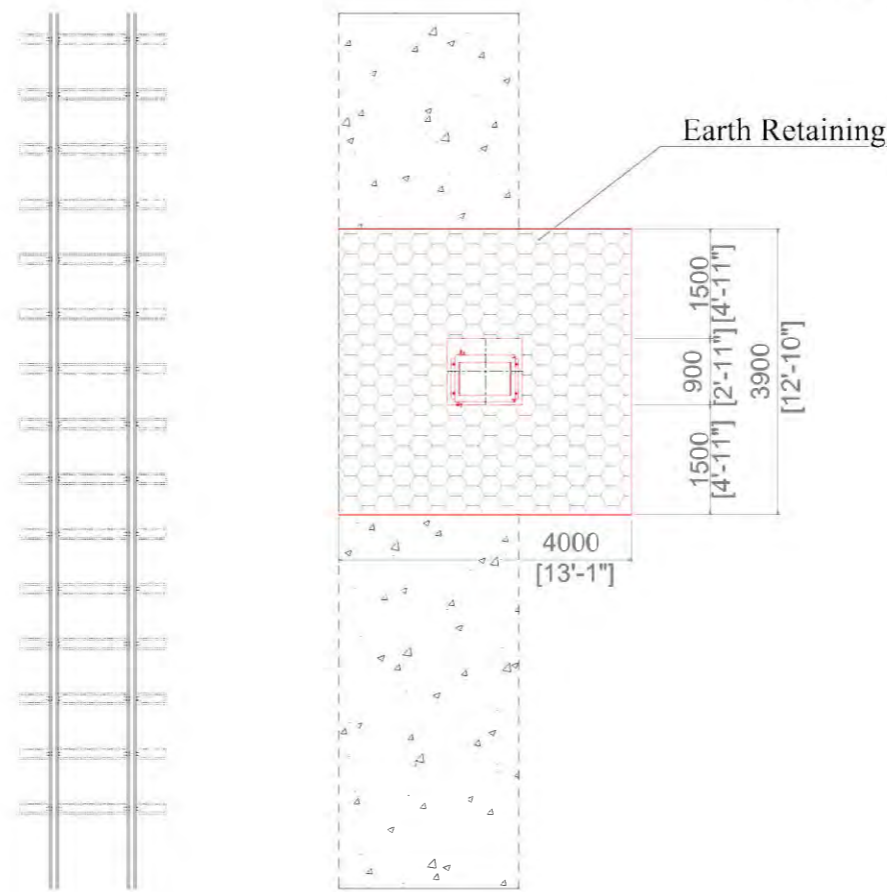
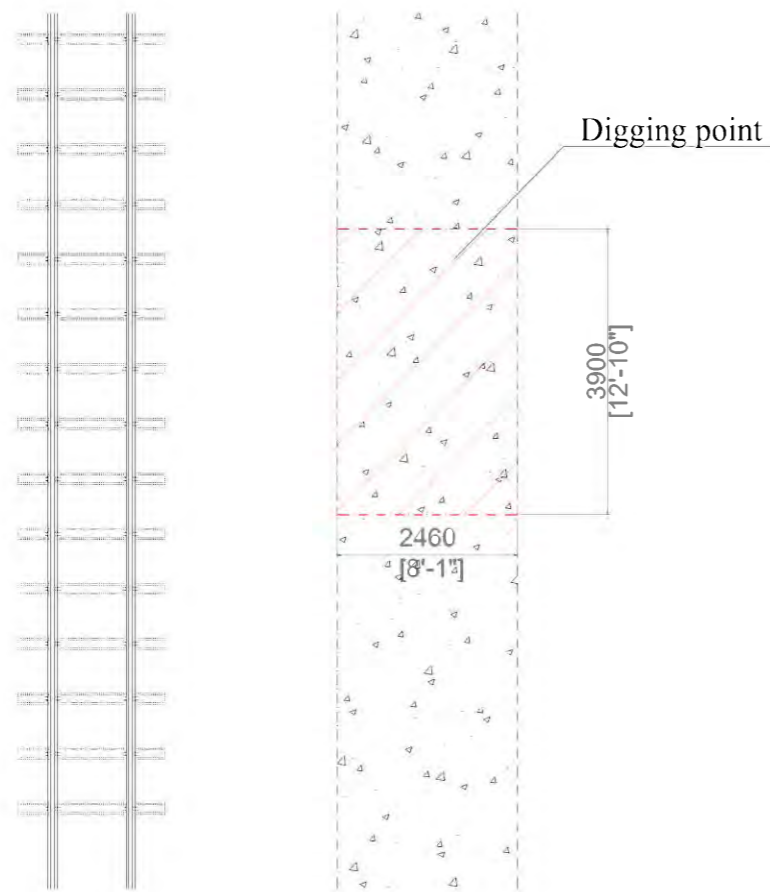
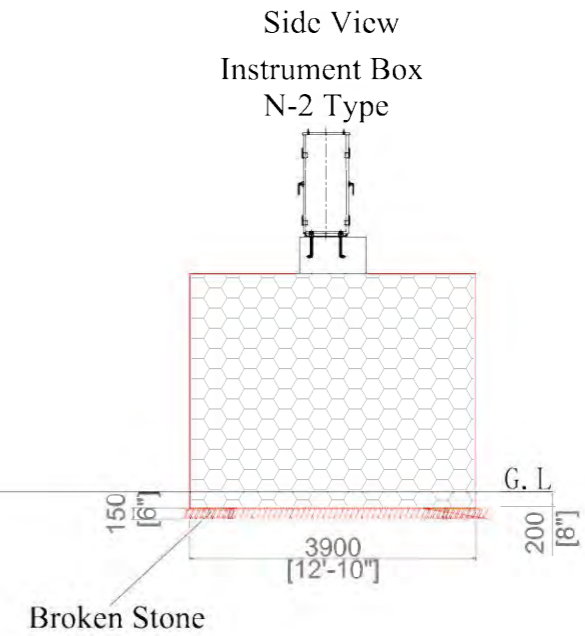
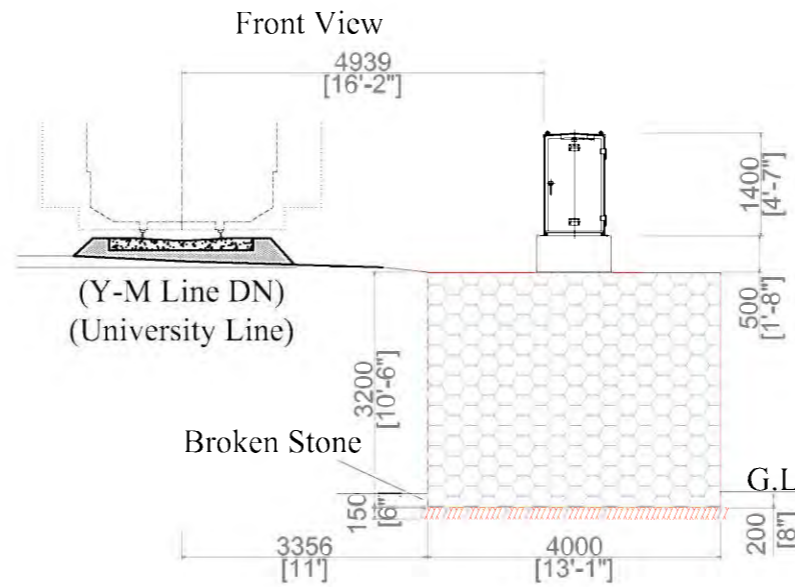
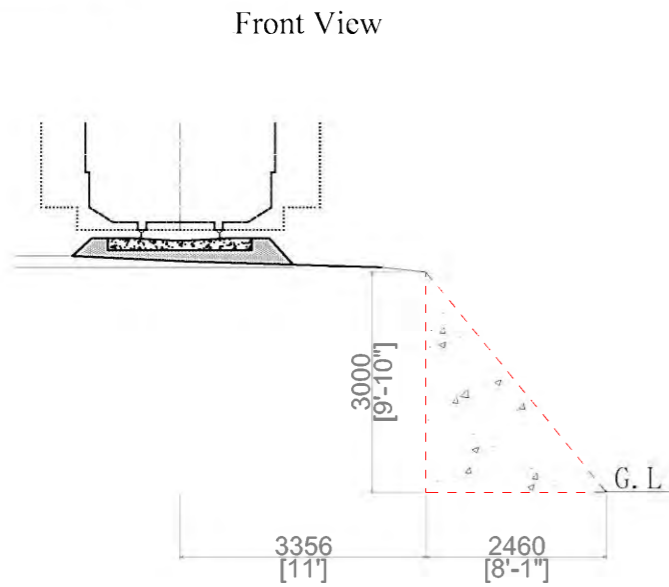
Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC
 
Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:
The Project for Installation of Operation Control Center System and Safety Equipment
ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line
SCALE: 1:100
TITLE: Foundation Drawing Earth Retaining Plan(1)
DRAWING NUMBER: BD2-06-05



Top View
Digging point

Top View
Earth Retaining

NOTES:
1.
2.

LEGEND

Ceiling concealment line	—	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	- - -	Fall	Polyethylene insulation cable	CV
Exposure Wiring	- - - -	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	- · - · - ·	Earthing	Communication cable	CPEV
Overhead line	— — — —	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

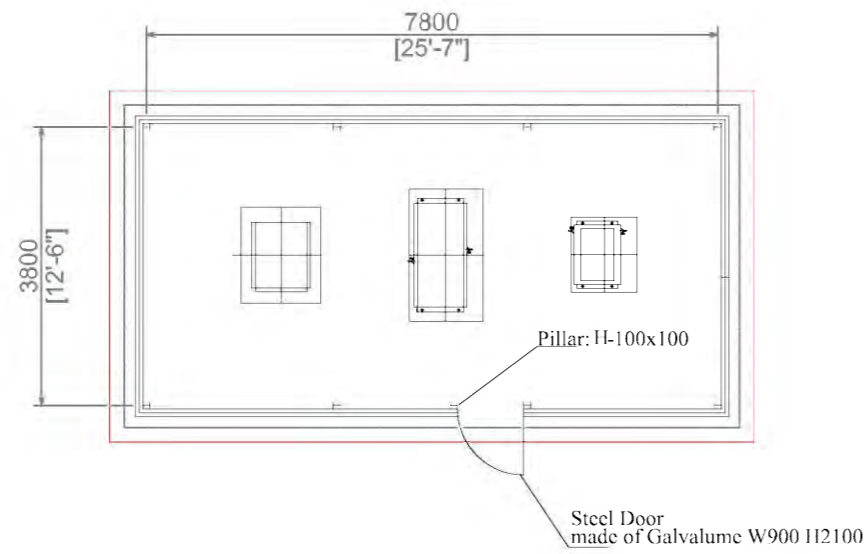
1:100

TITLE:

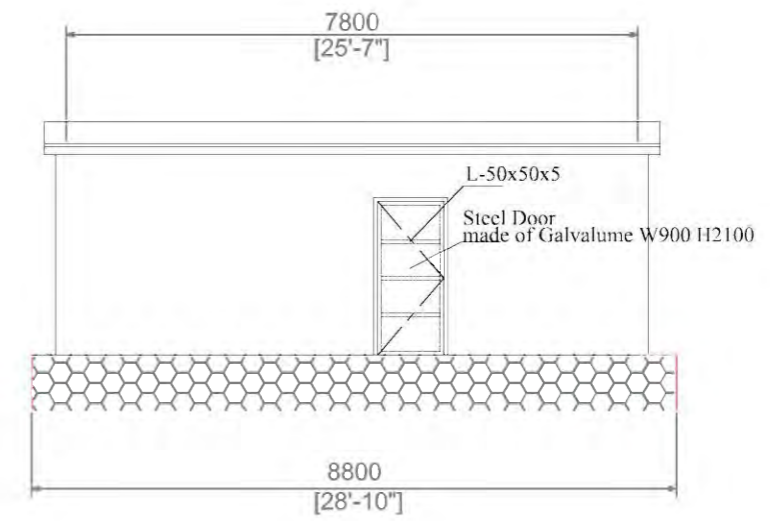
Foundation Drawing
Earth Retaining Plan(2)

DRAWING NUMBER

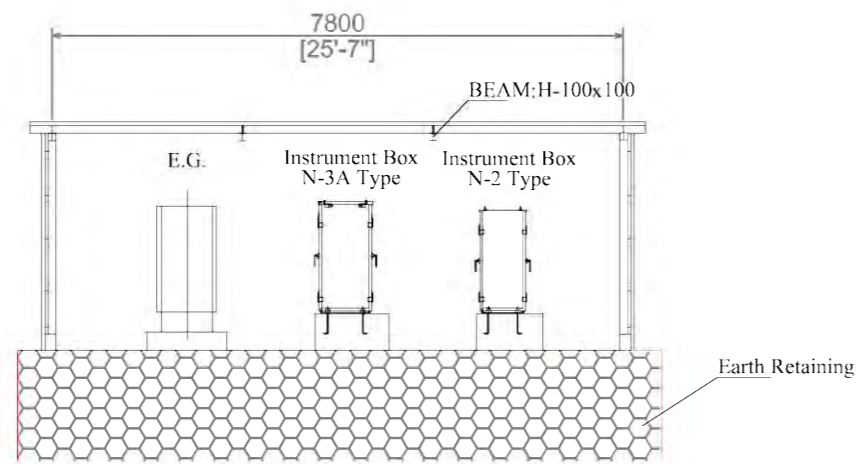
BD2-06-06



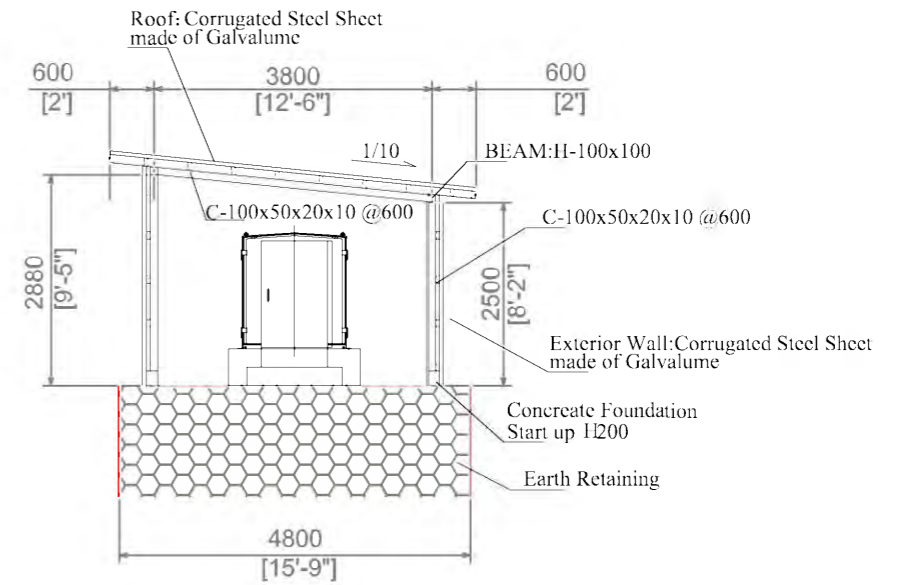
Top View



Rear view



Cross-sectional view



Longitudinal Section profile

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

ii) Automatic alarm device for level crossings of Yangon-Mandalay Main Line

SCALE:

1:100

TITLE:

Foundation Drawing
Earth Retaining Plan(3)

DRAWING NUMBER

BD2-06-07

iii) Centralized Train Monitoring System in Bago division OCC area (Yangon - Pyuntaza section) for reference

Drawings List

Drawing Number	TITLE	Scale	Drawing Number	TITLE	Scale
BD3-02-01-101	Yangon Detail diagram (2 / 3)	1:100	BD3-02-01-203	Yangon Detail diagram(2/2)	1:100
BD3-02-02-101	Pzundaung Layout drawing	1:100	BD3-02-02-201	Pazundaung Detail diagram(1/2)	1:50
BD3-02-03-101	Mahlwagon Detail diagram (1 / 2)	1:50	BD3-02-02-202	Pazundaung Detail diagram(2/2)	1:50
BD3-02-03-102	Mahlwagon Detail diagram (2 / 2)	1:50	BD3-02-03-201	Mahlwagon, Thingangyun, Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu Detail diagram	1:50
BD3-02-04-101	Thingangyun Detail diagram (1 / 2)	1:50	BD3-02-04-201	Toegyaungkalay, Ywathagyi, Shwele, Payagyi, Pyinbongyi, Daik-u Detail diagram	1:50
BD3-02-04-102	Thingangyun Detail diagram (2 / 2)	1:50	BD3-02-05-201	Darbain, Bago Detail diagram	1:50
BD3-02-05-101	Toegyaungkalay Detail diagram (1 / 3)	1:50	BD3-02-06-201	Kadok Detail diagram	1:50
BD3-02-05-102	Toegyaungkalay Detail diagram (2 / 3)	1:50	BD3-02-07-201	Eimshaylayse Detail diagram(1/2)	1:50
BD3-02-05-103	Toegyaungkalay Detail diagram (3 / 3)	1:50	BD3-02-07-202	Eimshaylayse Detail diagram(2/2)	1:50
BD3-02-06-101	Ywathagyi Detail diagram (1 / 1)	1:50	BD3-02-08-201	Pyuntaza Detail diagram	1:50
BD3-02-07-101	Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu, Layout drawing	1:100	BD3-02-09-201	Penwegon, Nyaungchidauk, Taungoo, Swa, Thawati Detail diagram	1:50
BD3-02-08-101	Darbain Layout drawing	1:100	BD3-02-10-201	Naypyitaw Layout drawing	1:1000
BD3-02-13-101	Bago Layout drawing	1:100	BD3-02-10-202	Naypyitaw Detail diagram(1/2)	1:100
BD3-02-14-101	Shwele Layout drawing	1:100	BD3-02-10-203	Naypyitaw Detail diagram(2/2)	1:100
BD3-02-15-101	Payagyi Layout drawing	1:100	BD3-02-03-301	Mahlwagon Layout drawing	1:100
BD3-02-16-101	Pyinbongyi Layout drawing	1:100	BD3-02-04-301	Thingangyun Layout drawing	1:100
BD3-02-17-101	Kadok Layout drawing	1:100	BD3-02-07-301	Laydaungkan Layout drawing	1:100
BD3-02-18-101	Panugdawthi Layout drawing	1:100	BD3-02-13-301	Bago Layout drawing	1:200
BD3-02-19-101	Eimshaylayse Layout drawing	1:150	BD3-02-14-301	Shwele Layout drawing	1:150
BD3-02-20-101	Daik-u Layout drawing	1:100	BD3-02-27-301	Naypyitaw Detail diagram (1 / 3)	1:2000
BD3-02-21-101	Pyuntaza Layout drawing	1:100	BD3-02-27-302	Naypyitaw Detail diagram (2 / 3)	1:2000
BD3-02-27-101	Naypyitaw Detail diagram	1:100	BD3-02-27-303	Naypyitaw Detail diagram (3 / 3)	1:2000
BD3-02-01-201	Yangon Layout drawing	1:400	BD3-03-00-101	Train Monitoring System (TMS) System Configuration Diagram	
BD3-02-01-202	Yangon Detail diagram(1/2)	1:50			

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System in Bago division OCC area (Yangon - Pyuntaza section)

SCALE:

Non scale

TITLE:

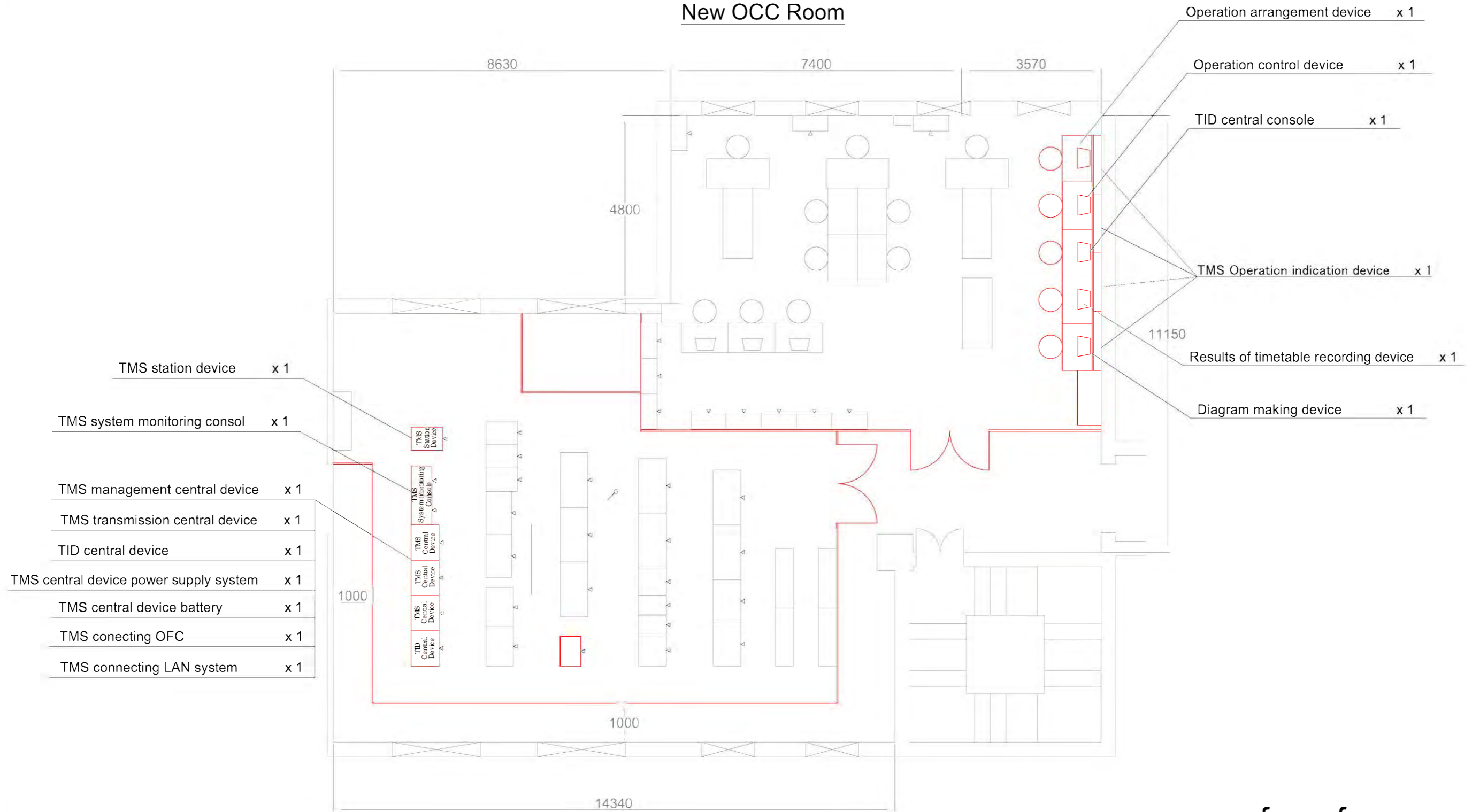
Drawings List (1)

DRAWING NUMBER

BD3-00-00-001

Yangon Detail diagram (2 / 3)

New OCC Room



for reference

NOTES
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

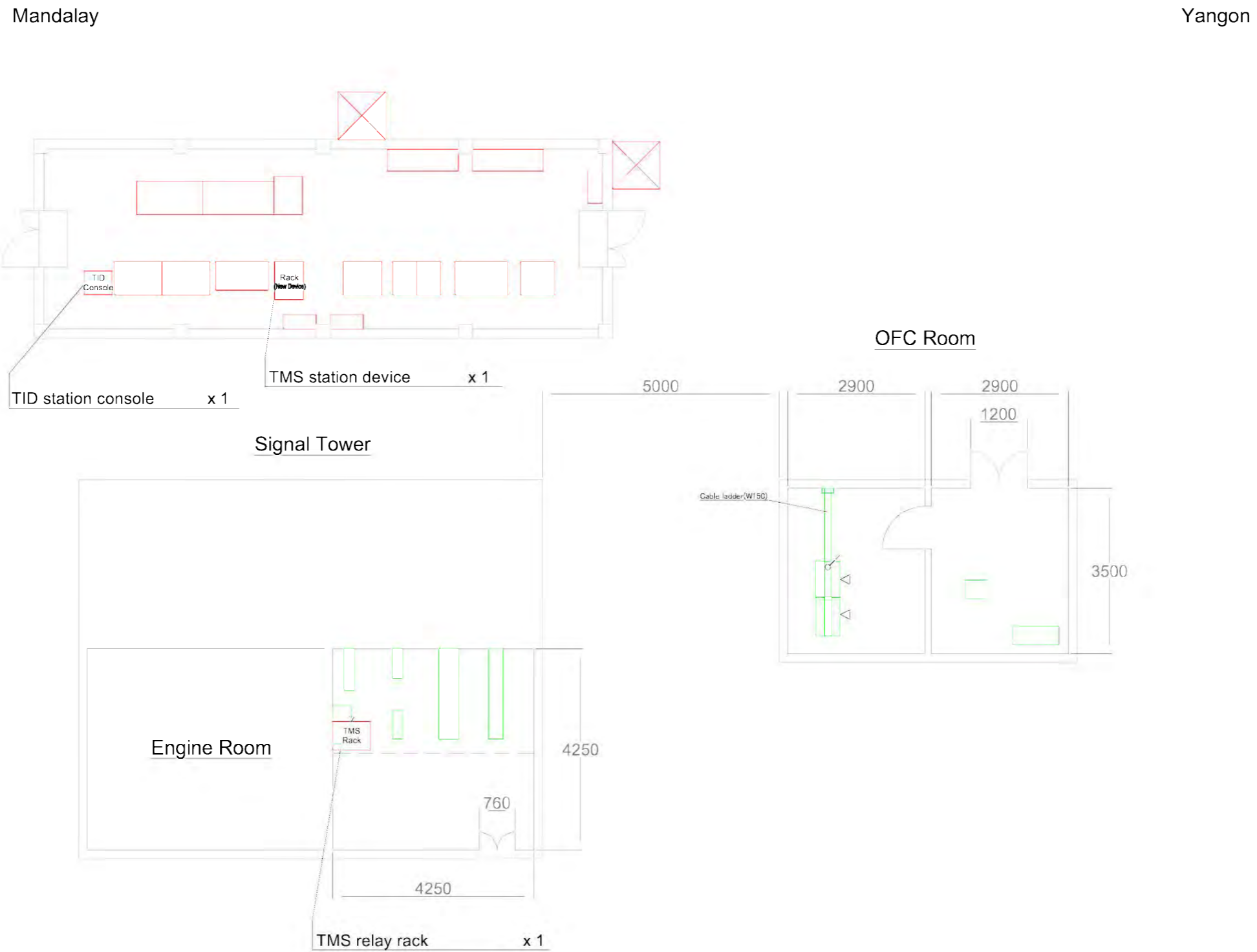
TITLE:

Yangon Detail diagram (2 / 3)

DRAWING NUMBER

BD3-02-01-101

Pazundaung Layout drawing



for reference

NOTES
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

TITLE:

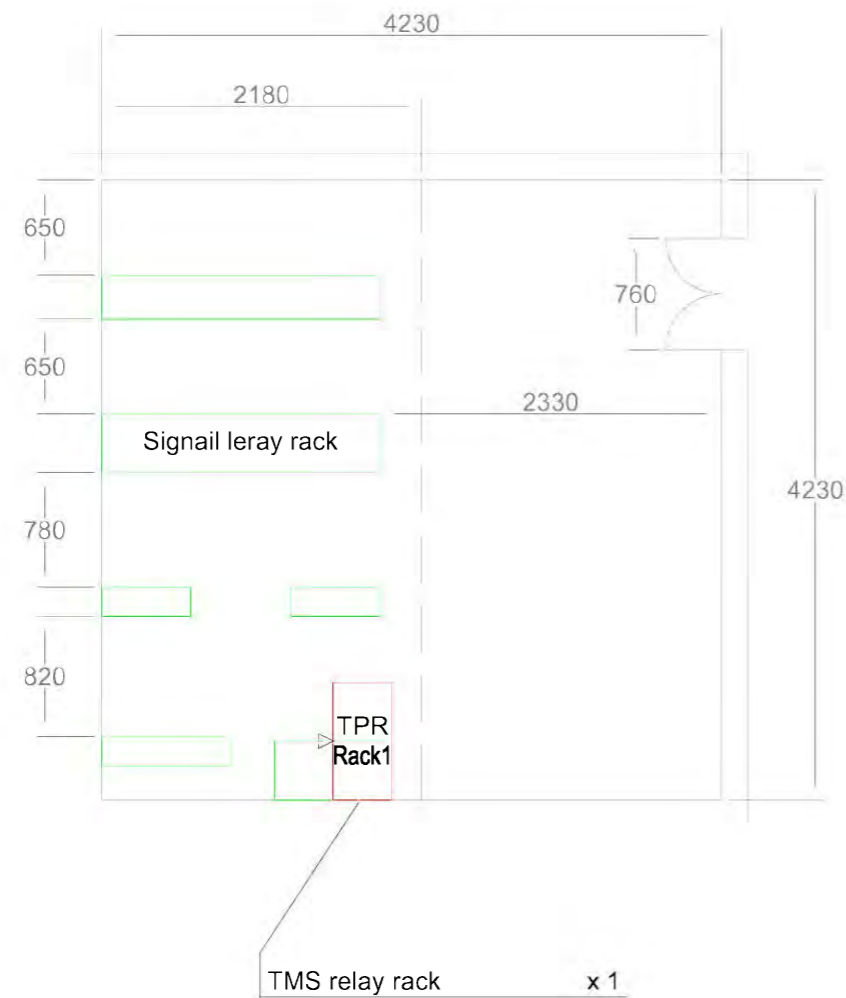
Pazundaung Layout drawing

DRAWING NUMBER

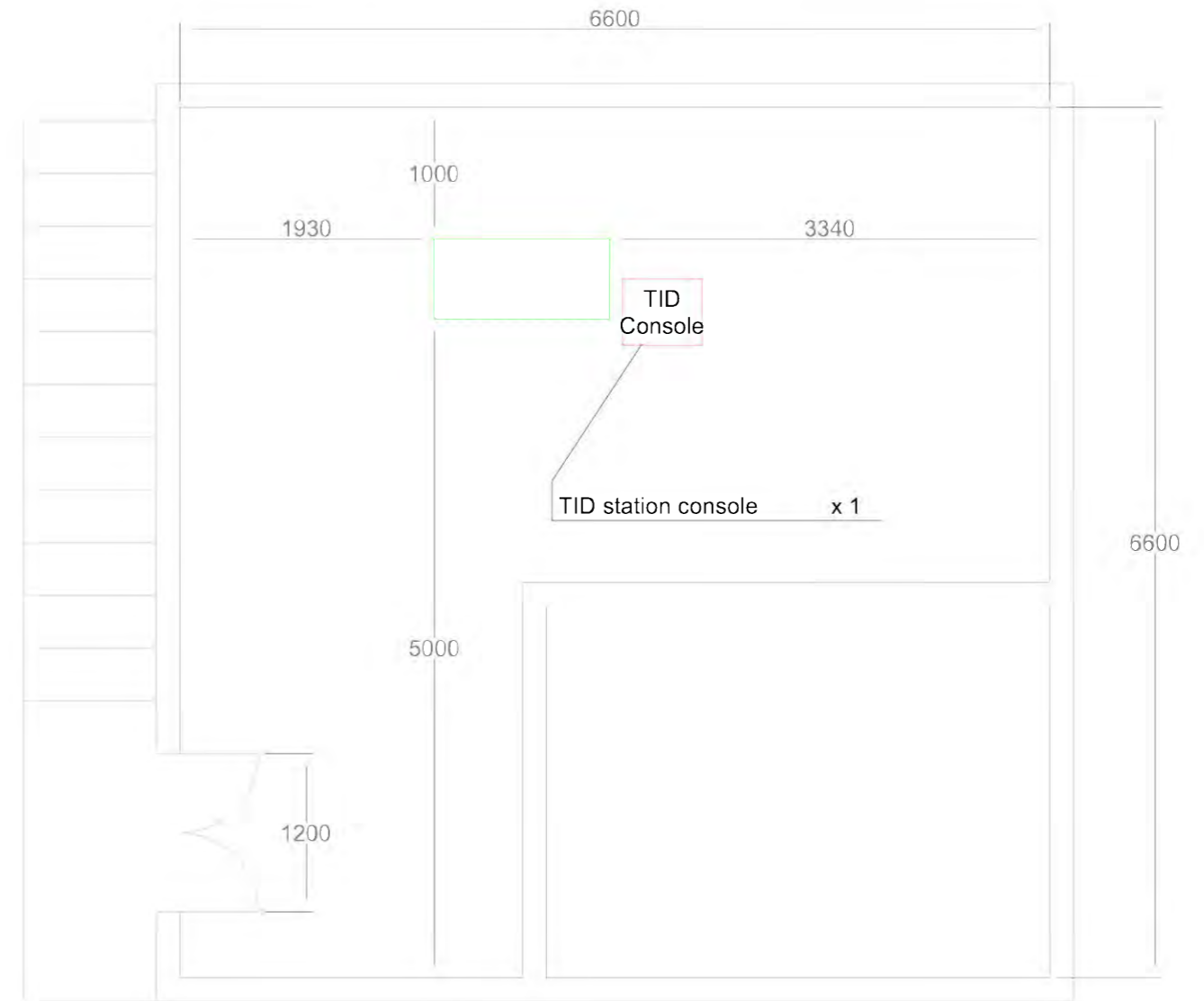
BD3-02-02-101

Mahlwagon Detail diagram (1 / 2)

Signal Tower Ground Floor



Signal Tower First Floor

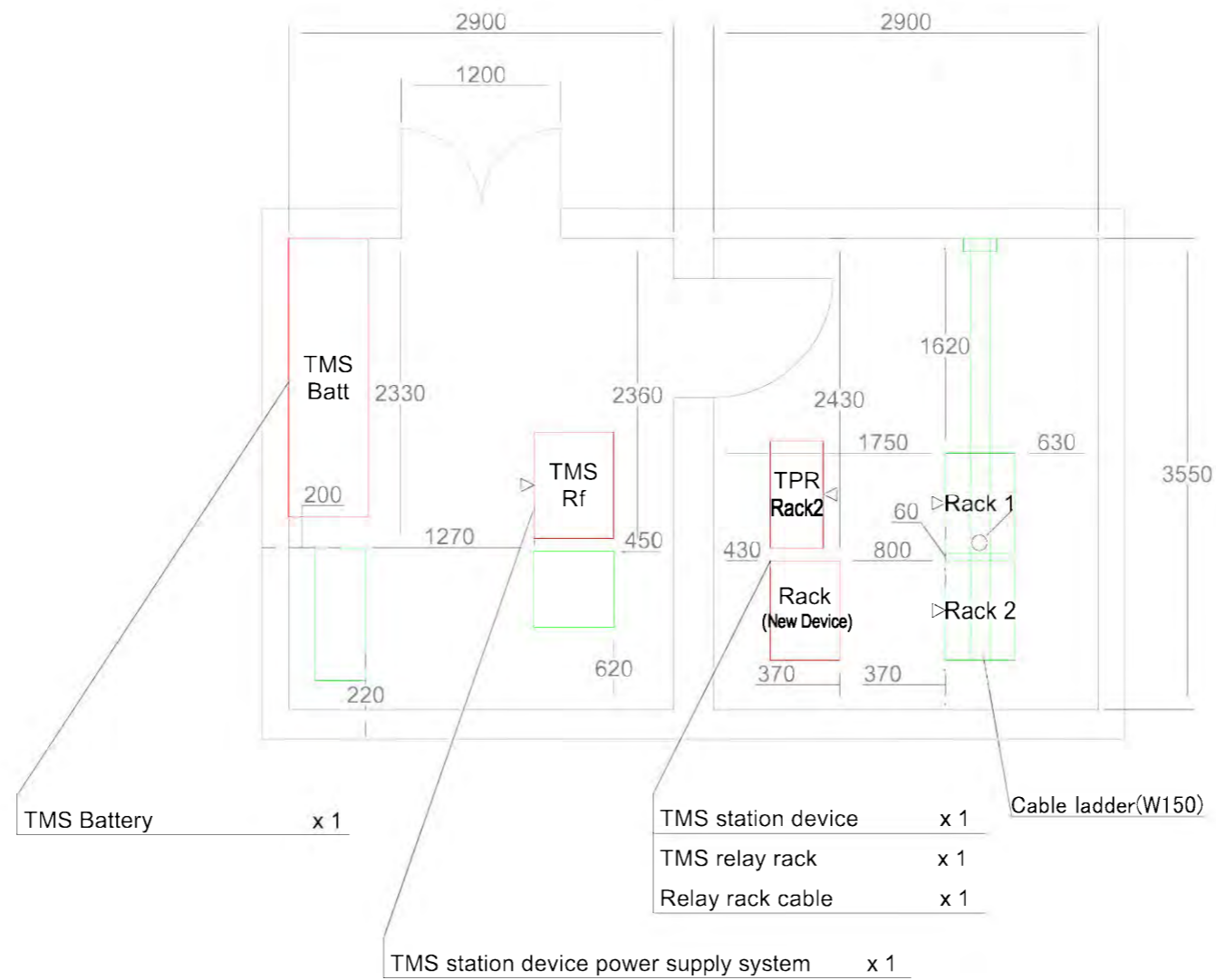


for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line  Floor concealment line  Exposure Wiring  Undergrounding wiring  Overhead line 	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	SCALE: 1 / 50	TITLE: Mahlwagon Detail diagram (1 / 2)
DRAWING NUMBER BD3-02-03-101					

Mahlwagon Detail diagram (2 / 2)

OFC Room

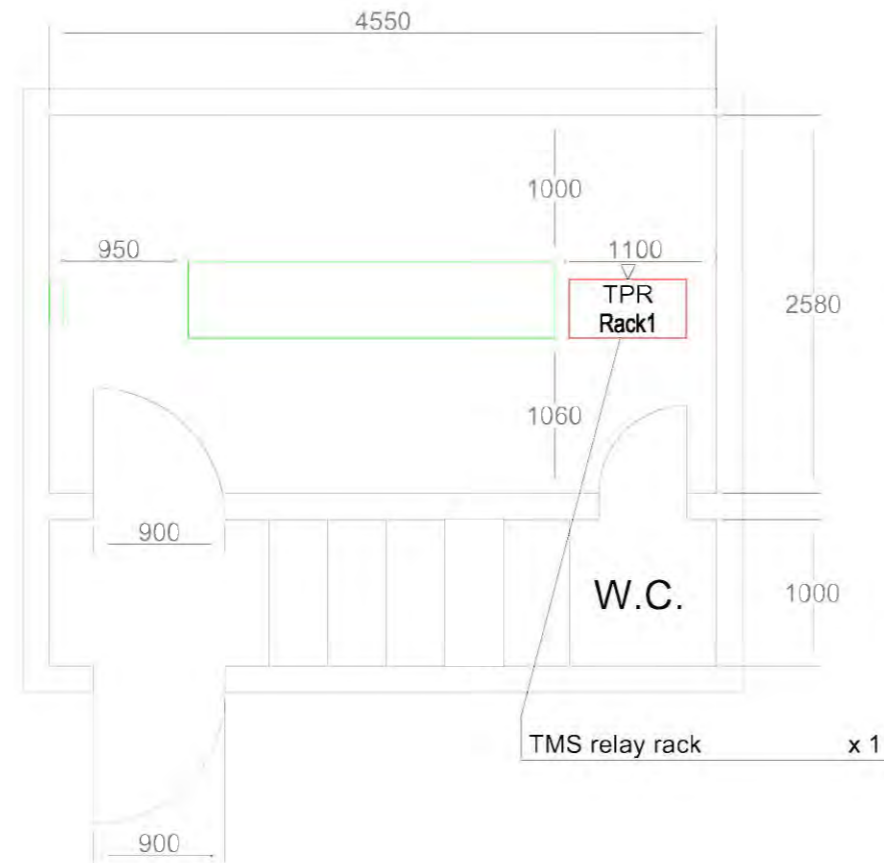


for reference

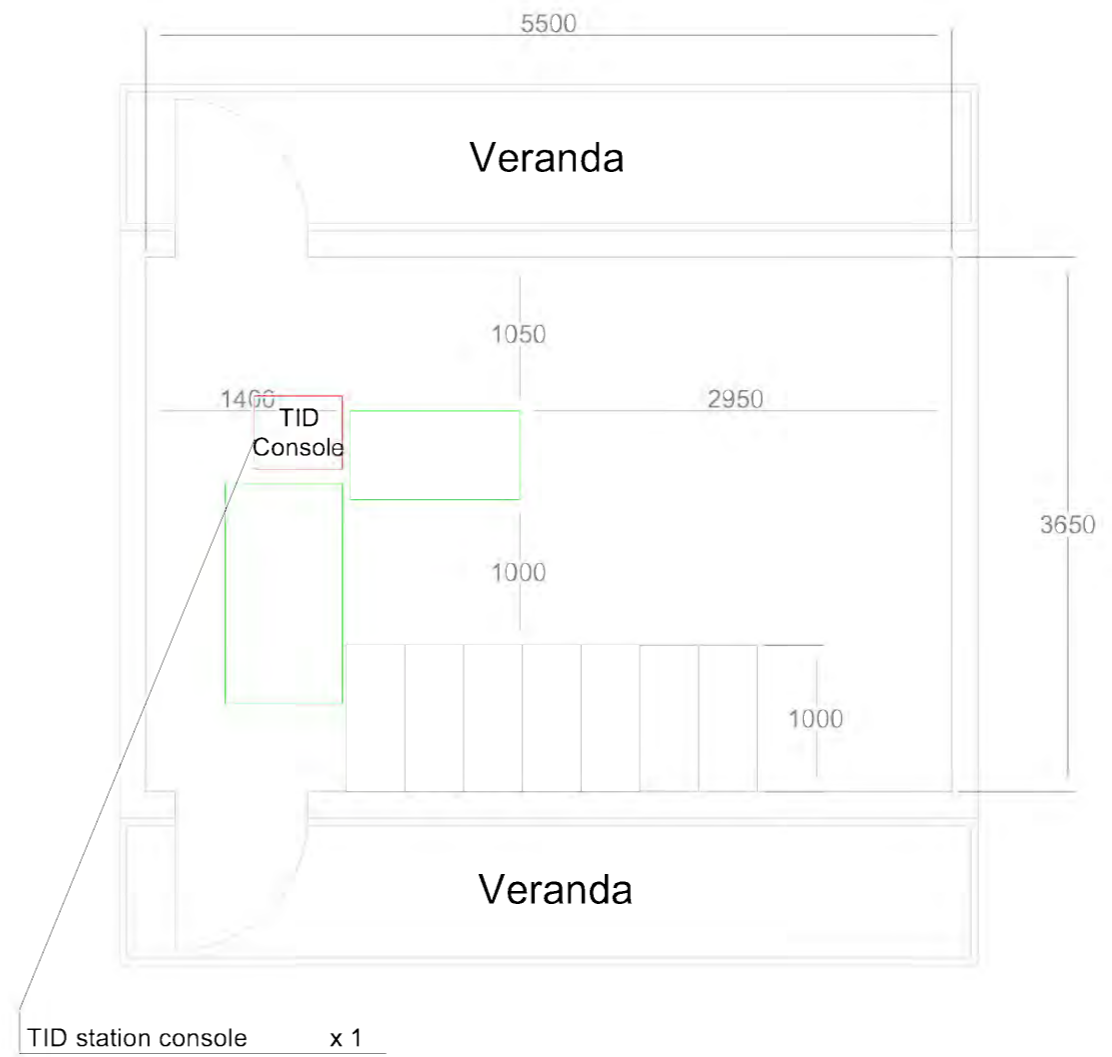
NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
LEGEND					SCALE: 1 / 50	TITLE: Mahlwagon Detail diagram (2 / 2)
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - Overhead line ————	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	DRAWING NUMBER BD3-02-03-102		

Thingangyun Detail diagram (1 / 2)

Signal Cabin Ground Floor



Signal Cabin First Floor

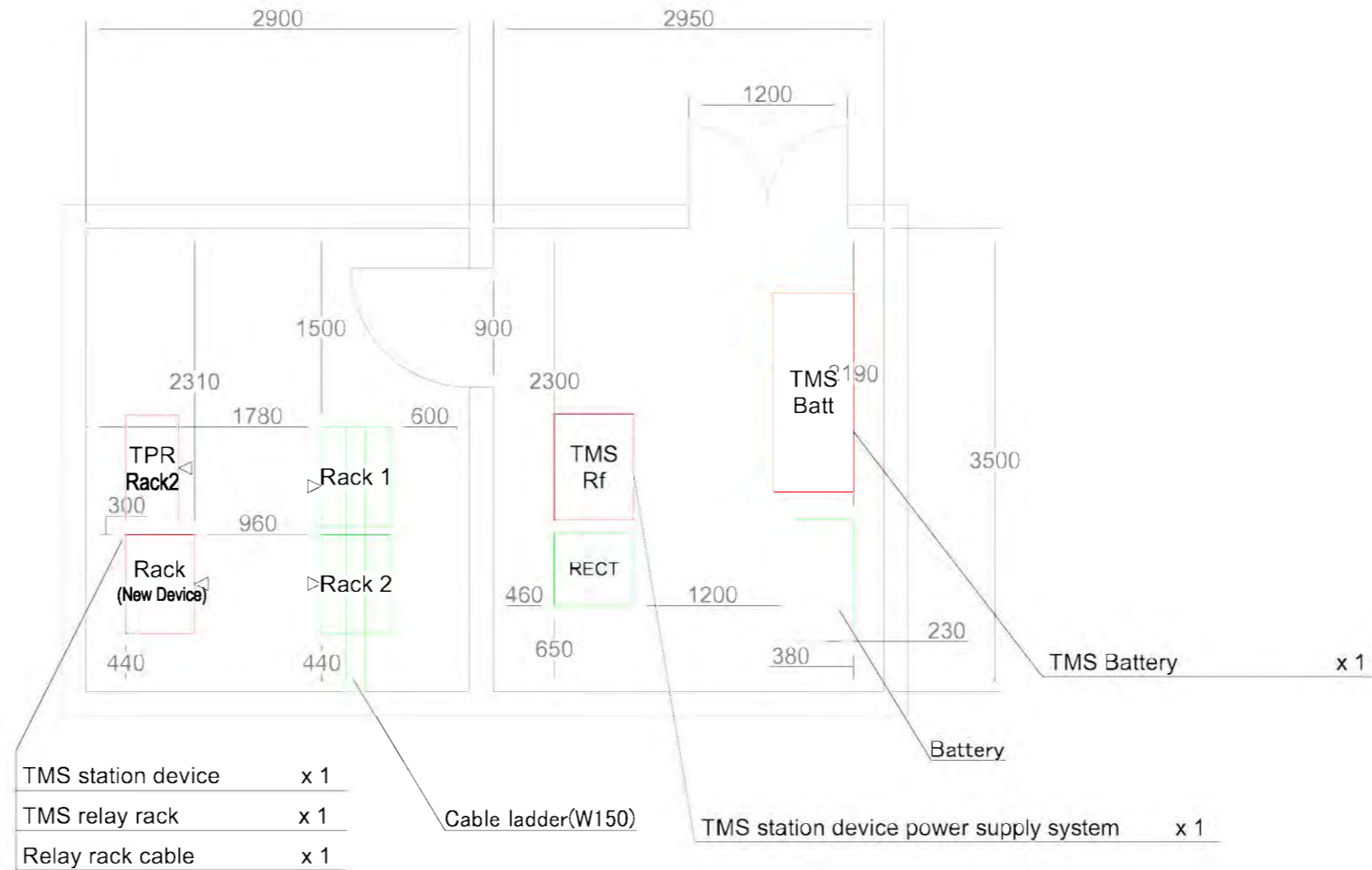


for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 50 TITLE: Thingangyun Detail diagram (1 / 2)
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - · Overhead line ————	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	DRAWING NUMBER BD3-02-04-101	

