

Myanma Railways (MR)

Japan International Cooperation Agency (JICA)

**PROJECT ON IMPROVEMENT OF SERVICE AND
SAFETY OF RAILWAY IN MYANMAR**

PROGRESS REPORT

For 2nd JCC

February 2014

**JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO., LTD
ORIENTAL CONSULTANTS CO., LTD
SUMITOMO CORPORATION**

Project on Improvement of Service and Safety of Railway in Myanmar Progress Report for 2nd JCC

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1. Project Summary

1.1 Project background

In recent years, Myanma Railways (MR) and Ministry of Rail Transportation have come to recognize the importance of maintenance/repair of existing lines. In the past, however, MR invested more than a half of the budget in the construction of new railway lines, with only a small portion appropriated for the renewal of existing facilities and equipment. As a result, MR now have crucial subjects how to recover the deteriorated safety level and passenger services. In concrete terms, facilities and equipment have extremely superannuated and machines, tools and materials are running short. Maintenance, and management have not been implemented appropriately in the past. As a matter of fact, 118 accidents including derailment and collision have occurred in fiscal 2011 in the Yangon–Mandalay section. There are a number of problems in the section relating to safety and service such as frequent accidents, delays of train operation, lowered train speed and worsened ride comfort.

The status of the safety of train operation is as follows. From 2011 through 2012, 118 accidents occurred in the 620.4 km-long Yangon–Mandalay section, of which those attributed to tracks, rolling stock and others accounted for 50, 29 and 21%, respectively. This means that most of the accidents were caused by deteriorated tracks.

The status of services is as follows according to the statistics from 2011 to 2012. There are a number of factors that govern the service level, such as train speed, punctuality, comfort (ride comfort, cleanliness in the passenger room) and fare and charge. The scheduled speed between Yangon and Mandalay is as low as 39 km/h, with train speed limited at various points. The on-time operation rate of express passenger trains in the same section is as low as 41% during the past three years of 2009 - 2011, with trains delayed 59% by improper track conditions and 22% by malfunction of rolling stock. This means that train delay is caused mostly by deteriorated tracks and rolling stock. Furthermore, trains vibrate excessively and passenger rooms are not clean. MR is required to eliminate these drawbacks and improve passenger services.

1.2 Circumstances having led to the project

With the above facts in the background, the government of Myanmar requested the government of Japan to implement a project of technical cooperation, namely “The Project on Improvement of Service and Safety of Railway.” Based on this request, JICA delegated a detailed project planning study team in October 2012 and surveyed the present status of the railways around Yangon and in the suburbs of Naypyidaw and also had the consultations with MR.

According to the Record of Discussion (hereinafter referred to as R/D) signed on March 25, 2013, between President of MR and General Manager, JICA office in Myanmar, agreement was reached upon the detailed contents of the Project and cooperation of JICA to be extended thereto.

1.3 Purpose of the Project

Administration and maintenance ability is improved for the enhancement of service and safety of Myanma Railways.

2. Basic Plan of Project Implementation

2.1.1 Overall goal and Project purpose

Overall goal and Project purpose of this Project and expected outputs are as follows.

Overall goal and Project purpose	
1	Service and safety level of Myanmar Railways is improved (Overall goal)
2	Administration and maintenance ability is improved for the enhancement of service and safety of Myanmar Railways (Project purpose)



Expected outputs	
Output1	Based on accident analysis, issues are clarified for the enhancement of service and safety in the administration and maintenance process, and the improvement plan is drawn.
Output2	Technical Transfer of Track Maintenance Technology to improve the level of Service and Safety through implementation of the Pilot Project

2.1.2 Implementation plan

Implementation plans which accomplish the project purpose are as follows.

Implementation plan for Output1
To survey current situations of track, rolling stock, signal and telecommunication, and operation, and to establish system for collecting information in these various areas above.
To promote familiarization on the investigation and analysis method of accident cause based on the comprehensive factors of track, rolling stock, signal and telecommunication, and operation.
To conduct the investigation and analysis mentioned above with due consideration on hardware (facilities, equipments), and software (operational and maintenance standards, human errors etc.)
To provide recommendation based on the above analysis on necessary technical standards relating to operational and maintenance aspects to improve service and safety level
To draw up the improvement plan of railway facilities through discussion with the "Working Group of service and safety improvement"

Implementation plan for Output2
To draw up technology transfer plan of track maintenance through OJT in the Pilot Section.
According to the technology transfer plan above, to procure the necessary equipments and materials.
To conduct track maintenance (inspection, planning, work) jointly with MR staff, making use of the equipments and the materials.
To summarize points to be improved obtained during track maintenance operation mentioned above, and to feed back to the successive measures.
To revise the track maintenance manual based on the feedback above.
To conduct seminars, training for technical improvement of the track maintenance

2.1.3 Project Section

The site between Yangon and Bago in the Yangon suburban area. Pilot section of about 20km are selected between Yangon and Bago.

2.2 Flow Chart of project implementation

The flow chart of the project implementation is shown in Figure2-1.