Thingangyun Detail diagram (2 / 2)

OFC Room

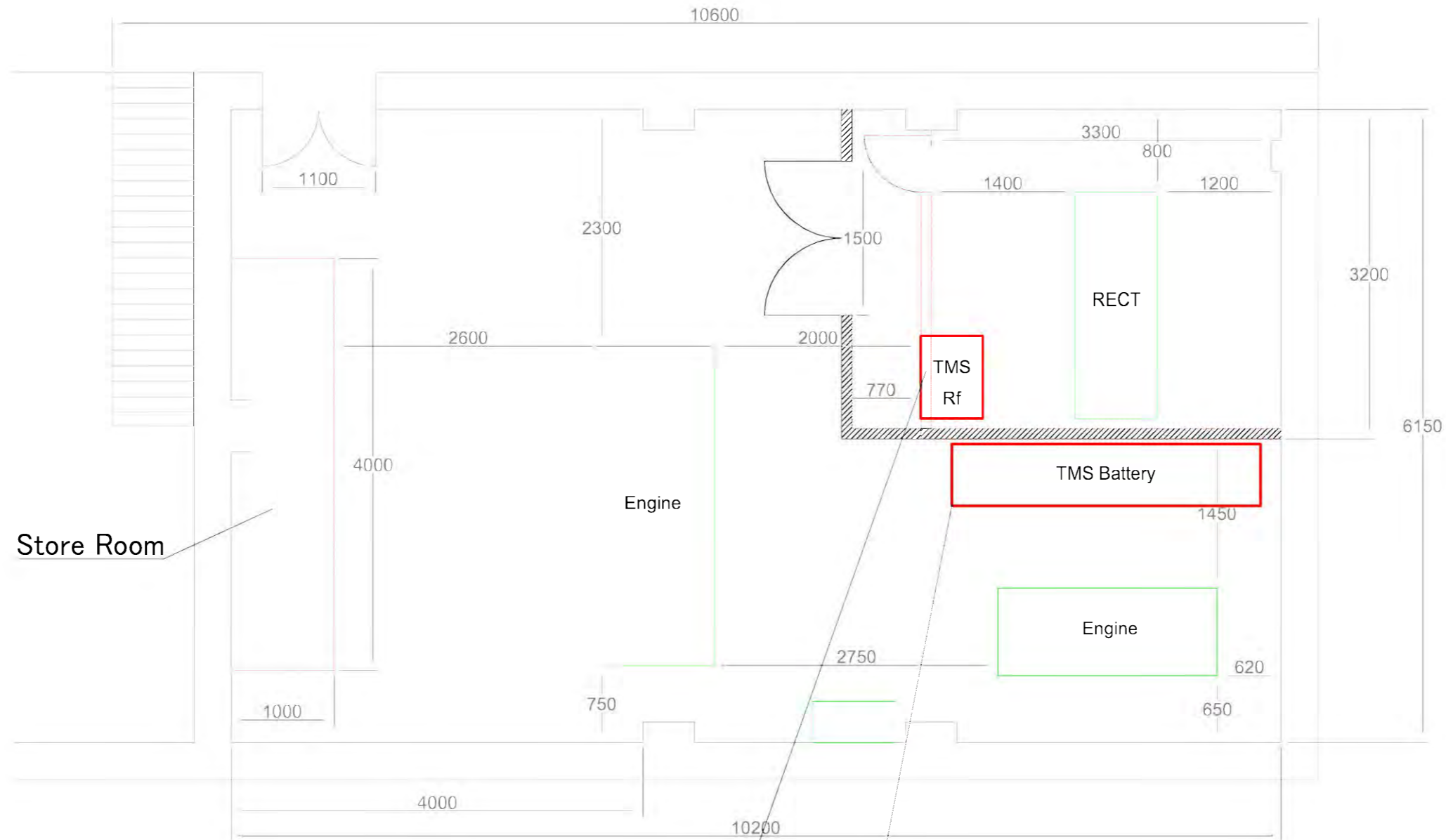


for reference

<p>NOTES: 1. 2.</p>	<p>CLIENT: Japan International Cooperation Agency</p>	<p>CONSULTANTS: Consortium of JIC and OC Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE: MARCH 2014</p>	<p>PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>							
LEGEND											
<p>Ceiling concealment line </p> <p>Floor concealment line </p> <p>Exposure Wiring </p> <p>Undergrounding wiring </p> <p>Overhead line </p>	<p>Startup </p> <p>Fall </p> <p>Through </p> <p>Earthing </p> <p>Hand Hall </p>	<p> 600V Vinyl insulation electric wire</p> <p> Polyethylene insulation cable</p> <p> Vinyl insulation cable for control</p> <p> Communication cable</p> <p> UTP cable</p>	<p>IV</p> <p>CV</p> <p>CVV</p> <p>CPEV</p> <p>UTP</p>	<p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<table border="1" style="width: 100%;"> <tr> <td style="width: 30%;">SCALE:</td> <td style="width: 30%;">1 / 50</td> <td style="width: 40%;">TITLE: Thingangyun Detail diagram (2 / 2)</td> </tr> <tr> <td>DRAWING NUMBER</td> <td colspan="2">BD3-02-04-102</td> </tr> </table>	SCALE:	1 / 50	TITLE: Thingangyun Detail diagram (2 / 2)	DRAWING NUMBER	BD3-02-04-102	
SCALE:	1 / 50	TITLE: Thingangyun Detail diagram (2 / 2)									
DRAWING NUMBER	BD3-02-04-102										

Toegyaukcalay Detail diagram (1 / 3)

Signal Tower Ground Floor



TMS Battery x 1

TMS station device power supply system x 1

for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 50

TITLE:

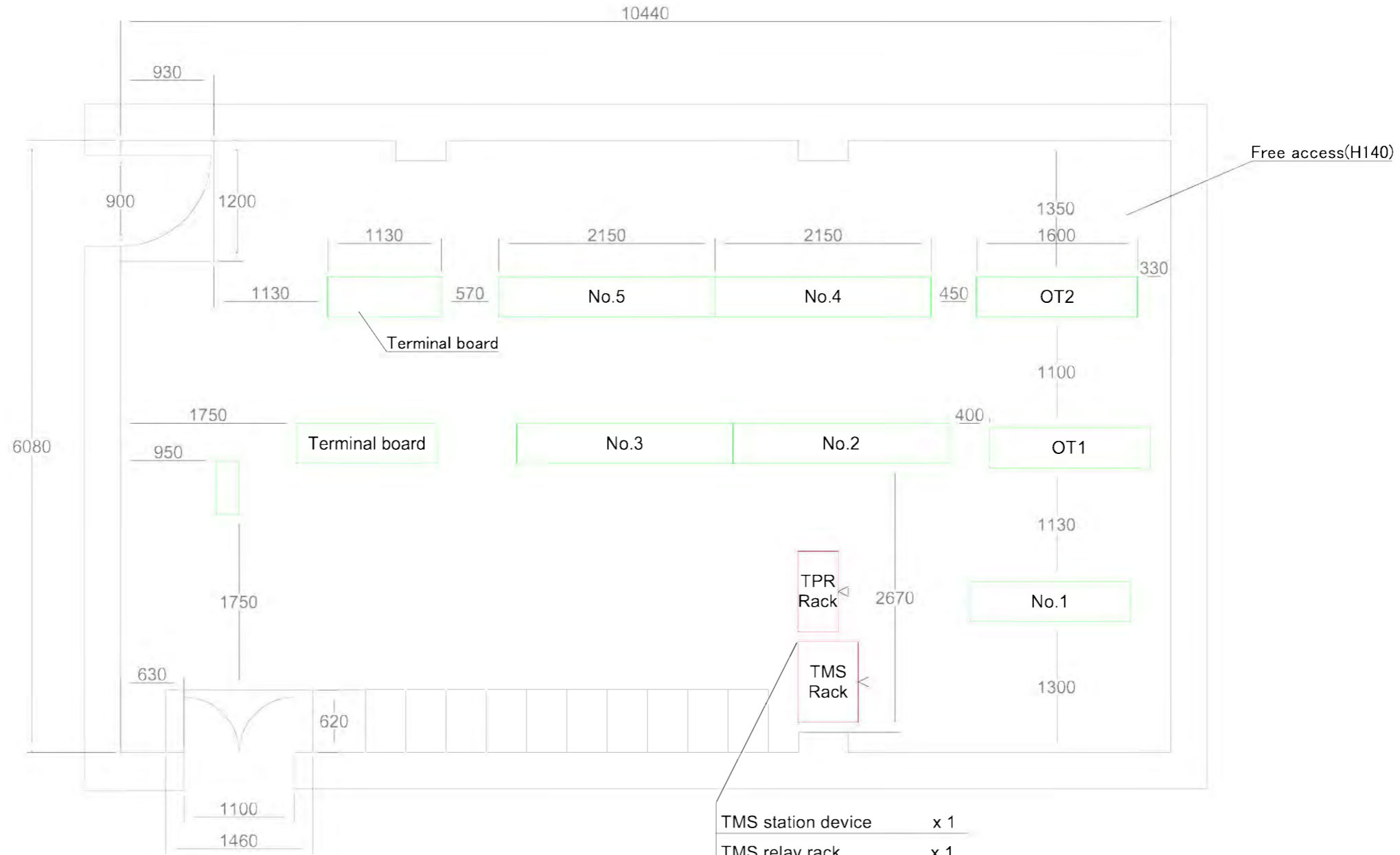
Toegyaukcalay Detail diagram (1 / 3)

DRAWING NUMBER

BD3-02-05-101

Toegyaukkalay Detail diagram (2 / 3)

Signal Tower First Floor



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 50

TITLE:

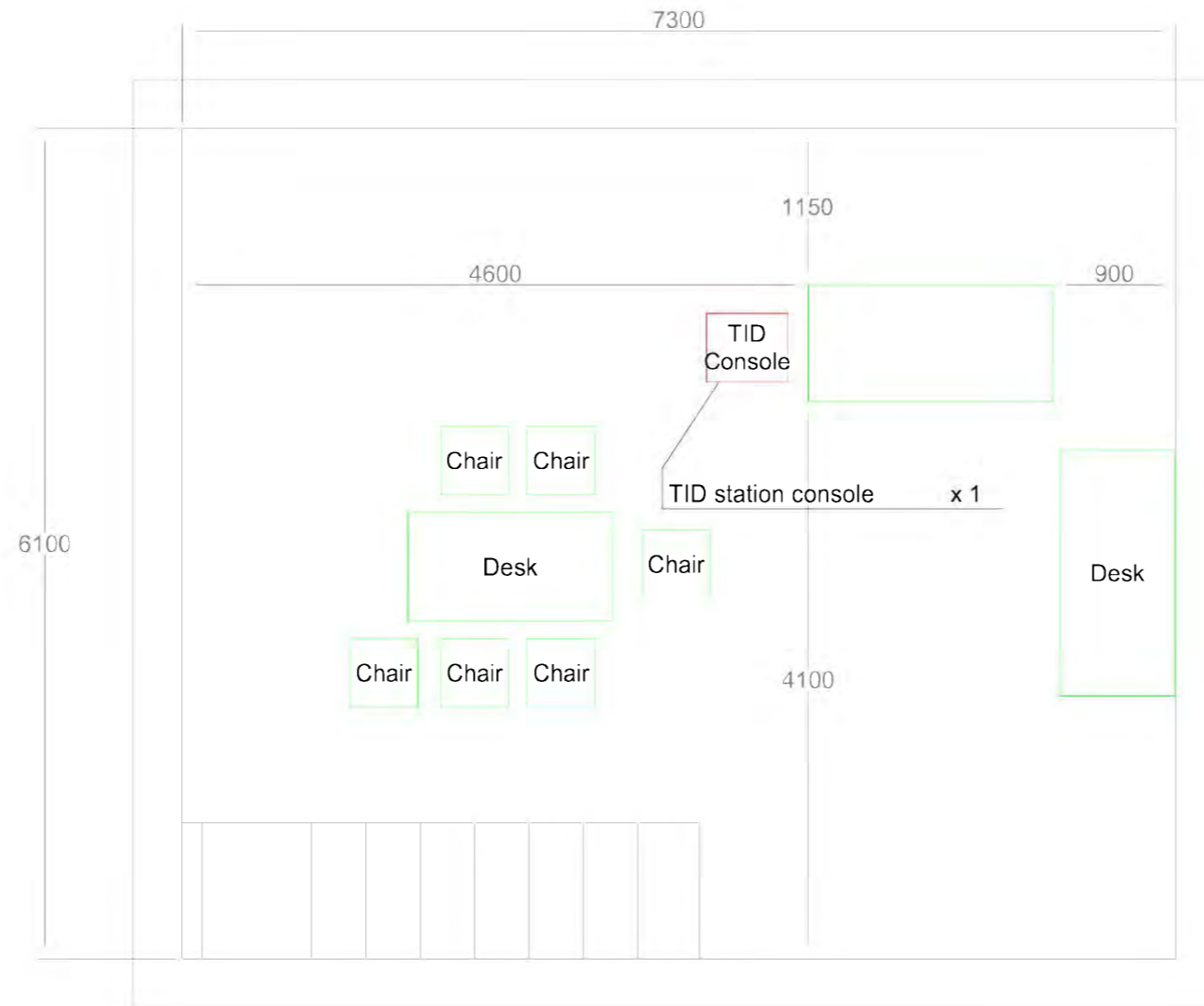
Toegyaukkalay Detail diagram (2 / 3)

DRAWING NUMBER

BD3-02-05-102

Toegyaukcalay Detail diagram (3 / 3)

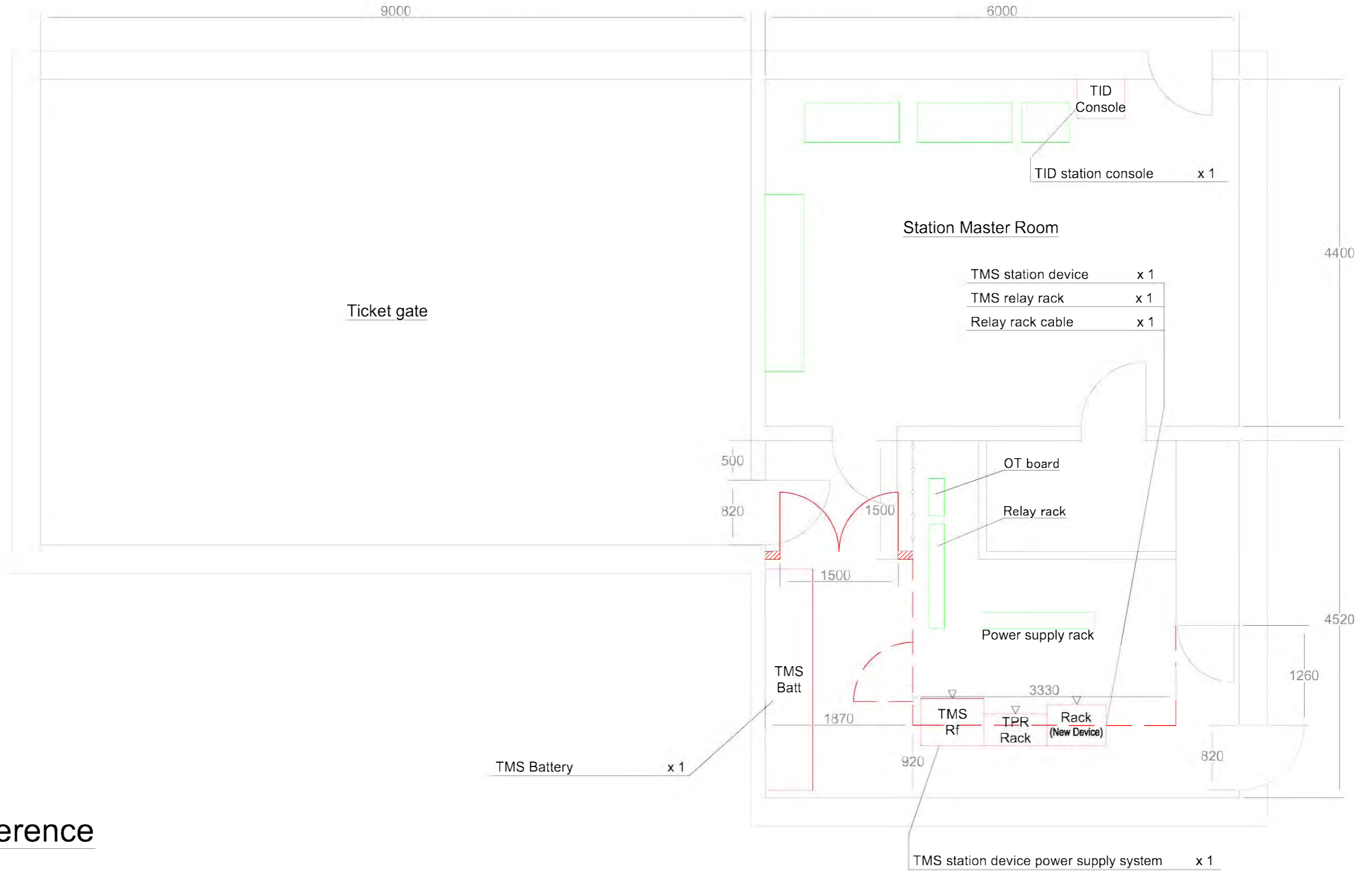
Signal Tower Second Floor



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
LEGEND					SCALE: 1 / 50	TITLE: Toegyaukcalay Detail diagram (3 / 3)
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - · Overhead line — — — — —	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	DRAWING NUMBER BD3-02-05-103		

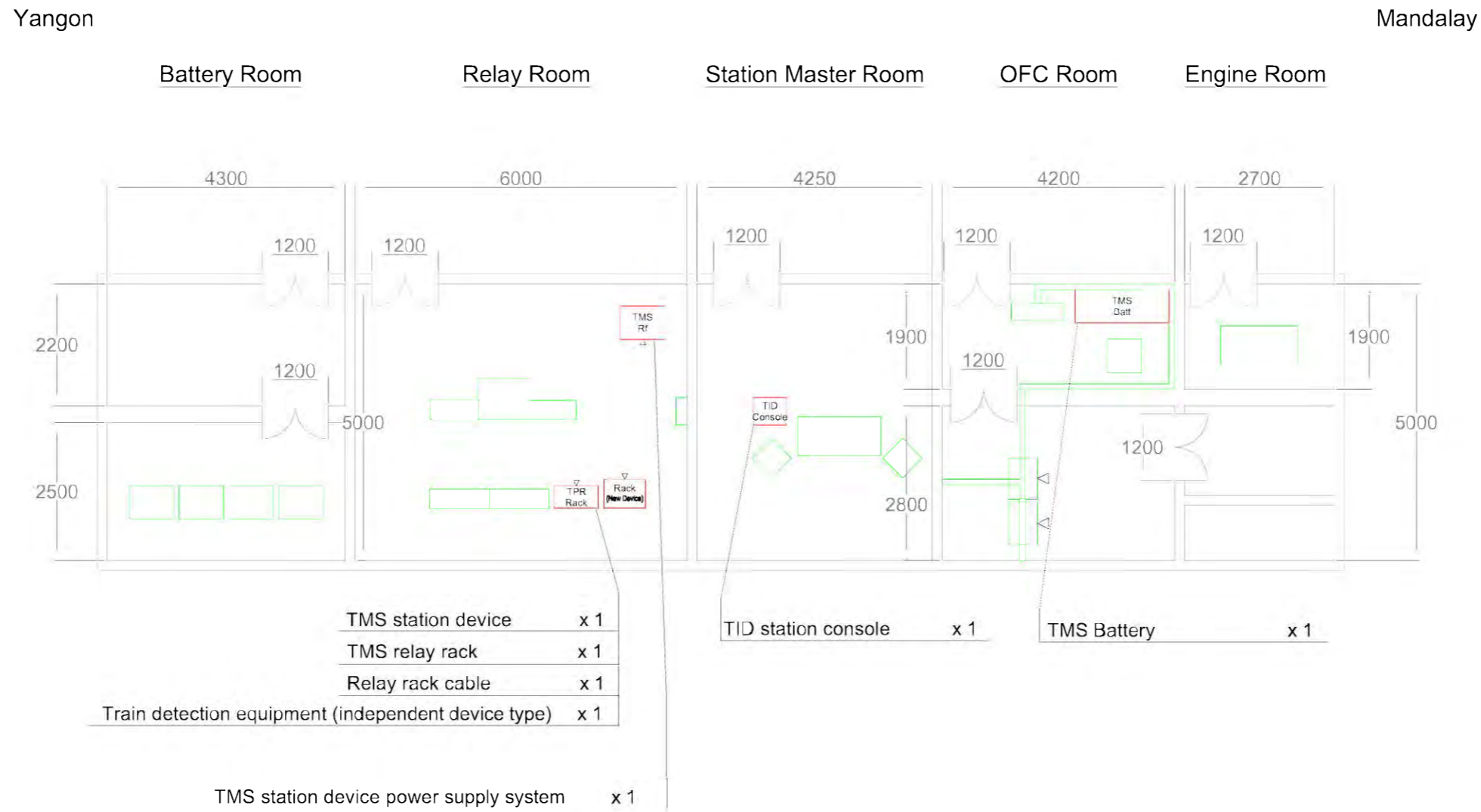
Ywathagyi Detail diagram (1 / 1)



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
LEGEND					SCALE: 1 / 50	TITLE: Ywathagyi Detail diagram (1 / 1)
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - Overhead line ————	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP			
		DRAWING NUMBER BD3-02-06-101				

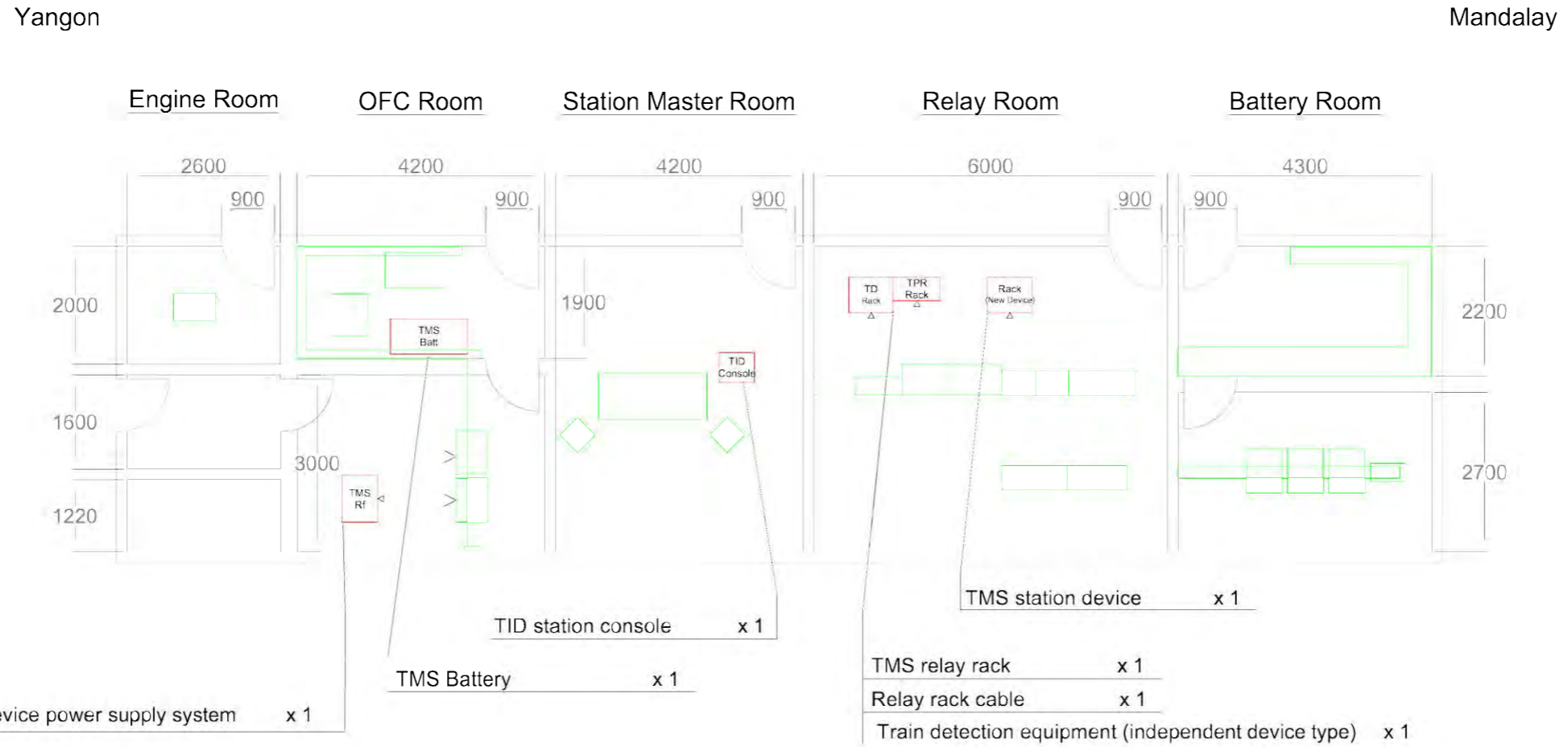
Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu Layout drawing



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 100
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV	TITLE: Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu Layout drawing	
Floor concealment line	Fall	Polyethylene insulation cable	CV		
Exposure Wiring	Through	Vinyl insulation cable for control	CVV		
Undergrounding wiring	Earthing	Communication cable	CPEV		
Overhead line	Hand Hall	UTP cable	UTP		
					DRAWING NUMBER BD3-02-07-101

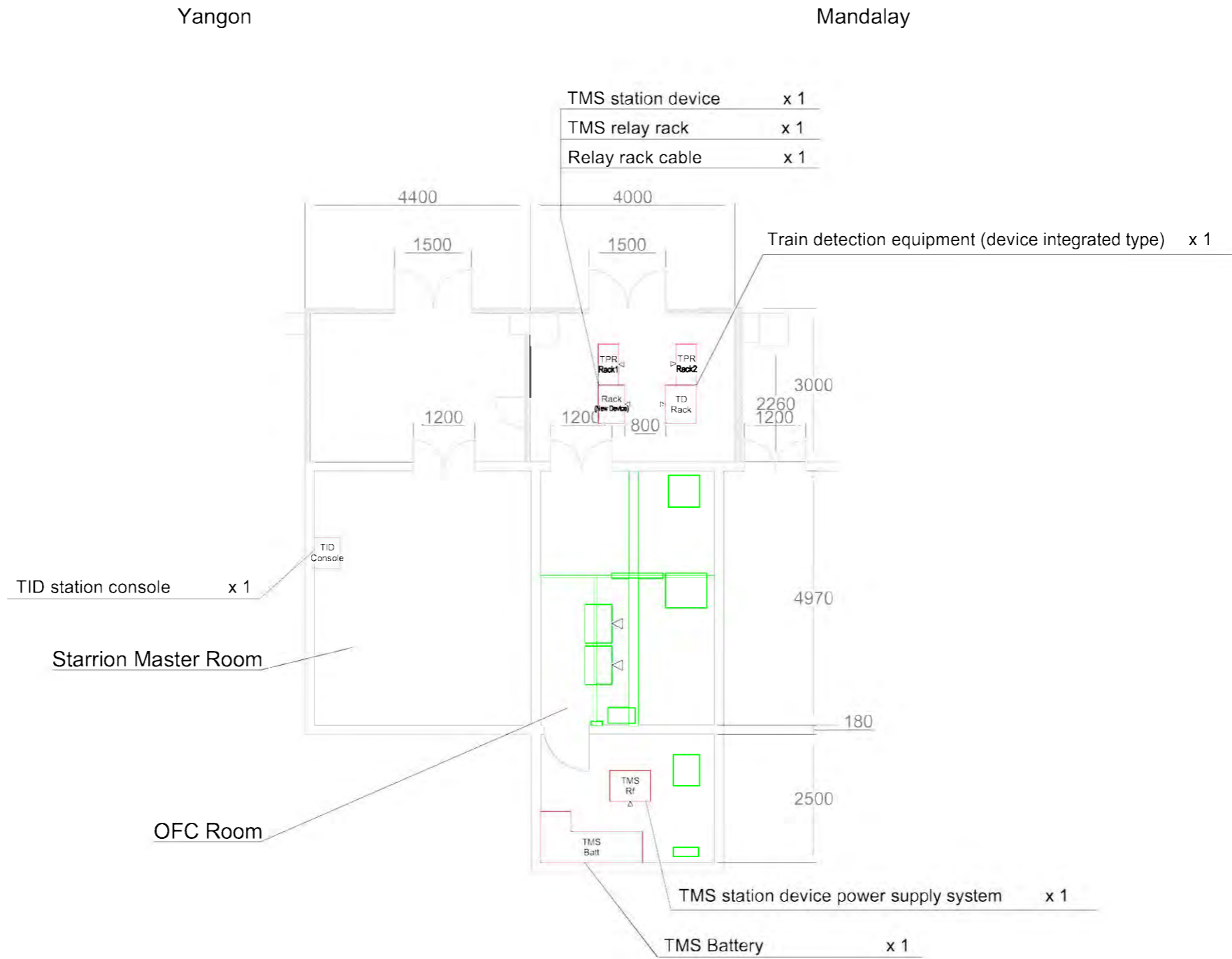
Darbain Layout drawing



for reference

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>																							
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP	<p>SCALE: 1 / 100</p> <p>TITLE: Darbain Layout drawing</p>	
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																								
Floor concealment line	Fall		Polyethylene insulation cable	CV																								
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																								
Undergrounding wiring	Earthing		Communication cable	CPEV																								
Overhead line	Hand Hall		UTP cable	UTP																								
<p>DRAWING NUMBER</p>		<p>BD3-02-08-101</p>																										

Bago Layout drawing



for reference

NOTES
1.
2.

LEGEND

Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV
Floor concealment line	Fall		Polyethylene insulation cable	CV
Exposure Wiring	Through		Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing		Communication cable	CPEV
Overhead line	Hand Hall		UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

TITLE:

Bago Layout drawing

DRAWING NUMBER

BD3-02-13-101

Shwele Layout drawing

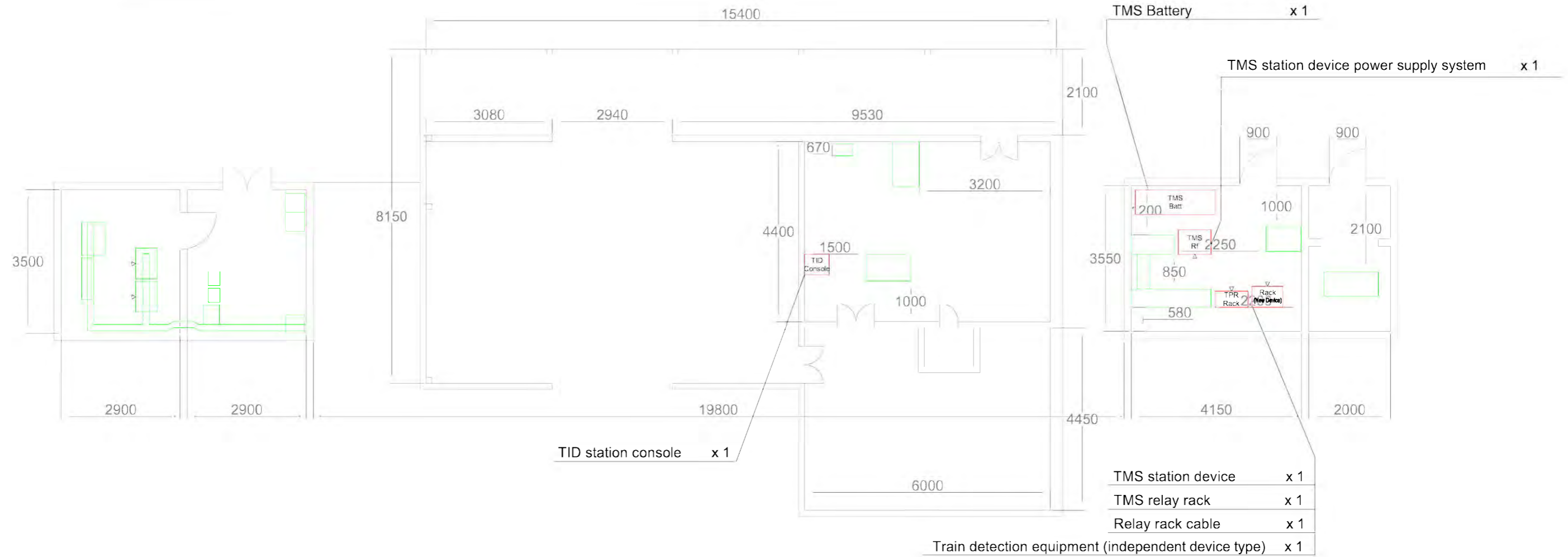
Mandalay

Yangon

OFC Room

Station Master Room

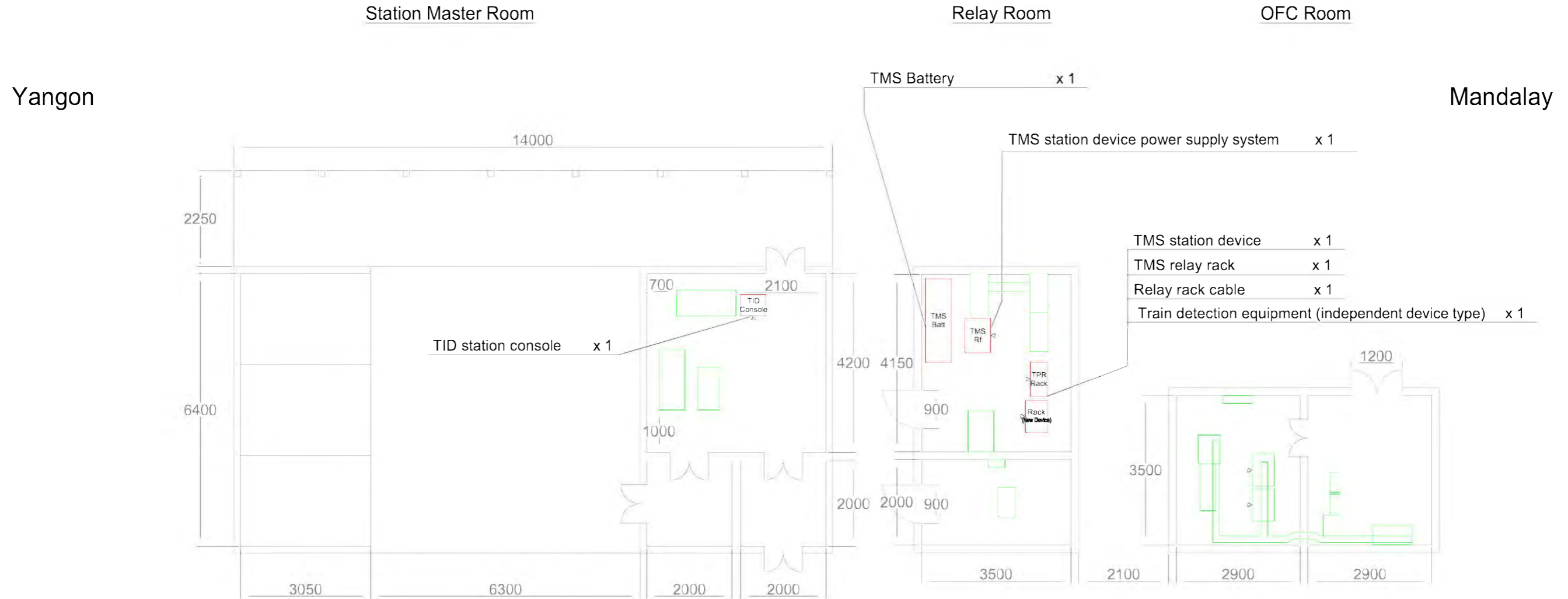
Relay Room



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 100
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV	TITLE: Shwele Layout drawing	
Floor concealment line	Fall	Polyethylene insulation cable	CV		
Exposure Wiring	Through	Vinyl insulation cable for control	CVV		
Undergrounding wiring	Earthing	Communication cable	CPEV		
Overhead line	Hand Hall	UTP cable	UTP	DRAWING NUMBER BD3-02-14-101	

Payagyi Layout drawing



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - Overhead line ————	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	SCALE: 1 / 100	TITLE: Payagyi Layout drawing
DRAWING NUMBER		BD3-02-15-101			

Pyinbongyi Layout drawing

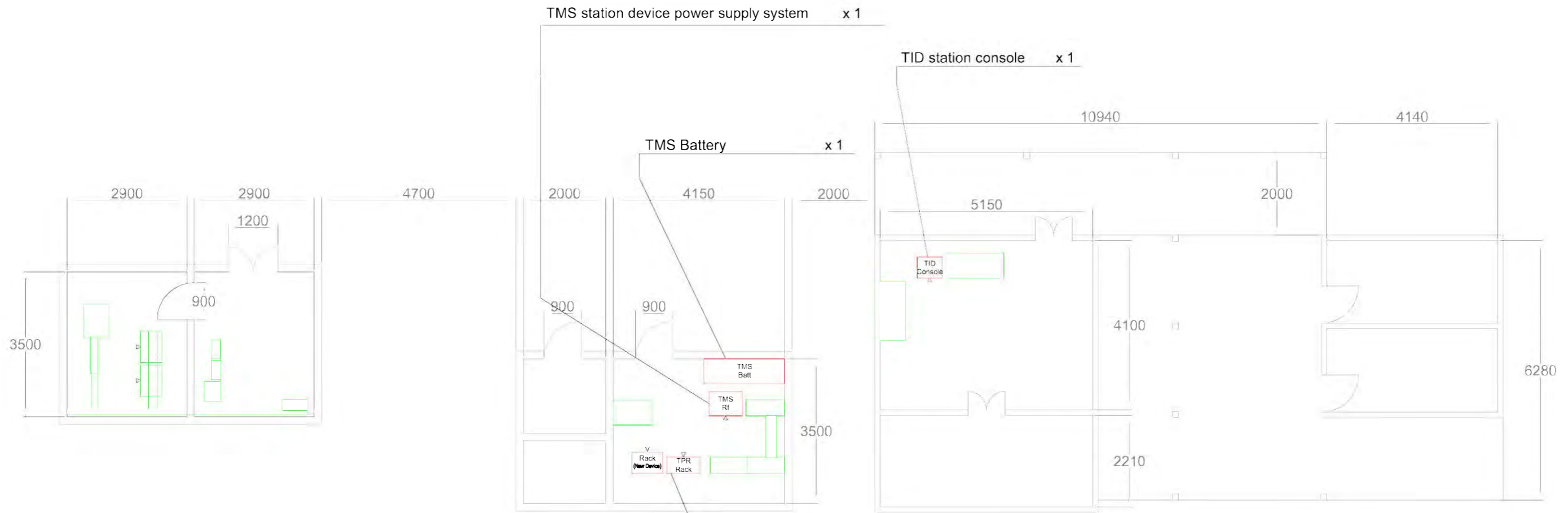
Yangon

Mandalay

OFC Room

Relay Room

Station Master Room



- TMS station device x 1
- TMS relay rack x 1
- Relay rack cable x 1
- Train detection equipment (independent device type) x 1

for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

TITLE:

Pyinbongyi Layout drawing

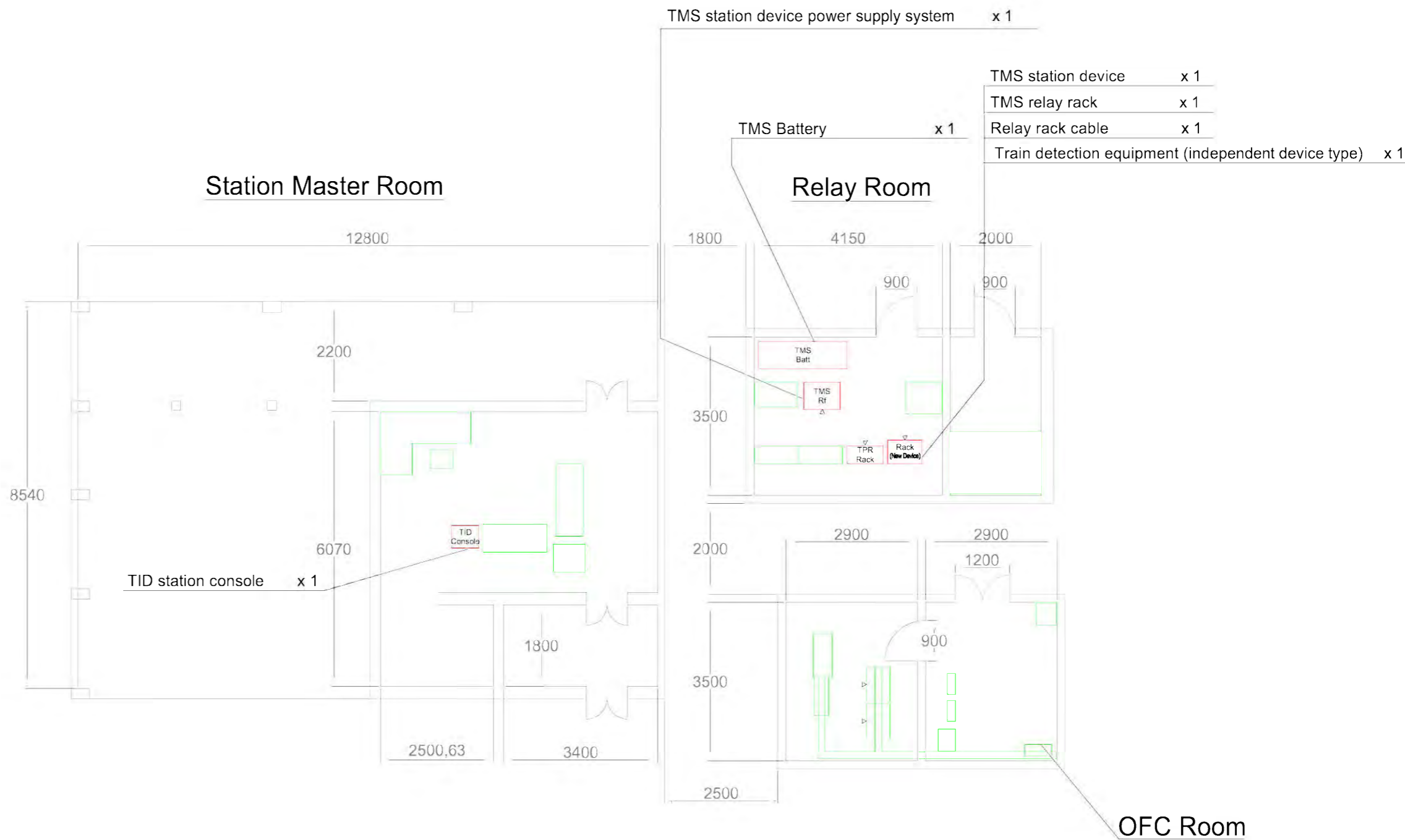
DRAWING NUMBER

BD3-02-16-101

Kadok Layout drawing

Yangon

Mandalay



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
LEGEND					SCALE: 1 / 100	TITLE: Kadok Layout drawing
Ceiling concealment line ———— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - · Overhead line ————	Startup Fall Through Earthing Hand Hall	600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP			
DRAWING NUMBER		BD3-02-17-101				

Panugdawthi Layout drawing

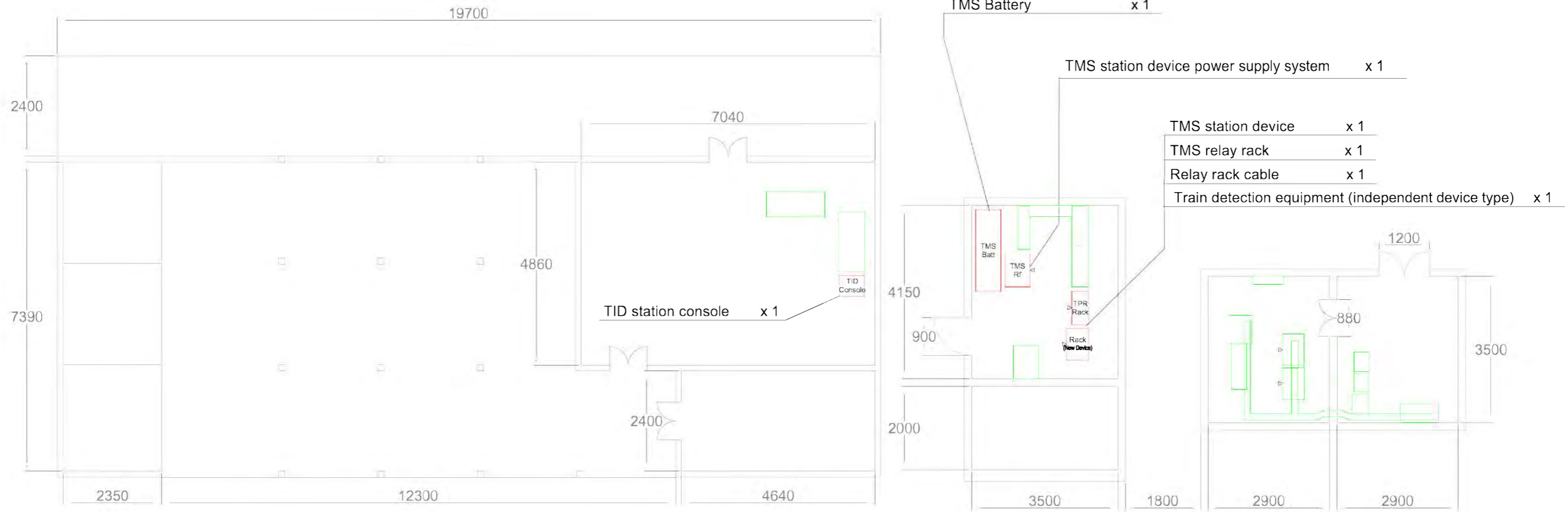
Yangon

Mandalay

Station Master Room

Relay Room

OFC Room



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 100
Ceiling concealment line ——— Startup Floor concealment line - - - - - Fall Exposure Wiring - - - - - Through Undergrounding wiring - · - · - Earthing Overhead line - - - - - Hand Hall	 600V Vinyl insulation electric wire IV  Polyethylene insulation cable CV  Vinyl insulation cable for control CVV  Communication cable CPEV  UTP cable UTP				TITLE: Panugdawthi Layout drawing
					DRAWING NUMBER BD3-02-18-101

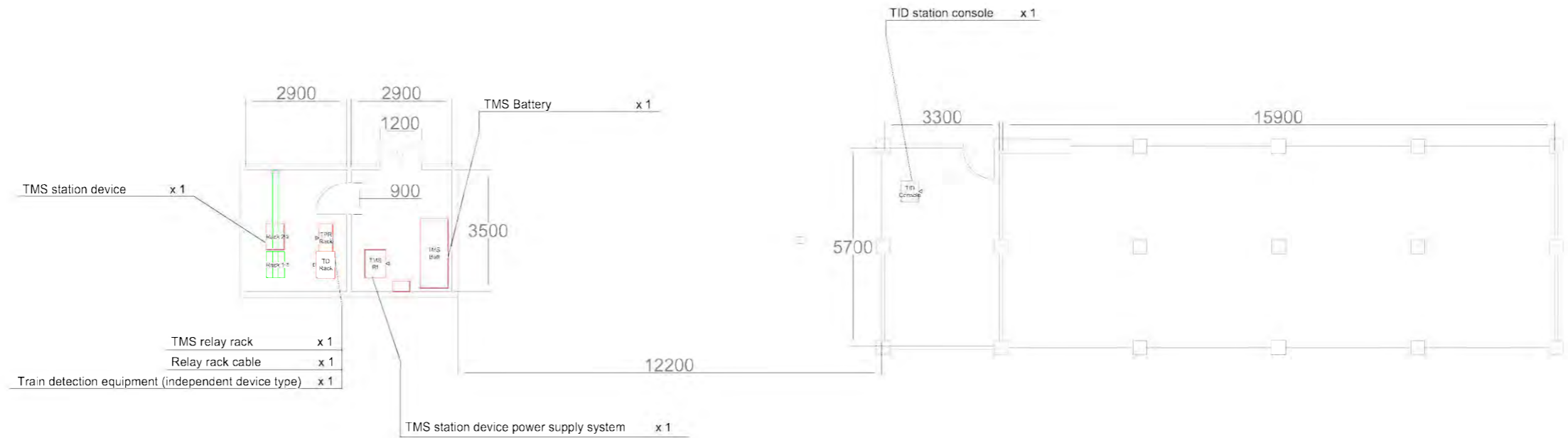
Eimshaylayse Layout drawing

Yangon

Mandalay

OFC Room

Station Master Room



for reference

NOTES
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 150

TITLE:

Eimshaylayse Layout drawing

DRAWING NUMBER

BD3-02-19-101

Daik-u Layout drawing

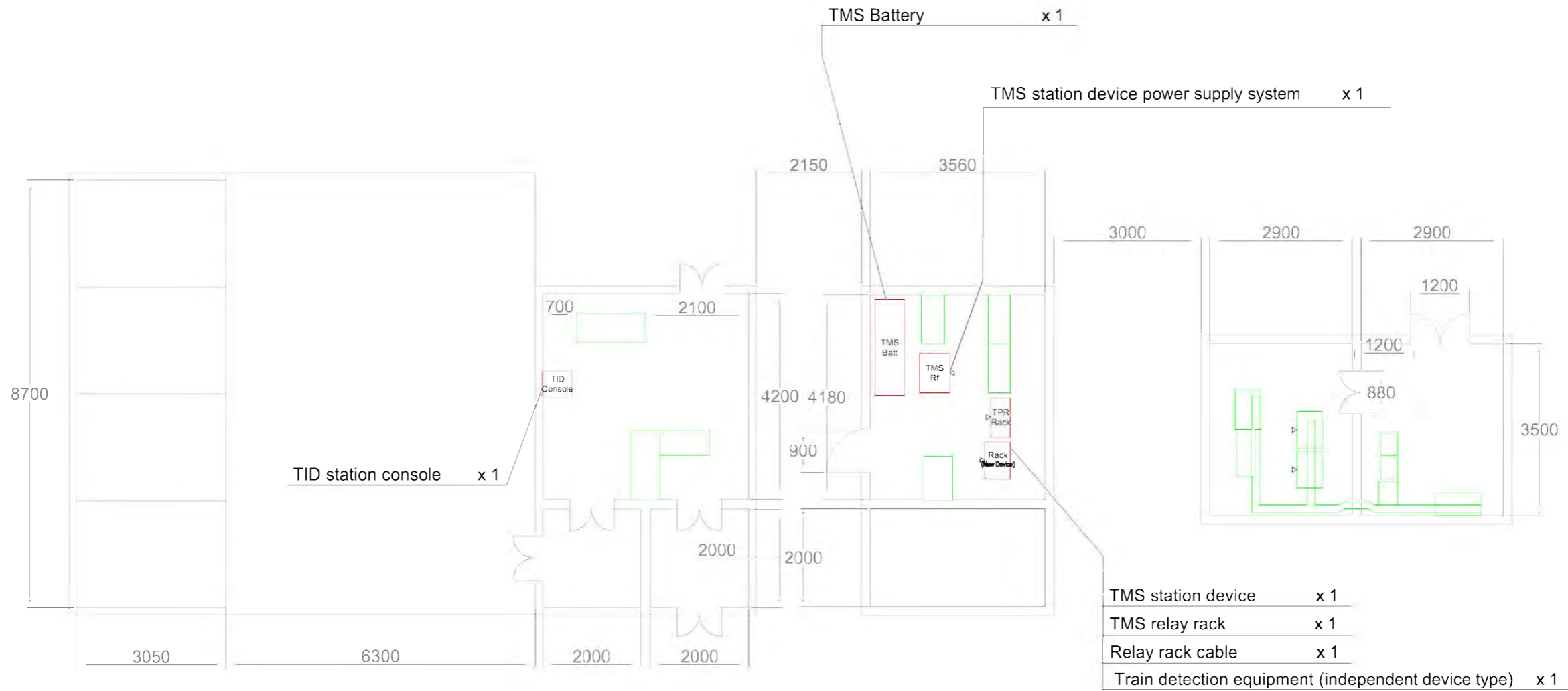
Yangon

Mandalay

Station Master Room

Relay Room

OFC Room



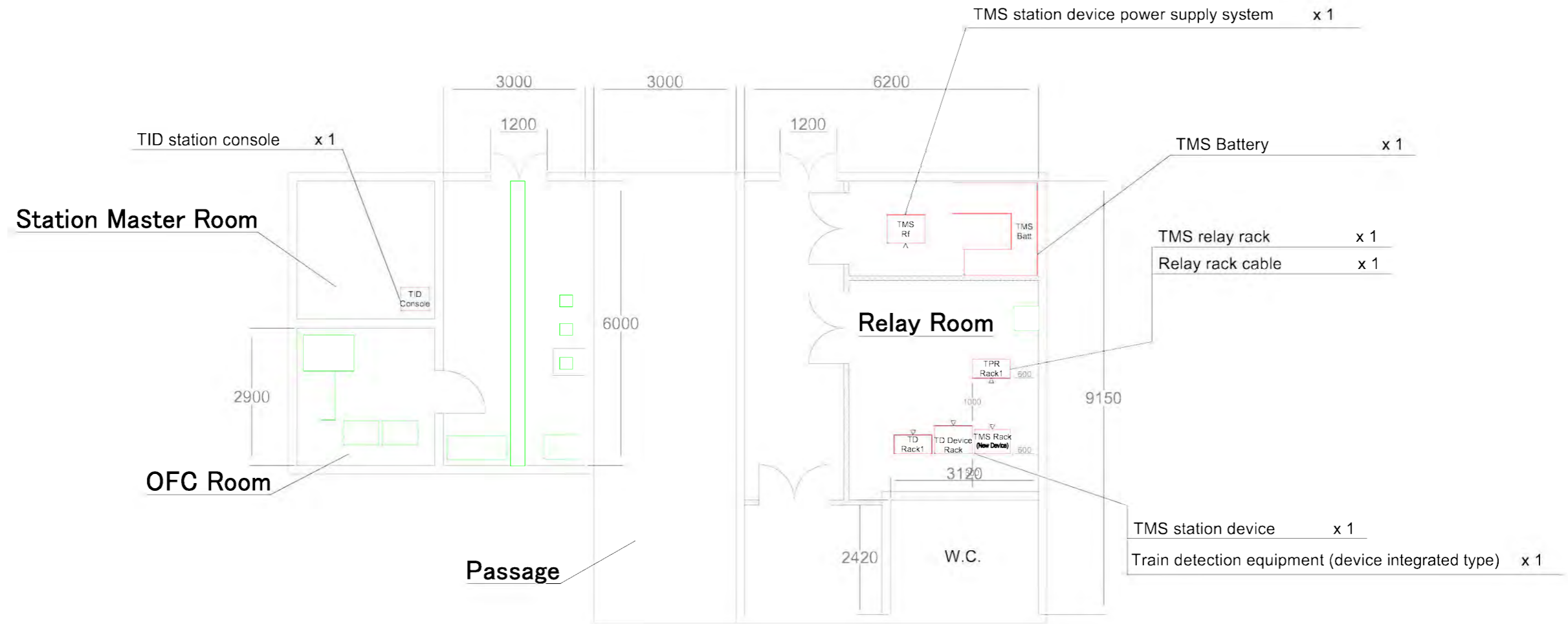
for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND Ceiling concealment line ——— Startup Floor concealment line - - - - - Fall Exposure Wiring - - - - - Through Undergrounding wiring - · - · - Earthing Overhead line - - - - - Hand Hall		600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP	SCALE: 1 / 100 TITLE: Daik-u Layout drawing DRAWING NUMBER: BD3-02-20-101		

Pyuntaza Layout drawing

Yangon

Mandalay

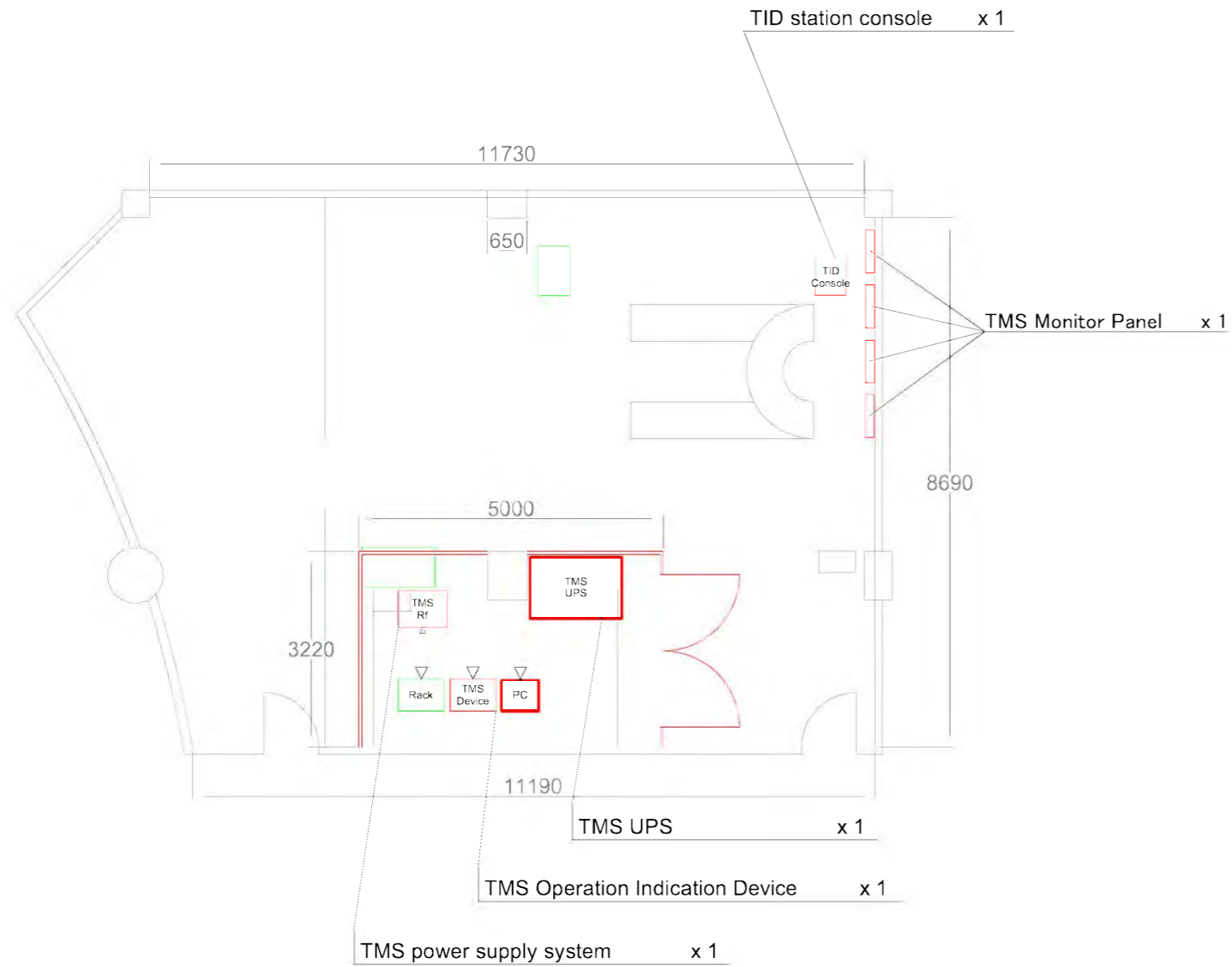


for reference

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>																							
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP	<p>SCALE: 1 / 100</p> <p>TITLE: Pyuntaza Layout drawing</p>	
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																								
Floor concealment line	Fall		Polyethylene insulation cable	CV																								
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																								
Undergrounding wiring	Earthing		Communication cable	CPEV																								
Overhead line	Hand Hall		UTP cable	UTP																								
<p>DRAWING NUMBER</p>		<p>BD3-02-21-101</p>																										

Naypyitaw Detail diagram

Central OCC



for reference

NOTES
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

TITLE:

Naypyitaw Detail diagram

DRAWING NUMBER

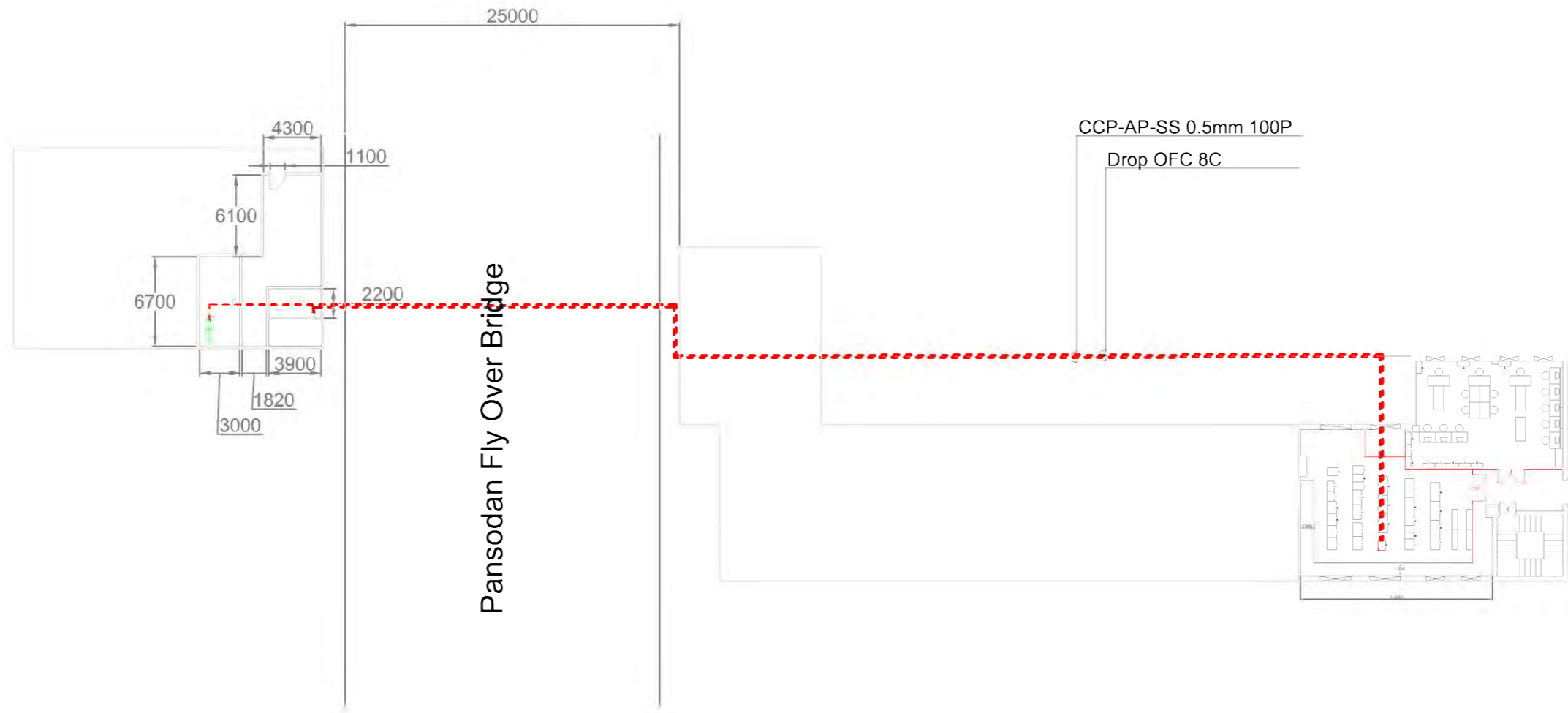
BD3-02-27-101

Yangon Layout drawing

to Mandalay

OFC Room

New OCC Room



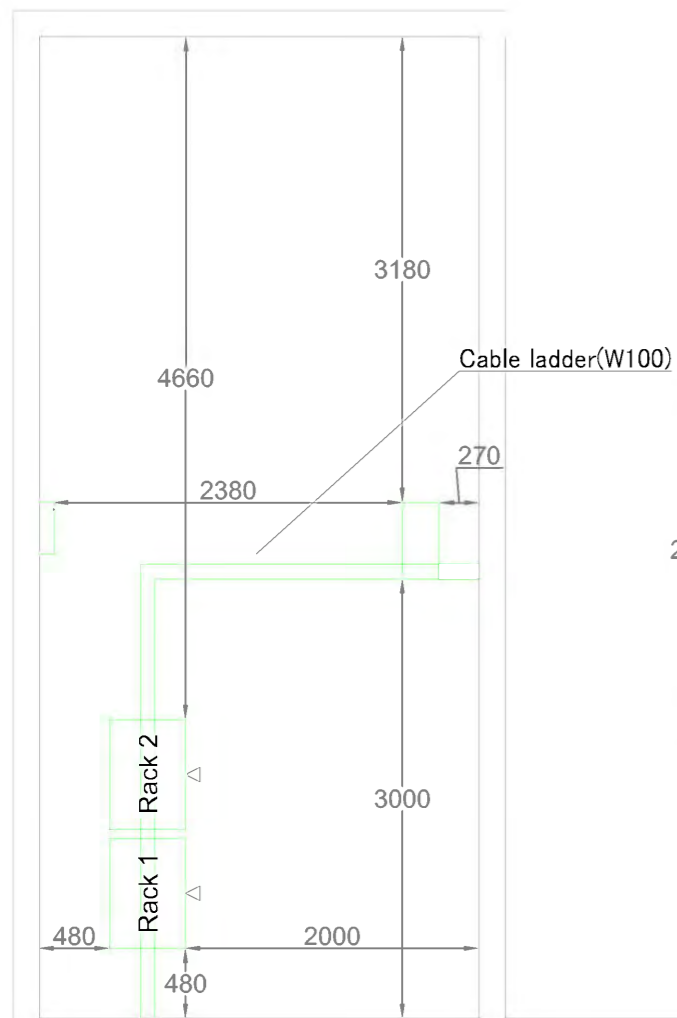
for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line ——— Floor concealment line - - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - Overhead line - - - - -	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	SCALE: 1 / 400 TITLE: Yangon Layout drawing DRAWING NUMBER: BD3-02-01-201	

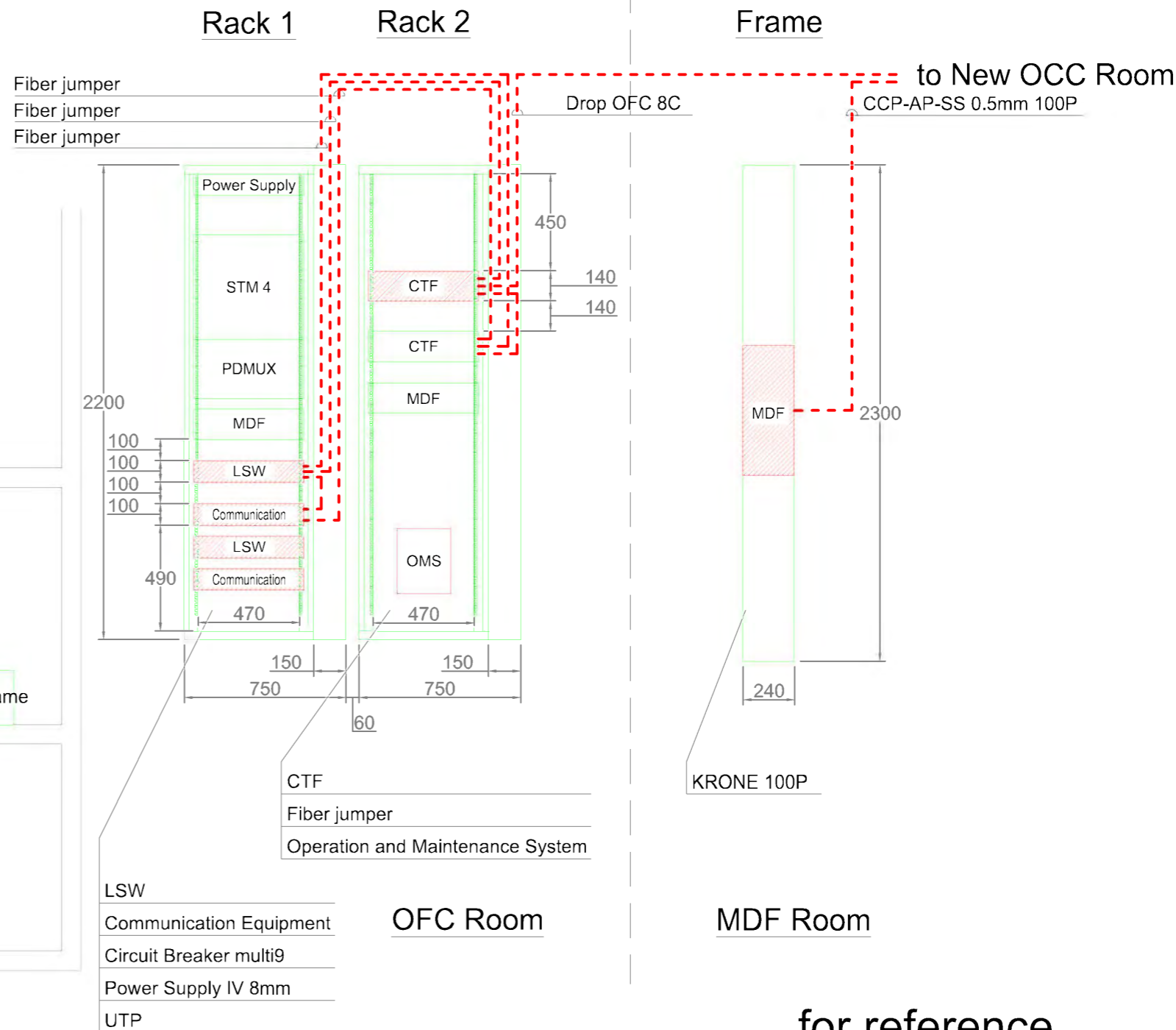
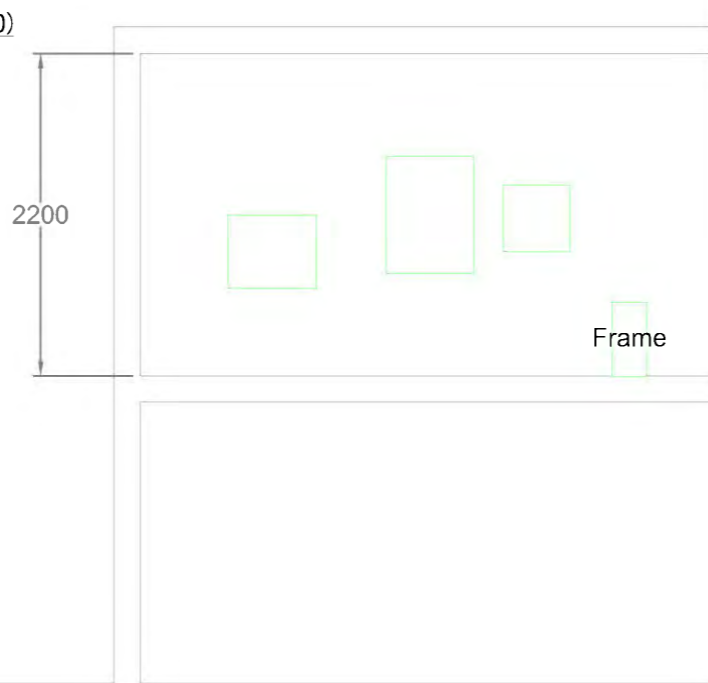
Yangon Detail diagram (1 / 2)

Elevation of Rack (Scale : 1 / 25)

OFC Room



MDF Room



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 50

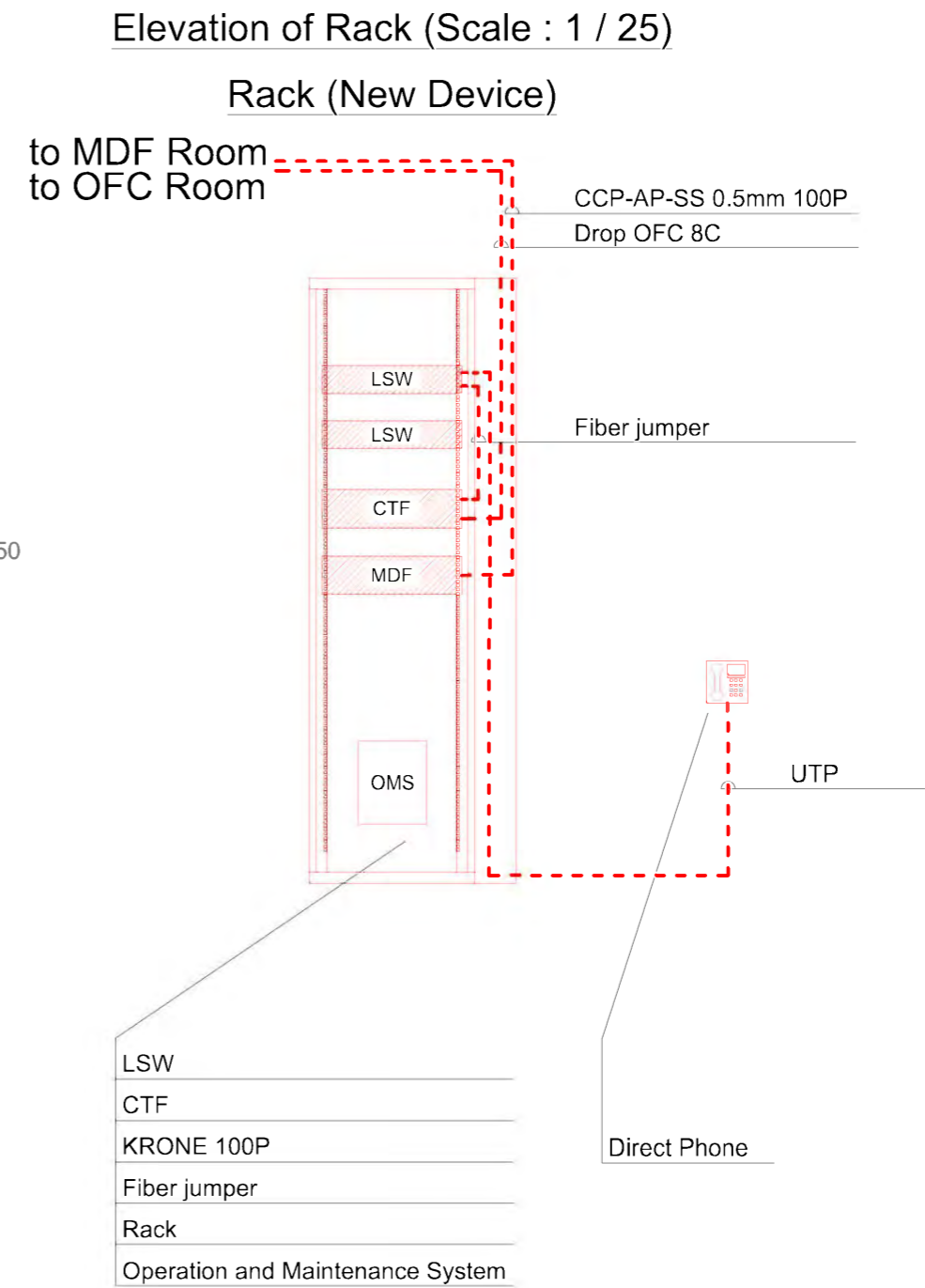
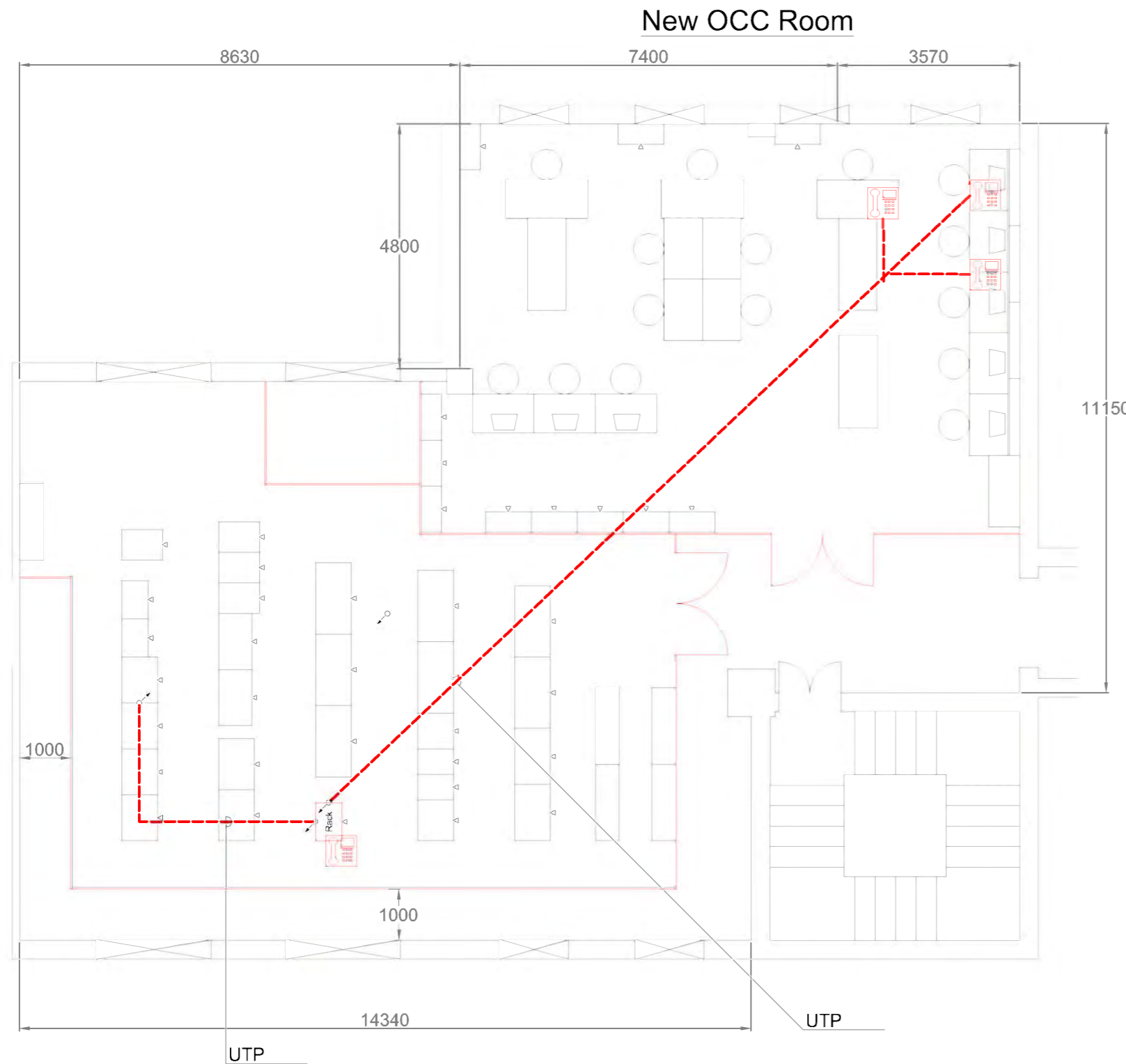
TITLE:

Yangon Detail diagram (1 / 2)

DRAWING NUMBER

BD3-02-01-202

Yangon Detail diagram (2 / 2)



for reference

NOTES: 1. 2.		CLIENT: 		CONSULTANTS: Consortium of JIC and OC 		DATE: MARCH 2014		PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment	
LEGEND		600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable UTP		Japan International Cooperation Agency Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.		THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY		iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall			SCALE: 1 / 100 TITLE: Yangon Detail diagram (2 / 2)		DRAWING NUMBER: BD3-02-01-203			

189

Pazundaung Detail diagram (1 / 2)

SH

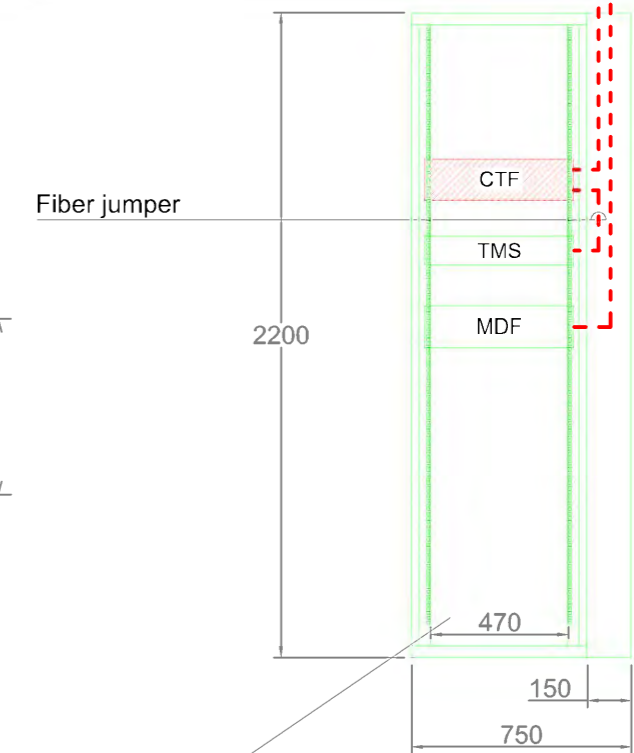
Elevation of Rack (Scale : 1 / 25)

Rack

to OFC Room

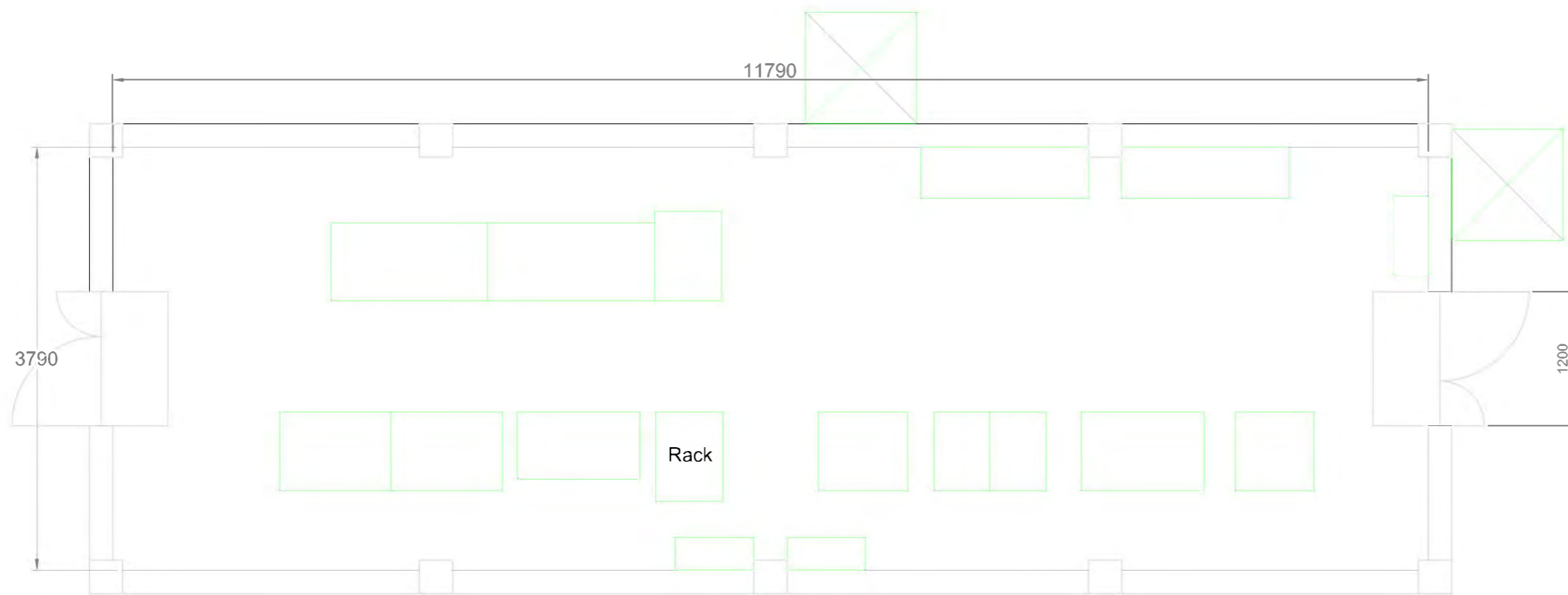
CCP-AP-SS 0.5mm 10P

Drop OFC 8C



CTF
KRONE 10P

for reference



NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

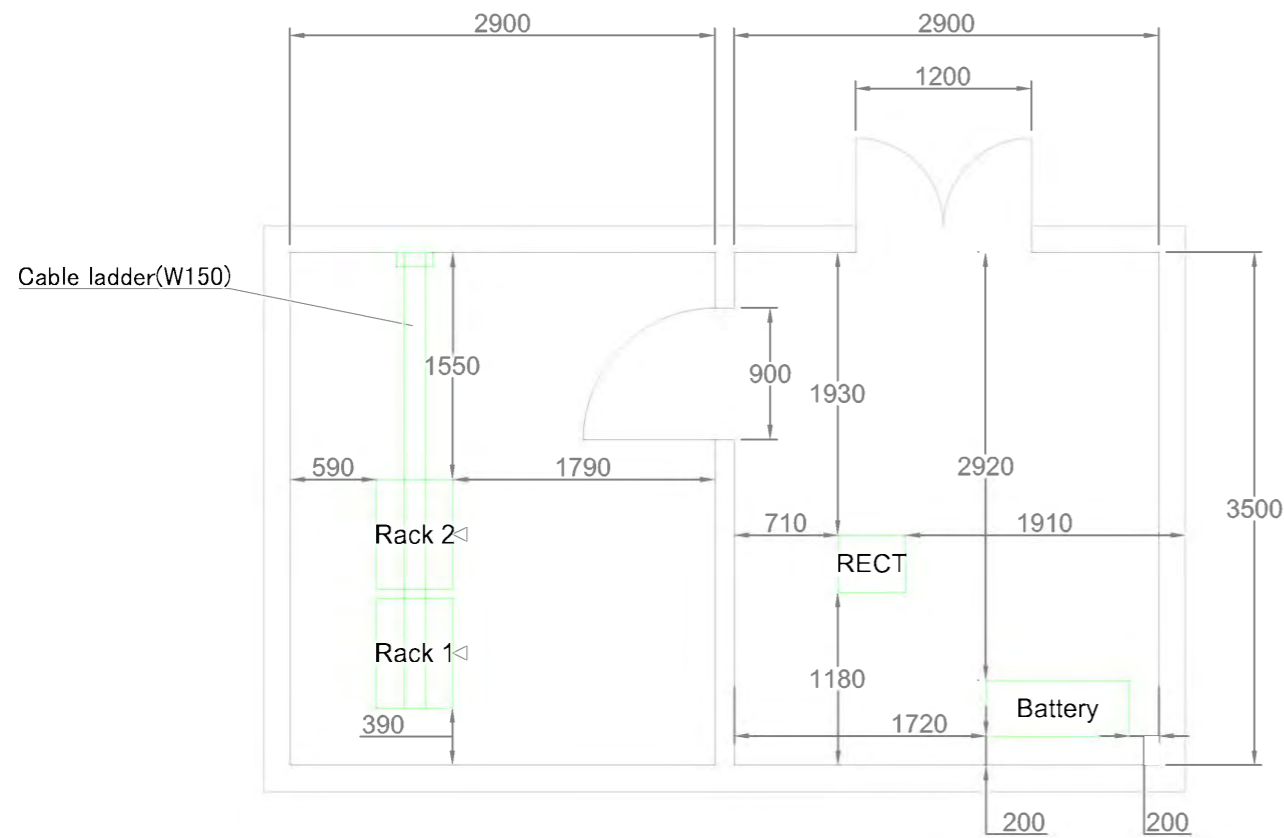
SCALE:
1 / 50

TITLE:
Pazundaung Detail diagram (1 / 2)

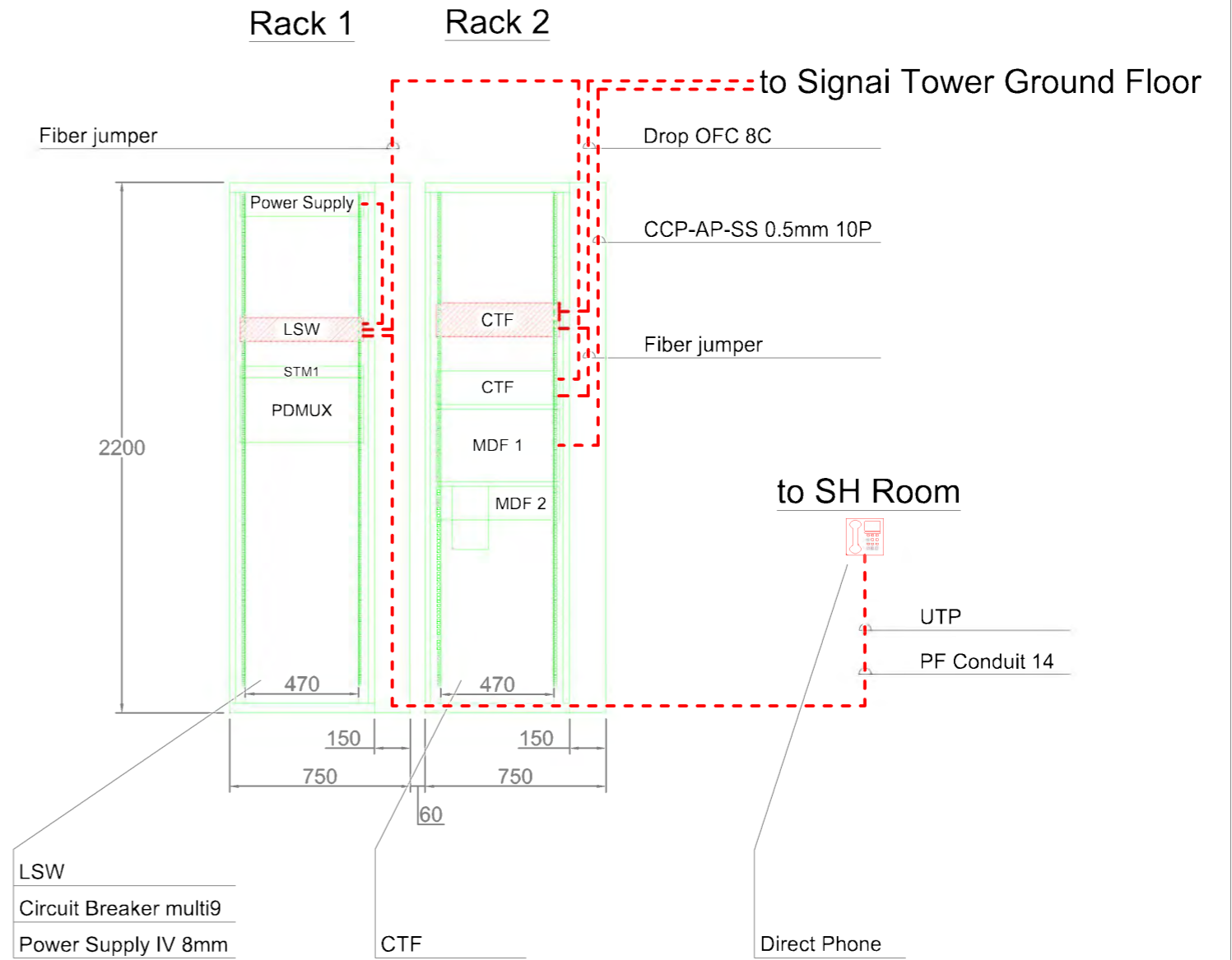
DRAWING NUMBER
BD3-02-02-201

Pazaundaung Detail diagram (2 / 2)

OFC Room



Elevation of Rack (Scale : 1 / 25)



LSW
Circuit Breaker multi9
Power Supply IV 8mm

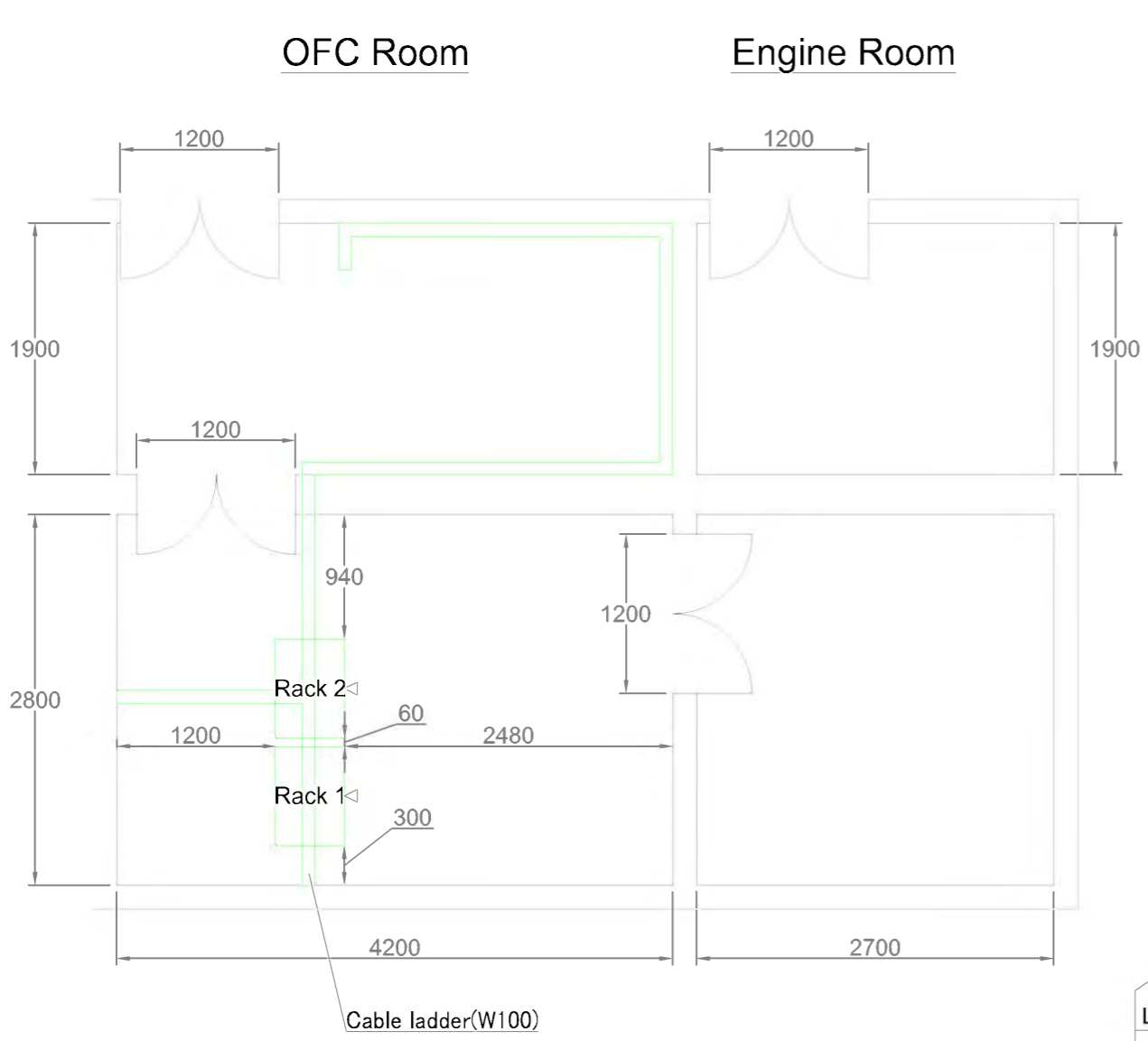
CTF

Direct Phone

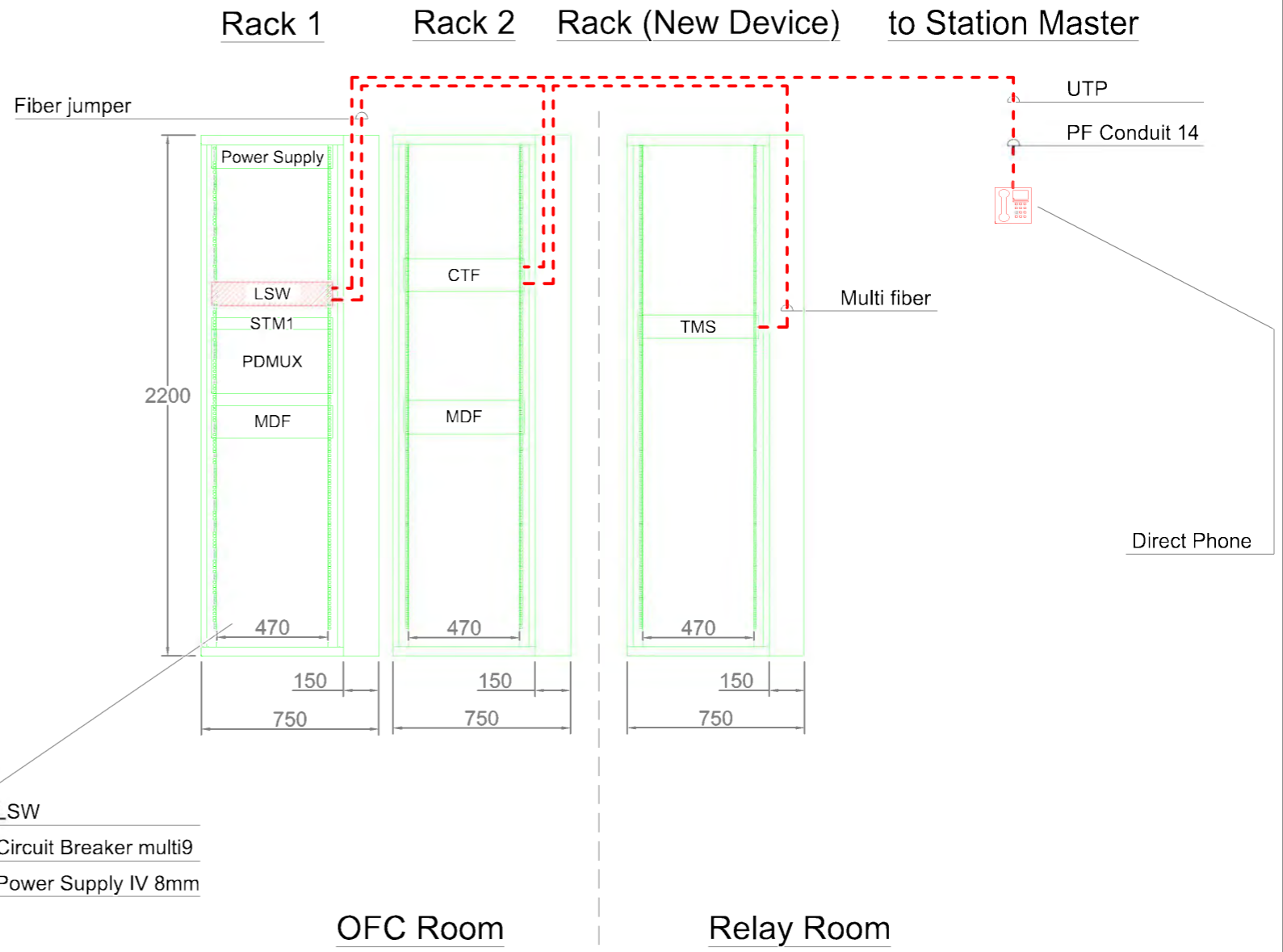
for reference

NOTES: 1. 2.		CLIENT: 		CONSULTANTS: Consortium of JIC and OC 		DATE: MARCH 2014		PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment	
LEGEND						THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY		iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP	Japan International Cooperation Agency Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	SCALE: 1 / 50	TITLE: Pazundaung Detail diagram (2 / 2)	DRAWING NUMBER BD3-02-02-202		

Mahlwagon, Thingangyun, Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu Detail diagram



Elevation of Rack (Scale : 1 / 25)



LSW
Circuit Breaker multi9
Power Supply IV 8mm

OFC Room

Relay Room

for reference

NOTES:
1.
2.