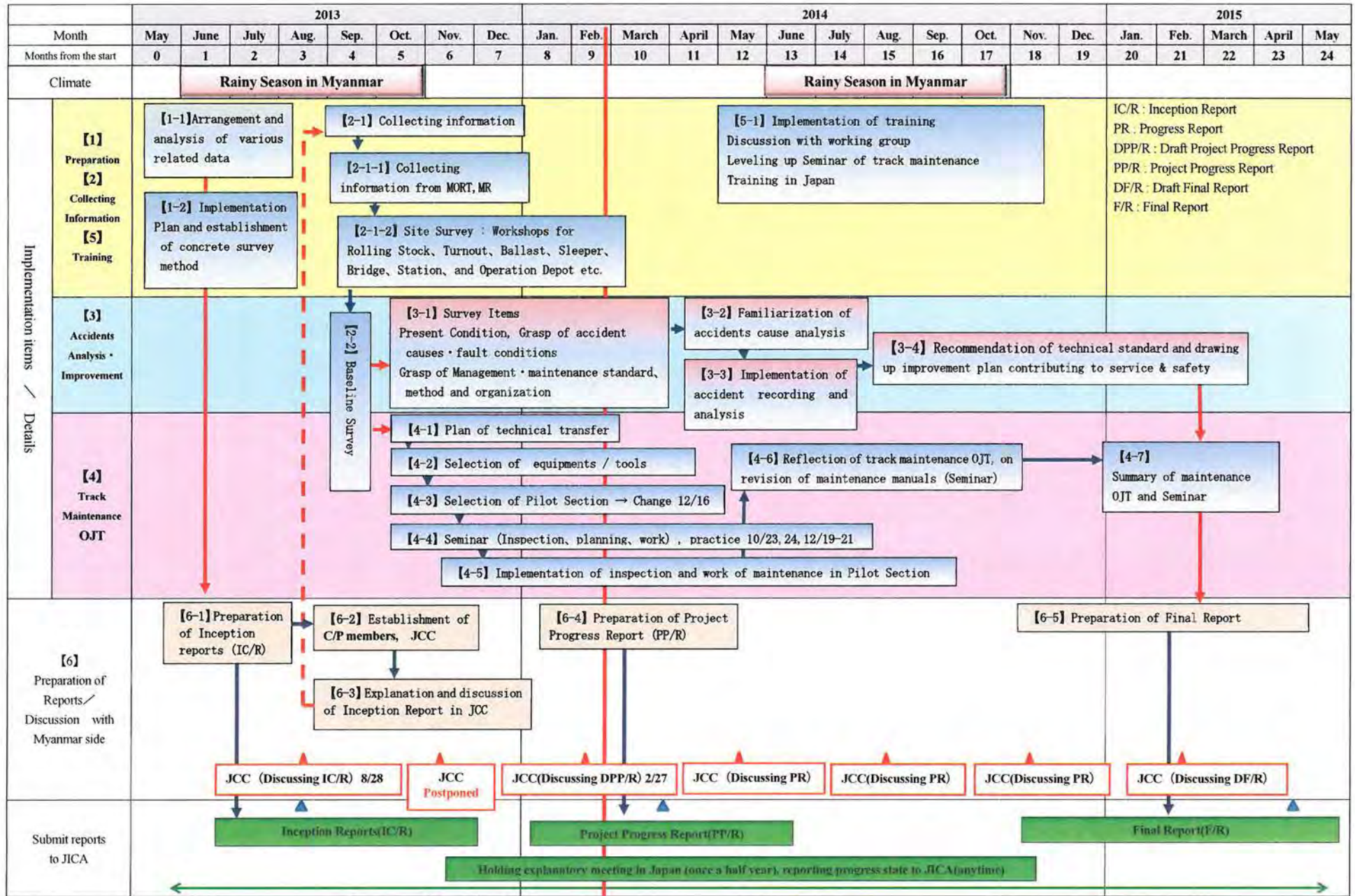


Figure 2-1 Project Implementation

3. Detailed Methods for the Project Implementation

3.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level.

Safety can be compared to “air” not only in railways but also in other traffic, and transport services cannot exist without safety, though it is not visible or tangible. Further, the improvement of customer services is an indispensable element for existence for any transport systems that are being exposed to the waves of modal shift and competition with other transport modes.

Bearing in mind such a concept, JICA Team surveys in this project the present status of safety and customer services of MR and present recommendation on technical standards related to its maintenance and management. We also extract items for improvement and have discussions with Working Groups (W/G), and based on the results of which we aim at determining the items of improvement for the short-, medium- and long-term phases.

3.1.1 Preparation of a working plan

The working plan Table 3-1 was proposed as described in the Inception Report. It should be noted that 2nd JCC was postponed from Nov. 28th 2013 to Feb 27th 2014, according to the agreement between MR side and JICA Expert team.

3.1.2 Survey of the present status and establishment of organization to collect information

To ensure smooth implementation and high efficiency of project activities, JICA Team grasps the present status and collect relevant information on the basic/general item, methods of accident prevention and action at the occurrence of accidents through the newly appointed counterpart (C/P).

3.1.3 Guidance and familiarization of the technique to analysis the present status and causes of accidents and poor services.

Safety of railways assumes learning from the heavy toll of human lives of properties caused by the past accidents and makes it a prerequisite to disseminate among employees an oath never to repeat the same accidents. Regarding passenger services on the other hand, employees shall understand that the closer to customers they are, the heavier responsibilities they are supposed to have.

Aiming at “visualized management,” we create a database on accidents and malfunctions in MR from 2010 through 2012 together with the C/P using Excel and other software for calculation. Based on the database, we analyze the trend of the occurrence of accidents/malfunctions and discuss counter measures against. We also guide the C/P on the method to create a simplified database on accidents and introduce cases of compiling monthly and yearly reports.

3.1.3-A Safety

We adopt cases of collision, derailment, train separation and level crossing accidents recently experienced by MR, and compile a text book to introduce methods to verify/analyze causes of selected accidents and accident preventing measures.

In selecting cases of accident for the above purpose, we consult with the C/P and consider the important items and those in which MR is interested.

By utilizing the text book, we familiarize the MR staff methods to analyze causes of accidents and to establish measures for accident prevention.