LEGEND			
Ceiling concealment line	Startup		IV
Floor concealment line	Fall		CV
Exposure Wiring	Through		CVV
Undergrounding wiring	Earthing		CPEV
Overhead line	Hand Hall		UTP

CLIENT:

Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC

Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:
The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

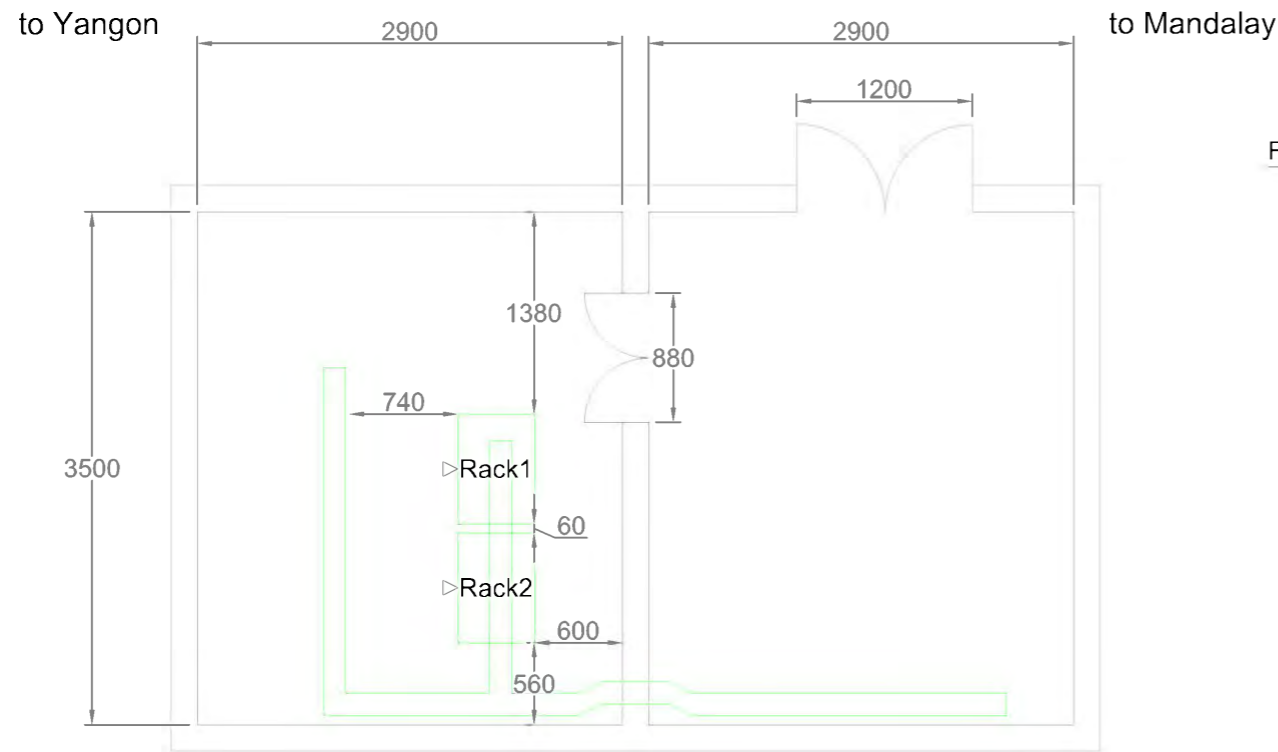
SCALE: 1 / 50

TITLE: Mahlwagon, Thingangyun, Laydaungkan, Tongyi, Kyauktan, Tawa, Payathonzu Detail diagram

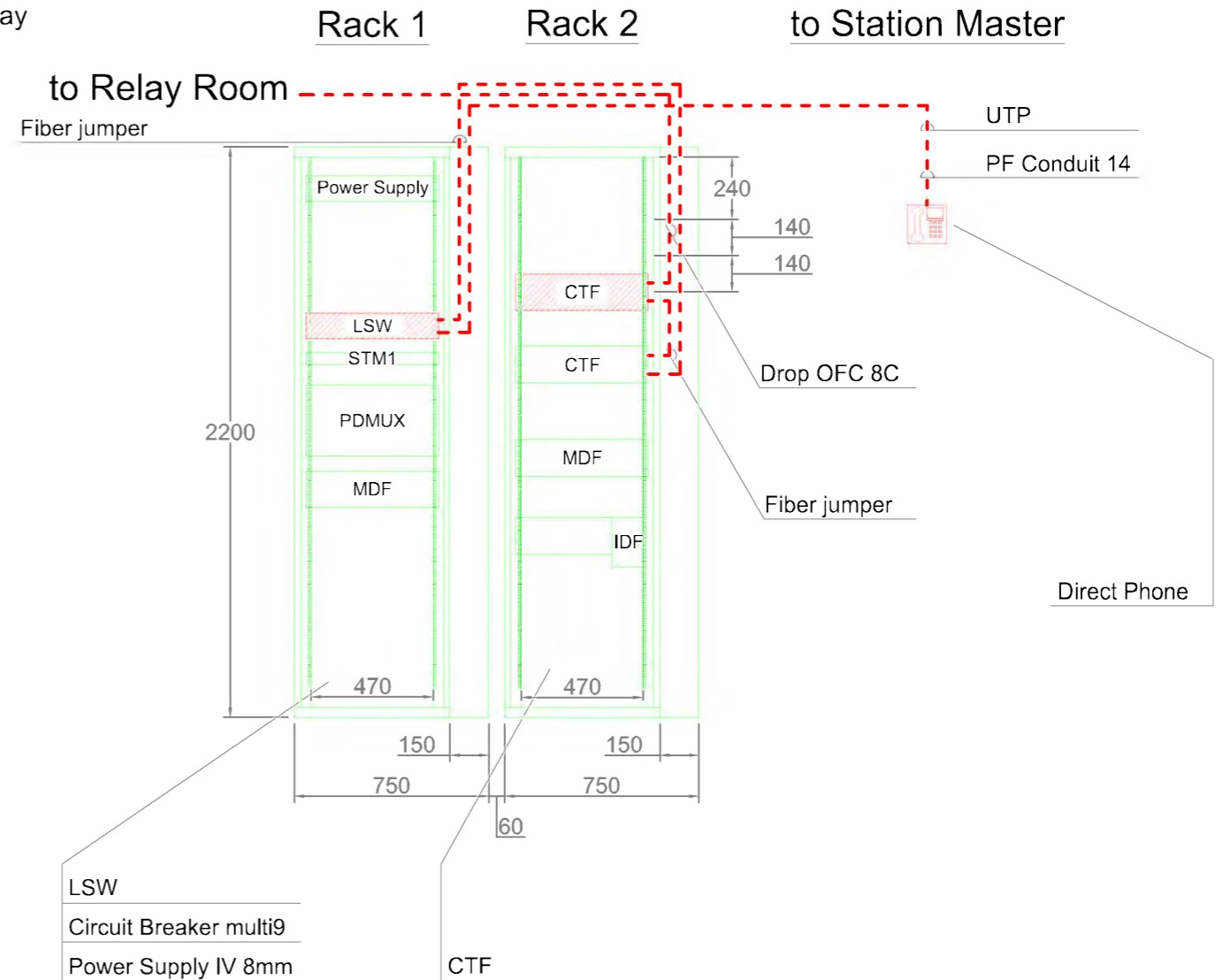
DRAWING NUMBER: BD3-02-03-201

Toegyaungkalay, Ywathagyi, Shwele, Payagyi, Phinbongyi, Panugdawthi, Daik-u Detail diagram

OFC Room



Elevation of Rack (Scale : 1 / 25)



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 50

TITLE: Toegyaungkalay, Ywathagyi, Shwele, Payagyi, Phinbongyi, Panugdawthi, Daik-u Detail diagram

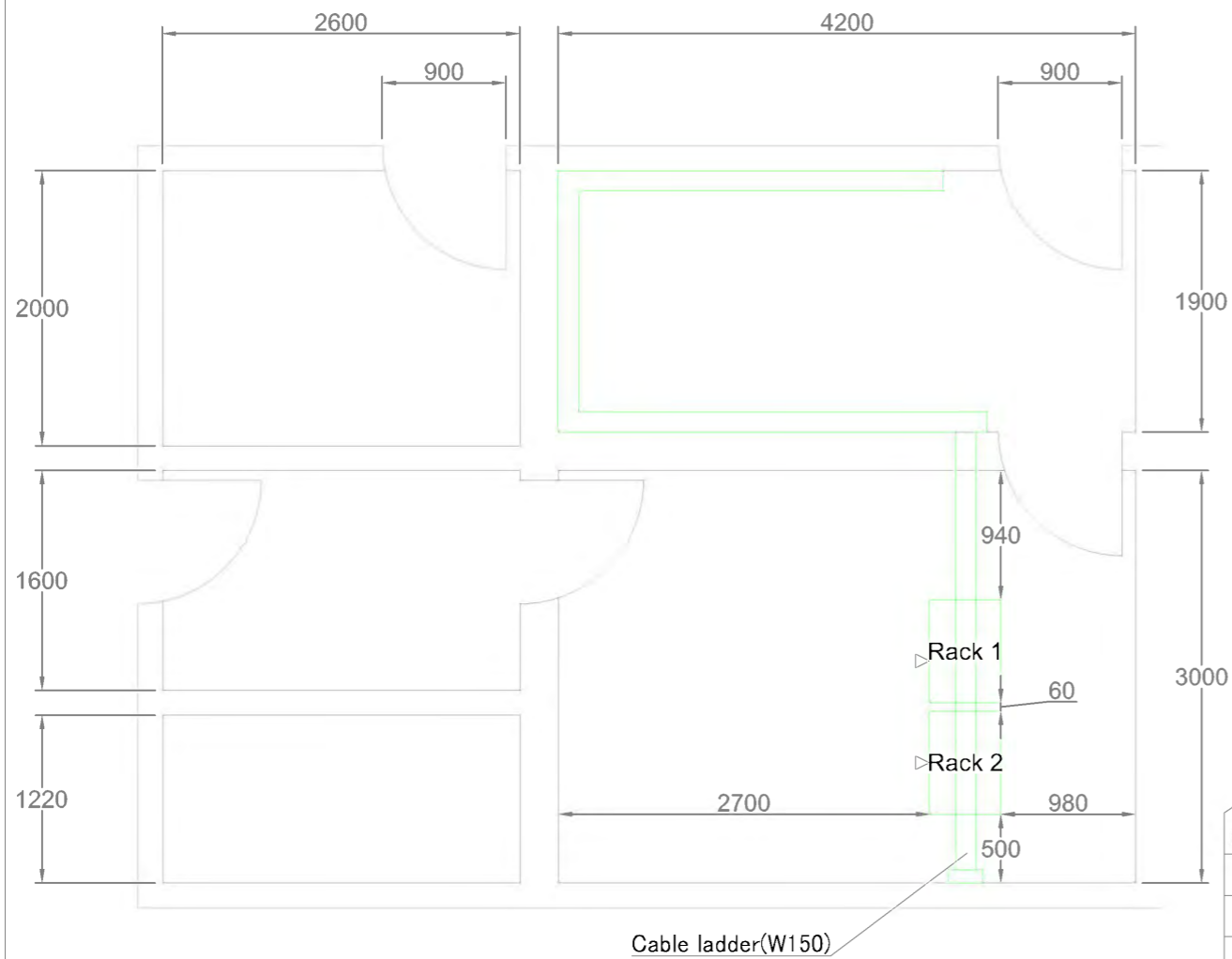
DRAWING NUMBER

BD3-02-04-201

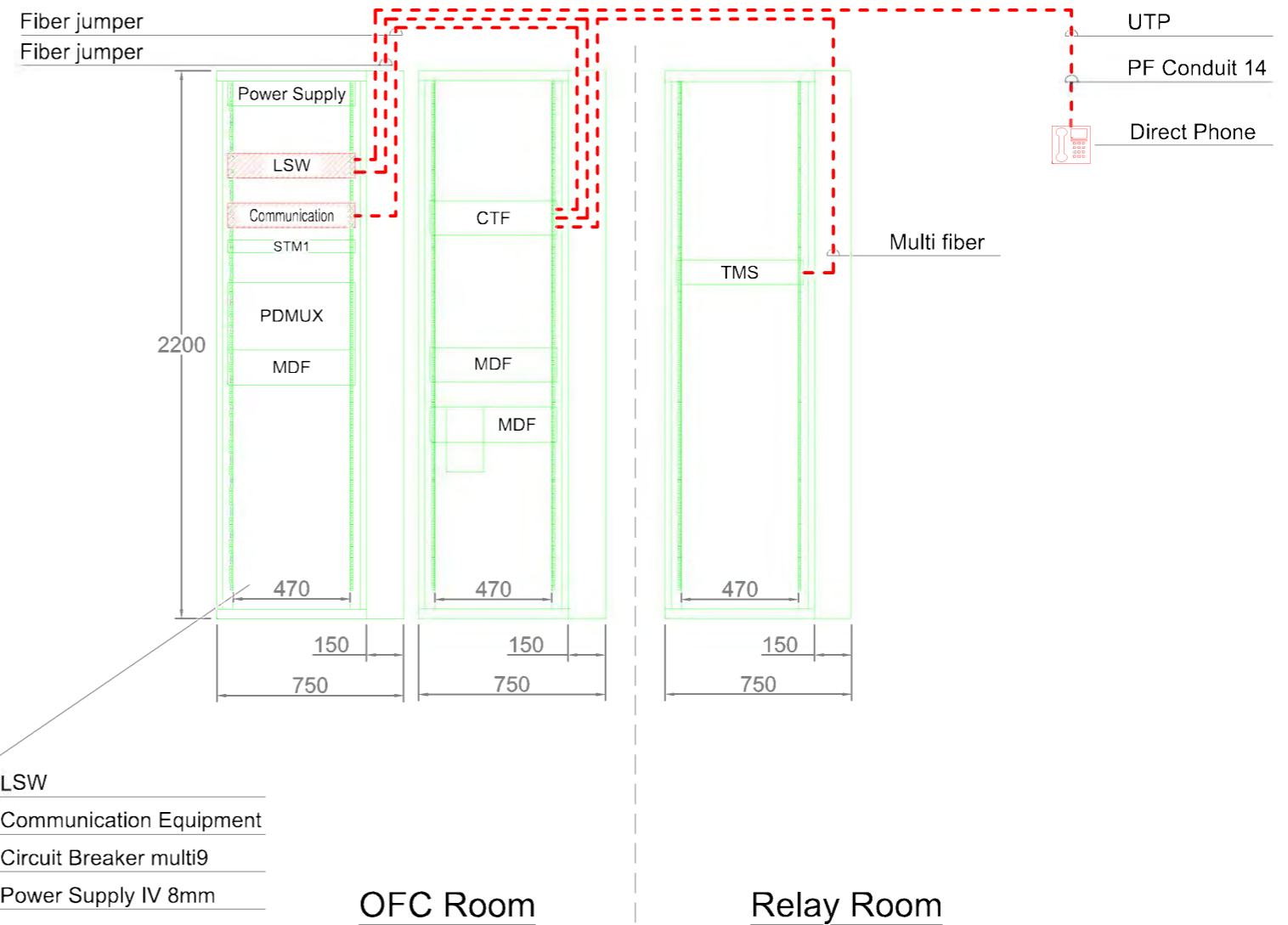
Darbain, Bago Detail diagram

Elevation of Rack (Scale : 1 / 25)

OFC Room



Rack 1 Rack 2 Rack (New Device) to Station Master



for reference

NOTES: 1. 2.			
LEGEND			
Ceiling concealment line	Startup		IV
Floor concealment line	Fall		CV
Exposure Wiring	Through		CVV
Undergrounding wiring	Earthing		CPEV
Overhead line	Hand Hall		UTP

CLIENT:

Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC

Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

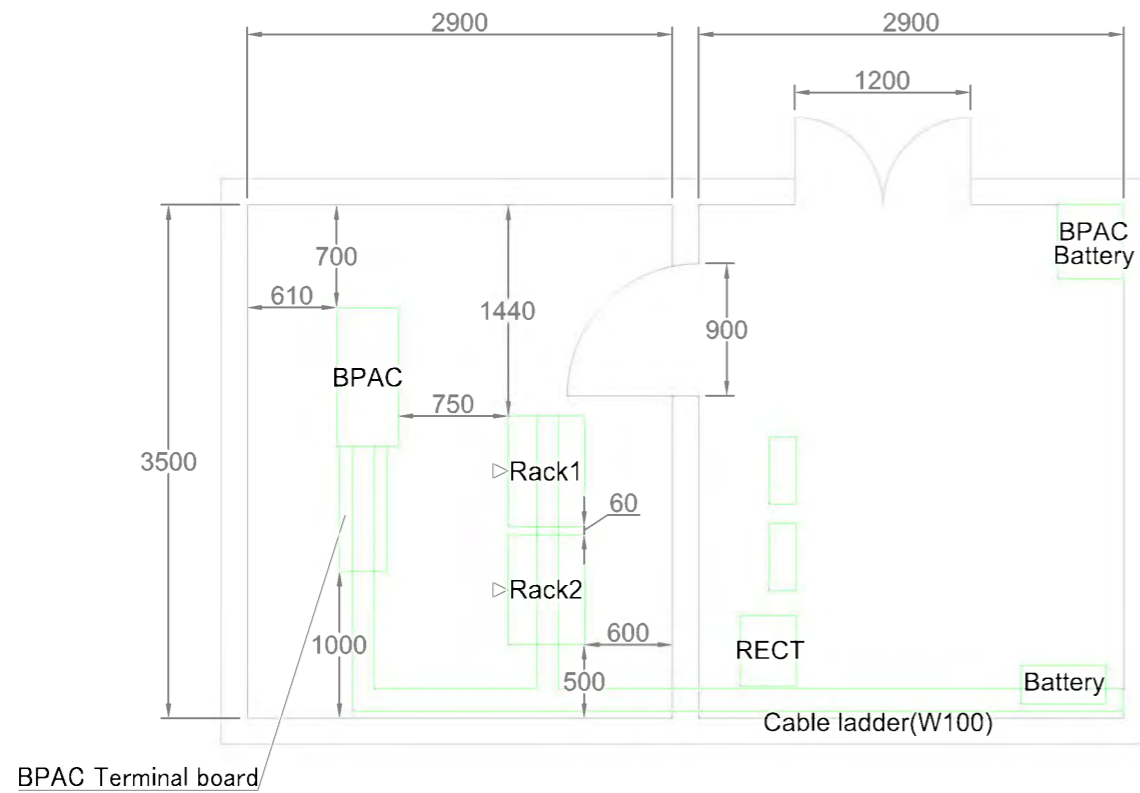
PROJECT:
The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

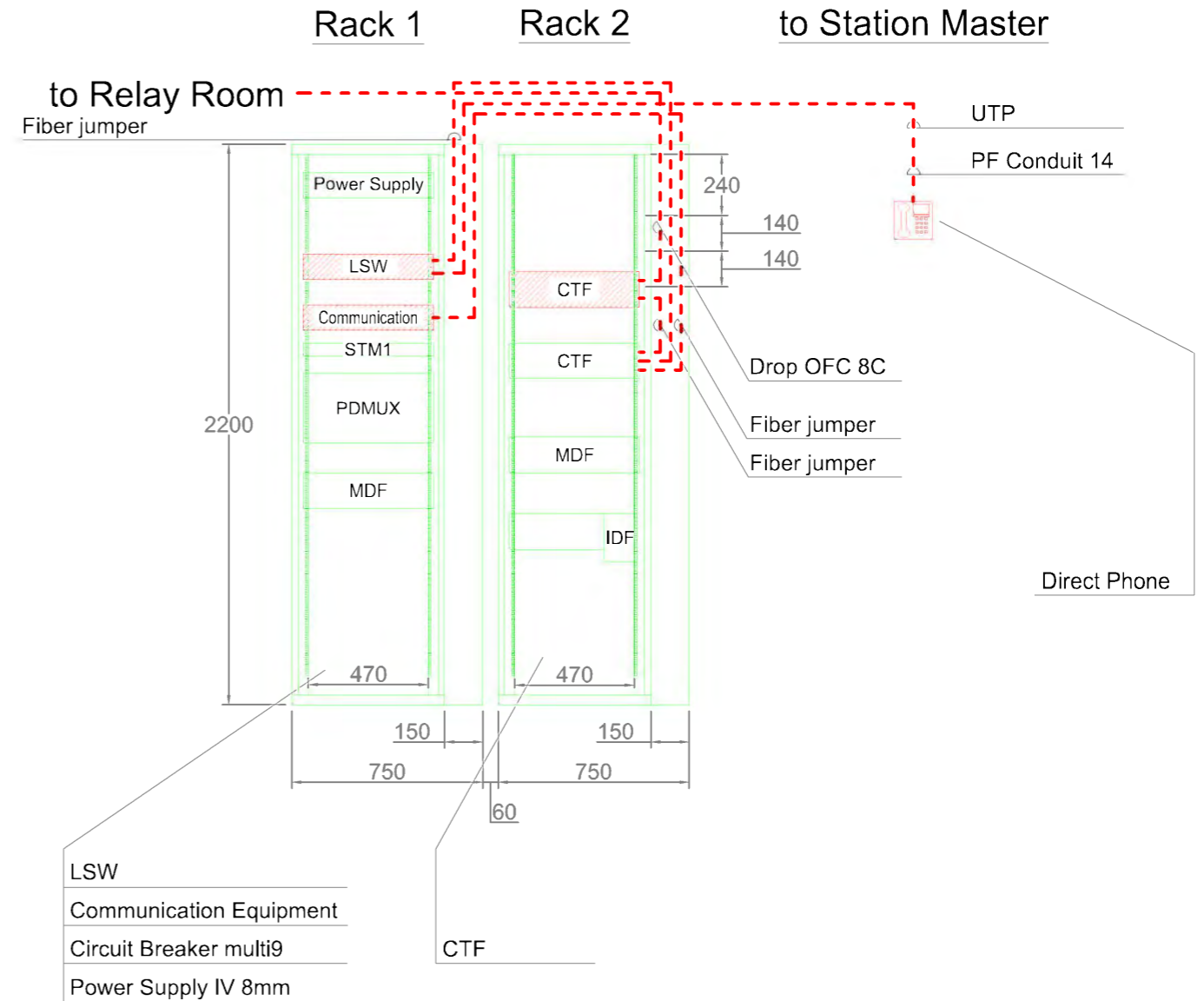
SCALE:	1 / 50	TITLE:	Darbain, Bago Detail diagram
DRAWING NUMBER	BD3-02-05-201		

Kadok Detail diagram

OFC Room



Elevation of Rack (Scale : 1 / 25)



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 50

TITLE:

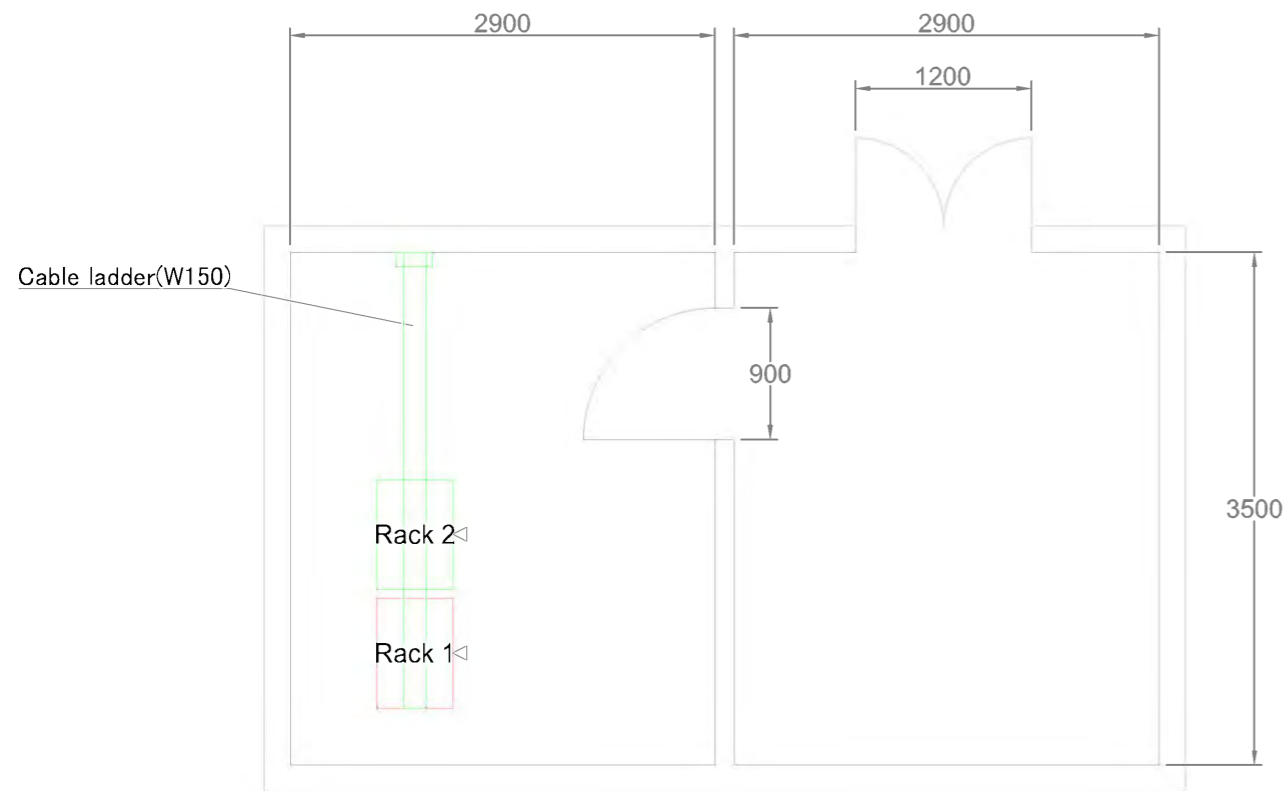
Kadok Detail diagram

DRAWING NUMBER

BD3-02-06-201

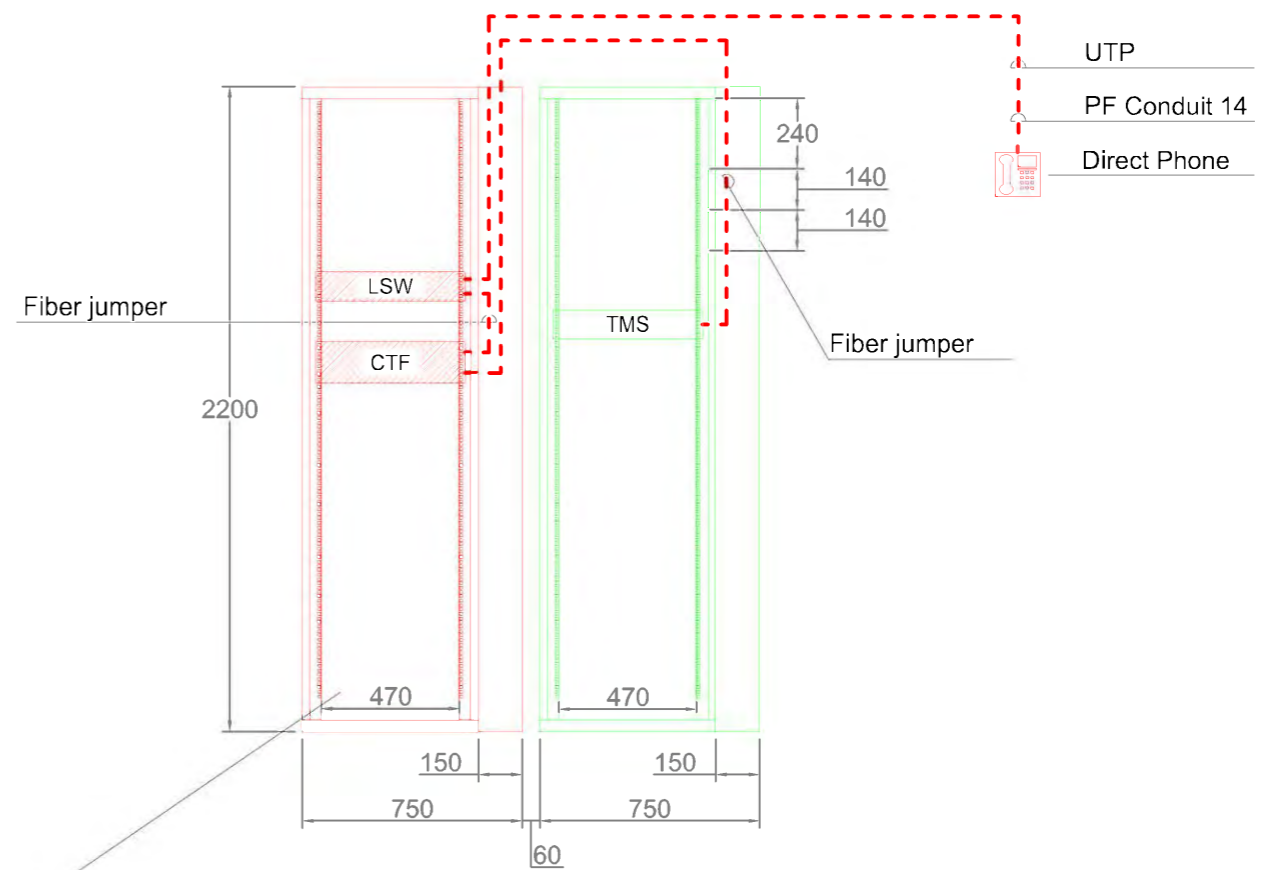
Eimshaylayse Detail diagram (1 / 2)

OFC Room



Elevation of Rack (Scale : 1 / 25)

Rack1 (New Device) Rack2 (New Device) to Station Master

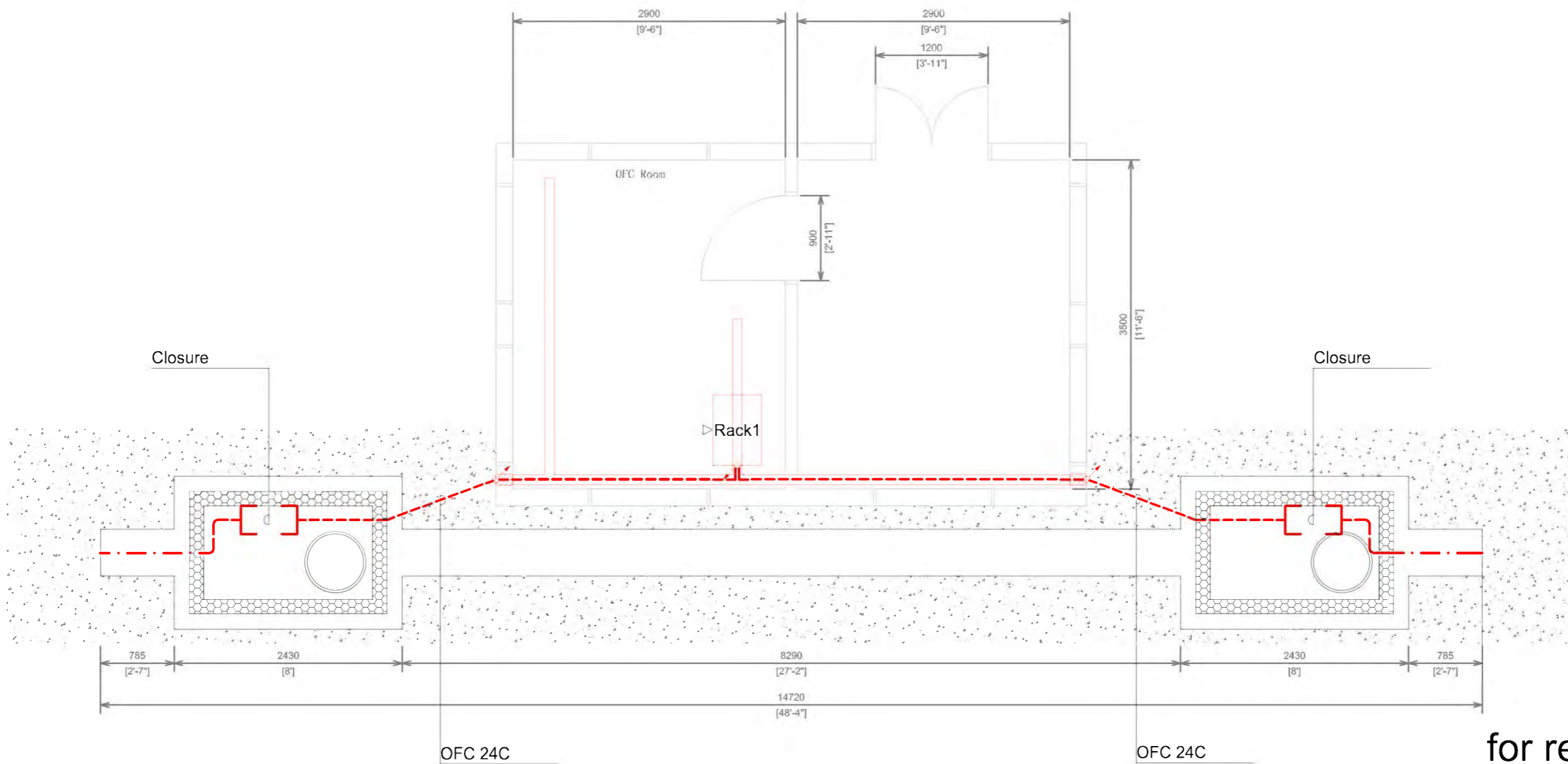


- LSW
- CTF 48C
- Rack

for reference

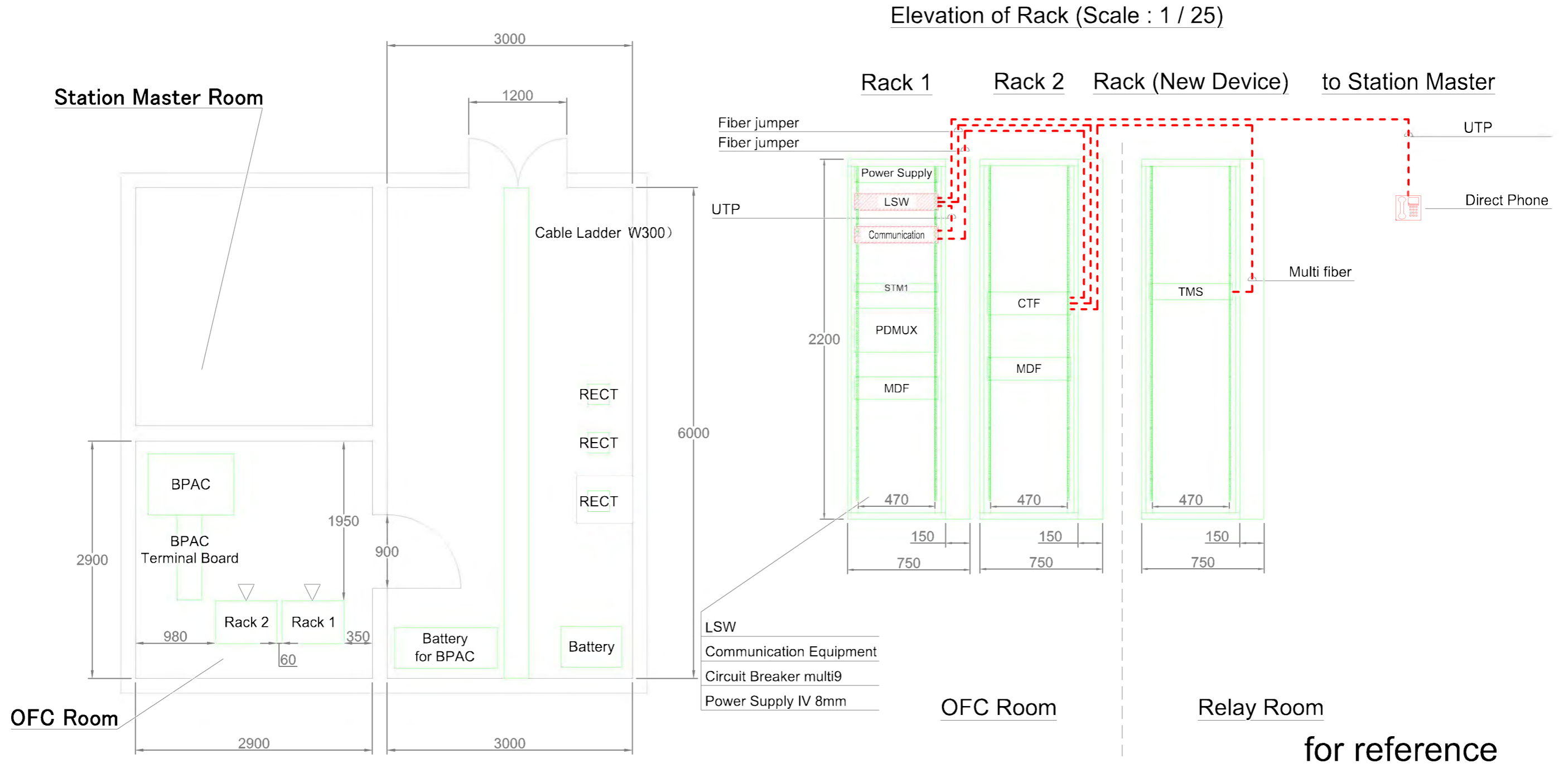
NOTES: 1. 2.		CLIENT: 		CONSULTANTS: Consortium of JIC and OC 		DATE: MARCH 2014		PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment	
LEGEND						THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY		iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line	
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP	Japan International Cooperation Agency	Japan International Consultants for Transportation Co., Ltd.	Oriental Consultants Co., Ltd.	SCALE: 1 / 50	TITLE: Eimshaylayse Detail diagram (1 / 2)	
DRAWING NUMBER		BD3-02-07-201							

Eimshaylayse Detail diagram (2 / 2)



NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 50
Ceiling concealment line ——— Floor concealment line - - - - Exposure Wiring - - - - - Undergrounding wiring - · - · - Overhead line - - - - -	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP	TITLE: Eimshaylayse Detail diagram (2 / 2)	DRAWING NUMBER BD3-02-07-202

Pyuntaza Detail diagram



NOTES:
1.
2.

LEGEND			
Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:

CONSULTANTS:
Consortium of JIC and OC

DATE:
MARCH 2014

PROJECT:
The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:
1 / 50

TITLE:
Pyuntaza Detail diagram

DRAWING NUMBER
BD3-02-08-201

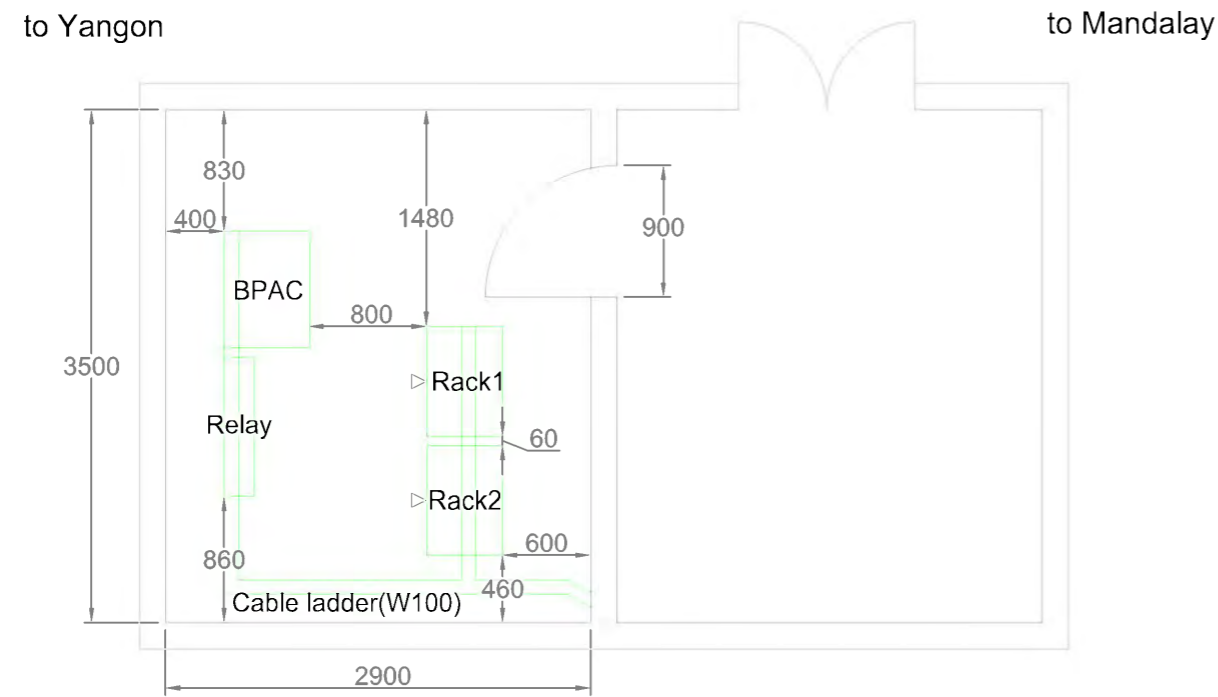
JICA
Japan International Cooperation Agency

JIC
Japan International Consultants for Transportation Co., Ltd.