(1) Compilation of the text book

- 1) Introduction of the efforts of Japan and European countries towards to analysis of accidents and improvement of safety level.

MR currently relies not on national railway technical standards, but on railway technical standards adopted by International Union of Railways (UIC) and the European Railway Industry (UNIFE). Therefore, we introduce the accident preventing measures adopted not only in Japan but also in European countries.

As a successful case in Japan, we cite the measures to prevent level crossing accidents to make MR understand that, in order to decrease the total number of accidents, it is effective to respond to the most frequently occurring incidents on a preferential basis, and to allocate a budget for hardware measures.

Simultaneously, we introduce the importance of human factors that allows prompt application without requiring particular budgetary arrangements, but requires five- to 10-year for generating successful results.

- 2) Introduction of the causes of and countermeasures against typical accidents in the past in Japan

It includes accidents of collision, derailment, train fire, ones caused by natural disasters and others.

(2) Studying and learning with text books

We use the compiled text books to make the C/P discuss the causes of and preventive measures against accidents by themselves from the standpoint of the railway operator and disseminate the importance of learning from accidents.

(3) Summarization of the results of analysis and countermeasures against accidents.

We hold a workshop to deeper the understanding of MR staff of analysis and establishment of causes measures against accidents, and make MR including the management share the outcome of the workshop.

3.1.3-B Service level

The level of passenger services implies widely-ranged factors, such as train speed, punctuality, fare and charge, comfort (ride comfort, cleanliness and train operation diagrams) and also related with comparison with other transport facilities. The evaluation criterion of each factor depends on the subjectivity and sensitivity of individuals. In this Project, we adopt comparatively clear-cut items, such as low levels of scheduled speed, punctuality (frequency of train delays) and ride comfort (vibration of train).

(1) Compilation of text books

We introduce technical measures in Japan to raise train speed, ensure punctuality and improve ride comfort together with the methods (evaluation items and means) to survey customer satisfaction (CS) with railways.

(2) Results of cause analysis for the low service level and countermeasures

We shall be provided with the data in 2011,2012 on “the sections and factors of speed limit” and “delayed operations” of the trains between Yangon and Mandalay, categorize it with constraining conditions such as geographical conditions, conditions of tracks, track beds and bridges, rolling stock performance and train operation procedures and signal/telecommunication facilities and discuss measures against such problems together C/P.

Regarding ride comfort, we make data visible by using vibration measuring instruments. .

We also implement hearing surveys over customers during the Project period.

(3) Summarization of the results of cause analysis for the low service level and countermeasures

We hold a workshop to deepen understanding of MR staff of causes analysis and establishment of measures to improve the service level and make MR including the top management share the outcome of the workshop.

3.1.4 Recommendation on technical standards relating to administrative and maintenance aspect to improve the service level and safety

We clarify the items prioritized for the improvement of safety and service level. To ensure safety, nothing is more important than motivation of employees, with observance of standards and efforts for improvement by employees being a key to attain sustainable success. To prepare an environment for this purpose, therefore, it is important to create organizational norms and climates to allow evaluating the efforts by employees in a visible form.

It is expected that passenger flows will become more active not only in Myanmar but also to/from other countries as a result of economic development from now on. Improvement of service level is of utmost importance for MR in order to win the competition with other transport facilities and make railways survive and develop further in the future.

3.1.5 Drawing up of short- , medium- and long-term railway facilities improvement plan

We organize “Working group to improve the service level and safety (tentative naming)”, make it analyze a series of surveys and extract improvement items for each phase based on the outcome of the workshop. After that, we draw an improvement road map for discussion.

Improvement plan consists of short-term (three-year) improvement plan, medium-term (5- to 10-year) improvement plan, and long-term (10- to 30-year) improvement plan.

3.1.6 Education/training in Japan

We educate and train approximately 11 trainees relating to railway institutional management for two weeks in Japan, including implementation of site tours to the Integrated Education/ JR East, and the Overseas Human Resources and Industry Development Association (HIDA), with concrete programs subject to determination through consultations with MR.

3.1.7 Major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation

(1) Working group to improve the service level and safety has been established with the consensus between MR and JICA expert team, as shown in Table 4.3.

(2) To implement the Project more smoothly, additional counterpart experts were added to the original counterpart experts as shown in Table 4.1.

(3) Workshop in the training program was arranged such that not only the cause analysis of accidents and low service level and establishment of countermeasures are to be presented by MR experts, but also JICA experts can deepen the understanding of the current situation of MR system in tackling with prevention of accidents and low service level, and their improvement.

Table 3.1 Table of working planning schedule

Subject	F Year	2013												2014												2015					Note
	Month	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5					
	Past Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24					
3.1.1 Survey of the present status and Establishment of an organization to Collect information																															
3.1.2 Guidance and familiarization of the analyzing technique of the causes (1) Safety 1) Compilation of text books 2) Studying and learning with text books 3) Summarization of accident analysis and countermeasures (Workshop) (2) Services level 1) Compilation of text books 2) Studying and learning with text books 3) Summarization of cause analysis and countermeasures (Workshop)																															
3.1.3 Recommendation on technical standards for service level and safety (1) Proposal (2) Summarizing																															
3.1.4 Drawing up short-, medium- and long-term railway improvement items (1) Proposal (2) Summarizing																															
Education/training in Japan																															
Discussion on the report/JCC																															
Submission of the report (JICA)																															

Progress Report of Project Implementation

Table 3.2 Tentative Schedule(Track Maintenance)