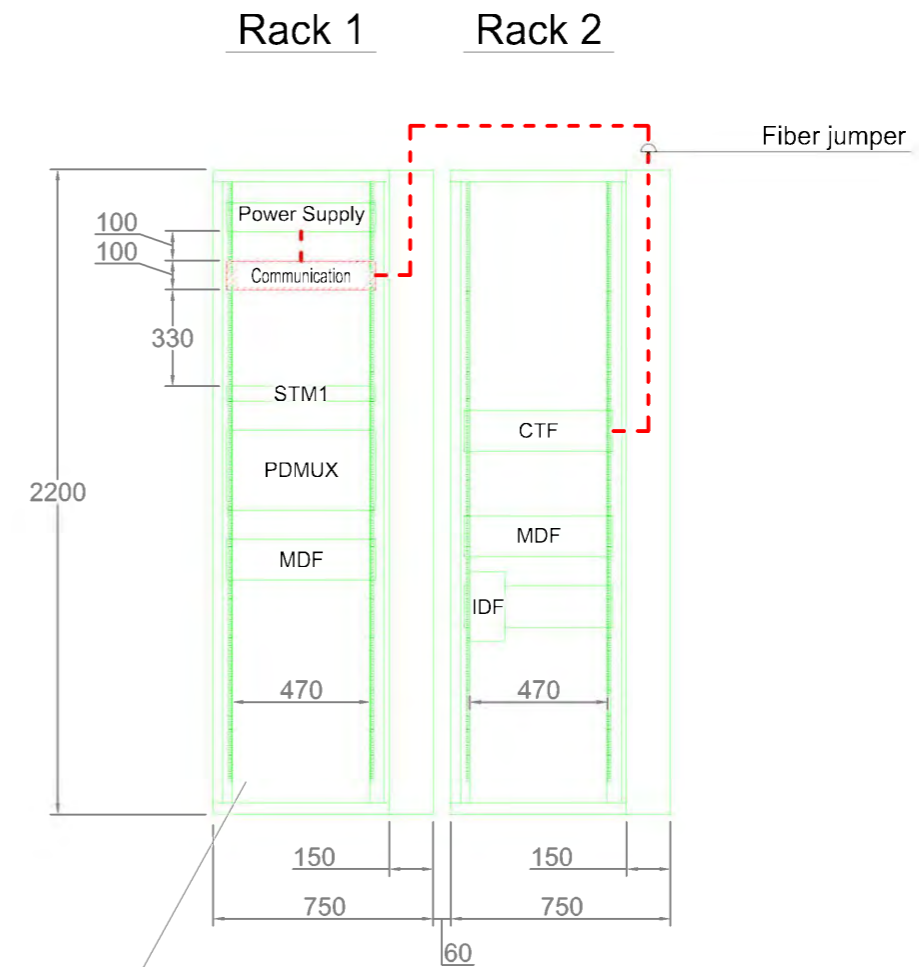
ORICONSUL
Oriental Consultants Co., Ltd.

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

Penwegon, Nyaungchidauk, Taungoo, Swa, Thawati Detail diagram



Elevation of Rack (Scale : 1 / 25)

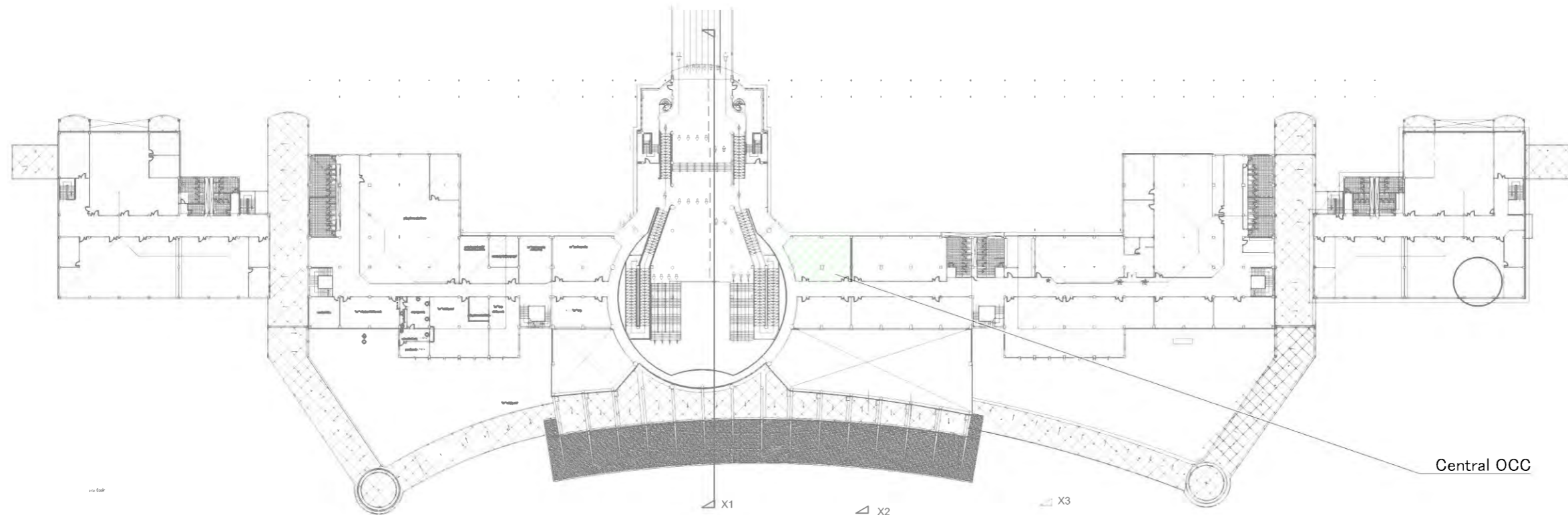


- Communication Equipment
- Circuit Breaker multi9
- Power Supply IV 8mm

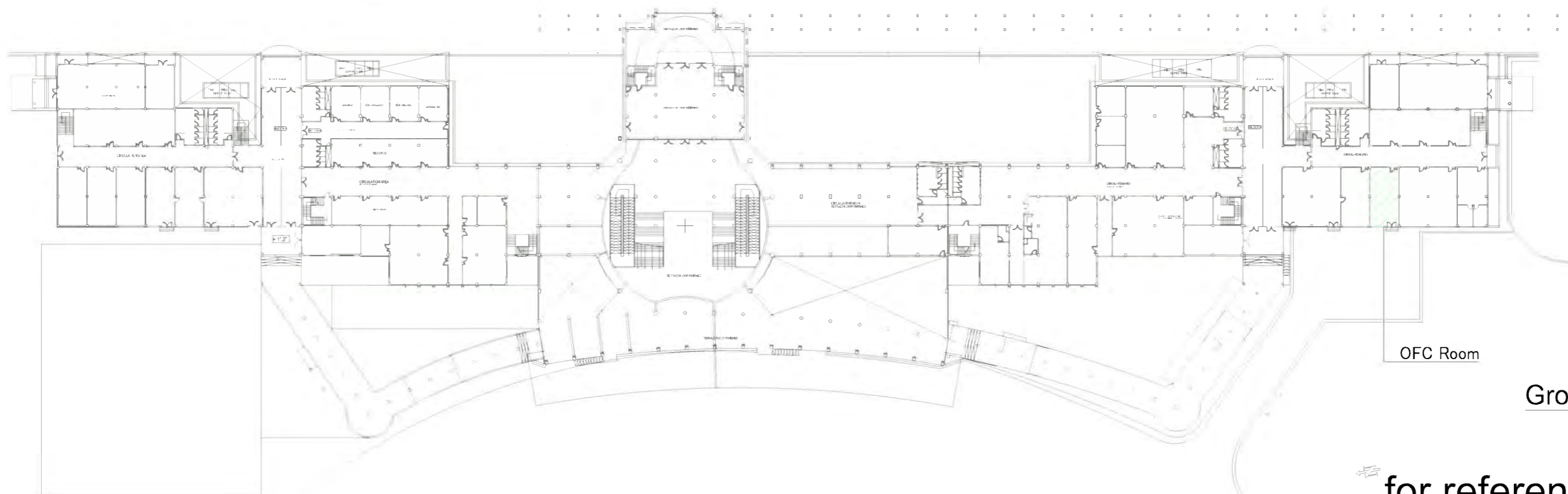
for reference

<p>NOTES:</p> <p>1.</p> <p>2.</p>		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>																									
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP	<p>SCALE: 1 / 50</p> <p>TITLE: Penwegon, Nyaungchidauk, Taungoo, Swa, Thawati Detail diagram</p>			
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																										
Floor concealment line	Fall		Polyethylene insulation cable	CV																										
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																										
Undergrounding wiring	Earthing		Communication cable	CPEV																										
Overhead line	Hand Hall		UTP cable	UTP																										
<p>DRAWING NUMBER</p>		<p>BD3-02-09-201</p>																												

Naypyitaw Layout drawing



First floor



OFC Room

Ground floor

for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 1000

TITLE:

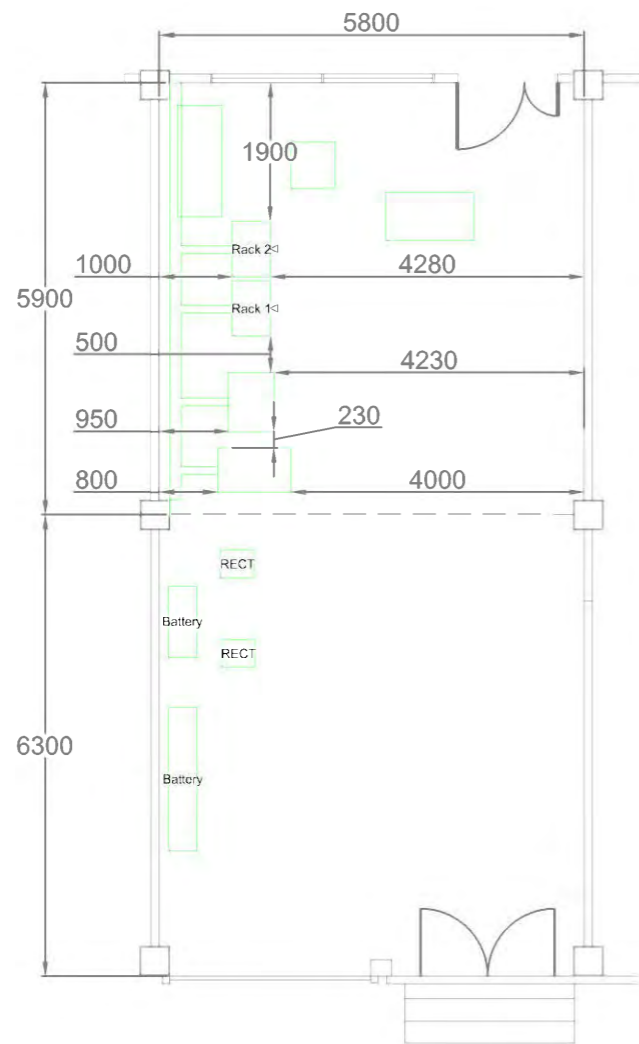
Naypyitaw Layout drawing

DRAWING NUMBER

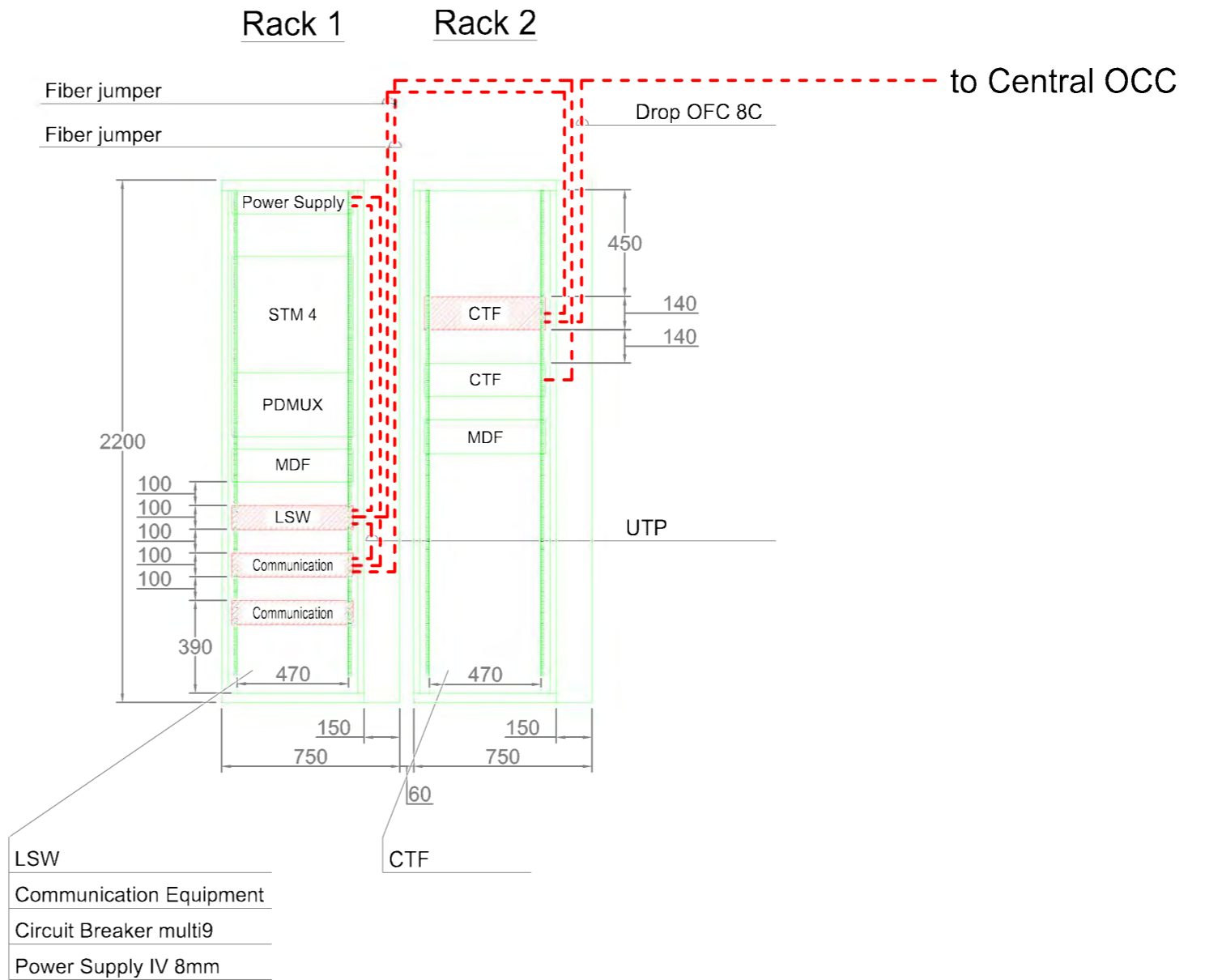
BD3-02-10-201

Naypyitaw Detail diagram (1 / 2)

OFC Room



Elevation of Rack (Scale : 1 / 25)



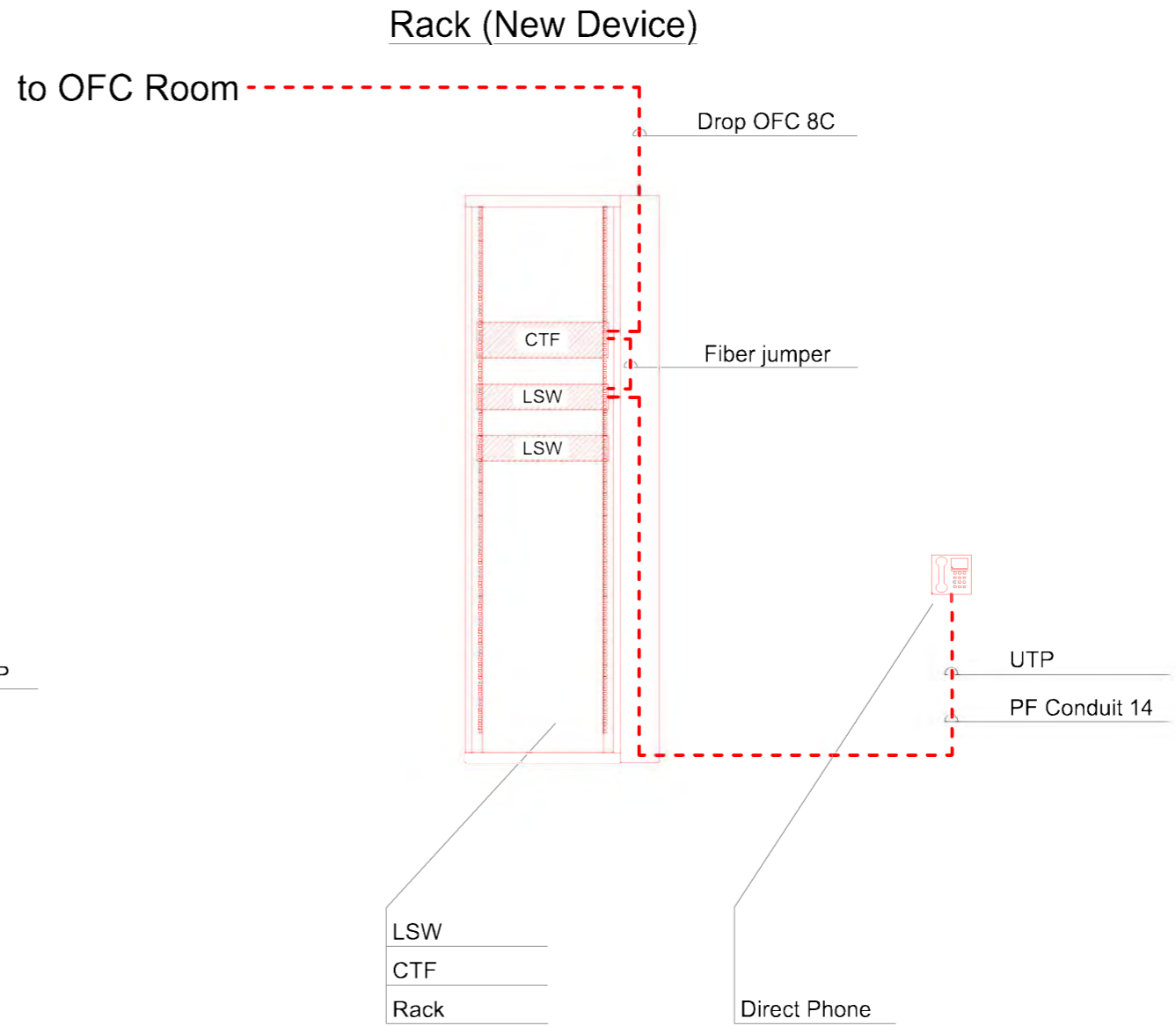
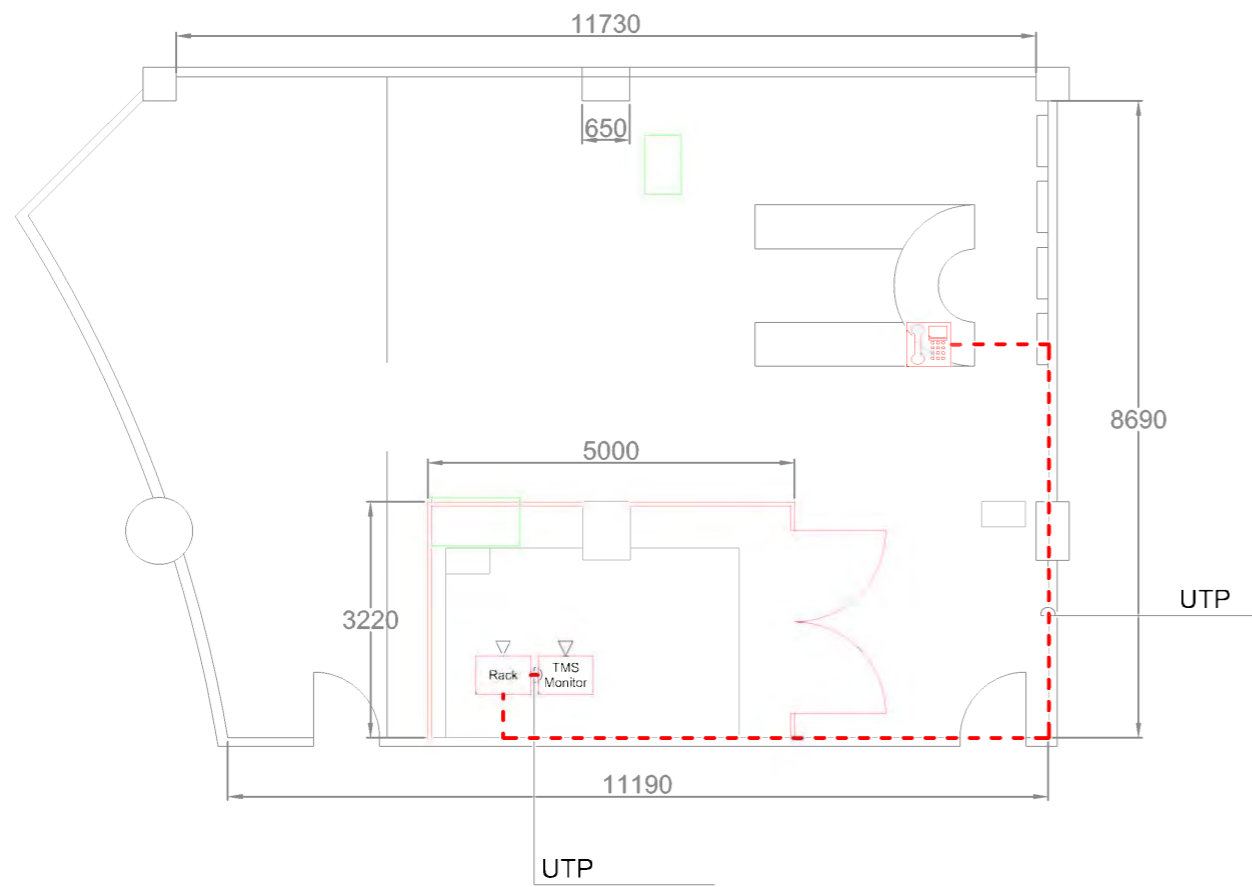
for reference

<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>																									
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP				
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																										
Floor concealment line	Fall		Polyethylene insulation cable	CV																										
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																										
Undergrounding wiring	Earthing		Communication cable	CPEV																										
Overhead line	Hand Hall		UTP cable	UTP																										
<p>DRAWING NUMBER</p> <p>BD3-02-10-202</p>																														

Naypyitaw Detail diagram (2 / 2)

Central OCC

Elevation of Rack (Scale : 1 / 25)



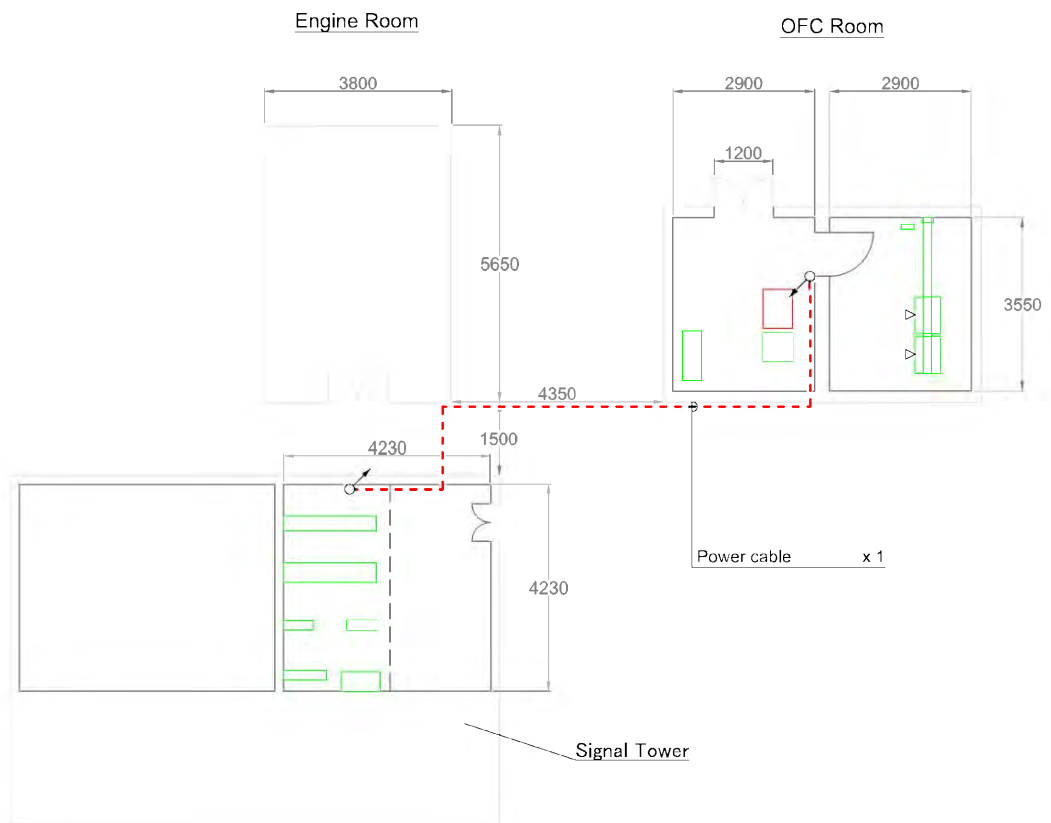
for reference

NOTES: 1. 2.		CLIENT: Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire Polyethylene insulation cable Vinyl insulation cable for control Communication cable UTP cable	IV CV CVV CPEV UTP		
DRAWING NUMBER		BD3-02-10-203			
SCALE:		1 / 100			
TITLE:		Naypyitaw Detail diagram (2 / 2)			

Mahlwagon Layout drawing

Mandalay

Yangon



for reference

NOTES:

- 1.
- 2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

1 / 100

TITLE:

Mahlwagon Layout drawing
Cover

DRAWING NUMBER

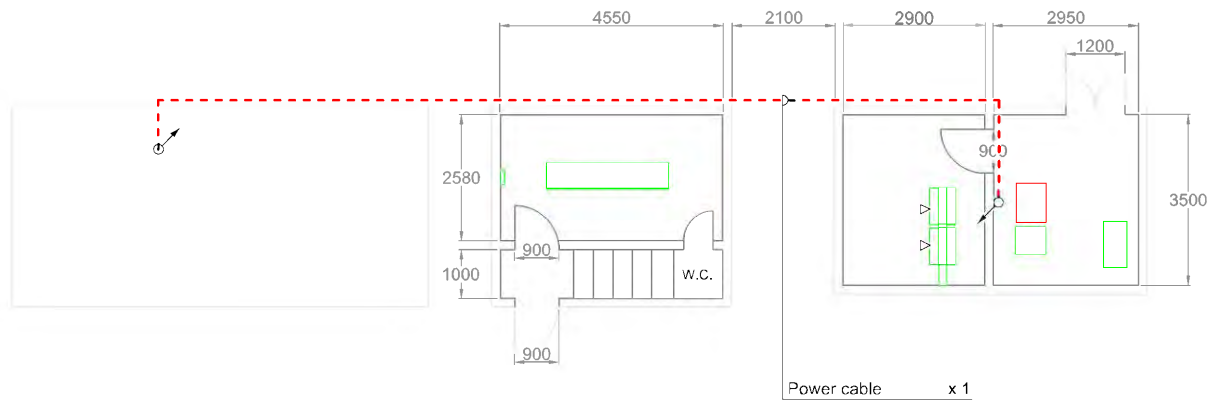
BD3-02-03-301

Thingangyun Layout drawing

Yangon

Mandalay

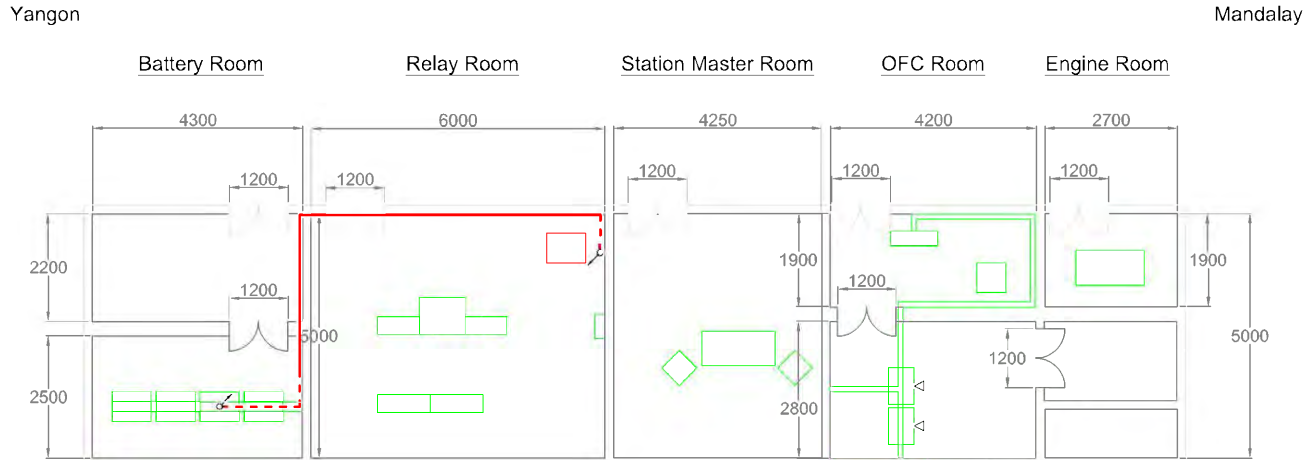
Electric Power Room



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line Floor concealment line Exposure Wiring Underground wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP		
DRAWING NUMBER		BD3-02-04-301			
TITLE:		Thingangyun Layout drawing Cover			

Laydaungkan Layout drawing



for reference

NOTES: 1. 2.		CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					
Ceiling concealment line Floor concealment line Exposure Wiring Underground wiring Overhead line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP		
DRAWING NUMBER		DRAWING NUMBER BD3-02-07-301			

Bago Layout drawing

Yangon

Mandalay



for reference

NOTES:			
1.			
2.			
LEGEND			
Ceiling concealment line	Startup		IV
Floor concealment line	Fall		CV
Exposure Wiring	Through		CVV
Undergrounding wiring	Earthing		CPEV
Over-head line	Hand Hall		UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:

Consortium of JIC and OC




Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.

DATE: MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment

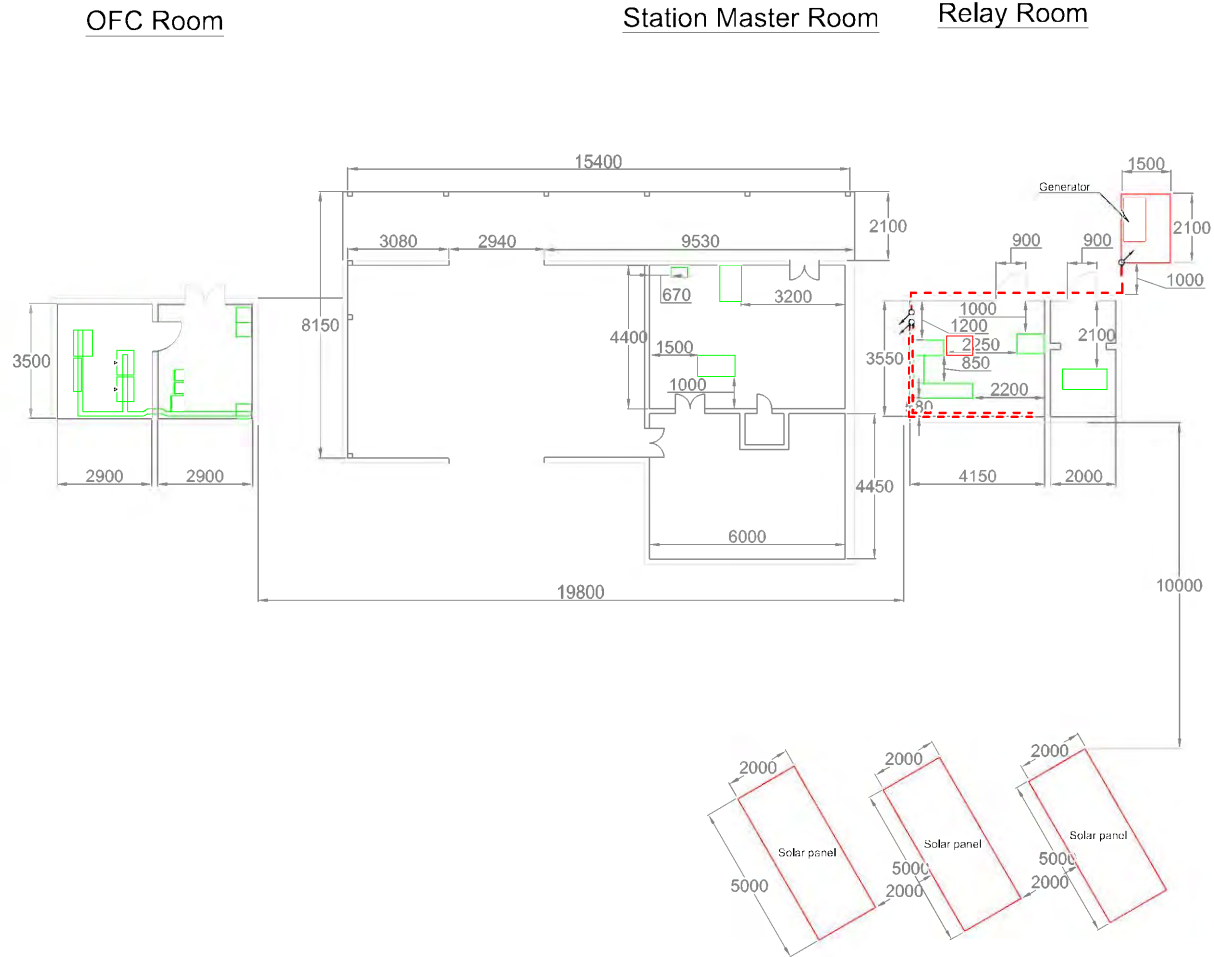
iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:	1 / 200	TITLE:	Bago Layout drawing Cover
DRAWING NUMBER	BD3-02-13-301		

Shwele Layout drawing

Mandalay

Yangon

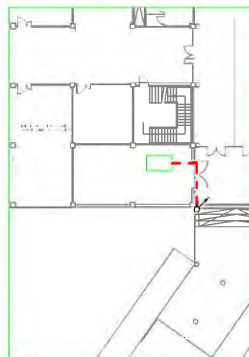


for reference

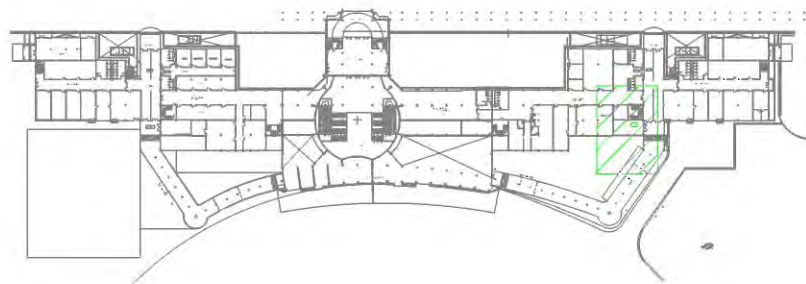
<p>NOTES:</p> <ol style="list-style-type: none"> 		<p>CLIENT:</p>  <p>Japan International Cooperation Agency</p>	<p>CONSULTANTS:</p> <p>Consortium of JIC and OC</p>   <p>Japan International Consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.</p>	<p>DATE:</p> <p>MARCH 2014</p> <p>THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY</p>	<p>PROJECT:</p> <p>The Project for Installation of Operation Control Center System and Safety Equipment</p> <p>iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line</p>																							
<p>LEGEND</p> <table border="0"> <tr> <td>Ceiling concealment line</td> <td>Startup</td> <td></td> <td>600V Vinyl insulation electric wire</td> <td>IV</td> </tr> <tr> <td>Floor concealment line</td> <td>Fall</td> <td></td> <td>Polyethylene insulation cable</td> <td>CV</td> </tr> <tr> <td>Exposure Wiring</td> <td>Through</td> <td></td> <td>Vinyl insulation cable for control</td> <td>CVV</td> </tr> <tr> <td>Undergrounding wiring</td> <td>Earthing</td> <td></td> <td>Communication cable</td> <td>CPEV</td> </tr> <tr> <td>Overhead line</td> <td>Hand Hall</td> <td></td> <td>UTP cable</td> <td>UTP</td> </tr> </table>		Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV	Floor concealment line	Fall		Polyethylene insulation cable	CV	Exposure Wiring	Through		Vinyl insulation cable for control	CVV	Undergrounding wiring	Earthing		Communication cable	CPEV	Overhead line	Hand Hall		UTP cable	UTP		
Ceiling concealment line	Startup		600V Vinyl insulation electric wire	IV																								
Floor concealment line	Fall		Polyethylene insulation cable	CV																								
Exposure Wiring	Through		Vinyl insulation cable for control	CVV																								
Undergrounding wiring	Earthing		Communication cable	CPEV																								
Overhead line	Hand Hall		UTP cable	UTP																								
				<p>SCALE:</p> <p>1 / 150</p>	<p>TITLE:</p> <p>Shwele Layout drawing Cover</p>																							
				<p>DRAWING NUMBER</p> <p>BD3-02-14-301</p>																								

Naypyitaw Detail diagram (1 / 3)

Naypyitaw ground floor Enlarged view(Scale : 1 / 500)



Naypyitaw ground floor General drawing (Scale : 1 / 2000)

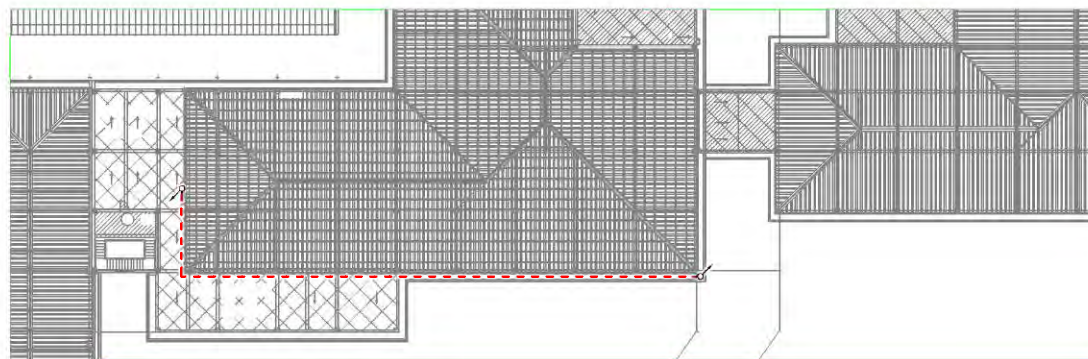


for reference

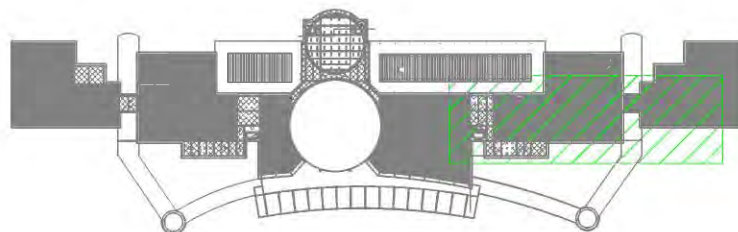
NOTES: 1. 2.			CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Co-consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND						
Ceiling concealment line 	Startup 	 600V Vinyl insulation electric wire	IV			
Floor concealment line 	Fall 	 Polyethylene insulation cable	CV			
Exposure Wiring 	Through 	 Vinyl insulation cable for control	CVV			
Undergrounding wiring 	Earthing 	 Communication cable	CPEV			
Over-head line 	Hand Hall 	 UTP cable	UTP			
			DRAWING NUMBER	BD3-02-27-301	SCALE: 1 / 2000	TITLE: Naypyitaw Detail diagram (1 / 3) Cover

Naypyitaw Detail diagram (2 / 3)









Naypyitaw RF Enlarged view(Scale : 1 / 500)



Naypyitaw RF General drawing (Scale : 1 / 2000)

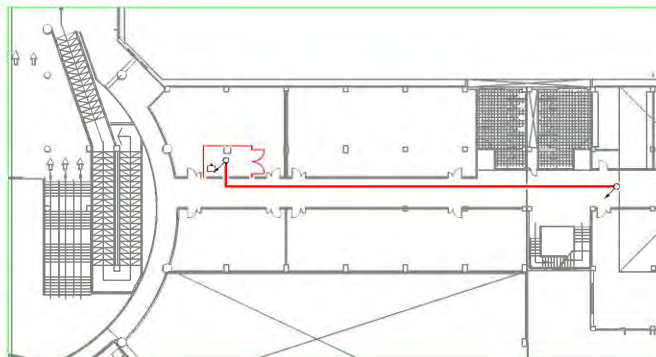


for reference

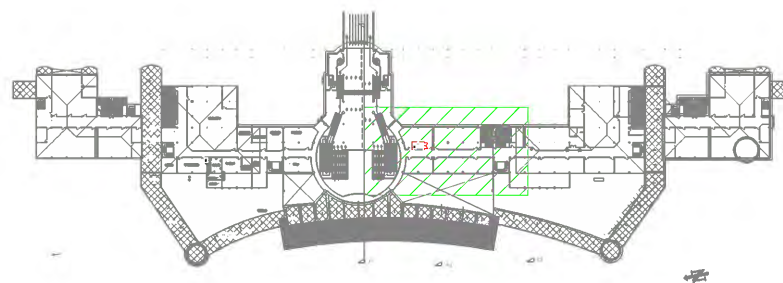
NOTES: 1. 2.			CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Co-consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND					SCALE: 1 / 2000	TITLE: Naypyitaw Detail diagram (2 / 3) Cover
Ceiling concealment line Floor concealment line Exposure Wiring Undergrounding wiring Over-head line	Startup Fall Through Earthing Hand Hall	 600V Vinyl insulation electric wire  Polyethylene insulation cable  Vinyl insulation cable for control  Communication cable  UTP cable	IV CV CVV CPEV UTP		DRAWING NUMBER BD3-02-27-302	

Naypyitaw Detail diagram (3 / 3)















Naypyitaw first floor Enlarged view (Scale : 1 / 500)



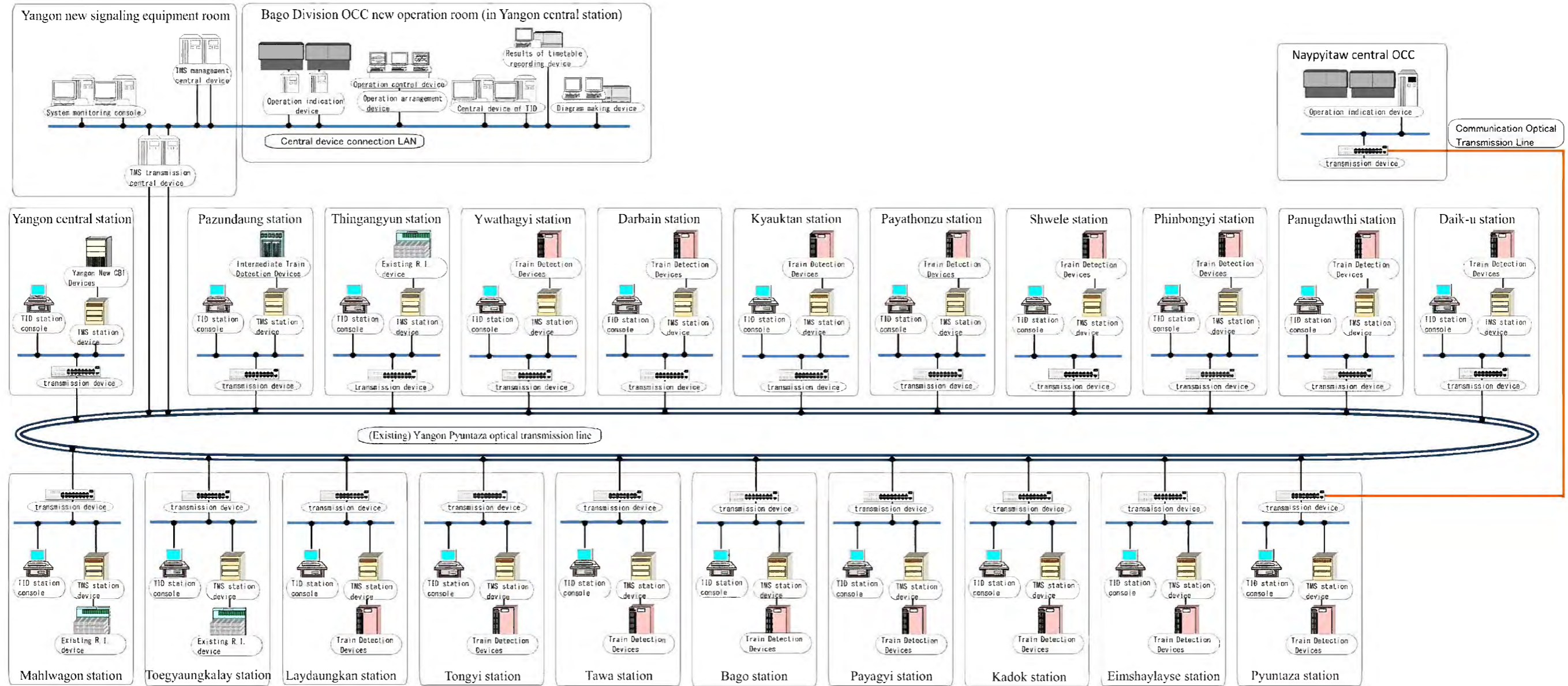
Naypyitaw first floor General drawing(Scale : 1 / 2000)



for reference

NOTES: 1. 2.			CLIENT:  Japan International Cooperation Agency	CONSULTANTS: Consortium of JIC and OC   Japan International Co-consultants for Transportation Co., Ltd. Oriental Consultants Co., Ltd.	DATE: MARCH 2014 THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY	PROJECT: The Project for Installation of Operation Control Center System and Safety Equipment iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line
LEGEND						
Ceiling concealment line  Startup Floor concealment line  Fall Exposure Wiring  Through Undergrounding wiring  Earthing Over-head line  Hand Hall	Startup  Fall  Through  Earthing  Hand Hall 	600V Vinyl insulation electric wire IV Polyethylene insulation cable CV Vinyl insulation cable for control CVV Communication cable CPEV UTP cable  UTP				
DRAWING NUMBER			DRAWING NUMBER			
BD3-02-27-303			BD3-02-27-303			

Train Monitoring System (TMS) System Configuration Diagram



for reference

NOTES:
1.
2.

LEGEND

Ceiling concealment line	Startup	600V Vinyl insulation electric wire	IV
Floor concealment line	Fall	Polyethylene insulation cable	CV
Exposure Wiring	Through	Vinyl insulation cable for control	CVV
Undergrounding wiring	Earthing	Communication cable	CPEV
Overhead line	Hand Hall	UTP cable	UTP

CLIENT:



Japan International Cooperation Agency

CONSULTANTS:
Consortium of JIC and OC



Japan International Consultants for Transportation Co., Ltd.



Oriental Consultants Co., Ltd.

DATE:

MARCH 2014

THIS DRAWING MAY NOT BE REPRODUCED OR USED WITHOUT THE WRITTEN PERMISSION FROM JAPAN INTERNATIONAL COOPERATION AGENCY

PROJECT:

The Project for Installation of Operation Control Center System and Safety Equipment

iii) Centralized Train Monitoring System for Yangon-Mandalay Main Line

SCALE:

TITLE:

Train Monitoring System (TMS) System Configuration diagram

DRAWING NUMBER

BD3-03-00-101

2-2-4 Implementation Plan

(1) Construction Policy and Procurement Plan

① Construction Policy

The following is the construction policy and requirements of technicians for each component.

i) Construction policy of the Concentrated Electronic Interlocking System

- Construct the new OCC and signal cabin in the same room in consideration of train operation.
- A crane is needed for installation at Yangon Central Station.
- Construct an equipment room in Pazundaung station.
- Electronic equipment should be prevented from falling.
- Replace way-side equipment.
- Replace points in sequence.
- After installing all the signals near the signal now being used, switchover will be all held at once.
- Cables should be buried or installed on high places as anticrime measures.
- Ensure a power supply for new equipment, and install batteries and engine generators for electricity outages.

✓ Requirement of technicians for the Concentrated Electronic Interlocking System

- Operation tests
- System qualification
- Installation and adjustment of motor points and track circuits
- Equipment operation guidance

ii) Construction policy of the automated level crossing alarm facilities between Toegyaungkalay and Ywathagyi

- The installation should be implemented with the “Project on Improvement of Service and Safety of Railway” for rail track maintenance.
- The concrete poles for power supply, which have an effect on constructing railway crossing gates, must be removed in the early stages of the construction after consultation between MR and YESB (Yangon Electricity Supply Board).
- Cables should be buried as anticrime measures.
- If needed, soil retaining foundation must be constructed at poor installation environments, such as slopes.
- Ensure a power supply for new equipment, and install batteries and engine generators for electricity outages.