Subject	F Year Month Past Month	2013												2014												2015					The degree of achievement (%)	Note				
		5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5										
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24										
4.2.1 Drawing up a technical transfer plan (1) Collection of basic information (2) Plan of technical transfer																																		100		
4.2.2 Selection/procurement of equipments/tools (1) Selection of equipments/tools (2) Acquisition of import license, tax exemption procedure (3) Import procedure (4) Freight control																																			100	
4.2.3 Selection of Pilot Section (1) Site witnessing (2) Selection of a section (3)Base line survey																																			100	Change pilot section in December
4.2.4 Implementation of track maintenance work (inspection, planning, work, control) (1) Compilation of text books (2) Classroom education and practical (3) Prior measurement and survey at the Pilot Section Implementation of work After completing the maintenance work of a 100 m-section in principle, move to the next 100 m-section (with the number of working days depending on the workload of each 100 m-section).																																			100	Pallarell with Implementation of work
4.2.5 Education/training (1) Seminars on the improvement of track maintenance technologies (2) Education/training in Japan																																			25	
4.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards																																			0	
4.2.7 Final smmarization and seminars Discussion on the report/JCC Submission of the report (JICA)																																			0	

3.2 Technology Transfer of Track Maintenance Technology to improve the level of Service and Safety through Implementation of The Pilot Project

3.2.1 Drawing up a plan for technology transfer

The system of track maintenance work currently in practice in Myanmar is a version of the old-fashioned system implemented in the past in Japan. Through this Project, track maintenance workers of MR shall receive education/training of basic track maintenance works, while aiming at a mechanized maintenance system to use large-scale maintenance machines in the future. This means a conversion from the current gang system to a larger sized maintenance depot system or a re-construction of maintenance system. Bearing in mind this long-term vision, we prepare a plan for technology transfer focused on the track maintenance OJT for two years.

See Table 3.2 for the schedule of technology transfer.

3.2.2 Procurement of the required equipments / tools

(1) Table 3.3 summarizes the required equipments / tools, which will be procured by the Japan side.

Table 3.3 : List of the required equipments / tools

No.	Item	Unit	Manufacturer
1	Analog standard gauge	5	KANEKO CO., LTD.
2	Instrument detection for track	5	GIDOU GIKEN
3	Mesuring instrument for rail wearing depthe	2	HARADA SEISAKUSYO
4	Gap gauge	5	TRSUKO NAKAYAMA CO., LTD.
5	Taper gauge	5	KANEKO CO., LTD.
6	Thermometer for rail	5	KANEKO CO., LTD.
7	Square for rail	5	KANEKO CO., LTD.
8	Trackmaster	1	KANEKO CO., LTD.
9	Mesuring instrument for train swing	1	SHINYEI TECHNOLOGY CO.,LTD
10	Cloth measuring tape (30 m)	5	YAMAYO SOKUTEKI CO., LTD.
11	Steel measuring tape (30 m)	5	YAMAYO SOKUTEKI CO., LTD.
12	Square	5	TETUYU KOGYO CO., LTD
13	Slate pencil , Chalk	4	NIHON HAKUBOKU KOGYO CO., LTD.
14	Tie tamper	1	SHIBAURA ELRTEC CORPORATIO
15	Beater	18	ISHI TEKOU CO., LTD
16	Shovel	18	TONBO KOGYO CO.,LTD.
17	Bar	35	ISHI TEKOU CO., LTD
18	Spike hammer	13	ISHI TEKOU CO., LTD
19	Panpuller	18	HOSEN KIKI SEIBI CO.,LTD
20	Jack for rail	40	NICH CO., LTD.
21	Equipment for ballast tamping	5	HITACHI KENKI KAMINO CO., LTD.
22	Generator	1	SHIBAURA ELRTEC CORPORATIO
23	Generator	5	HONDA MOTOR CO., LTD.

24	Shovel	9	TONBO KOGYO CO.,LTD.
25	Dump shovel	9	KATOU SEISAKUSYO CO., LTD.
26	Shovel with blade divided into multiple	9	KATOU SEISAKUSYO CO., LTD.
27	Hoe with blade like nail of wild goose	9	KYOUWA CO., LTD.
28	Hand screen	15	IRIE KOUGYO CO., LTD.
29	Hoe with blade of traiangle	9	IRIE KOUGYO CO., LTD.
30	Wooden maul	9	KONDO KASHIZAI MOKOUSYO CO., LTD.
31	Basket made by bamboo or plastic	9	SEKISUI KAGAKU KOGYO CO., LTD.
32	Jack traverser	10	TOKO SANGYO CO., LTD.
33	Rail sawing machine	3	TETUYU KOGYO CO., LTD
34	Rail boring machine	3	KOBORI TEKOUSYO CO., LTD.
35	Core cutter	10	KOBORI TEKOUSYO CO., LTD.
36	Rail bending machine	1	RIKEN KIKI CO., LTD.
37	Rail joint expandor	1	TETUYU KOGYO CO., LTD
38	Sleeper replacing machine	1	HOSEN KIKI SEIBI CO.,LTD
39	Rail carrying machine	9	YOSHIKE KAKEN KIKI CO., LTD.
40	Rail carrying tongs	9	YOSHIKE KAKEN KIKI CO., LTD.
41	Shovel	18	TONBO KOGYO CO.,LTD.
42	Single open ended spanner	9	ISHI TEKOU CO., LTD
43	Chisel	5	ISHI TEKOU CO., LTD
44	Rail fork	5	NICH CO., LTD.
45	Disc grinder	5	HITACHI KOUKI HANBAI CO., LTD.
46	Power wrench	5	MAKITA CO., LTD.
47	Low joint maintenance machine	1	L. GEISMAR
48	Spanner for joint bolt	9	IJIMA KIKOU CO., LTD.
49	Rail grinding machine	1	YOSHIKE KAKEN KIKI CO., LTD.
50	Swager for back bolt	1	NIPPON POP RIVETS AND FASTENERS LTD
51	Hydraulic lining machine	5	TETUYU KOGYO CO., LTD
52	Low roller	7	HOSEN KIKI SEIBI CO.,LTD
53	Chisel with handle	3	ISHI TEKOU CO., LTD
54	Spanner for bed plate / rail brace	7	IRIE KOUGYO CO., LTD.
55	Adz	9	ISHI TEKOU CO., LTD
56	Hand hammmar	9	TORASUKO NAKAYAMA CO., LTD.
57	Spanner for huck bolt	9	IJIMA KIKOU CO., LTD.
58	Engine Drilling Machine	13	NIKOU TANAKA ENJINYARING CO., LTD.
59	Drill 22mm	13	NIKOU TANAKA ENJINYARING CO., LTD.
60	Gouge	9	KAKURI SANGYO
61	Electric saw	5	HITACHI KOUKI HANBAI CO., LTD.
62	Boring machine	3	MAKITA CO., LTD.
63	Sleeper carrying tongs	9	KATOU SEISAKUSYO CO., LTD.
64	Pad remover	9	ORUHA CO., LTD.
65	Light track trolley	5	YOSHIKE KAKEN KIKI CO., LTD.
66	Gas cutting machine	2	YAMATO SANGYO CO.,LTD

No.	Item	Unit	
67	Rail lifting machine	3	TOKO SANGYO CO., LTD.
68	Spanner	2	TOPU KOGYO CO., LTD.
69	Track jack	9	TETUYU KOGYO CO., LTD>
70	Low elasticity pad	20	NIHON ESURAITO CO., LTD.
71	Track shim	20	TETUDOU YOUHIN CO., LTD.
72	Huck bolt	40	KONDO TEC CO., LTD.
73	Brushcutter	4	HONDA MOTOR CO., LTD.
74	Chip cutter for Brushcutter	4	HONDA MOTOR CO., LTD.

(2) Figure 3-1 illustrates the flow of the import procedure for equipments / tools in the procurement process. Below explained are the major points to be observed.

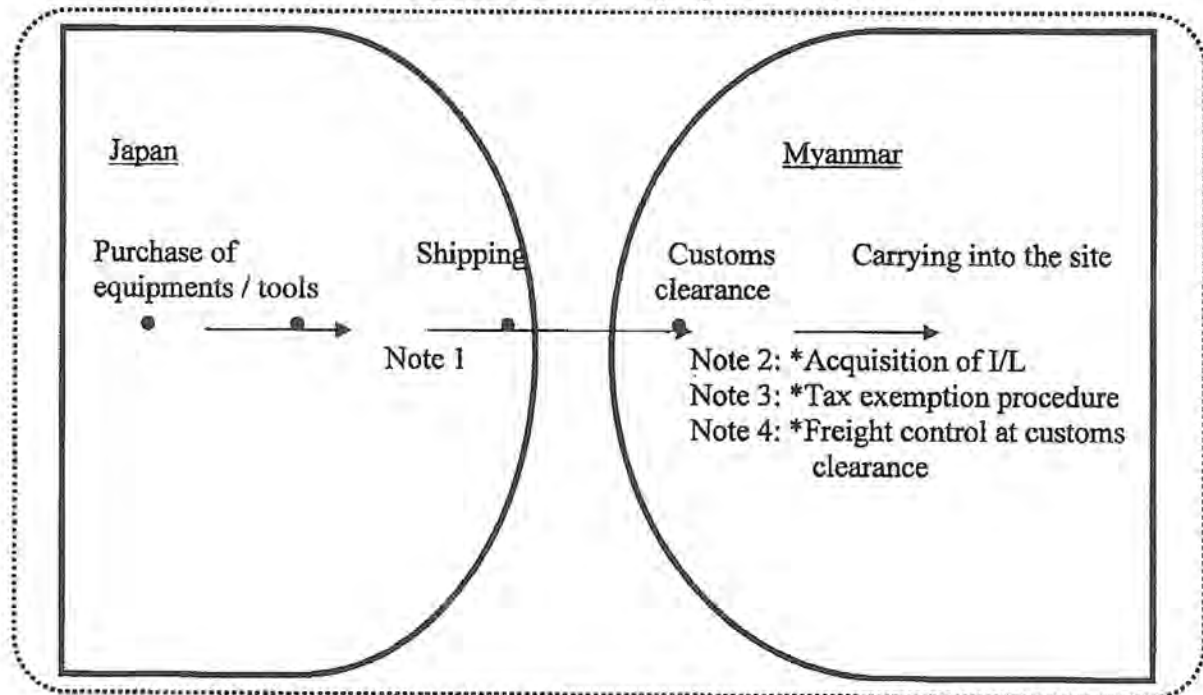


Fig. 3-1 : Flow of the equipments / tools import procedure.

1) Acquisition of import license (I/L) (Notes 1 and 2)

Trading in Myanmar requires importers to acquire an import license (I/L) in advance.

Importers shall acquire an import license before shipment (Note 1) as a prior procedure required for import clearance in landing the purchased equipments / tools.

2) Shipping of equipments / tools

If the cargo has been shipped from the export country before the acquisition of an import license, the importer shall be subject to confiscation of cargo or other penalties by Myanmar. Therefore, due attention shall be paid to the dates of I/L acquisition and cargo shipping from the export country. Furthermore, the cargo shall arrive at Myanmar before the last day of import specified in the import license.

3) Import declaration (Note 2)

Although import declaration can be performed by the importer, it is normally entrusted to a professional agent called a customs broker with a fee paid, as the clearance procedure is extremely complicated and requires expertise knowledge of laws.