✓ Requirement of technicians for the automated level crossing alarm facilities between Toegyaungkalay and Ywathagyi

- Not needed.

iii) Construction policy of the Centralized Train Monitoring System for Yangon-Pyuntaza section

- Construct the new OCC and signal cabin in the same room in consideration of train operation.
 - A crane is needed for installation at Yangon Central Station.
 - Electronic equipment should be prevented from falling.
 - If the road to the station is narrow, equipment should be transported by train rather than trucks.
 - Cables should be buried or installed on high places as anticrime measures.
 - If needed, soil retaining foundation must be constructed at poor installation environments, such as slopes.
 - Ensure a power supply for new equipment, and install batteries and engine generators for electricity outages. If the reservation of power supply is difficult, photovoltaic installation is needed.
- Requirement of technicians for the Centralized Train Monitoring System for Yangon-Pyuntaza section
- Operation tests
 - System qualification
 - Installation and adjustment of track circuits
 - Equipment operation guidance

② Consideration for procurement plan

Major devices such as electronic interlocking, train monitoring systems, and automatic level crossings are specialized products for modern railway systems, and no local products exist. Japanese products shall be procured, taking into account the required technical standards, durability, economy, ease of installation, handling, and maintenance.

The Consultants and Contractors shall be Japanese who shall employ local sub-consultants and sub-contractors.

Cement, reinforcing bars, and wooden material shall be procured in the local market. However, due to quality requirements, imported material may be purchased in the local market. Local labor shall be employed in the local market. If necessary, some specialized skilled labor shall be employed from outside Myanmar.

The policy of scope of work for procurement between Japan and Myanmar shall be as follows.

The Japanese side will be responsible for works such as the inland transportation of equipment from the port of landing to each construction site, and for equipment procurement, packing, and marine transport in Japan and the local market. The Japanese side shall also perform the unpacking

of equipment parts, importation, installation, assembly, adjustment, examination and initial operation, and operative instruction.

The Myanmar side will be responsible for tax exemption & customs clearance procedures, providing convenience, support for acquiring construction permission, the removal of existing equipment, and securing installation space, sound dedicated lines, and optical cable lines for TMS.

(2) Special Instruction

① Special Instruction for Installation

Specific installation is not needed in this project, due to Myanmar law and MR regulation.

② Consideration for procurement plan

The installation location of the equipment of each system to be introduced in this project is located on the Yangon-Mandalay Railway line. It is proper to transport equipment by train after having coordinated with MR because accessible roads are not sufficiently maintained in some station sections. For warehouses and temporary storage of materials and equipment installation, permission to use the warehouse and existing facilities of MR will be requested.

Because this project is a grant aid project, the Japanese consultants signed a procurement contract with the Myanmar government, to carry out procurement supervision of construction work along with the creation of tender documents for construction and procurement of this plan. Then, according to the specifications created by consultants, contractors for equipment procurement design, manufacture, factory test, transport the equipment, and pack for export. In addition, contractors take a position of leadership for the test and installation work in the field and verify the performance after the installation of each equipment.

(3) Obligations of Recipient Country

In this project, obligations of recipient country are as follows:

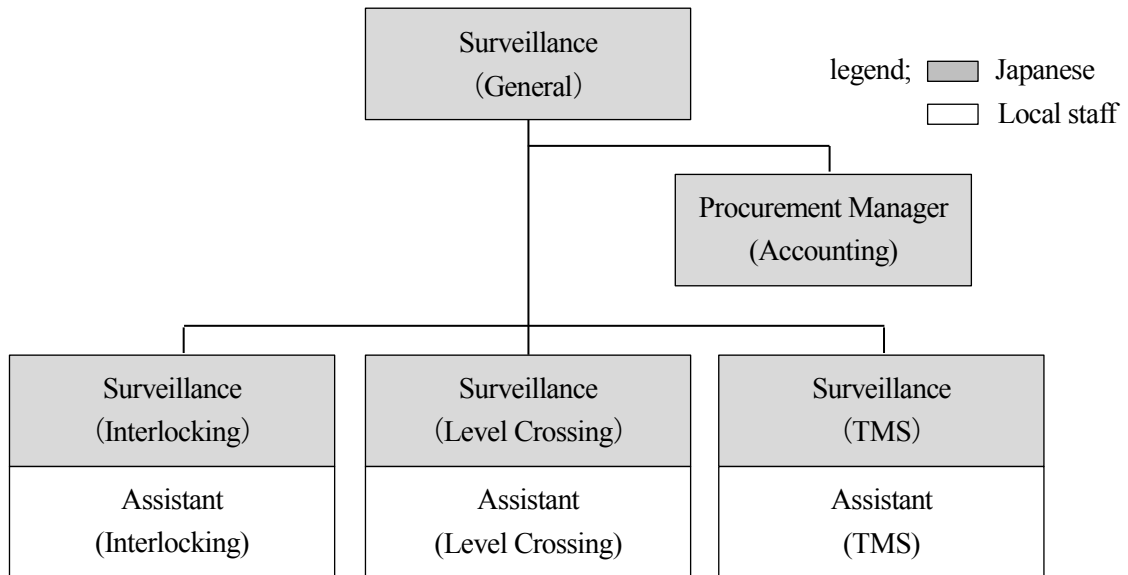
- Arrange new Bago division OCC room and station cabin at Yangon station.
- Arrange space for equipment at Nay Pyi Taw OCC room.
- Arrange space for new signal equipment house at Pazundaung station.
- Arrange space for equipment at other stations.
- Ensure cores of optical fiber cable between Yangon and Nay Pyi Taw.
- Ensure direct telephone lines for STM.
- Adjustment of concrete poles, which have an effect on constructing railway crossing gates at Kyan Sit Thar level crossing.
- Secure a depository at Yangon station for construction equipment.
- Make preliminary arrangements with YESB (Yangon Electricity Supply Board) to ensure power supply for Yangon station.
- Attendance at proceedings for electronic equipment installation and participation in operation training.
- Removal of existing interlocking systems in Yangon Central station and Pazundaung station.

- Removal of existing railway crossing equipment at Kyan Sit Thar level crossing, such as gates, etc.

(4) Construction Management and Surveillance Organization

① Surveillance Organization

Because specific skills are needed to construct the train signaling system, people with consulting ability will be deployed at each component.



Source: The Study Team

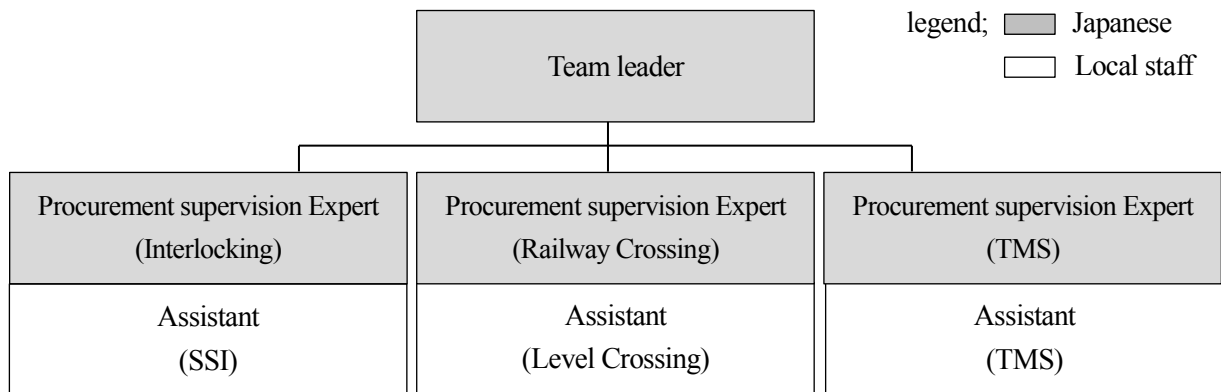
Figure.2-38 Surveillance Organization

② Procurement supervision plan

To perform drawing approval confirmation, prior confirmation with the local organization in charge, attendance in the product inspection, attendance in the pre-shipment inspection, consignment of the third party, and attendance in the pre-shipment comparison inspection.

To perform confirmation of results according to construction progress, attendance in the initial operation instruction by the procurement supplier (or manufacturer), and attendance in inspections and handovers performed at any time.

The organization chart of procurement supervision is shown in following figure.



Source: The Study Team

Figure.2-39 organization chart of Procurement supervision plan

Consultant shall perform a defect inspection one year after handover. The number of days required for each component will be assumed as follows.

Electronic interlocking

The construction site is located between Yangon Station and Pazuntaung Station. It takes 5 days for inspection, 2 days for travel, and 3 days for writing reports.

Automatic level crossing

The construction site is located at only one place, so the defect inspection will be held in another component.

Central monitoring

It will take 2 days for travel and 11 days for inspection because the construction site is located from Yangon to the wide area of Pyuntaza and Nay Pyi Taw. And also 2 days will be needed for writing reports.

Table.2-16 Procurement supervision working month of the consultant

		Unit	Work in Japan	Work in Myanmar	Passage (time)
Japanese Expert	Team Leader	month		4.73	9
	Procurement supervision specialist Electronic interlocking device	month		21.23	3
	Procurement supervision specialist Automatic road warning device	month		6.73	1
	Procurement supervision specialist Automatic road warning device	month		19.16	3
	Inspection technician	month	0.40		
Local Staff	Procurement supervision specialist Electronic interlocking device	month		21.23	
	Procurement supervision specialist Automatic road warning device	month		6.73	
	Procurement supervision specialist Automatic road warning device	month		19.16	

Source: The Study Team

(5) Quality Control Plan

Because the electronic interlocking and TMS are highly specific train signaling systems, manufacturer skilled workers will be deployed for system and communication tests.

(6) Equipment procurement plan

As specified in the procurement policy, the principal equipment and material of this project are Japanese products. The list of the local procurement equipment and materials is as follows.

① Materials for equipment installation and construction-related components

Judging from the local product distribution, construction scale, and technical standards, the use of local products such as hand holes or cable racks for communication facilities, concrete for construction and renovation of equipment rooms or huts, and materials for construction-related components or reinforcing rods is possible.

② Power supply-related equipment

There are local companies which manufacture various types of materials related to transmissions and transformers for power plants and manufacturers in Myanmar. Electric poles, cross-arms for electric poles, power switchboards, and panel boards are available in the local market.

Regarding replacement parts and expendable supplies, the manufacturer's guarantee term for the procurement equipment is one year, and the manufacturer carries out defect repairs such as troubleshooting of the apparatus without compensation during the term. The project will prepare the spare parts that are considered to be necessary for maintaining the facilities for at least one year taking into consideration incidental failures caused by a natural disaster such as lightning strikes and heavy rains.

(7) Operation Guidance Plan

The equipment that will be procured in this project has capabilities equivalent or superior to the existing equipment. However, initial operation training is essential because the operation and maintenance methods are different and have new functionality. Therefore the initial operation training will be provided by technicians delegated by the manufacturer from Japan or the country where the product is manufactured through OJT for the MR staffs and their managers who will actually be engaged in the operation. The technicians to provide the training will be those who have experience in adjustment and testing of the concerned equipment actually.

For the interlocking devices, the training that will be provided is mainly regarding: the signal route setting using the actual display terminal of the interlocking for the staffs at the signal cabins in the stations; and judgment methods in the case of disorder, exercises in replacement of IC boards and relays using the actual devices, and required measurement of voltage and current for the maintenance staff. For wayside equipment, training will be provided regarding replacement of the LED signal unit and adjustments of the electric point machine. It is anticipated that training will take 4 months for both Yangon Central Station and Pazundaung Stations after the equipment will be installed.

For the level crossings, training will be provided for equipment checks on the crossing controller and backup devices, weight adjustment of barrier equipment in the actual devices, and replacement for the crossing rod. The training term is anticipated to be finished 1 month after the installation work is complete.

For the centralized train monitoring system, training will mainly be provided to the dispatchers in the OCC to enable them to check train locations and train numbers on the actual display terminal. In addition to that, they will be trained to input diagrams and train numbers. For the maintenance staff, training will be provided regarding judgment methods in the case of disorder, IC board replacement using the actual devices, and equipment check on the power supply devices and the train detection equipment. The training term is anticipated to be 2 months after the installation work is complete.

(8) Soft Component (Technical Assistance) Plan

The soft components will be carried out according to the following three items. In this soft component, due to the nature of working with railway equipment, it is considered essential for the program trainers to have sufficient know-how of signal equipment maintenance in order to effectively carry out the program. Also, as level crossing safety campaigns are regularly conducted in Japan, it is considered necessary to effectively transfer the know-how to MR. From these viewpoints, the personnel resources will be provided directly by the contracted consultant.

1) "Support for development of equipment inspection rules"

In this activity, common inspection rules that are applicable to the regular inspection of the newly introduced equipment will be defined in order to ensure a uniform quality of inspection operations regardless of the inspector who performs the inspection. It is intended to prevent degradation of equipment, reduce the use of spare parts, and thus reduce total maintenance costs by establishing rule-based inspection operations.

(a) The technologies and types of business required for the program implementation

Trainers are required to have sufficient knowledge on the maintenance of the equipment to be introduced. In particular, it is desirable that the trainers have experience as a railway operator or maintenance contractor with maintenance operation experience of the equipment.

(b) Current status of MR and the level required

At present, regular inspection of signal equipment is only partially carried out by MR, and it is not aggressively promoted. As such, measurements and troubleshooting are made on a case by case basis after a failure occurs. Also, there is no systematic framework for recording and archiving the measurement data at MR, and measurements are only personally recorded by the inspector in a notebook. As such, it is currently difficult for MR to detect any symptoms of failure or follow the progress of equipment deterioration.

To improve the situation, we have planned the implementation of a framework that can ensure regular inspections of the equipment according to predefined procedures and intervals, as well as

the archiving of records, and thus detect failure symptoms and understand equipment deterioration trends.

(c) Target people

MR employees in the signaling and communication sector will be targeted. In particular, the managers will be trained mainly on how to store and analyze the inspection result data, and the inspectors will be trained mainly on the understanding of the inspection rules and how to record the data.

(d) Implementation method

- i) We will determine the specific details, frequency, and points of the facility inspection, define the inspection items, and then prepare the inspection table. It is expected that there will be more than 600 inspection items because more than 30 items are expected to be inspected for each of the following devices: "main unit of the interlocking device," "train detecting device," "color light signal," "shunting signal," "electric point machine," "power supply switch for signal," "uninterruptible power supply," for the electronic interlocking device: "level crossing control device," "crossing warning device," "electric crossing barrier," "gate signal," "special flashing light signal," for the automatic level crossing warning device: "central system," "station equipment," "operation terminal," "train detecting device," "transmission device," "uninterruptible power supply," for the centralized train monitoring system: "power generator" and "solar power unit." We will discuss the details of these items with MR after preparing the list of the inspection items and the inspection table in Japan.
- ii) We will provide guidance and training to enable the conduction of facility inspection according to the inspection table defined in the previous item i), in addition to the maintenance management training that will be conducted before starting the use of the actual facilities. In this training, the staff in charge of the soft component will provide guidance regarding the items listed on the inspection table; and the staff of the device supplier in charge of training on the use of the device will provide guidance regarding the technical aspects of maintenance. The staff should cooperate with each other in providing these guidance.
- iii) One year after the initial operation of the equipment (i.e., after a few inspections), the level of achievement will be checked by asking the employees to complete a questionnaire and checking the storage status of the inspection records. Depending on the result of the check, some follow up activities will be conducted if necessary.

Table2.17 Implementation schedule for "Support for development of equipment inspection rules"

Details	Number of months				
	1	2	3	4	5 1year after the beginning of operation
Support for development of equipment inspection rules (Electronic interlocking system and TMS)					
Study on draft of inspection rule (interlocking and TMS, 2people)	[White]				
Explanation to MR and publication of details (interlocking and TMS, 2people)		[Black]			
Preparation of example inspection check list (interlocking and TMS, 2people)		[White]			
Training of maintenance staff (interlocking and TMS, 2people)			[Black]		
Preparation of the 1st report (interlocking and TMS, 2people)			[White]		
Field guidance for well-establishing inspection rules (1 person)					[Black]
Preparation of final report (1 person)					[White]
<div style="display: flex; justify-content: space-around; align-items: center;"> [White] Work in Japan [Black] Work in Myanmar </div>					
Support for development of equipment inspection rules (Level crossing)					
Study on inspection rules	[White]				
Explanation to MR and publication of details		[Black]			
Preparation of draft of inspection check list		[White]			
Training of maintenance staff		[Black]			
Preparation of the 1st report			[White]		
Field guidance for well-establishing inspection rules					[Black]
Preparation of final report					[White]
<div style="display: flex; justify-content: space-around; align-items: center;"> [White] Work in Japan [Black] Work in Myanmar </div>					

Source: The Study Team

2) "Awareness education for level crossing users"

Awareness education activities will target pedestrians and car drivers who traverse level crossings. As there is a school in the neighborhood of the level crossing where the new equipment will be introduced, awareness education for the students of the school is planned, with the aim to establish a culture of safely traversing level crossings, taking advantage of the opportunity provided by the introduction of the new equipment. These efforts will help prevent the dangerous behavior of traversing level crossings when a train is approaching, realize the safe and reliable operation of trains, prevent damage to the level crossing equipment, and ultimately prevent unnecessary increases in maintenance costs.

(a) The technologies and types of business required for program implementation

Trainers will be required to have sufficient experience in similar promotion/education activities. In particular, since "level crossing accident prevention campaigns" are often conducted by district

transport bureaus of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) as well as by railway operators in Japan, it is considered desirable to make use of the existing know-how in conducting such campaigns.

(b) Current status of Myanmar and the level required

At present, it is quite common in Myanmar for people to traverse level crossings when a train is approaching or even when the gate is closed. This is in part due to the people's frustration with having to wait a long time for the gate to open as well as their underestimation of train speeds and belief that the trains are sufficiently slow enough to avoid getting hit by them. As such, an automobile entering the level crossing while a train is approaching may hit the gate boom and damage it. In some cases, not only the gate boom but also the main unit of the gate equipment can be damaged, leading to an increase in MR's cost of maintenance. In addition, such a situation makes it difficult to increase train speeds in the future, thus impeding the establishment of safe and reliable train operations.

To deal with the situation, it is necessary to make pedestrians and car drivers fully aware of and adhere to the rule that they are never allowed to traverse a level crossing as long as the alarm is being sounded.

(c) Target people

Neighborhood residents, especially the ones who often use the level crossing including automobile drivers and students commuting to a neighborhood school, will be targeted.

(d) Implementation method

- i) To promote appropriate behavior in and around level crossings, we will conduct hearings regarding successful cases in Japan for railway operators that have conducted any "level crossing accident prevention campaign". And we will prepare various leaflets, for example, for adults and children. To improve the effectiveness of the activity, we will prepare a questionnaire to understand the current situation as a part of the works conducted in Japan.
- ii) We will investigate the current situation regarding the behavior in and around level crossings by ourselves and by giving the questionnaire prepared in the previous step i) to the students of the schools in the vicinity of the level crossing and the passersby.
- iii) The specific actions to be taken, including the distribution of handouts, school visits and lectures, and others, will be determined in detail, based on the results of step ii) above.
- iv) The activities, including distribution of handouts, school visit and lecture, etc., will be conducted in line with the timing of the beginning of level crossing usage.
- v) After finishing the campaign activity, people's behavior at the level crossing will be checked again, and another questionnaire survey will be conducted for neighborhood

students and others to evaluate the effectiveness of the campaign.

Table.2-18 Implementation schedule for "Awareness education for level crossing users"

Details	Number of months											
	1				2				3			
Awareness education for level crossing users												
Preparation of leaflets and questionnaires												
Leaflet distribution around level crossing Visiting education in the schools in the vicinity of the level crossing												
Post questionnaire counting and analysis												
Activity reporting to MR and request to MR for public awareness activities in the future												
Preparation of report												

Work in Japan
 Work in Myanmar

Source: The Study Team

3) "Signal setting training for station staff and education and guidance for dispatchers"

In this activity, job instruction and training for station signal control and dispatch operations will be provided to the staff who work in the station signal cabins of the Yangon Central Station and Pazundaung Station and the train dispatchers working in the Bago OCC, using the training system. The goal of this activity is for the station staff to be able to properly set and control the railway station signals according to the train operation situation and for the dispatchers to become able to provide smooth dispatching operations through coordination with the station staff and train crew members.

(a) The technologies and types of business required for the program implementation

It is desirable that the trainers have work experience in signal cabins as railway operators or some similar field as well as experience with train dispatching operations.

(b) Current status of MR and the level required

At present, an electric relay interlocking device that was installed about 40 years ago is still operational at the Yangon Central station. While the signals and switches are centrally handled, the signal and switch levers have been separately implemented. As such, the operation of the current system is quite different from that of the electronic interlocking device to be introduced. Also, while the OCC is equipped with radio communication devices to connect each station and the OCC, there is no monitoring system to monitor the entire line. As such, the main task of the dispatchers is to record the train operation results, and train dispatching operations are mostly carried out by each station. Although the primary role of OCC should be to centrally monitor the status of train operation on the entire line and to provide proper instructions, this role is not being fulfilled.

(c) Target people

Employees of MR working at the station signal cabins of Yangon Central Station and Pazundaung Station

Train dispatchers of MR working at the Bago OCC and others engaged in related operations

(d) Implementation method

- i) We will prepare materials for guidance on station signal configuration [training and for the operation management staff in Japan. For the station signal configuration, the materials should include the specific details of operations in cases such as route conflict between the trains on Yangon - Mandalay main line and Yangon Loop Line, train schedule disorder, and facility failure. For the operation management, the materials should be prepared so as to allow the staff to understand that the roles of the dispatcher have been changed due to the modernization of the traffic control system.
- ii) Regarding the station signal control and train dispatching operations, the current status will be tracked and understood.
- iii) Based on the results of i), lectures will be provided on how the station signal control and train dispatching operations can be improved.
- iv) Before putting the new equipment into service, new operation procedures for station route settings and train dispatching operations will be explained using the training equipment.

Table.2-19 Implementation schedule for "Signal setting training for station staff and instruction for dispatchers"

Details	Number of months					
	1	2	3	4	5	6
Signal setting training for station staffs and instruction for dispatchers						
Preparation of material (signal setting training)	■					
Signal setting training in stations		■	■	■		
Preparation of report (signal setting training)			□			
Preparation of material (Guidance on train operation management)		■				
Guidance on train operation management			■	■	■	
Preparation of report (Guidance on train operation management)						□

Work in Japan
 Work in Myanmar

Source: The Study Team

(9) Implementation Schedule

The implementation schedule of each component is mentioned below.

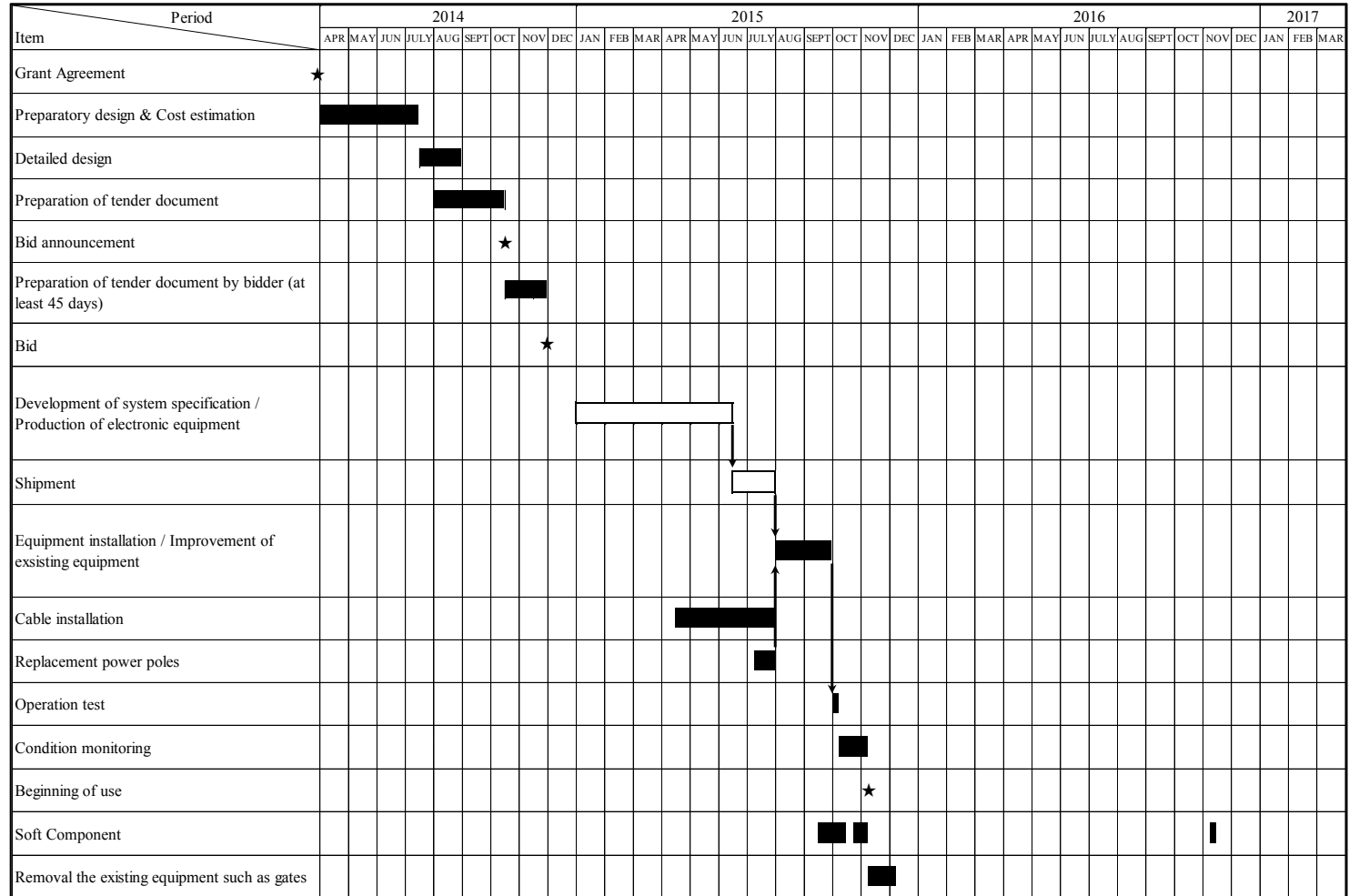
Table.2-20 Installation of Computer-Based Interlocking System at Yangon Central Station and Pazundaung Station

Item / Period	2014												2015												2016												2017		
	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR			
Grant Agreement	★																																						
Preparatory design & Cost estimation	■	■	■	■	■																																		
Detailed design				■	■																																		
Preparation of tender document					■	■	■	■																															
Bid announcement								★																															
Preparation of tender document by bidder (at least 45 days)								■	■																														
Bid									★																														
Development of system specification / Production of electronic equipment										□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	
Shipment																								□	□														
Equipment installation / Improvement of existing equipment																								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Construction of Pazundaung station equipment room											■	■	■	■	■																								
Construction of Yangon Central station signal cabin										■	■	■	■	■																									
Cable installation																								■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
Operation test / Training for dispatchers (Pazundaung Station)																																							
Beginning of use (Pazundaung Station)																																						★	
Operation test / Training for dispatchers (Yangon Central Station)																																							
Beginning of use (Yangon Central Station)																																						★	
Soft Component																																						■	
Removal the existing equipment such as interlocking																																					■		

Legend; ■ Myanmar □ Japan / Other Countries

Source: The Study Team

Table.2-21 Installation of automated alarm device for Kyan Sit Thar Level crossing of Yangon-Mandalay Main Line



Legend; ■ Myanmar □ Japan / Other Countries

Source: The Study Team

Table.2-22 Installation of Centralized Train Monitoring System for the Yangon-Mandalay Main Line

Item	2014												2015												2016												2017		
	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JULY	AUG	SEPT	OCT	NOV	DEC	JAN	FEB	MAR			
Grant Agreement	★																																						
Preparatory design & Cost estimation	■	■	■																																				
Detailed design				■	■																																		
Preparation of tender document				■	■	■																																	
Bid announcement																																							
Preparation of tender document by bidder (at least 45 days)																																							
Bid																																							
Development of system specification / Production of electronic equipment																																							
Shipment																																							
Construction of new OCC room / Renovation of station equipment room																																							
Communication and power supply equipment installation																																							
Signal equipment installation																																							
Operation test / Training for station attendants																																							
Beginning of use																																							
Soft Component																																							

Legend; ■ Myanmar □ Japan / Other Countries

Source: The Study Team

2-3 Outline of Major Undertakings by the Government of Myanmar (GOM)

The Annex-5 of the Minutes of Discussions shows “Major Undertakings to be taken by Each Government”. Table.2-23 presents further clarifications.

Table.2-23 Major undertakings by each Government

Item	To be covered by Grant Aid	To be covered by GOM
1. Tax exemption and customs clearance of the products at the port of disembarkation		✓
2. Payment of charges concerning customs clearance	✓	
3. To support in getting various approvals from the authorities concerned for implementation of the project		✓
4. Banking Arrangement, Authorization to Pay		✓
5. Provision including all expenses of GOM officers for site supervision, and witnessing for testing/commissioning		✓
6. Clearing of the existing facilities		✓
7. Temporary stockyards for facilities after customs clearance		✓
8. Provision of Consultants Office and Land for Contractors Office		✓
9. Temporary stockyards for site installation works		✓
10. Coordination with the related authorities in terms of implementation of the soft component and guidance of initial operation, testing and commissioning		✓
11. To secure necessary number of cores for TMS in existing optical fiber cable for the implementation of the project		✓
12. To secure necessary number of exclusive voice STM lines for direct telephone		✓
13. To secure spaces in cases concerning the installation of TMS in existing rooms		✓
14. To confirm and secure correct functions in any aspects, of existing train detection system in order to ensure proper installation of TMS		✓
15. Phasing switchover arrangement or construction related to electronic interlocking phasing installations, testing/commissioning, and trial operation		✓
16. Phasing switchover arrangement or construction related to TMS installations, testing/commissioning, and trial operation TMS		✓
17. Necessary arrangement of electric power supply for signalling & telecoms. equipment concerning GOM		✓
18. To secure spaces in cases concerning the installation of the operation training simulators for electronic interlocking system and centralized train monitoring system.		✓

Source: The Study Team

2-4 Plan of Operation and Maintenance

The facilities, devices, and their maintenance items are shown in Table.2-24 All facilities shall be inspected at least once a year to recognize signs of degradation and make temporary repairs. It will enable to reduce the rate of changing parts and maintenance costs.

Table.2-24 Maintenance items and cycles

Facilities / Devices (Lifetime expectancy)	Maintenance items	Recommended cycle		
		Weekly	Monthly	Yearly
Electronic Interlocking (15 to 20 years)				
Main unit	Periodic inspection			✓
	Replacement of HDDs, LCDs, and Terminals			4~5Y
	Overhaul			10Y
Train detector	Periodic inspection			✓
Signal	Periodic inspection			✓
Electric switch machine	Lubrication and cleanup		✓	
	Periodic inspection			✓
	Overhaul			8~10Y
Power supply switching control device	Periodic inspection			✓
UPS	Periodic inspection			✓
	Fan replacement			✓
	Battery replacement			3~6Y
Automated alarm facilities at level crossing (20 years)				
Control device	Periodic inspection			✓
	Battery replacement			3Y
Cross buck	Periodic inspection			✓
Electric barrier machine	Periodic inspection			✓
	Overhaul			10Y
Gate signal	Periodic inspection			✓
Obstruction warning indicator	Periodic inspection			✓
Train Monitoring System (15 to 20 years)				
Main Unit	Periodic inspection			✓
	Replacement of HDDs and LCDs			4~5Y
	Overhaul			10Y
Unit in each stations	Periodic inspection			✓
	Replacement of HDDs and LCDs			4~5Y
	Overhaul			10Y

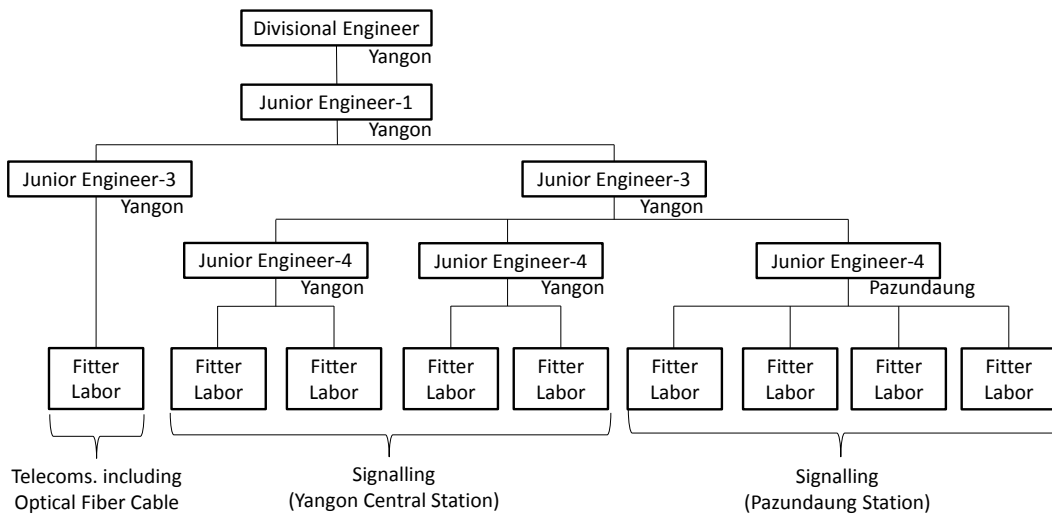
Facilities / Devices (Lifetime expectancy)	Maintenance items	Recommended cycle		
		Weekly	Monthly	Yearly
Terminal	Periodic inspection			✓
	Replacement			5Y
Train detector	Periodic inspection			✓
Transmission device	Periodic inspection			✓
UPS	Periodic inspection			✓
	Fan replacement			✓
	Battery replacement			3Y
Engine Generator (20 years)				
Engine Generator	Refueling	✓*1		
	Periodic inspection			✓
	Overhaul			✓*1
Solar power generator (30 years)				
Solar power generator	Periodic inspection			✓
	Replacement of power conditioner			10Y
Others				
Relay	Periodic inspection	Refer to each facility		
	Replacement			10Y

*1 Depends on running time.

Source: The Study Team

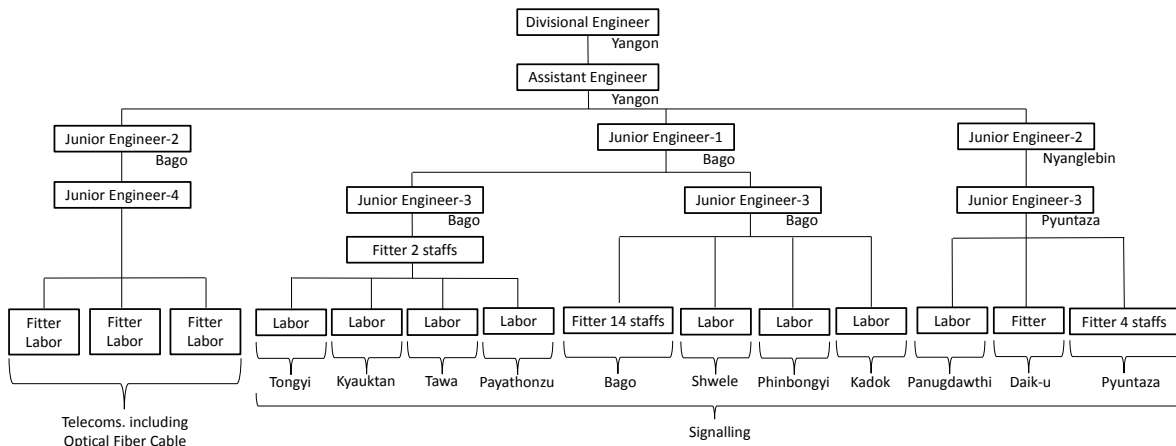
For the maintenance staff and their organizational structure, the study team discussed with the MR signal and telecommunication department so that the execution organization of the operation and maintenance and the number of maintenance staff are as same system as the existing one. (Figure.2-40 & Figure.2-41) This is why the maintenance staff will be required to have general knowledge about the equipment installed in the area of which they take charge and the inspection frequency of the facilities to be introduced in this project will be less than once a year.

Furthermore, the Japan side will provide introduction training including OJT to improve the staff's maintenance capabilities.



Source: The Study Team

Figure.2-40 Maintenance organization for Yangon Central Station and Pazundaung Station



Source: The Study Team

Figure.2-41 Maintenance organization for the section between Tongyi Station and Pyuntaza Station

Chapter 3 Project Evaluation

3-1 Preconditions

The project will be carried out as a Japan Grant Aid project. For smooth implementation of the project, timely implementation of the undertakings by the Government of Myanmar were agreed upon with the MR in the discussion in October 2013 at each stage, including necessary mobilization, construction, and post-construction.

(1) Mobilization Stage

- 1) Land acquisition, relocation and removal of obstacles, arrangement of temporary utilities such as power and water supply, etc. required for the Project.
- 2) Necessary arrangement with relevant authorities for power supply and any other necessary telecommunication equipment and facilities for the Project.
- 3) Necessary arrangement regarding environmental and social considerations for the Project.

(2) Construction Stage

- 1) Exemption of customs duties for imported equipment and material, tax exemptions related to implementation of the Project.
- 2) Banking Arrangement and issuing Authorization to Pay etc., which will be necessary for the Payment of the Project.
- 3) Various procedures involved in construction work and cooperation on necessary arrangements.

(3) Operation Stage

- 1) Implementation of proper operation and maintenance, ensuring the necessary budget, and maintaining the technical level of the maintenance personnel.

3-2 Necessary Inputs by Recipient Country

In order to achieve the overall plan of the Project, the following subjects proposed in the soft component plan shall be carried out reliably by MR in the operation stage.

- 1) Ensure proper operation and maintenance of the system, facilities and equipment through development of rules for inspection of MR's telecommunication facilities.
- 2) Enhance traffic safety and reduce interruptions to operation due to accidents in at-grade level crossings through educational activities to train the pedestrians how to safely use the level crossings.

3-3 Important Assumptions

The important assumptions to ensure and maintain the effectiveness of the Project are summarized as follows.

(1) Ensure Stable Budget for Operation and Maintenance

In order to ensure and maintain the effectiveness of the Project after delivery to the MR, MR's stable organizational management will be required. However, due to not only the

increase of railway fares in 2011, but also the improvement in long distance bus service, the number of passengers of MR has been declining in the past few years.

To increase the share of MR, improvement in rail transport services, improvement in the access to the railway stations, and measures to provide greater convenience will be required.

(2) Improvement of Railway Transportation Service

In order to improve the railway transportation services, improvement of MR's organizational management capacity, as well as the improvement of performance on track maintenance will be essential. Japan has been cooperating in the provision of material and equipment, technical transfer on track maintenance, and so on through "The Project on Improvement of Service and Safety of Railways in Myanmar", and the achievement and maintenance of its outcome is required.

3-4 Project Evaluation

3-4-1 Relevance

(1) Beneficiaries of the Project

Target beneficiaries of this project are as follows.

- 1) Improvement of the efficiency of the railway transport on the Yangon- Mandalay Main Line and Yangon Circular Line and the optimization of the train operation management will produce an increase in the transport capacity, which will in turn contribute to the future socio-economic growth of the country of Myanmar.
- 2) Introduction of an automatic alarm system at the Kyan Sit Thar level crossing will contribute to improvement of the residential environment through safety improvement for not only railway users, but also road users and local residents.

(2) Necessity and Urgency of the Project

Through the site investigation and interviews with MR officials in this study, MR's lack of efficiency in operation management, the risk of equipment failure, and problems with pedestrians practicing risky behaviour have been confirmed.

- 1) Submergence of the interlocking device in Yangon Central Station occurs about 20 times a year. The interlocking system does not work while submerged and therefore at those times, the route setting is carried out by a hand wheel and flag signalling. Submergence of Yangon Central Railway Station is due to a depression in the terrain and drastic measures to correct the problem would be difficult to implement.
- 2) In Kyang Sit Thar level crossing, control of the road users is performed by a gatekeeper with flag signalling. However, after closure of the barrier, pedestrians and bicycles enter into the level crossing. This is not limited to Kyang Sit Thar level crossing; a similar situation was also observed at other level crossings.
- 3) The reporting of each train location is conducted by UHF radio contact, only in the event of an accident or service failure. Track circuits are only provided for limited sections, therefore knowledge of the train locations depends on the reports to the OCC at the time of arrival at and departure from the station by the stationmaster.

The importance and urgency, as well as the validity of the Project under Japan grant aid

was agreed upon through the discussions with MR in view of the current situations described above.



Figure 4-1 Kyang Sit Thar Level Crossing
(A bicycle passes near a train after gate closing)



Figure 4-2 Yangon Central Station
(Flood level reaches just below the platform level)

Source: The Study Team

(3) Relationship with Mid-Long Term Development Plans

This project is intended to take part in the improvement and modernization of Yangon-Mandalay Railway Main Line designated as a new priority project by MR. In addition, rehabilitation of Yangon Circular Line is scheduled under Japan's emergency assistance scheme (Preparatory Survey).

Prior to the elimination of at-grade crossings on the Main Line and Circular Line between Yangon Central Station and Pazundaung Station, replacement of the electrical interlocking system with an electronic interlocking system will facilitate the future change in track layout.

(4) Consistency with the Japan's Assistance Policy

In April 2012, the Japanese Government announced "Development of infrastructure and related systems necessary for sustainable economic development" as one of the high priority issues in Japan's economic cooperation policy for Myanmar.

The modernization of Yangon Circular Line is also designated as one of the most important projects in the "Preparatory Study on the Development of the Yangon Metropolitan Area: Urban Transport" commenced by JICA in December 2012.

Therefore, it is clear that this project is consistent with Japan's assistance policy for Myanmar.

It is confirmed in official discussions that completion of this project will contribute to the socio-economic growth of Myanmar through improvement of the efficiency of MR's railway transportation and that this Project is consistent with the Official Development Assistance policy of Japan.

3-4-2 Effectiveness

(1) Quantitative Effectiveness

Expected quantitative effectiveness by the Project is as shown in the table below.

Table 4-1 Quantitative Effectiveness

Index	Baseline (in 2013)	Target Value (in 2016) [3 years after completion]
1) Real time positioning of trains	0%	100%
2) Time of level crossing closure	86~96 Sec.	70 Sec.

Source:The Study Team

(2) Qualitative Effectiveness

Expected qualitative effectiveness of the Project is summarized below.

- 1) The modernized train monitoring system will achieve safe and efficient traffic control corresponding to the increase in the number of trains and improvement in the speed limits in the future.
- 2) A failure risk minimizes by taking waterproof measures.
- 3) Continuous operation even in the case of failure will be guaranteed due to the electronization of the device and facilities and the redundant configuration system.
- 4) The risk of the operation disorder will be minimized because the time of period required to detect and restore the failure will be reduced due to the introduction of the self-diagnosis function.
- 5) The efficiency of route setting for the at-grade intersection will be improved because the centralized interlocking devices will be introduced in Yangon Central and Pazundaung Station.
- 6) The safety level will be improved for the road user, train crews, and passengers due to the installation of the warning device with excellent viewability.
- 7) Labor of the crossing guard will be saved because the crossing barrier will be controlled by using an electronic circuit.
- 8) The safe traffic through the level crossing will be guaranteed even when the speed limit will be increased in the future.

Chapter 4 Conclusion and Challenges in the future

4-1 Conclusion

This project is regarded as a priority program of the Ministry of Railway Transportation of Myanmar for improvement and modernization of the main line. It is expected to take a role for decreasing the passenger travel time between Yangon and Mandalay to 8 hours or less.

To achieve the goal, the following three components will be implemented in this project:

- (1) Upgrading of interlocking devices in Yangon Central and Pa Zun Daung Stations (including the field equipment and cables)
- (2) Introduction of automatic warning device in Kyansittha level crossing located between Toe Gyaung Kalay and Ywar Thagyi Stations
- (3) Introduction of TMS in Bago Division OCC of Yangon - Mandalay main line

In Myanmar, as described in Chapter 1, the interlocking devices have been or are being upgraded in 29 small-size stations which are no junction stations with onerous aid by the other nations other than Japan since 2000, however, no such an upgrading has been conducted in any large station. It is expected that the upgrading of interlocking devices in Yangon Central and Pa Zun Daung Stations, for which Japan has conducted the study, contributes to the modernization and the elimination of the at-grade intersection obstruction in Pa Zun Daung Station that constitutes a bottleneck in the future. It is expected to be a strong driving force to achieve the objectives.

In addition to the achievement of the objectives, the introduction of the automatic warning device in Kyansittha level crossing is expected to contribute to improvement of the safety. Furthermore, the transport capacity will be stabilized by the introduction of TMS. In addition to the important role to achieve its primary objectives, this project is expected to bring two more elements of improvement as mentioned above.

As a matter of course, this project has not been completed in this study. Therefore, because this project includes the items for which Myanmar will take responsibility to implement, it is required that the both nations will cooperate closely to complete this project.

4-2 Challenges in the future

The scope of this project is as described above, however, there are three development plans for the railways in Myanmar that have a relation to this project as of July 2014:

- (1) Yangon - Mandalay main line modernization project phase 1 (Yangon - Taungoo section)
- (2) Yangon Loop Line modernization project
- (3) Redevelopment plan for the area including Yangon Central Station

To implement the projects above that follow this project, it is required to forward this project systematically in advance. Furthermore, it is required to take the interface with the above-mentioned projects into consideration because the same objective area is included in these projects. Even in the other projects mentioned above, it is required to develop the plan and implement it while understanding the details of this project.

Appendices

Member List of the Study Team

Member List of the Study Team

	Title	Name	Company
1	Leader	Mr. Ken Imai	JICA
2	Project Manager / Railway Facilities Planning Specialist	Mr. Kiichi Takemura, P.E.Jp.	JIC
3	Railway Signalling Specialist (1)	Mr. Ryuhei Mitani	JIC
4	Railway Signalling Specialist (2)	Mr. Nobuhiro Nakada	JIC (JRE)
5	Telecommunications Specialist	Mr. Norihisa Matsumoto	JIC (NDS)
6	Train Monitoring System Specialist	Mr. Hisao Matsumoto	JIC
7	Train Operation Plan Specialist	Mr. Hideaki Mizukawa	JIC
8	Level Crossing Specialist	Mr. Motoshi Kishimoto	JIC (NDS)
9	Power Supply Specialist	Mr. Hiroshi Hashimoto, P.E.Jp.	JIC
10	Equipment Procurement Plan Specialist	Dr. Zayar Win	OC
11	Operation & Maintenance Plan Specialist	Mr. Daisuke Hidaka	JIC (JRE)
12	Operation & Maintenance Plan Specialist	Mr. Shuichi Umehara	JIC
13	Construction Plan / Natural Condition Specialist	Mr. Michitaka Ito	JIC (JRE)
14	Cost Estimate Specialist (1)	Mr. Yoichi Yoshida	OC
15	Cost Estimate Specialist (2)	Mr. Sumio Morita	OC
16	Project Evaluation Specialist	Mr. Atsushi Kamiyama	OC
17	Project Administration / Railway Facilities Planning Assistant	Mr. Shuichi Umehara	JIC

Note: JICA: Japan International Cooperation Agency

JIC: Japan International Consultants of Transportation Co., Ltd.; OC: Oriental Consultants Co., Ltd.; JRE:

East Japan Railway Company; NDS: Nippon Tetsudou Denki Sekkei Co. Ltd.

Study Schedule

Study Schedule

No.	Task	2013			2014							
		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	
1	Kick-off Meeting with MR	▼										
2	1st Survey for Signalling, Telecommunications and Power Supply, O&M, etc. in Myanmar											
3	Rough Specification & Design											
4	Rough Project Cost & O&M Cost Estimation											
5	Progress Meeting with MR											
6	2nd Survey for Signalling, Telecommunications and Power Supply, Procurement, O&M, etc. in Myanmar											
7	Detailed Specification & Basic Design											
8	Project Cost & O&M Cost Estimation											
9	Making Report & Drawings											
10	Final Meeting with MR											
11	Deliverables	▼ ICR			▼ DFR1					▼ DFR2	▼ FR	

List of the Counterparts

List of the Counterparts

A list of counterpart of the survey appointed in a kickoff meeting of October 28, 2013 is shown as follows:

No.	MR counterpart	Sector	Remark
1	U Soe Shwe Assistant Manager, Division 5	Train Operation	U Htay Myint Aung, Assistant General Manager, Operation
2	U Pan Sein Assistant Manager, Division 6	Train Operation	
3	U Kyaw Myint Assistant Manager, Division 7	Train Operation	
4	U Hla Htut Divisional Engineer, Division 6,8,9	Signalling TelecommunicationLevel Crossing	U Han Nyunt, Assistant General Manager, Signalling
5	U Myint Lwin Divisional Engineer, Division 7	Signalling TelecommunicationLevel Crossing	
6	U Aung Myint Assistant General Manager, Electrical	Power Supply	U Zaw Win, Deputy General Manager, Electrical
7	U Saw Aung Assistant Engineer, Division 7	Construction, Civil Engineering	U Maung Maung Thwin, Deputy General Manager, Civil
8	U Htaung Sian Kan Deputy General Manager, Planning	Maintenance, Training, Regulation & Manual	U Saw Valentine, General Manager, Technical and Admin. Support

Minutes of Discussions

(M/D)

**MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
FOR THE PROJECT FOR INSTLLATION OF
OPERATION CONTROL CENTER SYSTEM
AND SAFETY EQUIPMENT**


In response to a request from the Government of the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar"), the Government of Japan decided to conduct a Preparatory Survey on "The Project for Installation of Operation Control Center System and Safety Equipment" (hereinafter referred to as "the Project"). In accordance with this decision, Japan International Cooperation Agency (hereinafter referred to as "JICA") decided to commence the survey.

JICA sent the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Ken IMAI, Advisor, Transportation and ICT Division 1, Transportation and ICT Group, Economic Infrastructure Department, JICA, and is scheduled to stay in the country from October 19th to November 30, 2013.

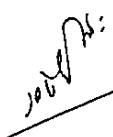
The Team held discussions with the officials concerned of Myanmar side, and conducted a field survey at the Project site.

In the course of discussions, the both sides confirmed the main items described on the attached sheets. The Team will proceed to further works and prepare a Draft Report of the Preparatory Survey.

Nay Pyi Taw, October 24, 2013



Ken Imai
Leader
Preparatory Survey Team
Japan International Cooperation Agency



U Thurein Win
Managing Director
Myanma Railways
Ministry of Rail Transportation
The Republic of the Union of Myanmar

ATTACHMENT

1. Objective of the Project

The objective of the Project is to contribute to the improvement of safety of Myanmar Railways

2. Project Site

The Project site is as shown in Annex-1.

3. Responsible and Implementing Authority

- 3-1. The responsible ministry is the Ministry of Rail Transport (MORT).
- 3-2. The implementing agency is Myanmar Railways (MR)
- 3-3. The organization charts are shown in Annex-2-1 and 2-2 respectively.

4. Scope of the Project agreed by the both sides

- 4-1. The Myanmar side asked the Team to explain the idea of the Team on the scope of the Project. Based on it, the Team explained its idea on the scope as follows;

- Interlocking Systems on the Yangon Mandalay Main Line including Yangon Central station
- Centralized Train Monitoring Systems on Yangon Mandalay Main Line
- Level Crossings on Yangon Mandalay Main Line

The Team added that both of interlocking systems and train monitoring systems, in particular, are essential for the railway operation in terms of the safety and both should be included in the scope of the Project.

- 4-2. The Myanmar side confirmed the target area/section of each item which the Team explained. The Team replied, as a current idea, as follows;

- The target section of Concentrated Train Monitoring System is between Yangon Central Station and Pyuntasa Station because this section is under jurisdiction area of Yangon operation center.
- The target area of Interlocking Systems is between Yangon Central Station and Pazundaung Station because this area includes the crossing point of Yangon Mandalay Main Line and Yangon Circular Line, which is considered as a bottle neck point in terms of the safety.
- The target section of Level Crossings is between Togyauungale Station and Ywathagyi Station, and the number of the points is one or two as a pilot case.

The Team explained that the number of the equipment as well as the target area/section mentioned in above may be changed after cost estimation due to the

limitation of the budget. The Myanmar side agreed its explanation.

- 4-3. The Myanmar side asked whether the Project Site could change from Yangon Mandalay Main Line to Yangon Circular Line or not. The Team mentioned the reason why the Project site stipulated in 2 of this ATTACHMENT as follows;
- At present, there is no concreted plan such as master plan and/or feasibility study on Yangon Circular Line.
 - It is effective and efficient to invest the resources in the particular section/area.

The Myanmar side understood the explanation by the Team.

- 4-4. The Myanmar side commented that the Project should harmonize with the future "Yangon Mandalay Railway Improvement Project (Phase I)", the candidate ODA loan project in FY2013, because the Project site is a part of the future ODA loan project site. The Team agreed on the comment by the Myanmar side.
- 4-5. The both side agreed on the Scope of the Project mentioned in 4-1. of this ATTACHMENT.

5. Japan's Grant Aid Scheme

- 5-1. The Myanmar side understood the Japan's Grant Aid scheme explained by the Team as described in Annex-3 and Annex-4.
- 5-2. The Myanmar side agreed to take the necessary measures, as described in Annex-5 for the smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.
- 5-3. The Myanmar side understood that they should cover the cost for the maintenance as well as the operation after the completion of the Project, and agreed to allocate the necessary cost for the operation and maintenance. In addition to that, the Myanmar side requested the Team to consider the reduction of operation and maintenance cost. The Team agreed on it as much as possible.
- 5-4. The Myanmar side asked whether the equipment to be procured and installed by the Project should be compatible to use in the future project such as Japanese ODA loan project. The Team explained that it is necessary to reinstall/utilize the equipment to be procured and installed by Japanese grant aid project. The Myanmar side understood it.

6. Schedule of the Study

- 6-1. The Team will proceed with further field survey until November 30, 2013.
- 6-2. JICA will prepare the 1st draft report and the 1st draft specification and dispatch a mission in order to explain their contents around January, 2014.
- 6-3. JICA will prepare the 2nd draft report and the 2nd draft specification and

dispatch a mission in order to explain their contents around May, 2014.

- 6-3. If the contents of the report are accepted in principle by the Government of Myanmar, JICA will complete the final report and send it to Myanmar side around July, 2014.

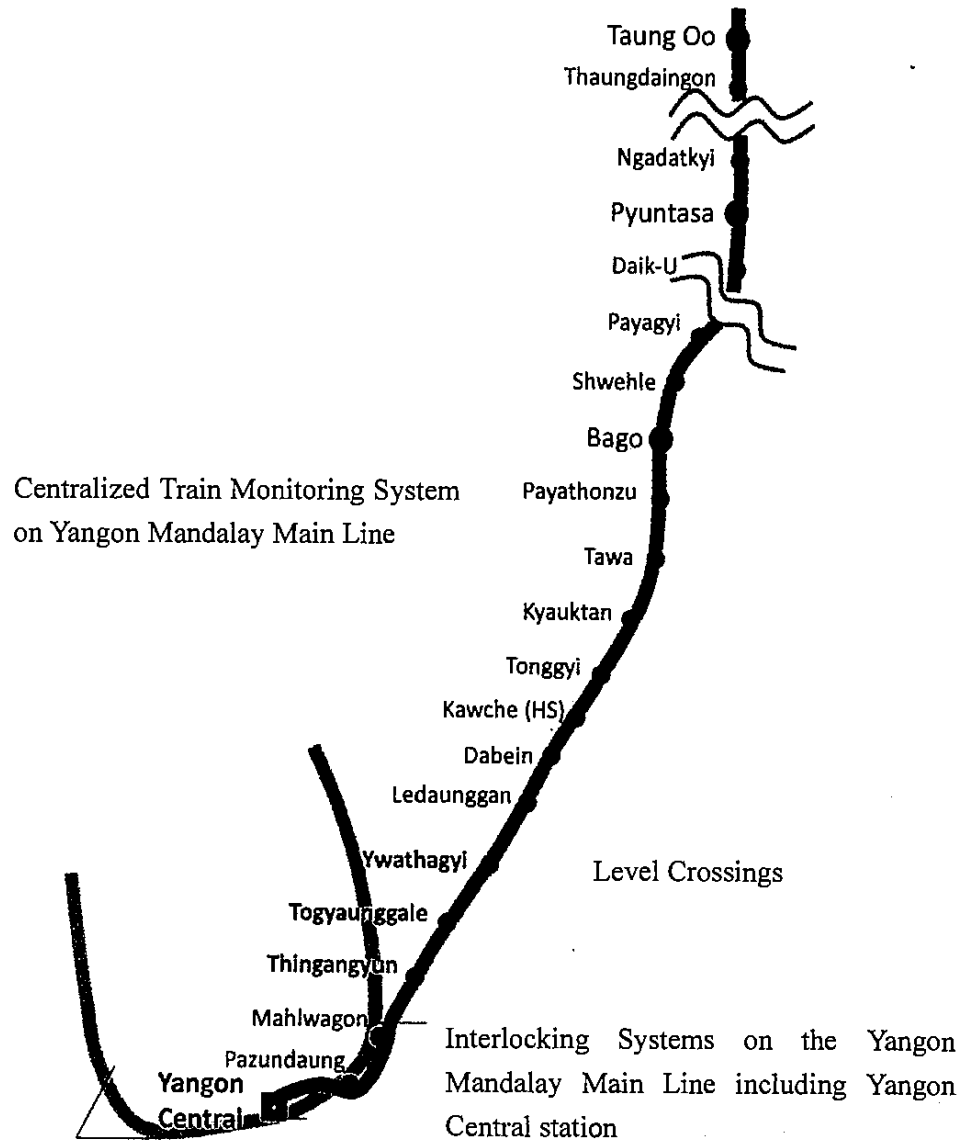
7. Environmental and Social Considerations

- 7-1. The Myanmar side agreed to give due environmental and social considerations during implementation of the Project, and after completion of the Project, in accordance with the JICA Guidelines for Environment and Social Considerations (April, 2010), if needed.

8. Others

- 8-1. The Myanmar side mentioned that they recognized the name of the project was "the Project of Installation of Railway Operation Control Center System", and asked the reason of changing the name. The Team explained that the name of the Project change in line with the scope mentioned in 4-1. of this ATTACHMENT. The Myanmar side expressed their gladness of this changing because the Project can include safety equipment in addition to operation control system. The Myanmar side, however, asked the Team that JICA would inform the changing of the Project name by official letter to Ministry of National Planning and Economic Development as well as Myanma Railways. The Team agreed to issue the letter.
- 8-2. This Minutes of Discussions is only for the survey for the Project, and the implementation of the Project is not guaranteed by this Minutes.

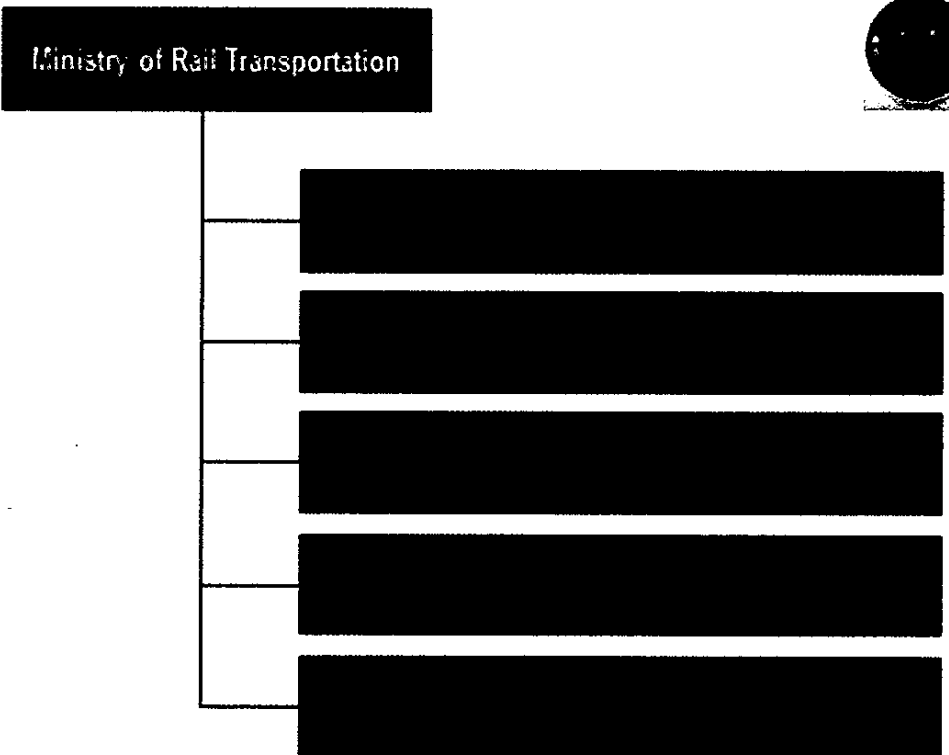
- Annex-1 Project Site
Annex-2 Organization Charts
Annex-3 Japan's Grant Aid
Annex-4 Flow Chart of Japan's Grant Aid Procedures
Annex-5 Major Undertakings to be taken by Each Government



1

4

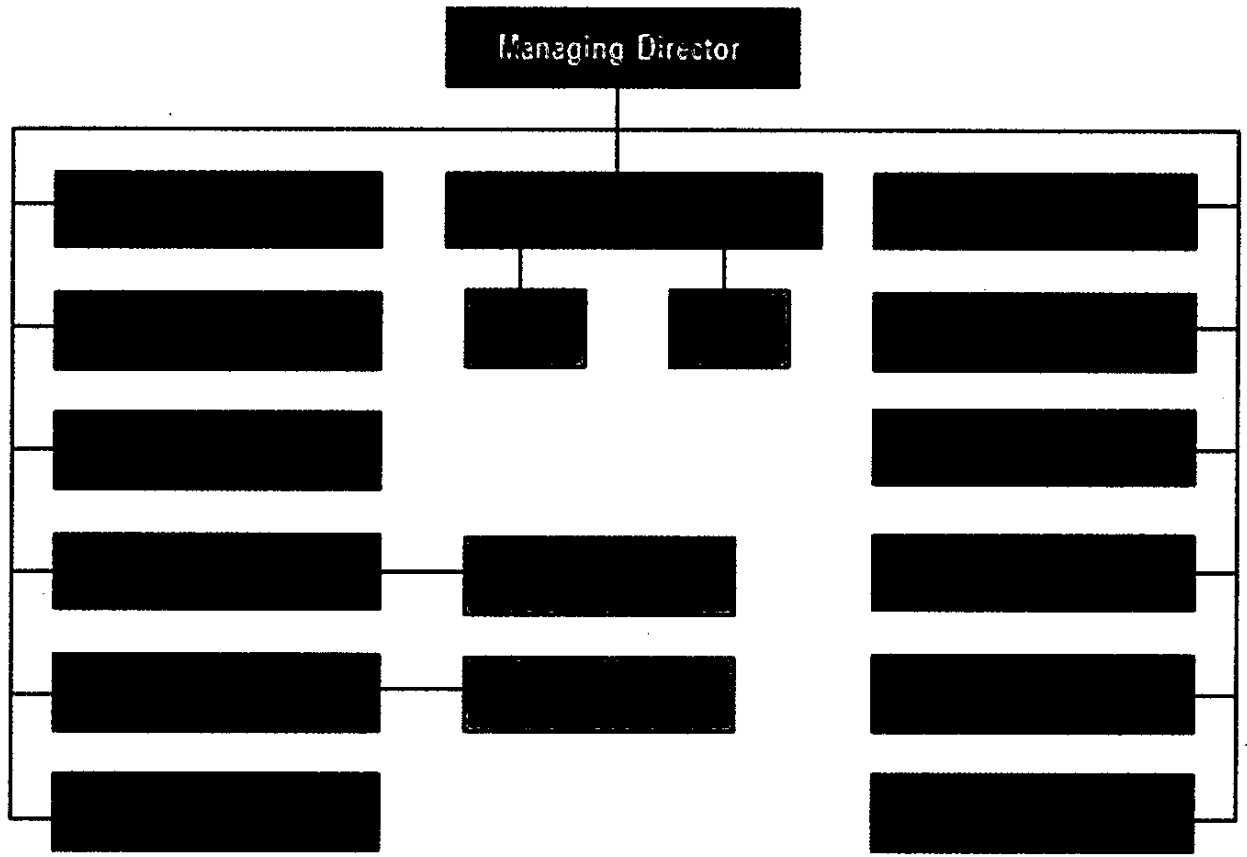
Organization Chart of MORT



3

W

12



Note: Divisions (1- 11) are under General Managers

Organization Chart of MR

Annex-2-2

12

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as “the GOJ”) is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on this law and the decision of the GOJ, JICA has become the executing agency of the Grant Aid for General Projects etc.

The Grant Aid is non-reimbursable fund provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development in accordance with the relevant laws and regulations of Japan. The Grant Aid is not supplied through the donation of materials as such.

1. Grant Aid Procedures

The Japanese Grant Aid is supplied through following procedures :

- Preparatory Survey
 - The Survey conducted by JICA
- Appraisal & Approval
 - Appraisal by the GOJ and JICA, and Approval by the Japanese Cabinet
- Authority for Determining Implementation
 - The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as “the G/A”)
 - Agreement concluded between JICA and a recipient country
- Implementation
 - Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the preparatory Survey is to provide a basic document necessary for the appraisal of the Project made by the GOJ and JICA. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed between both parties concerning the basic concept of the Project.
- Preparation of an outline design of the Project.
- Estimation of costs of the Project.

The contents of the original request by the recipient country are not necessarily approved in their initial form as the contents of the Grant Aid project. The Outline

Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of the jurisdiction of the organization of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

For smooth implementation of the Survey, JICA employs (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be signed between the GOJ and the Government of the recipient country to make a pledge for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

The Government of the recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by JICA. This "Verification" is deemed necessary to fulfill accountability to Japanese taxpayers.

(5) Major undertakings to be taken by the Government of the Recipient Country
In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

The products purchased under the Grant Aid should not be exported or re-exported from the recipient country.

(8) Banking Arrangements (B/A)

- a) The Government of the recipient country or its designated authority should open an account under the name of the Government of the recipient country in a bank in Japan (hereinafter referred to as "the Bank"). JICA will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.
- b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions paid to the Bank.

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure land and water area (project site, temporary yard and etc.)		•
2	To clear, level and reclaim the site when needed		•
3	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the products at the port of disembarkation		•
4	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted / be borne by the Authority without using the Grant		•
5	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
6	To ensure that the facilities and equipment be maintained and used properly and effectively for the implementation of the Project		•
7	To give due environmental and social consideration in the implementation of the Project		•
8	To bear all the expenses, other than those covered by the Grant, necessary for implementation of the Project		•
9	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•

(B/A : Banking Arrangement, A/P : Authorization to Pay)

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES

Stage	Flow & Works	Recipient Government	Japanese Government	JICA	Consultant	Contractor	Others
Application	Request (T/R: Terms of Reference)	✓					
	Screening of Project → Evaluation of T/R → Project Identification Survey*		✓	✓			
Project Formulation & Preparation	Preparatory Survey	Preliminary Survey* → Field Survey Home Office Work Reporting	✓	✓	✓		
		Outline Design Study → Selection & Contracting of Consultant by Proposal → Field Survey Home Office Work Reporting	✓	✓	✓	✓	
		Explanation of Draft Final Report → Final Report	✓	✓	✓	✓	
Appraisal & Approval	Appraisal of Project		✓	✓			
	Inter Ministerial Consultation		✓				
	Presentation of Draft Notes	✓	✓				
	Approval by the Cabinet		✓				
Implementation	E/N and G/A (E/N: Exchange of Notes, G/A: Grant Agreement)	✓	✓	✓			
	Banking Arrangement	✓					✓
	Consultant Contract → Verification → Issuance of A/P	✓		✓	✓		
	Detailed Design & Tender Documents → Approval by Recipient Government → Preparation for Tendering	✓		✓	✓		
	Tendering & Evaluation	✓		✓	✓	✓	
	Procurement / Construction Contract → Verification → A/P	✓		✓	✓	✓	
	Construction → Completion Certificate Recipient Government → A/P	✓		✓	✓	✓	
	Operation → Post Evaluation Study	✓		✓			
	Ex-post Evaluation → Follow up	✓	✓	✓			

51

43

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting Kickoff Meeting with MR		Date of Meeting: 28th October, 2013	
Work Package Kickoff Meeting of the Study	Recorded by Shuichi Umehara	Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	1. U Saw Valentine, General Manager (Tech., Admin & Support) 2. Daw Myint Myint San, General Manager (Admin & Planning) 3. U Htaung Sian Kan, Deputy General Manager (Planning) 4. U Maung Maung Thwin, Deputy General Manager (Civil) 5. U Thet Lwin, Deputy General Manager (Locomotive) 6. U Khin Maung Thein, Deputy General Manager (Signalling & Communication) 7. U Htay Myint Aung, Assistant General Manager (Operating)
	Team Members	1. Mr. Kiichi Takemura 2. Mr. Hisao Matsumoto 3. Mr. Shuichi Umehara
Agenda		1. Study Area 2. Scope of Work 3. Survey Schedule 4. Request on counterpart
Data/information	Distributed	Kickoff Meeting for the Project Survey for Installation of Operation Control Center System and Safety Equipment
	Collected	None
No.	Discussion Topic	Necessary Follow Ups
1.	1) In this study, the study team will make a survey as follows: i) Introduction of Train Monitoring System between Yangon Central Station and Pyuntaza Station with central devices & monitors in Yangon OCC and monitors for central monitoring in MR headquarters ii) Introduction of automatic alarm device at 1 or 2 level crossings between Togyauungale and Ywathagyi. iii) Renewal of interlocking system in Yangon Central Station and Pazundaung Station 2) We will decide the level crossing as soon as possible after checking the site situation with MR counterparts and members of "Project on Improvement of Service and Safety of Railway in Myanmar". The place that we select will be near	

Widakee
SaS

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

	<p>school and have a lot of traffic volume.</p> <p>3) To introduce automatic alarm device in Level Crossing, it is necessary to educate level crossing users until launch of the level crossings.</p> <p>4) After launch of Train Monitoring System (TMS), the operation procedure of OCC will be changed. The dispatchers in OCC can monitor train operation in whole Yangon OCC area and totally control operations to recover train operations as soon as possible in case of train delay.</p>	
2.	<p>1) Our main scope of works are as follows:</p> <ul style="list-style-type: none"> i) Survey of the existing equipment in the study area ii) Making detailed specification of materials and basic design iii) Making construction plan including survey of environmental condition iv) Methodology of O&M and technical support from Japan v) Estimation of construction cost and O&M cost vi) Evaluation for the project feasibility <p>2) Mr. Zayar Win, OC, will collect various data concerning materials which are made in Myanmar. The study team asked MR to support him about the data collection.</p>	
3.	<p>1) The schedule of this survey is very tight so that it is necessary for MR to support the study. In this survey, there are works in Japan. While making design in Japan, experts of the study team will communicate the contents and information to counterparts of MR by e-mail, etc.</p>	
4.	<p>1) MR agreed the request on counterparts. U Htaung Sian Kan will arrange the counterparts and handle the list.</p>	

Myanma Railways

JICA Study Team

Myint Myint San
28/11/2013
 By: Daw Myint Myint San
 for Managing Director
 General Manager (Admin: & Planning)

Daisuke Hidaka
 By: Daisuek HIDAKA
 for Project Manager
 Operation & Maintenance Plan Specialist

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting 1st Technical Meeting with MR		Date of Meeting: 5th November, 2013	
Work Package	The study & design plan	Recorded by	Shuichi Umehara
		Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	<ol style="list-style-type: none"> U Khin Maung Thein, Deputy General Manager (Signal & Telecommunication) U Zaw Win, Deputy General Manager (Electrical) U Han Nyunt, Assistant General Manager (Signal & Telecommunication) U Aung Myint, Assistant General Manager (Electrical) U Aung Moe Kyaw, Manager (Operation) U Tun Wai, Assitant Enginner (Signal & Telecommunication) U Soe Thein Aung, Assistant Engineer (Signal & Telecommunication)
	Team Members	<ol style="list-style-type: none"> Mr. Kiichi Takemura Mr. Ryuhei Mitani Mr. Nobuhiro Nakada Mr. Norihisa Matsumoto Mr. Hisao Matsumoto Mr. Hideaki Mizukawa Mr. Motoshi Kishimoto Mr. Hiroshi Hashimoto Mr. Shuichi Umehara
Agenda		<ol style="list-style-type: none"> Outline Interlocking System of Yangon Sta. & Pazundaung Sta. Automatic Alarm Device in Level Crossing Train Monitoring System (Signalling) Train Monitoring System (Telecommunication) Power Supply
Data/information	Distributed	<ol style="list-style-type: none"> The image of renewal interlocking Operation Control Center and Train Monitoring System Level Crossing (Kyan Sit Thar L.C. and comparison chart) Telecommunication Design Power Supply Plan

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

		Collected	None
No.	Discussion Topic	Necessary Follow Ups	
1.	<ol style="list-style-type: none"> 1) The study team would like to confirm basic pre-condition in this meeting. 2) One of key critical matters is to decide the place of new OCC, Signal Cabin and Signal Equipment Room. The study team has already made a survey and selected some alternatives. 3) As for renewal of level crossing, the study team will have a plan to keep how to handle gate closing (manual handling by switch) when automatic alarm device takes action. As next stage, the study team will propose automatic gate closing. 4) It is necessary to discuss how to switch over from existing equipment to new one with operation department staffs. 5) As for Train Monitoring System (TMS), the train position will be roughly indicated when trains are in home track in stations and one track as between stations. The dispatchers in OCC are key persons and the role of them will be more important. 		
2.	<ol style="list-style-type: none"> 1) The study team has a plan to install new sub-equipment room in Pazundaung Station, which seems to be near existing equipment room. 2) Change-over switch equipment near equipment in site is temporarily installed in switching over because of old cables. 3) The study team has a plan to replace new motor machine and cables in consideration of submergence in rainy season. 4) The study team will confirm whether some train routes are needed in Yangon Central Station and Pazundaung Station. MR operation and signal members of division (7) will take place meeting in Yangon. 5) MR has new re-development plan and requests the study team to consider the plan. 		4) Data collection: interlocking chart, shunting diagram and existing alignment
3.	<ol style="list-style-type: none"> 1) The study team made a survey and selected "Kyan Sit Thar Level Crossing" between Togyaunggale Station and Ywathagyi Station because this level crossing is not related to station interlocking, there is a school and its traffic volume is high. In this time, only one level crossing was selected because of the budget limited in Grant Aid Project. 		

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

	<ol style="list-style-type: none">2) MR members agreed to select "Kyan Sit Thar Level Crossing" between Togyaunggale Station and Ywathagyi Station.3) The level crossing road will be improved in cooperation with "Project on Improvement of Service and Safety of Railway in Myanmar"	
4.	<ol style="list-style-type: none">1) U Khin Maung Thein agreed to introduce TMS because dispatchers recognize the train position in big station such as Bago Station.2) The functions of TMS are as follows:<ol style="list-style-type: none">i) Train position indicationii) Train number indicationiii) Recording actual diagram3) The detection device will be installed at Mechanical Interlocking Stations such as Bago Station.	
5.	<ol style="list-style-type: none">1) Between Yangon and Pyuntaza, 4 cores of Optical Fiber Cable will be used because of redundancy configuration. 2 cores will be needed between Pyuntaza and Nay Pyi Taw.	
6.	<ol style="list-style-type: none">1) Power supply design will be implemented by each facility.2) In Nay Pyi Taw Station, electricity will receive from extra high tension line. In Yangon Central Station, receiving from high tension line.3) Engine Generator will be installed in accordance with the capacity of each load.	



5

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting	2nd Technical Meeting with MR	Date of Meeting:	20th Nov., 2013
Work Package	Report of the survey result	Recorded by	Daisuke HIDAHA
		Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	<ol style="list-style-type: none"> U Khin Maung Thein, Deputy General Manager (Signal & Telecommunication) U Han Nyunt, Assistant General Manager (Signal & Telecommunication) U Aung Moe Kyaw, Manager (Operation) U Han Tun, Manager (Operation) Daw Yi Kalaya Thein, Assistant Engineer (Electrical)
	Team Members	<ol style="list-style-type: none"> Mr. Ryuhei Mitani Mr. Nobuhiro Nakada Mr. Norihisa Matsumoto Mr. Motoshi Kishimoto Mr. Hiroshi Hashimoto Mr. Daisuke Hidaka Mr. Michitaka Ito Mr. Yoichi Yoshida Mr. Shuichi Umehara
Agenda		<p>The result of the survey</p> <ol style="list-style-type: none"> Train Monitoring System Telecommunication System Interlocking System Level Crossing Telecommunication System Power Supply.
Data/information	Distributed	<ol style="list-style-type: none"> Train Monitoring System (TMS) install plan Telecommunication Design Interlocking System plan Level Crossing plan Electric Power supply plan
	Collected	None

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

No.	Discussion Topic	Necessary Follow Ups
1.	<p>The study team explained the installation plan of Train Monitoring System.</p> <p>Then the study team reconfirmed the scope of the grant aid project with U Khin Maung Thein.</p>	
2	<p>The study team explained the installation plan of Telecommunication System.</p> <p>U Khin Maung Thein request to replace existing optical fiber cable line with new one. The study team reconfirmed the scope of the grant aid project with U Khin Maung Thein again.</p>	
3	<p>The study team explained the installation plan of Interlocking System.</p> <p>U Khin Maung Thein requested the study team to design the system with considering the relocation of new equipment due to the demolition of Seno Building. Then the study team agreed, but explained that this grant aid project expects to simply replace existing interlocking in Yangon Station with Computer-Based Interlocking. So the relocation of the equipment in the future due to the redevelopment of Yangon station should be done by Myanmar Railway itself. And the study team explained the advantage of the replacement of interlocking in Yangon Station.</p> <p>U Han Nyunt confirmed that existing point-motors will be replaced.</p>	
4	<p>The study team explained the installation plan of Interlocking System, especially for the plan that the role of gateman will not be changed.</p> <p>The study team requested MR as following. Then U Han Nyunt acknowledged.</p> <ul style="list-style-type: none"> 1) To relocate the electric power line above the gate. 2) The signal lights for trains are green when the gates are closed. <p>U Han Nyunt requested the study team that The signal lights for trains are only red when the gateman push the emergency button. Then the study team acknowledged.</p>	
5	<p>The study team explained the installation plan of Electric Power Supply.</p>	

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

U Han Nyunt asked the study team about the defrayer of construction fee of the new distributed power line. The study team answered that the defrayer is MR.	
---	--



5

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting	Meeting for the agreement with MR	Date of Meeting:	20th Nov., 2013
Work Package	To sign the agreement	Recorded by	Daisuke HIDAKA
		Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	<ol style="list-style-type: none"> U Saw Valentine, General Manager (Tech., Admin. & Support) U Maung Maung Lwin, General Manager (Finance) U Htaung Sian Kan, Deputy General Manager (Planning & Administration) U Maung Maung Thwin, Deputy General Manager (Civil) U Khin Maung Thein, Deputy General Manager (Signal & Telecommunication) U Win Naing, Deputy General Manager (Carriage) U Thein Myint, Assistant General Manager (Planning)
	Team Members	<ol style="list-style-type: none"> Mr. Ryuhei Mitani Mr. Nobuhiro Nakada Mr. Motoshi Kishimoto Mr. Daisuke Hidaka Mr. Michitaka Ito Mr. Yoichi Yoshida Mr. Shuichi Umehara
Agenda		<ol style="list-style-type: none"> Agreement for the new Signal Cabin, Signal Equipment Room & OCC placement in Yangon Central Station Agreement for selection of the level crossing the study team makes a survey
Data/information	Distributed	None
	Collected	<ol style="list-style-type: none"> Agreement for the new Signal Cabin, Signal Equipment Room & OCC placement in Yangon Central Station Agreement for selection of the level crossing the study team makes a survey
No.	Discussion Topic	Necessary Follow Ups
1.	Myamnm Railways and JICA Study Team agreed as attached documents.	

Kam
21/11

Ds
Daisuke Hidaka



20th November, 2013

Subject: Agreement for the new Signal Cabin, Signal Equipment Room & OCC placement in Yangon Central Station

As for selecting the new Signal Cabin, Equipment Room & OCC placement installed in Yangon Central Station, the first proposal of the JICA study team is to install them in the Seno building.

However, the study team heard that the Seno building might be pulled down so that the study team made a survey with Myanmar Railways (MR) officials again and selected the second floor of the Yangon Central Station main building as shown in the attachment.

According to the above survey, the study team calculated the weight of all the equipment for constructing in the new room, and resulted it would be more than 5,000kg (see the attachment). The study team is afraid that the floor's strength would not be enough. To make a correct decision, the study team is planning to inspect the floor's strength from now on.

The result of the floor's strength is very important, but due to proceeding detailed design, MR and the study team would make agreement using the second floor of Yangon Station main building and after receiving the results of the floor's strength, the study team would like to make a review again.

And also, as the letter that the study team sent on 11th November to MR, it is necessary to keep the space to build new Signal Equipment Room (about 50m² (538 ft²)) in Pazundaung Station. MR and the study team would agree to this matter.

Myanmar Railways

JICA Study Team

[Handwritten signature]
By: Thurein Win
Managing Director

for
Kiichi Takemura

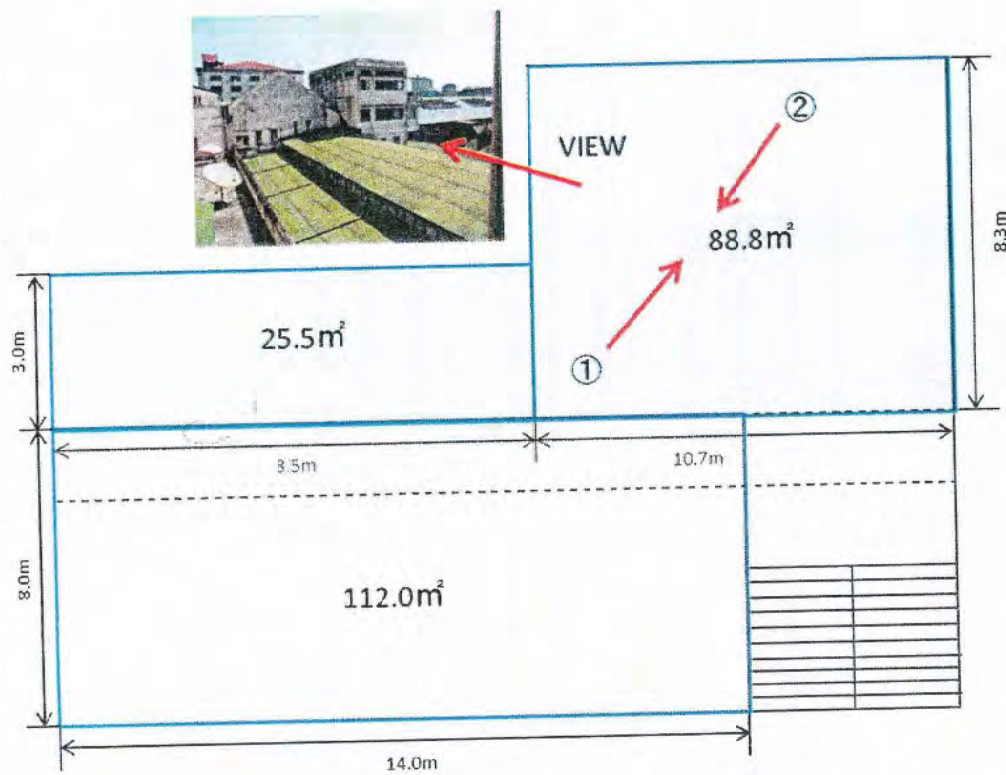
By: Kiichi Takemura
Project Manager

(Manager, JICA)

2
20/11
DWM
(24)

[Handwritten signature] 10.22.13
[Handwritten signature] 20/11/13

SKETCH OF NEW SC, SH, OCC SPACE



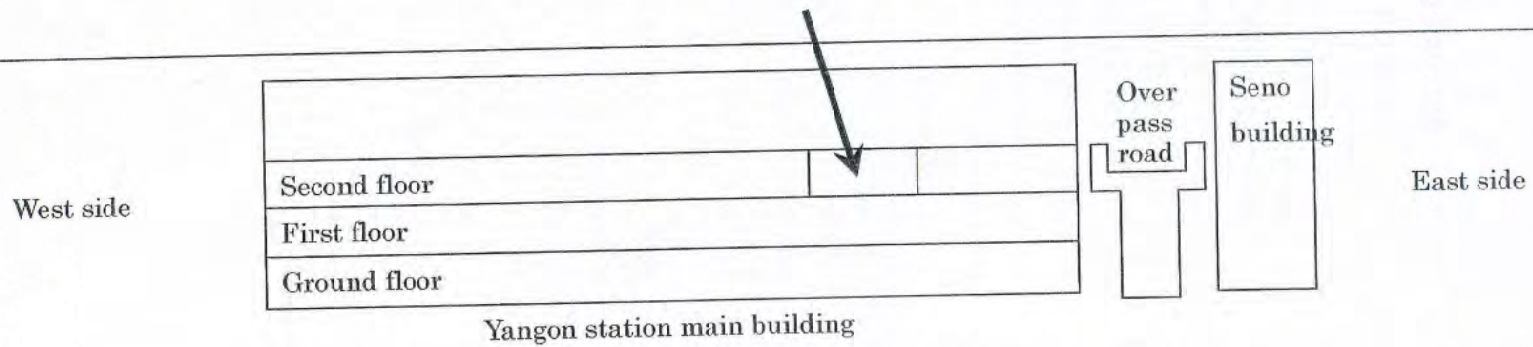
YANGON MAIN BUILDING



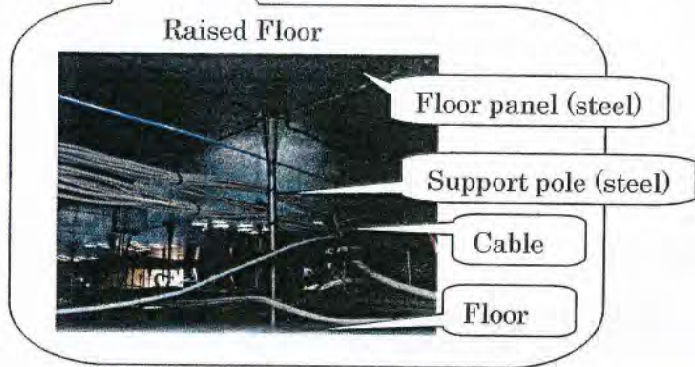
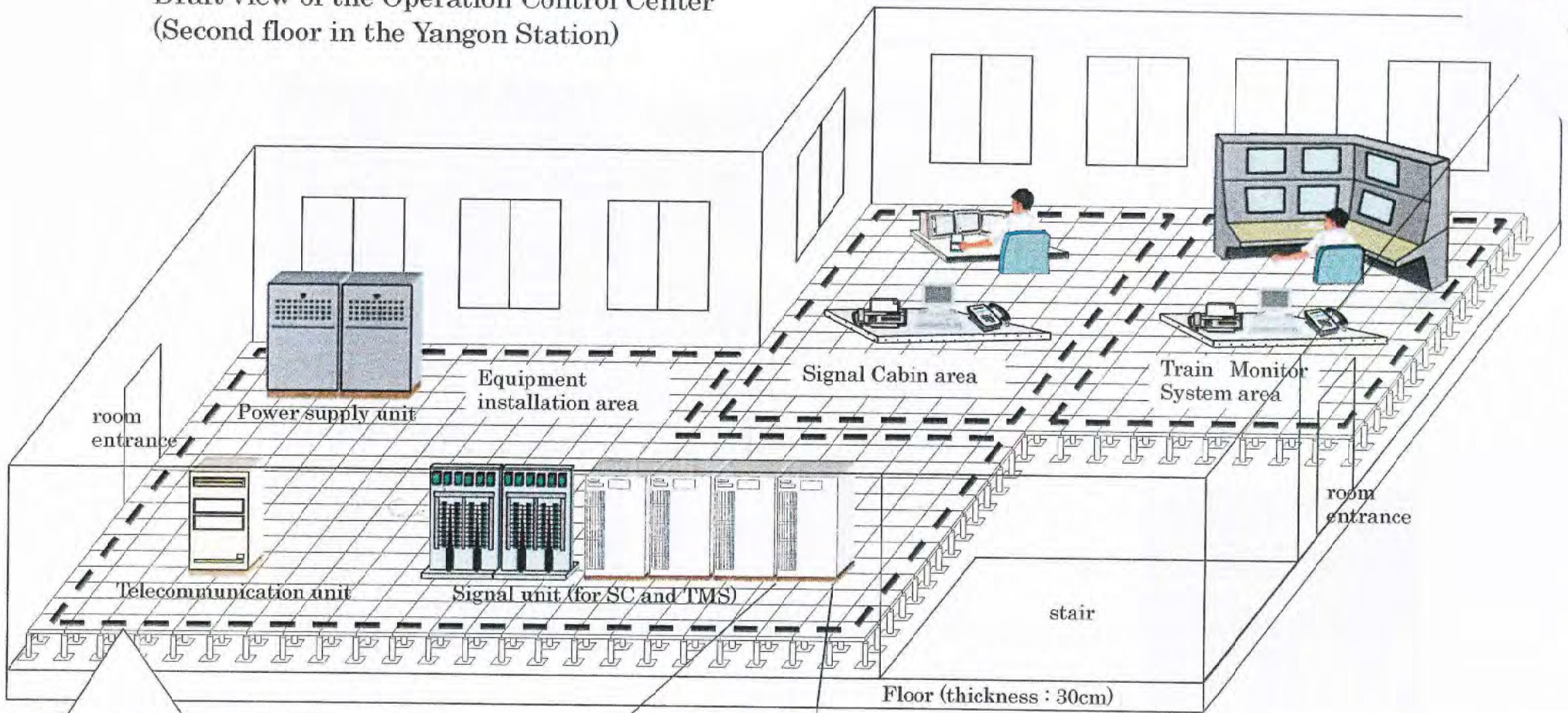
PIC①



PIC②

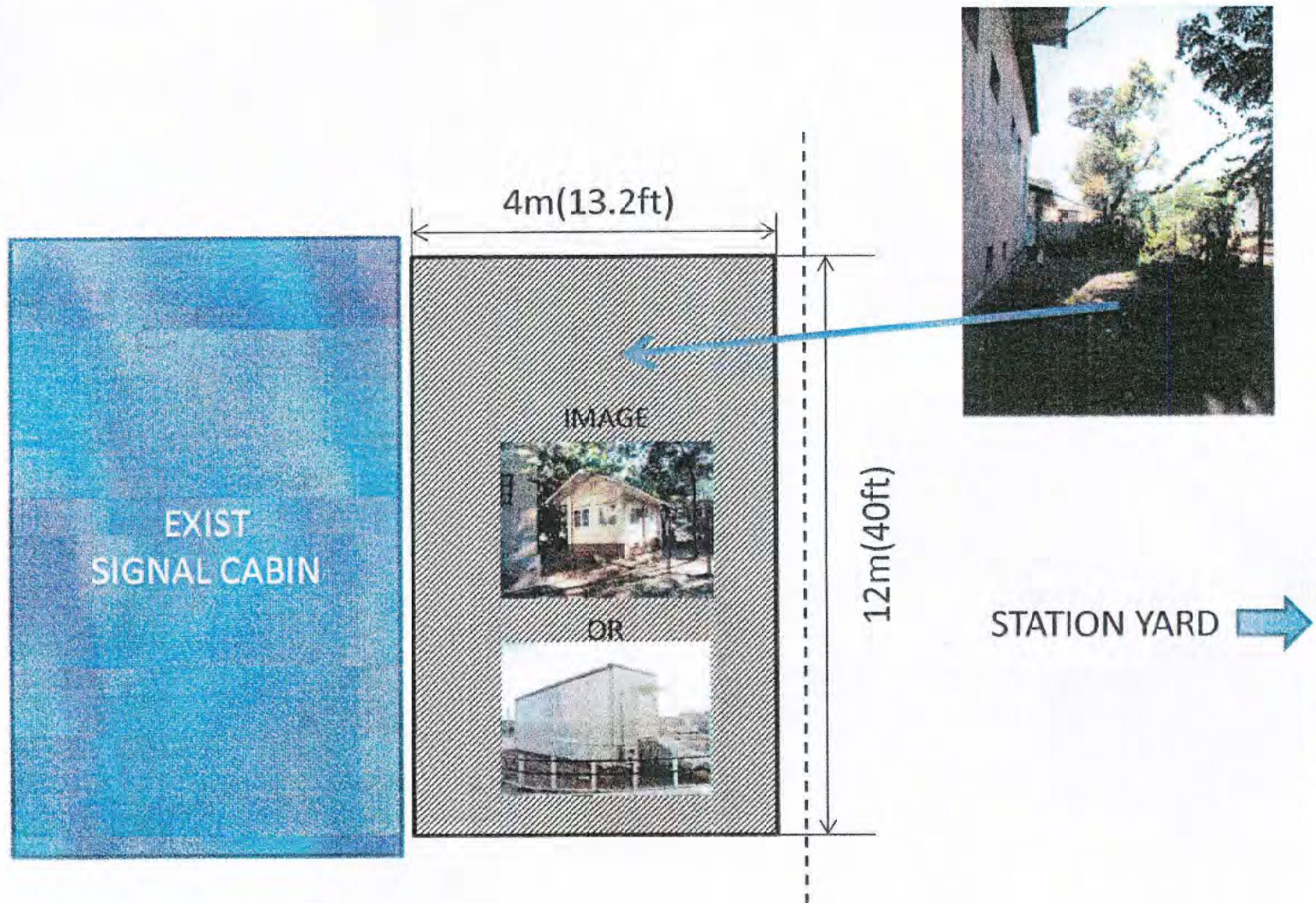



Draft view of the Operation Control Center (Second floor in the Yangon Station)



<Weight>
 Equipment: 2,000kg
 Raised floor: 2,400kg
 Workers: 600kg
 (Total weight: 5,000kg)

PROPOSED NEW SIGNAL EQUIPMENT HOUSE AT PAZUNDAUNG STATION





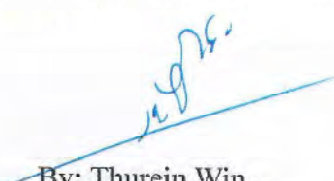
20th November, 2013

Subject: Agreement for selection of the level crossing the study team makes a survey

After the agreement for level crossing renewal in the kick-off meeting between Myanmar Railways (MR) and the JICA Study Team on 28th October, the study team had made a survey with MR counterparts (Civil & Signal) and concerned people of "Project on Improvement of Service and Safety of Railway in Myanmar"


As a result, the study team selected "Kyan Sit Thar Level Crossing" between Togyaunggale Station and Ywathagyi Station as Grant Project Survey. The study team proceeds to make a design from now on.