Checking and signing the documents for clearance can be done only by the registered customs specialists belonging to a customs broker.

4) Import clearance (Note 2)

This is a procedure for importers to obtain permission from the customhouse with the cargo subject to inspection after (1) reporting cargo items, categories, quantities, prices and other particulars and (2) paying custom duties and other relevant taxes.

Until this procedure completes, the cargo retains the status of a foreign article without becoming a domestic one and, therefore, it cannot be handed over to the Myanmar territory from the bond area. As omission/ignorance of this procedure or false file of return constitutes smuggling, due attention shall be paid.

5) Procedure for tax exemption (Note 3)

Importers shall obtain permission of the customhouse for tax exemption before the clearance procedure in importing cargos that fall in the category of tax-free articles. Detailed procedures in this regard shall be subject to prior confirmation with competent offices and customhouses in Myanmar.

6) Freight control at import clearance (Note 4)

After the arrival of the cargo at the landing port of Myanmar, the importer cannot claim it until the import clearance completes. In the meantime, the importer is required to bear warehouse expenses, container yard rental fees and other extra costs. It is required for the importer, therefore, to promptly complete the custom clearance procedure and take other actions to avoid otherwise unnecessary expenses.

3.2.3 Selection of Pilot Section

In the 46.5 mile section (74.8 km long) between Yangon and Bago, we implement track maintenance as a means of technical transfer in the approximately 20 km-long Pilot Section, which is to be selected through a site survey to allow experiencing maintenance of different track structures, such as defective, sound, straight and curved tracks, turnouts in station yards and bridges, so that the effect of technical transfer is readily obtainable.

Japan side proposed the pilot section consisting of Pilot Section 1 and Pilot Section 2 at the 1st JCC. This is selected by the reason that there are many types of tracks and structures such as straight line, curve, turnouts and bridges, etc in Pilot Section 1 and the vehicle vibration acceleration values are big according to the results of vibration measurement in Pilot Section 2.

We proposed the Pilot Section by the formal letter which was agreed by the Myanmar side, and the Myanmar side wanted to start the track maintenance practice in Pilot Section 2 earlier than that in the Pilot Section 1 because Pilot Section 2 has very bad track conditions.

After that, there was a request of early start of track maintenance practice in the section from 12km200m to 14km550m between Toekyaungkalay Sta. and Ywathargyi Sta. from Myanmar side on 11th December. Thereby, the order of track maintenance practice in the Pilot Section was changed from 16th December.

3.2.4 Implementation of track maintenance (inspection, planning, work and control)

(1) Compilation of text book

To use for classroom education and practical training, we compiled a text book in three parts, each covering the fields of (1) safety of work, (2) track maintenance work and (3) track inspection.

We implemented practical training and maintenance work based on this text book and compile, (1) standards and (2) manuals, for track maintenance work, after modifying, adding or deleting contents of the text book based on review of track maintenance training.

(2) Classroom education and practices (seminars)

Before implementing actual track maintenance work on the Pilot Section, we had seminars on the particulars related to track maintenance such as inspection, planning and work for the workers to be assigned to the Pilot Section. This is the first classroom education and an important step to assess the level of local staff, which will significantly contribute to the work progress control in the future.

Before starting the maintenance work in the Pilot Section, we performed practical training on track maintenance (inspection and work) on non-commercial tracks.(Some are commercial tracks) As safety is one of the most important concerns for track maintenance workers, we also educate them on safety in practicing track maintenance work, with (1) wearing protectors and other protective equipment and (2) deployment of security guards (train watchmen) subject to prior negotiation with MR. However, we proposed at least wearing protective shoes, helmets and safety vests.

Regarding classroom education and practical exercises, we selected an inspector and three to four works from each gang; implemented education in the classroom in the morning and practical exercises using working tools in the afternoon, for about one month in consideration of the combinations of work category and associated job and the number of object trainees. As a part of base line survey, track irregularities (5 items), train vibration accelerations (Vertical and lateral), average speed in the Pilot Section were measured.

(3) Implementation of prior measurement and surveys of the Pilot Section

Before implementing track maintenance work for tracks used for commercial services in the Pilot Section, we measured track levels (transit measurement at curves) to calculate the amount of rail lift and the volume of ballast for the total length of the Pilot Section. Furthermore, we patrolled the total length to (1) visually checked the conditions of track structure/materials and (2) surveyed the workload required and the volume of materials in each 100 m-segment to draw up a working plan.

(4) Implementation of inspection, planning and work in the Pilot Section

Based on the working plan for each 100 m-segment compiled according to the results of prior measurement and surveys, we implemented in turn education and training for the inspector and workers of each track maintenance gang. In the course of this education/training for a particular gang until the track maintenance work in the range of track section in its charge completes, inspectors and workers for other gangs are expected to observe, witness and help the work in progress when necessary in order to make these gang-wise separated operations yield an extended effect over the whole Pilot Section.

For this education/training, In principle, we use the intervals between trains during the daytime. Based on the experience in practical training, time-consuming work will be shifted to the time zone when tracks are not used for commercial purposes.

See the items 1) to 11) below for the scheduled track inspection and maintenance work.

The contents which we are implementing now for technology transfer of track maintenance include the following.

- 1) Ballast compacting work (use of hand tie-tampers, beaters or shovels)
 - ① Inspection of track irregularities and conditions
 - ② Correction of track irregularities
- 2) Ballast sieving
 - ① Inspection of ballast
 - ② Execution of work
- 3) Rail renewal work
 - ① Inspection of rail
 - ② Rail renewal work
- 4) Rail joint work (rework on rail clearance (rail joint clearance), correction of rail joint depression)
 - ① Inspection of rail joint
 - ② Clearance correcting work
 - ③ Rail joint correcting work
- 5) Track realignment work
 - ① Inspection of track displacement
 - ② Irregular alignment correcting work
- 6) Turnout maintenance work

- ① Inspection of turnout
- ② Repair and renewal of turnouts
- 7) Inspection and maintenance of bridge sections
 - ① Inspection
 - ② Maintenance work
- 8) Correction of track gauge
 - ① Inspection
 - ② Correction work
- 9) Welding of rails (preparation of long-rails and a measure to strengthen rail joints)
- 10) Improvement of formation
 - ① Inspection of ballast and roadbed
 - ② Although a standard width of formation is specified in Myanmar, we found through site surveys that sufficient widths are not maintained. To fully exert the effect of aforementioned ballast compacting work, we guide MR to expand the width of formation where it is insufficient.
- 11) Control and evaluation of track conditions

3.2.5 Education/training

In Myanmar, a rainy season starts every year at the end of May. As the track maintenance work in a rainy season is apprehended to adversely affect track beds, we will primarily implement education/training from the end of May to October, 2014.

(1) Seminars to improve track maintenance technologies

We assess the level of track maintenance technologies of MR employees and compile appropriate text books. Thereafter, we hold seminars to improve track maintenance technologies for those participated in the maintenance of pilot section (approximately 20 members) three times: at the start of track maintenance OJT, after completion of track maintenance and at the final summarization of track maintenance OJT.

(2) Education/training in Japan

We implement a two-week education/training program twice in Japan each for approximately 11 trainees including some MTT operators, in which education/training on track technologies (centering on lectures and practical training) will be performed under the cooperation of JR East and Japan Railway Track Consultants, at the Integrated Education/Training Center (Shin-Shirakawa), JR East, and at the Overseas Human Resources and Industry Development

Association (HIDA). MTT operators are included in the above program to prepare for introduction of MTTs into track maintenance in the future.

We practice actual work at the side tracks, and observe the nighttime work to use MTTs in the suburbs of Tokyo.

We discuss the detailed contents of curriculum so as to reflect the level of MR engineers, and also discuss with MR about suitable timing of training in Japan.

3.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards

We summarize the points of reflection through the whole of maintenance work and compile the maintenance manuals to meet the present status of the track maintenance in Myanmar in consideration of the local organizations, working conditions and climates. The essentials of maintenance manuals will be easy to use, while including the steps of work and handling of machines/materials for track maintenance.

3.2.7 Final summarization and seminars

In closing the above technical transfer course on track maintenance work, we will open seminars for the trainees participated in the program and track maintenance members for other sections selected through consultation with MR. As this is the final step for MR employees to receive technology transfer, which is expected to evolve as a model shop to every section of the country in the future, we will avail ourselves of this opportunity to totally wipe unknowns out of MR members regarding the whole of track maintenance work.

3.2.8 Major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation

To implement the Project more smoothly, some JICA track experts were added to the original JICA experts.

4. Project implementation Organization

4.1 Structure of project implementation Organization

Based on R/D, a project implementation Organization was organized as shown in Fig. 4.1.