Myanma Railways



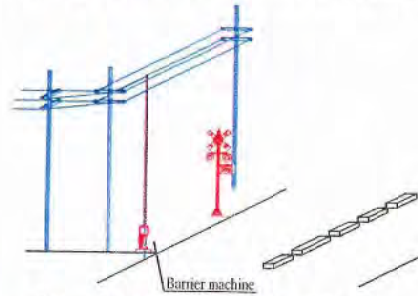
By: Thurein Win
Managing Director

JICA Study Team

for

By: Kiichi Takemura
Project Manager

(Manager, JIC)

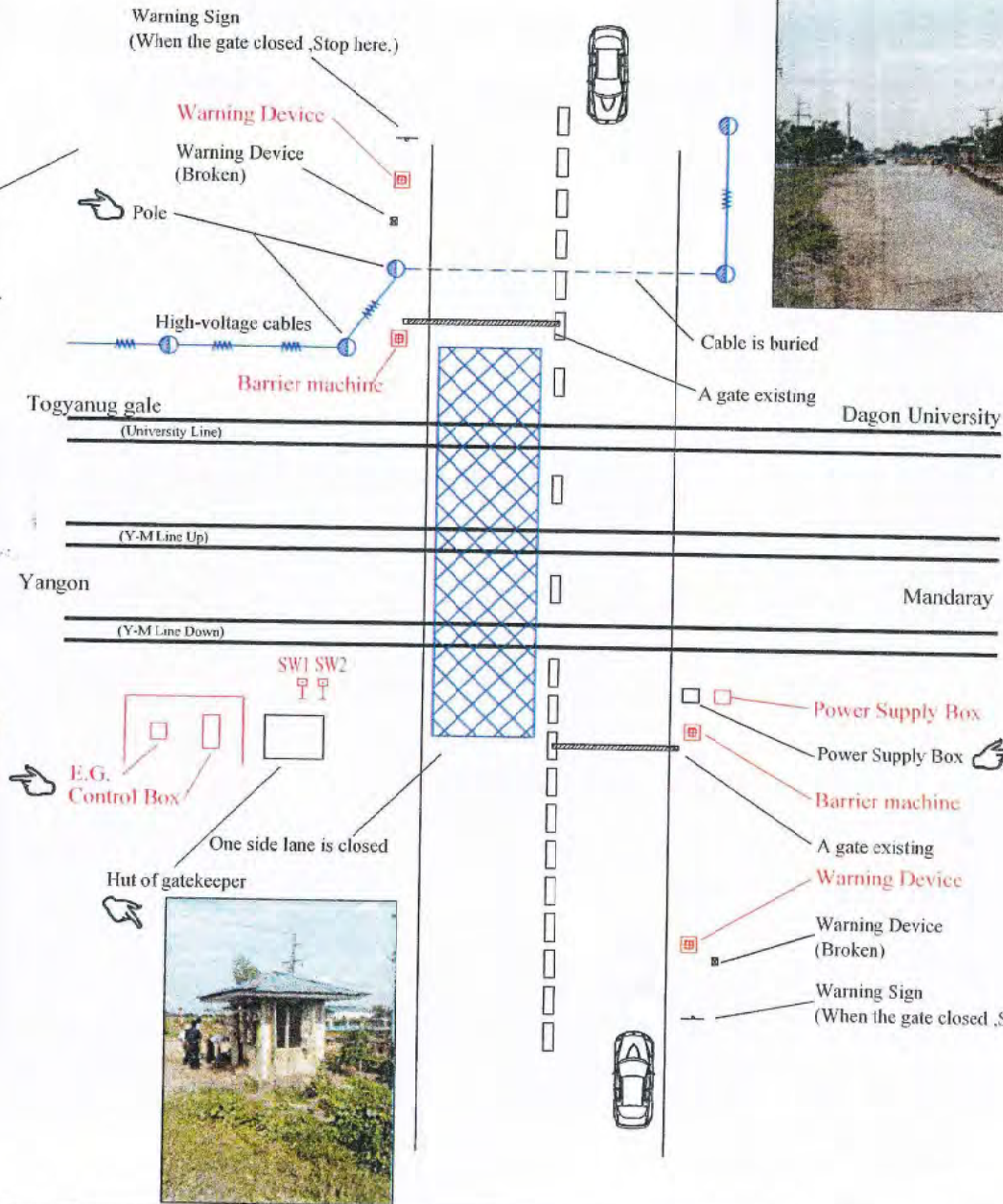
Survey results of Level Crossing (Kyun Sit Thar)



Dangerous contact with the cable
There is a need to transfer the pole and cable.



SW1: Warning device for level crossing
SW2: Control for barrier machine



The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting	Discussion about maintenance	Date of Meeting:	25th Nov., 2013
Work Package	O&M and Construction Plan	Recorded by	Daisuke HIDAKA
		Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	<ol style="list-style-type: none"> U Han Nyunt, Assistant General Manager (Signal & Telecommunication) U Aung Myint, Assistant General Manager (Electrical)
	Team Members	<ol style="list-style-type: none"> Mr. Daisuke Hidaka Mr. Michitaka Ito Mr. Shuichi Umehara
Agenda		<ol style="list-style-type: none"> Questions about signaling maintenance and training "Soft Component" Teaching how to use and maintain new equipment before the introduction The storage location to keep construction materials
Data/information	Distributed	<p>The project for Installation of Operation Control Center System and Safety Equipment</p> <ol style="list-style-type: none"> Questions about signaling maintenance and training "Soft Component" "How does MR learn how to maintain new equipment?"
	Collected	None
No.	Discussion Topic	Necessary Follow Ups
1	The study team asked the questions about the current situation of signaling maintenance and training.	
2	<p>The study team explained the "Soft Component" plan.</p> <p>The suggestions are as following.</p> <ol style="list-style-type: none"> Assistance for establishing rules of signaling equipment inspection. The enlightenment program for good manner in level crossing. <p>MR agreed those suggestions.</p>	
3	<p>The study team explained following items.</p> <ol style="list-style-type: none"> The difference of maintenance method between computer-based system and non-computer-based system. 	

CH
29/11/2013

Daisuke Hidaka

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

	ii) The location of the training equipment if it's possible to introduce it. The study team requested MR to consider where the training equipment will be introduced. Then MR agreed.	
4	The study team request MR to prepare the storage location to keep construction materials when the construction work will start. Then MR agreed.	

29/11/2013

Daisuke Hidaka

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting	Explanation about "Soft Component"	Date of Meeting:	28th Nov., 2013
Work Package	O&M Plan	Recorded by	Daisuke HIDAKA
		Ref. No.:	

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	U TAUNG SIAN KAN, Deputy General Manager (Planning)
	Team Members	Mr. Daisuke Hidaka
Agenda		"Soft Component"
Data/information	Distributed	The project for Installation of Operation Control Center System and Safety Equipment 1. Questions about signaling maintenance and training 2. "Soft Component" 3. "How does MR learn how to maintain new equipment?"
	Collected	None
No.	Discussion Topic	Necessary Follow Ups
1	The study team explained the "Soft Component" plan. The suggestions are as following. i) Assistance for establishing rules of signaling equipment inspection. ii) The enlightenment program for good manner in level crossing. MR agreed those suggestions.	

Kam
28.11.2013

Daisuke HIDAKA


**MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON FOR THE PROJECT FOR INSTLLATION OF
OPERATION CONTROL CENTER SYSTEM AND SAFETY EQUIPMENT
(THE 1st DRAFT REPORT EXPLANATION)**

In October and November 2013, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team for "The Project for Installation of Operation Control Center System and Safety Equipment" (hereinafter referred to as "the Project") to the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar"). The Preparatory Survey Team held a series of discussions with the concerned officials of Myanma Railways, Ministry of Rail Transportation and conducted field survey. After returning back to Japan, based on the discussions, field survey results and technical examination, JICA prepared a 1st draft report of the survey as the Preparatory Survey on the Project (hereinafter referred to as "the 1st draft report").

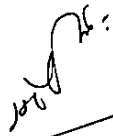
In order to explain and discuss with the Myanmar side on the contents of the 1st draft report, JICA sent to Myanmar, the 1st draft report explanation team (hereinafter referred to as "the Team"), which is headed by Mr. Ken Imai, Advisor, Transportation and ICT Division 1, Economic Infrastructure Department, JICA, from January 19 to January 23, 2014.

As a result of the discussion, both sides confirmed the main items described in the attached sheets.

Nay Pyi Taw, January 23, 2014



Ken Imai
Leader,
The 1st Draft Report Explanation Team
Japan International Cooperation Agency
Japan



U Thurein Win
Managing Director,
Myanma Railways
Ministry of Rail Transportation
The Republic of the Union of Myanmar

ATTACHMENT

1. Components of the 1st Draft Report

The Myanmar side agreed and accepted in principle the contents of the 1st draft report.

2. Japan's Grant Aid Scheme

The Myanmar side reconfirmed the Japan's Grant Aid scheme. The Myanmar side reassured to take the necessary measurements as explained by the Preparatory Survey Team and described in the Annex-5 of the Minutes of Discussions signed by both sides on October 24, 2013, in addition to the Annex-1 of this Minutes of discussion.

3. Schedule of the Study

JICA will report to the Government of Japan on the result of this discussion in order to take necessary procedure for the implementation of the Project as soon as possible. On the other hand, JICA will complete the 2nd draft report of the Preparatory Survey in English, in accordance with the confirmed items and dispatch the 2nd draft report explanation team to Myanmar around the coming March, 2014.

4. Cost Estimation

Both sides agreed that in order to secure a fair and equitable procurement, the Project Cost Estimation attached in Annex-1 should never be duplicated or released to any third parties before the signing of all the Contract(s) for the Project.

5. Other Relevant Issues

5-1. Both sides confirmed that budget necessary for operation and maintenance of the equipment to be procured and installed by the Project is per Annex-2 of this Minutes of Discussions. The Myanmar side assured to allocate necessary budget for operation and maintenance of the equipment mentioned in Annex-2.

5-2. The Team explained that it is essential and important that the Myanmar side undertake daily and periodic maintenance for the new equipment in order to reduce the future operation and maintenance cost. In this regard, the Team proposed that the Myanmar Railway would create a fund for the operation and maintenance on the equipment including interlocking system, level crossing and train monitoring system. The Myanmar side understood this point and mentioned that they would study the possibility of a fund.


5-3. The both sides confirmed that they will report and make a discussion each other in case any changes related to the Project will happen.


The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting Explanation about "Soft Component" plan		Date of Meeting: 23rd Jan., 2014
Work Package O&M plan	Recorded by Shuichi UMEHARA	Ref. No.:

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	1. U Han Nyunt, Assistant General Manager (Signal & Telecommunication Department)
	Team Members	1. Mr. Shuichi Umehara
Agenda		1. "Soft Component" plan
Data/information	Distributed	Material to explain "Soft Component" plan which is an extract from the DF/R Ver.1
	Collected	None
No.	Discussion Topic	Necessary Follow Ups
1.	<p>The Study Team explained to have instruction on operation management work as a part of "soft component" plan in addition to establishing inspection rules and level-crossing manner improvement campaign which Mr. Hidaka explain at the end of Nov., 2013.</p> <p>- Instruction on operation management work</p> <p>Introducing TMS enables operation dispatchers to monitor train operation of Yangon-Pyuntaza section. However, to realize more efficient railway operation, it is necessary not only to introduce TMS, but also that dispatchers can judge situation quickly and precisely. Because of this, the study team will teach operation management work to operation staffs such as dispatchers to upgrade their skill.</p> <p>MR agreed the above suggestion.</p>	


 23/1/14


 Shuichi Umehara

“Soft Component” plan in the Grant Aid Project

1) Establishing inspection rules

MR maintains its signaling system with “breakdown maintenance”, does not maintain records of inspection results, and fails to recognize signs of degradation. Therefore the study team will assist MR to establish inspection rules which stipulate inspection items, frequency, period, and approval, in order to use the new hardware stably, continuously, and inexpensively.

2) Level-crossing manner improvement campaign

At level-crossings, cars and people often cross tracks while the bars are coming down. In addition, people usually cross closed level-crossings. This situation can not only interfere with a train’s stable operation, but also increase the cost of repairing broken gate machines and gate bars caused by cars that try to cross closed level-crossings. This campaign’s aim is to improve their manner at level-crossings.

3) Instruction on operation management work

Introducing TMS enables operation dispatchers to monitor train operation of whole line. However, to realize more efficient railway operation, it is necessary not only to introduce TMS, but also that dispatchers can judge situation quickly and precisely. Because of this, the study team will teach operation management work to operation staffs such as dispatchers to upgrade their skill.

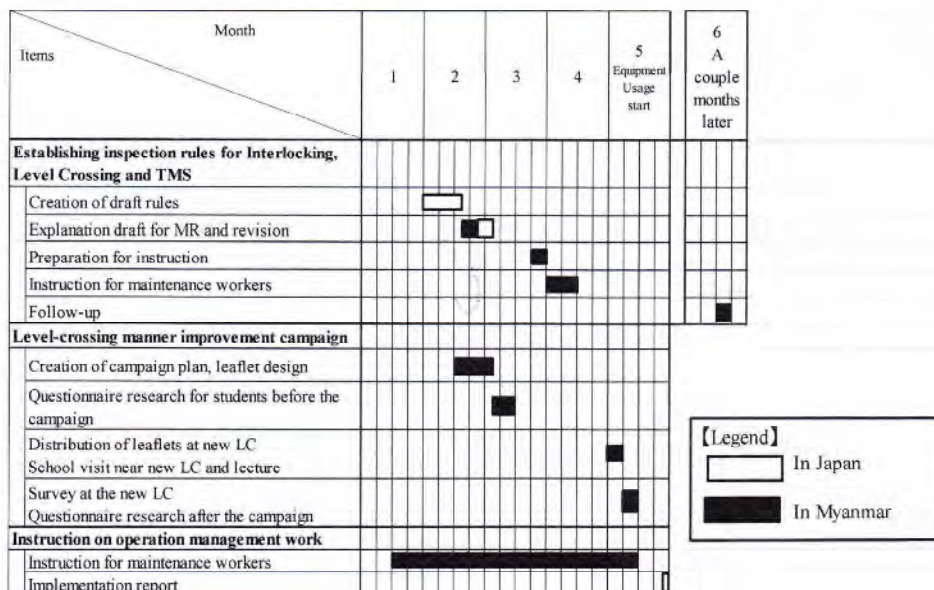


Figure The draft schedule of the “Soft Component” plan

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting Explanation about "Soft Component" plan		Date of Meeting: 23rd Jan., 2014
Work Package O&M plan	Recorded by Shuichi UMEHARA	Ref. No.:

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	1. U Htaung Sian Kan, Deputy General Manager (Planning & Administration)
	Team Members	1. Mr. Shuichi Umehara
Agenda		1. "Soft Component" plan
Data/information	Distributed	Material to explain "Soft Component" plan which is an extract from the DF/R Ver.1
	Collected	None
No.	Discussion Topic	Necessary Follow Ups
1.	<p>The Study Team explained to have instruction on operation management work as a part of "soft component" plan in addition to establishing inspection rules and level-crossing manner improvement campaign which Mr. Hidaka explain at the end of Nov., 2013.</p> <p>- Instruction on operation management work</p> <p>Introducing TMS enables operation dispatchers to monitor train operation of Yangon-Pyuntaza section. However, to realize more efficient railway operation, it is necessary not only to introduce TMS, but also that dispatchers can judge situation quickly and precisely. Because of this, the study team will teach operation management work to operation staffs such as dispatchers to upgrade their skill.</p> <p>MR agreed the above suggestion.</p>	

Kan
23.1.2014.

Shuichi
Umehara

“Soft Component” plan in the Grant Aid Project

1) Establishing inspection rules

MR maintains its signaling system with “breakdown maintenance”, does not maintain records of inspection results, and fails to recognize signs of degradation. Therefore the study team will assist MR to establish inspection rules which stipulate inspection items, frequency, period, and approval, in order to use the new hardware stably, continuously, and inexpensively.

2) Level-crossing manner improvement campaign

At level-crossings, cars and people often cross tracks while the bars are coming down. In addition, people usually cross closed level-crossings. This situation can not only interfere with a train’s stable operation, but also increase the cost of repairing broken gate machines and gate bars caused by cars that try to cross closed level-crossings. This campaign’s aim is to improve their manner at level-crossings.

3) Instruction on operation management work

Introducing TMS enables operation dispatchers to monitor train operation of whole line. However, to realize more efficient railway operation, it is necessary not only to introduce TMS, but also that dispatchers can judge situation quickly and precisely. Because of this, the study team will teach operation management work to operation staffs such as dispatchers to upgrade their skill.

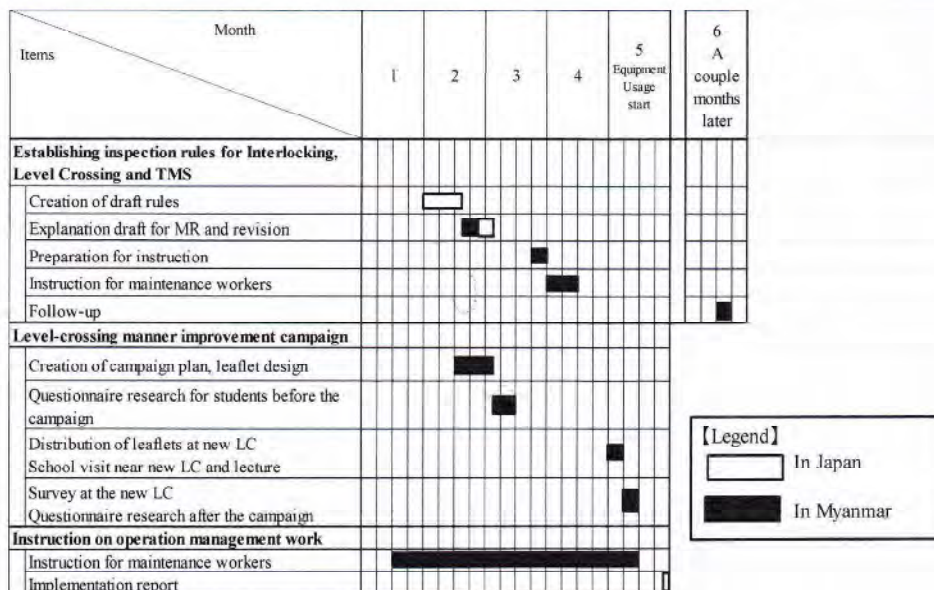


Figure The draft schedule of the “Soft Component” plan

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting: Meeting with Myanma Railways		Date of Meeting: 20th February, 2014
Work Package	Recorded by: Norihisa Matsumoto	Ref. No.:

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	1. U HLA HTUT, Senior Engineer (Signalling & Communication) Tel: 95-1-202553 E-mail: uhlahtut@gmail.com
	Location Contact E-mail/Tel	
	Team Members	1. Norihisa Matsumoto
Agenda		1. How to use the optical fiber cable
Data/information	Distributed	Question of direct phone telecommunication
	Collected	

No.	Discussion Topic	Necessary Follow Ups
1.	<p>To consider a configuration of direct phone, the study team asked U Hla Htut whether the existing STM1 would be available or not. He mentioned that the existing STM1 would not be good condition so that it should not be used in this project. He also said that the study team should have a plan to configure an additional new network. Based on his request, the study team explained that additional two (2) cores in the existing optical fiber cable would be required between Yangon Central Station and Pyuntaza Station.</p> <p>The discussion of this meeting came to the conclusion as follows: For the section from Yangon Central Station to Pyuntaza Station, a total of new six (6) cores will be used (TMS: 4C and Telecommunications: 2C). For the section from Pyuntaza Station to Naypyitaw Station, a total of new two (2) cores will be used (Telecommunications: 2C). MR and the study team agreed the above each other to accomplish the project.</p>	<p align="right">6/3/2014 Dum (Comm)</p> <p align="right">AGM</p>

Shuichi Umebara 1

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

Title of Meeting Meeting with MR on providing necessary spaces of the project		Date of Meeting: 16th Jun., 2014
Work Package	Recorded by Shuichi Umehara	Ref. No.:

Name of Organization		Myanma Railways (MR)
Attendance	Name & Title of Person Met	1. Daw Myint Myint San, General Manager (Admin: & Planning) (The study team explained the agenda to U Saw Valentine and U Khin Maung Thein in advance.)
	Team Members	1. Mr. Ken Imai (JICA) 2. Mr. Kiichi Takemura (The Study Team) 3. Mr. Ryuhei Mitani (The Study Team) 4. Mr. Hisao Matsumoto (The Study Team) 5. Mr. Shuichi Umehara (The Study Team)
Agenda		Discussion on necessary spaces of the Project
Data/information	Distributed	1. Request on Providing Necessary Spaces of the Project for Installation of Operation Control Center System and Safety Equipment
	Collected	None

No.	Discussion Topic	Necessary Follow Ups
1.	Mr. Imai and the study team explained that MR should prepare necessary spaces to implement the project, which are used as a store house to preserve equipment, a consultant office to manage the construction and procurement, a contractor office and a training room for the Electronic Interlocking and the Train Monitoring System (TMS) as shown in the attachment during the project as shown in the letter, "Request on Providing Necessary Spaces of the Project for Installation of Operation Control Center System and Safety Equipment." to Daw Myint Myint San. And the study team also said that they explained the above-mentioned to U Saw Valentine and U Khin Maung Thein in advance. She basically accepted the request of the study team only for	

Shuichi Umehara

*original original SAs
20/6/2014.*

The Project for Installation of Operation Control Center System and Safety Equipment

MEETING MINUTES

	consultant office.	
2.	For contractor office, MR can arrange only land. Contractor will prepare office building and the others by himself.	
3.	Mr. Imai explained schedule on making a tender document. About the procedure of bidding, he said that MR should follow the Grant Aid Guideline issued by JICA.	

Shinichi Takemura

*myils myilt 805
20/6/14*

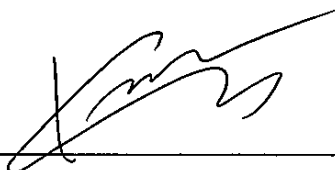
**MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON FOR THE PROJECT FOR INSTLLATION OF
OPERATION CONTROL CENTER SYSTEM AND SAFETY EQUIPMENT
(THE DRAFT FINAL REPORT EXPLANATION)**

In October and November 2013 and January 2014, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team for "The Project for Installation of Operation Control Center System and Safety Equipment" (hereinafter referred to as "the Project") to the Republic of the Union of Myanmar (hereinafter referred to as "Myanmar") respectively. The Preparatory Survey Team held a series of discussions with the concerned officials of Myanma Railways, Ministry of Rail Transportation and conducted field survey. Based on the discussions, field survey results and technical examination, JICA prepared a draft final report of the survey as the Preparatory Survey on the Project (hereinafter referred to as "draft final report").

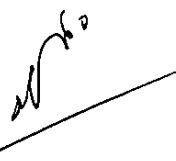
In order to explain and discuss with the Myanmar side on the contents of the draft final report, JICA sent to Myanmar, the draft final report explanation team (hereinafter referred to as "the Team"), which is headed by Mr. Ken Imai, Advisor, Transportation and ICT Division 1, Economic Infrastructure Department, JICA, from June 15 to June 17, 2014.

As a result of the discussion, both sides confirmed the main items described in the attached sheets.

Nay Pyi Taw, July 18, 2014



Ken Imai
Leader,
The Draft Final Report Explanation Team
Japan International Cooperation Agency
Japan



U Thurein Win
Managing Director,
Myanma Railways
Ministry of Rail Transportation
The Republic of the Union of Myanmar

ATTACHMENT

1. Components of the Draft Final Report

The Myanmar side agreed and accepted in principle the contents of the draft final report. The equipment to be procured and installed by the Project is mentioned in Annex-1

2. Japan's Grant Aid Scheme

The Myanmar side reconfirmed the Japan's Grant Aid scheme. The Myanmar side reassured to take the necessary measurements as explained by the Preparatory Survey Team and described in the Annex-5 of the Minutes of Discussions signed by both sides on October 24, 2013, in addition to the Annex-1 of the Minutes of Discussion signed by both sides on January 23, 2014.

3. Schedule of the Study

JICA will complete the Final Outline Design Report of the Preparatory Survey in English, in accordance with the confirmed items and send the report to the Myanmar side through JICA Myanmar Office by the end of July, 2014.

4. Cost Estimation

Both sides agreed that in order to secure a fair and equitable procurement, the Project Cost Estimation attached in Annex-2 should never be duplicated or released to any third parties before the signing of all the Contract(s) for the Project.

5. Other Relevant Issues

5-1. Both sides reconfirmed that the Myanma Railways assured to allocate necessary budget for operation and maintenance of the equipment mentioned in Annex-3 of the Minutes of Discussion signed by both sides on January 23, 2014.

5-2. In order that Myanma Railways will conduct necessary operation and maintenance of the equipment, JICA will provide support in the following fields through soft component scheme;

- Development of equipment inspection rules
- Awareness education for level crossing users
- Signal setting training for station staff and education and guidance for dispatchers

In this regard, the Team strongly requested Myanma Railways to fulfil the necessary actions for operation and maintenance of the equipment including the point mentioned in 5.5-1. Myanma Railways reconfirmed this issue.

5-3. Myanma Railways suggested that project's technology should be compatible with coming new projects such as Yangon Circular Upgrading Project, Yangon-Mandalay Upgrading Project and Yangon Station Redevelopment Project. The Team replied that JICA shall consider compatibility of the technology among the projects within the scope of the studies conducted by JICA and MR as far as possible.

5

43

List of Equipment

Equipment Number	Component Number	Equipment or Component name	Unit	Qty	Statement of Equipment							
					Yangon central station	Pazundaung station	Naypyitaw station	Bago Station	Pyuntaza station	Darbain station	Others	
1		Inter Locking										
1-1		Yangon central station (Indoor)										
	1-1-1	Solid state interlocking system	unit	1	1							
	1-1-2	Train detection device	unit	1	1							
	1-1-3	I/F rack	unit	1	1							
	1-1-4	Power supply devices for signaling	unit	1	1							
	1-1-5	Rack stand base	unit	1	1							
	1-1-6	Incidental facilities	unit	1	1							
1-2		Yangon central station yard										
	1-2-1	Signal	unit	1	1							
	1-2-2	Point machine	unit	1	1							
	1-2-3	Field train detectable devices	unit	1	1							
	1-2-4	Signal equipment box	unit	1	1							
	1-2-5	Cables	unit	1	1							
1-3		Pazundaung station(Indoor)										
	1-3-1	Solid state interlocking system	unit	1		1						
	1-3-2	Train detection device	unit	1		1						
	1-3-3	I/F rack	unit	1		1						
	1-3-4	Power supply devices for signaling	unit	1		1						
	1-3-5	Rack stand base	unit	1		1						
1-4		Pazundaung station yard										
	1-4-1	Signal	unit	1		1						
	1-4-2	Point machine	unit	1		1						

6
7

4/2

Equipment Number	Component Number	Equipment or Component name	Unit	Qty	Statement of Equipment							
					Yangon central station	Pazundaung station	Naypyitaw station	Bago Station	Pyuntaza station	Darbain station	Others	
	1-4-3	Field train detectable devices	unit	1		1						
	1-4-4	Signal equipment box	unit	1		1						
	1-4-5	Cables	unit	1		1						
	1-4-6	New signal equipment house	unit	1		1						
	1-5	Electric Power Source	set	1	1							
	1-6	SSI Training Device	unit	1								1
2		Level Crossing protection device	L.S									
	2-1	Control device for Level Crossing	L.S	1								1
	2-2	Road warning device(A type)	L.S	2								2
	2-3	Barrier machine	set	2								2
	2-4	Gate Signal	set	4								4
	2-5	Obstruction warning signal	set	4								4
	2-6	Control cable	m	6,650								6,650
	2-7	Electric Power Source	set	1								1
3		Centralized monitoring system for the Yangon - Pyuntaza section										
	3-1	Central equipment of Train Monitoring System	set	1	1							
	3-2	Station transmission equipment for Train Management	set	21	1	1	1	1	1	1		15
	3-3	Naypyitaw central OCC operation indication device (including visual display panel) for TMS	set	1			1					

32

24

Equipment Number	Component Number	Equipment or Component name	Unit	Qty	Statement of Equipment						
					Yangon central station	Pazundaung station	Naypyitaw station	Bago Station	Pyuntaza station	Darbain station	Others
	3-4-1	Train detection equipment (device integrated type for Bago station)	set	1				1			
	3-4-2	Train detection equipment (device integrated type for Pyuntaza station)	set	1					1		
	3-4-3	Train detection equipment (device integrated type for Darbain station)	set	1						1	
	3-5-1	Train detection equipment (separate device type for Eimshaylayse station)	set	1							1
	3-5-2	Train detection equipment (separate device type for other each station)	sets	11							11
	3-6	Works for securing the space for installation of TMS station equipment	site	5			1	1	1		2
	3-7	Room maintenance for installation of TMS station equipment	site	4							4
	3-11	For communication of TMS	set	1							1
	3-12	Optical cable for Eimshaylayse station	set	1							1
	3-13	OCC Direct Phone	unit	25	1	1	3	1	1	1	17
	3-14	Electric Power Source	set	1							1
	3-15	TMS Training System	unit	1							1

32

33

Soft Component Plan

Myanma Railways
Ministry of Rail Transportation
The Republic of the Union of Myanmar

The Project for Installation of Operation Control Center System and Safety Equipment

Soft Component Plan

June 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

Japan International Consultants for Transportation Co., Ltd.

Oriental Consultants Co., Ltd.

1. Background on the Planning of Soft Component

The Project for the Installation of Operation Control Center Systems and Safety Equipment in Myanmar (hereafter referred to as "this project") is intended to improve the safety and customer service of railway transport by Myanmar Railways (MR) through the installation of Electronic Interlocking Devices to be used for centralized control of the Yangon Central Station and Pazundaung Station, installation of a centralized Train Monitoring System (TMS) for the Yangon-Mandalay main line between Yangon Central Station and Pyuntaza Station, and the installation of Level Crossing Automatic Alarm systems between Toegyaungkalay Station and Ywathagyi Station.

As MR currently faces a constant lack of spare parts and shortage of the number of engineers, the core issue for them is the improvement of the maintenance framework. Under such circumstances, in order to ensure continuous operation and maintenance of the equipment installed in this project over a long period of time, it is considered necessary to establish a suitable maintenance framework for MR to properly maintain the equipment on their own, in addition to support of hardware to provide necessary spare parts. The aim of such a framework is to reduce the frequency of spare part usage through early detection and treatment of system failures, improving system reliability, and extending the service life of the systems.

Another problem is that in many cases, level crossing users (including automobile and motorcycle drivers) traverse level crossings when a train is approaching or ignore the crossing gate, as people's awareness of train safety is still low. This is in partly due to people's frustration with being prevented from crossing the railway by the crossing gate as well as their underestimation of train speeds and belief that the trains are sufficiently slow enough for them to safely cross the railway even immediately before the train's arrival. Such situations may not only hinder safe and reliable train operation but also cause damage to the crossing gate booms and other devices, leading to possible increases in repair costs and the wasteful use of spare parts. To prevent these harmful effects, it is considered necessary to properly educate level crossing users.

Regarding the installation of the electronic interlocking devices used for the centralized control of Yangon Central Station and Pazundaung Station and the TMS for the Yangon - Mandalay main line, it should be pointed out that MR is not familiar with these systems. As such, in order to prevent possible operational errors in the actual operations, the installation of a suitable training system is being planned for training the station staffs in charge of setting the signals and switches. In particular, while the train operation control work currently being carried out by in each station will be integrated into the Bago Operations Control Center (OCC), train dispatchers will be required to accurately recognize situations and provide quick and accurate instructions to station staffs and train crews. As discussed above, it is considered

essential to implement effective training programs to make full use of the training system for the training of signal setting and dispatching in accordance with actual train operational situation.

Based on the points described above, a soft component program will be planned for the following three subjects: "Support for development of equipment inspection rules," "Awareness education for level crossing users," and "Signal setting training for station staffs and education and guidance for dispatchers".

2. Expected Results of the Soft Component Program

(1) "Support for development of equipment inspection rules"

Establishment of the operation in which the inspections are conducted according to the specified rules and items

(2) "Awareness education for level crossing users"

Reduced incidences of dangerous behavior, such as traversing level crossings when a train is approaching

(3) "Signal setting training for station staffs and education and guidance for dispatchers"

Station personnel will be trained to be able to accurately set the railway station signals, and the dispatchers will be trained to provide smooth dispatching operations through coordination with the station staff and train crew members by the time the facilities are put into service.

3. Checking the Level of Achievement

(1) "Support for development of equipment inspection rules"

In order to make sure that facility inspection operations and management of the inspection result data are being properly carried out according to the implemented rules, the contracted consultant will check the level of achievement after a certain period has passed from the initial use of the equipment. Specifically, an on-site confirmation will be performed to check the implementation status of regular inspection operations, proper storage of inspection records, and adherence to the inspection procedures and items. In addition, the inspectors will be asked to complete a questionnaire for the evaluator to check their understanding of the inspection rules.

(2) "Awareness education for level crossing users"

Regarding awareness education campaign activities for the level crossings, a site survey will be conducted to check the current status of the dangerous behavior of level crossing users, such as traversing level crossings when a train is approaching. In addition, an interview will be done with the entity that conducted the campaign activity. Furthermore, to check for improvement in the safety consciousness of neighboring residents regarding level crossings, questionnaire from before and after the activities will be implemented and evaluated.

(3) "Signal setting training for station staffs and education and guidance for dispatchers"

This will be checked using the training system to see if signal setting in signal cabin can be properly performed according to the train operation situations for Yangon Central Station and Pazundaung Station. Regarding the train dispatching operations, it will be checked to see if the train dispatchers can quickly and accurately provide instructions to the station staffs and train crews based on accurate situation awareness and the correct checking of train numbers and other information.

Table-1 Achievement Evaluation for the Soft Component Program

Field	Achievement Goal	Achievement Evaluation
"Support for development of equipment inspection rules"	The establishment of the operation in which the inspections are conducted according to the specified rules and items	1. Whether or not the inspection is conducted according to the predefined inspection interval and inspection items
		2. Whether or not the inspection records are properly registered in record books and past records are readily accessible
		3. Whether or not the inspectors have the correct understanding of the inspection rules without disagreements in understanding between inspectors.
"Awareness education for level crossing users"	Reduce incidences of dangerous behavior, such as traversing level crossings when a train is approaching	1. Whether or not incidences of dangerous behavior at level crossings have been reduced?
		2. Whether or not the safety consciousness of the residents

		regarding level crossings has improved?
“Signal setting training for station staffs and education and guidance for dispatchers”	The station staff is capable of properly setting the route of signals according to the operational situation. In addition, the train dispatchers are able to smoothly perform dispatching operations through proper coordination with the station staff and train crew.	1. Whether or not the signal controller at the station can properly perform the signal and switch operations according to the traffic situation without causing errors.
		2. Whether or not the train dispatchers are capable of checking train positions and train numbers in real time.
		3. Whether or not the train dispatchers can accurately recognize situations and provide the station staff and train crew with instructions quickly and accurately.

4. Activities of the Soft Component Program

(1) "Support for development of equipment inspection rules"

In this activity, rules will be established that implement a constant level of inspection regularly for newly installed facilities even when different staff takes over and the inspection table will be made. It is intended to prevent degradation of equipment, reduce the use of spare parts, and thus reduce total maintenance costs by establishing rule-based inspection operations.

(a) The technologies and types of business required for the program implementation

Trainers are required to have sufficient knowledge on the maintenance of the equipment to be introduced. In particular, it is desirable that the trainers have experience as a railway operator or maintenance contractor with maintenance operation experience of the equipment.

(b) Current status of MR and the level required

At present, regular inspection of signal equipment is only partially carried out by MR, and it is not aggressively promoted. As such, measurements and troubleshooting are made on a case by case basis after a failure occurs. Also, there

is no systematic framework for recording and archiving the measurement data at MR, and measurements are only personally recorded by the inspector in a notebook. As such, it is currently difficult for MR to detect any symptoms of failure or follow the progress of equipment deterioration.

To improve the situation, we have planned the implementation of a framework that can ensure regular inspections of the equipment according to predefined procedures and intervals, as well as the archiving of records, and thus detect failure symptoms and understand equipment deterioration trends.

(c) Target people

MR employees in the signaling and communication sector will be targeted. In particular, the managers will be trained mainly on how to store and analyze the inspection result data, and the inspectors will be trained mainly on the understanding of the inspection rules and how to record the data.

(d) Implementation method

- i) We will determine the specific details, frequency, and points of the facility inspection, define the inspection items, and then prepare the inspection table. It is expected that there will be more than 600 inspection items because more than 30 items are expected to be inspected for each of the following devices: "main unit of the interlocking device," "train detecting device," "color light signal," "shunting signal," "electric point machine," "power supply switch for signal," "uninterruptible power supply," for the electronic interlocking device: "level crossing control device," "crossing warning device," "electric crossing barrier," "gate signal," "special flashing light signal," for the automatic level crossing warning device: "central system," "station equipment," "operation terminal," "train detecting device," "transmission device," "uninterruptible power supply," for the centralized train monitoring system: "power generator" and "solar power unit." We will discuss the details of these items with MR after preparing the list of the inspection items and the inspection table in Japan.
- ii) We will provide guidance and training to enable the conduction of facility inspection according to the inspection table defined in the previous item i), in addition to the maintenance management training that will be conducted before starting the use of the actual facilities. In this training, the staff in charge of the soft component will provide guidance regarding the items listed on the inspection table; and the staff of the device supplier in charge of training on the

use of the device will provide guidance regarding the technical aspects of maintenance. The staff should cooperate with each other in providing these guidance.

- iii) One year after the initial operation of the equipment (i.e., after a few inspections), the level of achievement will be checked by asking the employees to complete a questionnaire and checking the storage status of the inspection records. Depending on the result of the check, some follow up activities will be conducted if necessary.

(e) Resources for program implementation

- i) Level crossing: One person

In Myanmar: 1.0 M/M, In Japan: 0.9 M/M

- ii) Electronic interlocking device and train monitoring system: One person each (total of two people) until the month of service start

After one year of operation: One person

In Myanmar: 2.7 M/M, In Japan: 3.3 M/M

Because there are a number of different types of systems in the electronic interlocking device/ train monitoring system, the amount of inspection rules to be developed is large, so more consultants will be assigned compared to level crossings.

(f) Deliverables for MR

Equipment inspection rules

Equipment inspection table

(2) "Awareness education for level crossing users"

Awareness education activities will target pedestrians and car drivers who traverse level crossings. As there is a school in the neighborhood of the level crossing where the new equipment will be introduced, awareness education for the students of the school is planned, with the aim to establish a culture of safely traversing level crossings, taking advantage of the opportunity provided by the introduction of the new equipment. These efforts will help prevent the dangerous behavior of traversing level crossings when a train is approaching, realize the safe and reliable operation of trains, prevent damage to the level crossing equipment, and ultimately prevent unnecessary

increases in maintenance costs.

(a) The technologies and types of business required for program implementation

Trainers will be required to have sufficient experience in similar promotion/education activities. In particular, since "level crossing accident prevention campaigns" are often conducted by district transport bureaus of the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) as well as by railway operators in Japan, it is considered desirable to make use of the existing know-how in conducting such campaigns.

(b) Current status of Myanmar and the level required

At present, it is quite common in Myanmar for people to traverse level crossings when a train is approaching or even when the gate is closed. This is in part due to the people's frustration with having to wait a long time for the gate to open as well as their underestimation of train speeds and belief that the trains are sufficiently slow enough to avoid getting hit by them. As such, an automobile entering the level crossing while a train is approaching may hit the gate boom and damage it. In some cases, not only the gate boom but also the main unit of the gate equipment can be damaged, leading to an increase in MR's cost of maintenance. In addition, such a situation makes it difficult to increase train speeds in the future, thus impeding the establishment of safe and reliable train operations.

To deal with the situation, it is necessary to make pedestrians and car drivers fully aware of and adhere to the rule that they are never allowed to traverse a level crossing as long as the alarm is being sounded.

(c) Target people

Neighborhood residents, especially the ones who often use the level crossing including automobile drivers and students commuting to a neighborhood school, will be targeted.

(d) Implementation method

i) To promote appropriate behavior in and around level crossings, we will conduct hearings regarding successful cases in Japan for railway operators that have conducted any "level crossing accident prevention campaign". And we will prepare various leaflets, for example, for adults and children. To improve the effectiveness of the activity, we will prepare a questionnaire to understand the current situation as a part of the works conducted in Japan.

- ii) We will investigate the current situation regarding the behavior in and around level crossings by ourselves and by giving the questionnaire prepared in the previous step i) to the students of the schools in the vicinity of the level crossing and the passersby.
- iii) The specific actions to be taken, including the distribution of handouts, school visits and lectures, and others, will be determined in detail, based on the results of step ii) above.
- iv) The activities, including distribution of handouts, school visit and lecture, etc., will be conducted in line with the timing of the beginning of level crossing usage.
- v) After finishing the campaign activity, people's behavior at the level crossing will be checked again, and another questionnaire survey will be conducted for neighborhood students and others to evaluate the effectiveness of the campaign.

(e) Resources for program implementation

One person, In Myanmar: 1.0 M/M, In Japan: 1.1 M/M

(f) Deliverables for MR

- Handout of the level crossing safety campaign
- Level crossing questionnaire survey results

(3) "Signal setting training for station staff and education and guidance for dispatchers"

In this activity, job instruction and training for station signal control and dispatch operations will be provided to the staff who work in the station signal cabins of the Yangon Central Station and Pazundaung Station and the train dispatchers working in the Bago OCC, using the training system. The goal of this activity is for the station staff to be able to properly set and control the railway station signals according to the train operation situation and for the dispatchers to become able to provide smooth dispatching operations through coordination with the station staff and train crew members.

(a) The technologies and types of business required for the program implementation

It is desirable that the trainers have work experience in signal cabins as railway operators or some similar field as well as experience with train dispatching operations.

(b) Current status of MR and the level required

At present, an electric relay interlocking device that was installed about 40 years ago is still operational at the Yangon Central station. While the signals and switches are centrally handled, the signal and switch levers have been separately implemented. As such, the operation of the current system is quite different from that of the electronic interlocking device to be introduced. Also, while the OCC is equipped with radio communication devices to connect each station and the OCC, there is no monitoring system to monitor the entire line. As such, the main task of the dispatchers is to record the train operation results, and train dispatching operations are mostly carried out by each station. Although the primary role of OCC should be to centrally monitor the status of train operation on the entire line and to provide proper instructions, this role is not being fulfilled.

(c) Target people

Employees of MR working at the station signal cabins of Yangon Central Station and Pazundaung Station

Train dispatchers of MR working at the Bago OCC and others engaged in related operations

(d) Implementation method

- i) We will prepare materials for guidance on station signal configuration]training and for the operation management staff in Japan. For the station signal configuration, the materials should include the specific details of operations in cases such as route conflict between the trains on Yangon - Mandalay main line and Yangon Loop Line, train schedule disorder, and facility failure. For the operation management, the materials should be prepared so as to allow the staff to understand that the roles of the dispatcher have been changed due to the modernization of the traffic control system.
- ii) Regarding the station signal control and train dispatching operations, the current status will be tracked and understood.
- iii) Based on the results of i), lectures will be provided on how the station signal

control and train dispatching operations can be improved.

- iv) Before putting the new equipment into service, new operation procedures for station route settings and train dispatching operations will be explained using the training equipment.

(e) Resources for program implementation

Two people, In Myanmar: 5 M/M, In Japan: 1.2 M/M

(f) Deliverables for MR

- Training and education materials

5. How to provide the resources required for implementing the soft component program

The resources will be provided directly by the contracted consultant.

[Reason]

Due to the nature of working with railway equipment, it is considered essential for the program trainers to have sufficient know-how of signal equipment maintenance in order to effectively carry out the program. Also, as level crossing safety campaigns are regularly conducted in Japan, it is considered necessary to effectively transfer the know-how to MR. From these viewpoints, direct support by the contracted consultant is desirable.

6. Implementation Schedule of the Soft Component Program

(1) "Support for development of equipment inspection rules"

Table-2 Implementation schedule for "Support for development of equipment inspection rules"

Number of months Details	1					2					3					4					5 year after the beginning of operation																	
	Support for development of equipment inspection rules (Electronic interlocking system and TMS)																																					
Study on draft of inspection rule (interlocking and TMS, 2people)																																						
Explanation to MR and publication of details (interlocking and TMS, 2people)																																						
Preparation of example inspection check list (interlocking and TMS, 2people)																																						
Training of maintenance staff (interlocking and TMS, 2people)																																						
Preparation of the 1st report (interlocking and TMS, 2people)																																						
Field guidance for well-establishing inspection rules (1 person)																																						
Preparation of final report (1 person)																																						

Work in Japan
 Work in Myanmar

Number of months Details	1					2					3					4					5 year after the beginning of operation																		
	Support for development of equipment inspection rules (Level crossing)																																						
Study on inspection rules																																							
Explanation to MR and publication of details																																							
Preparation of draft of inspection check list																																							
Training of maintenance staff																																							
Preparation of the 1st report																																							
Field guidance for well-establishing inspection rules																																							
Preparation of final report																																							

Work in Japan
 Work in Myanmar

(2) "Awareness education for level crossing users"

Table-3 Implementation schedule for "Awareness education for level crossing users"

Details	Number of months								
	1			2			3		
Awareness education for level crossing users									
Preparation of leaflets and questionnaires	□								
Leaflet distribution around level crossing		■							
Visiting education in the schools in the vicinity of the level crossing									
Post questionnaire counting and analysis					□				
Activity reporting to MR and request to MR for public awareness activities in the future							■		
Preparation of report								□	

Work in Japan
 Work in Myanmar

(3) "Signal setting training for station staffs and instruction for dispatchers"

Table-4 Implementation schedule for "Signal setting training for station staff and instruction for dispatchers"

Details	Number of months																		
	1			2			3			4			5			6			
Signal setting training for station staffs and instruction for dispatchers																			
Preparation of material (signal setting training)	□																		
Signal setting training in stations		■																	
Preparation of report (signal setting training)																	□		
Preparation of material (Guidance on train operation management)				□															
Guidance on train operation management																			
Preparation of report (Guidance on train operation management)																		□	

Work in Japan
 Work in Myanmar

7. Deliverables for the Soft Component Program

(Support for development of inspection rules for the equipment)

- Equipment inspection rules
- Equipment inspection table
- Sample inspection checklist
- Inspector questionnaire survey results

- Performance report

(Awareness education for level crossing users)

- Handouts for the level crossing safety campaign
- Pictures taken during the campaign activity
- Level crossing questionnaire survey results
- Performance report

(Signal setting training for station staffs and instruction for dispatchers)

- Training and education materials
- Performance report

8. Responsibilities of the Partner Country

Efforts to be continued	Expected disincentives	Action to take upon impediment
Compliance with the inspection details	Rules become mere shells or dead letters Neglect of duty by inspectors	- Auditing and other activities to check the status of inspection - Retraining of inspectors - Voluntary improvement / revision of the inspection details (though they should not be thoughtlessly eased)
Observance of level crossing rules	Fading of the effects of awareness education	Conducting more awareness education campaigns (The awareness education campaign should be regularly and continuously conducted.)
Supervision and guidance for the station signal cabin staff and train dispatchers	Reversal to the conventional dispatching method	Provision of regular OJT and guidance, in view of future implementation of the centralized traffic control (CTC) system