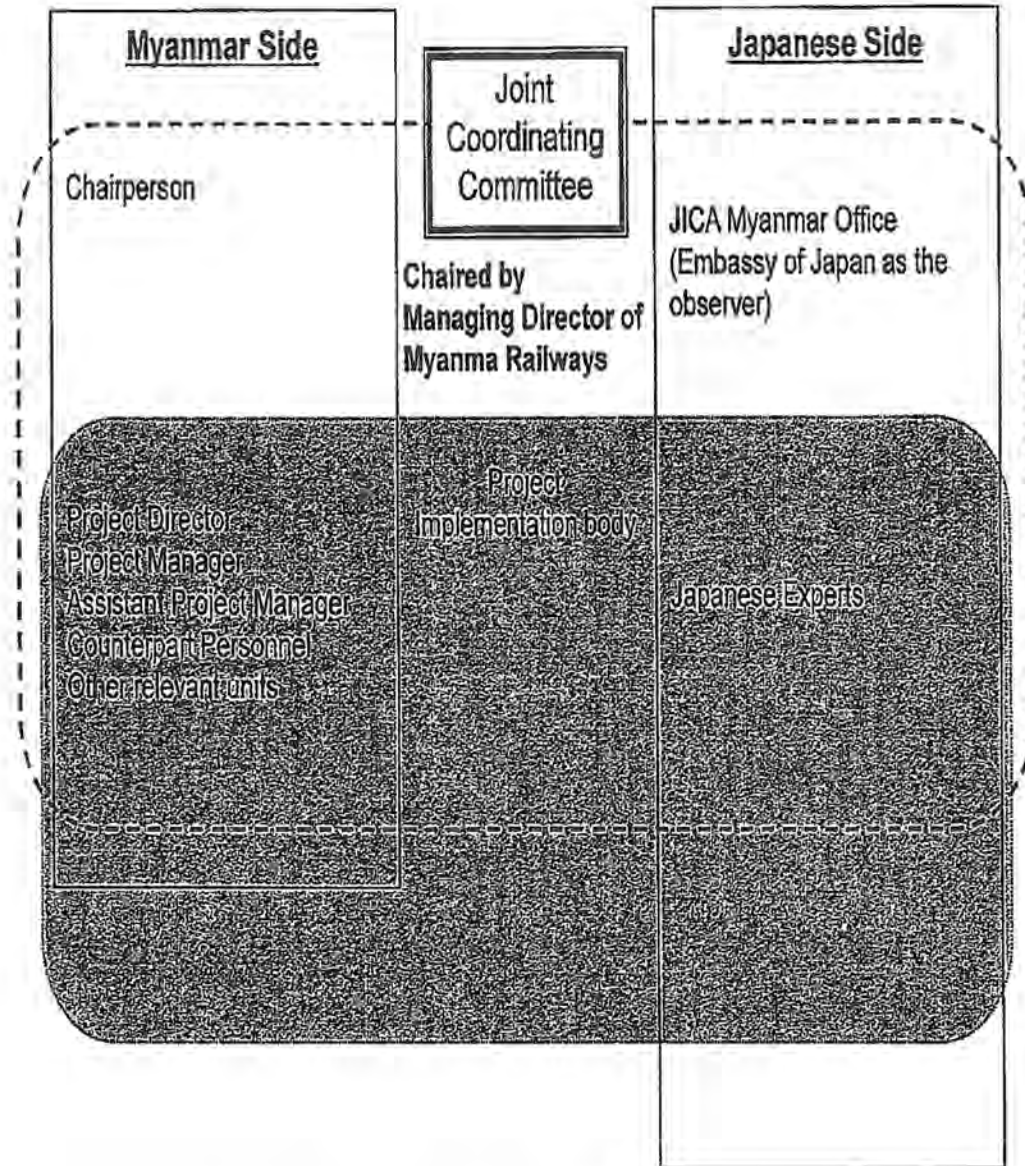


Fig. 4.1: Structure of project implementation Organization

This project is promoted as a scheme of “technical cooperation”. Implementation organization consists of (1) Myanmar Railways (MR) supported by the Ministry of Rail Transportation on the Myanmar side and (2) JICA and a tripartite consortium (JV) composed of Japan International Consultants for Transportation Co., Ltd. , Oriental Consultants Co., Ltd. , and Sumitomo Corporation. To ensure smooth implementation of the whole project, the Joint Coordinating Committee (JCC) was established as referred to later in 4.4.

4.2 Implementation body on the Myanmar side

MR plays a central role on the Myanmar side. To correspond to Japanese experts, a Counterpart Team was organized for this project. See Table 4.1. Project Director commands the general affairs and implementation of the project, while Project Manager manages the projects and directs technical affairs.

During the implementation of the Project, several experts locating at MR Headquarters at Nay Pyi Taw were added to the Counterpart Team, so that the analysis of accidents, low service level and discussion of countermeasures could be effectively executed under the cooperation of MR experts and JICA experts.

Namely the following experts were added to the Counterpart Team as shown in Table 4.1.

- (1) Track maintenance U Than Htay, DGM(Civil)
- (2) Signal/ Telecommunications U Han Nyant, AGM(S&T)
- (3) Rolling Stock U Thet Lwin, DGM (Rolling stock)
- (4) Train Operation U Htiay Myint Aung, AGM (Operation)
- (5) Structure U Tin Win, DGM(Civil)

4.3 Implementation body on the Japan side

The JICA experts selected from the above tripartite consortium guide/advise the personnel on the Myanmar side and offer recommendations where necessary for the project. See Table 4.1 for the list of the expert members.

During the implementation of the Project, the following replacement of Japanese experts was made due to inevitable circumstances.

- (1) Signals/ Telecommunications from Kiichi Takemura to Ryuhei Mitani
(since October 25, 2013)
- (2) Track Maintenance from Kazuhiko Murao to Masato Wakatsuki
(since October 28, 2013)

4.4 Establishment of Joint Coordinating Committee (JCC) and Its Functions

JCC is the committee to confirm the progress of the Project, discuss important matters and make decisions for the better implementation of the Project.

Managing Director of MR is the chairperson of the JCC. The members are listed in Table 4.2.

Corresponding to the replacement of Japanese experts as mentioned in the section 4.3, the JCC members on Japanese side were replaced as shown below.

- (1) Signal/ Telecommunication from Kiichi Takemura to Ryuhei Mitani
- (2) Track Maintenance from Kazuhiko Murao to Masato Wakatsuki

Originally it was planned to be held at least twice a year and when necessary arises.

However on the request of Myanmar side, it is planned to be held around once every 3 months.

Table 4.1 Administrative and Counterpart Personnel for the Project

Fields	Myanma Railways	Japanese Side (JICA Expert Team)
Project Director	U Saw Valentine, General Manager (Technical & Admin.support)	Sadaaki KURODA (Leader)
Project Manager	U Tin Soe , General Manager (civil)	Nobuyuki MATSUO (Duputy Leader)
Railway Policy/OM Improvement	U Kyaw Kyaw Myo Assistant General Manager (operating)	Hiroshi KOMATSU
Track Maintenance	U Maung Maung Than ,AGM (Civil) U Than Htay (DGM) Civil	Masato WAKATSUKI Kiyoshi MIYAMOTO
Procurement of Equipment & Materials	U Win Htein DGM(Supply)	Yuichi TANIGUCHI
Signalling & Telecommunications	U Myint Lwin, Assistant Engineer (S&T) U Han Nyunt ,AGM (S&T)	Ryuhei MITANI
Rolling Stock	U San Myint (Train Operation) U Thet Lwin, DGM (Rolling Stock)	Makoto ISHIKAWA
Train Operation	U zaw Pe Sein (Divisional Traffic Manager) U Htay Myint Aung, AGM (operating)	(Hideharu IGAGASHI)
Structure	U Tin Win ,DGM (Civil)	Mitsuru TAKAMI (Coordination)

Table 4.2 JCC Personnel

Chairman U Thurein Win Managing Director of Myanma Railways			
Myanmer Side		Japanese Side	
Name	Position (Major)	Name	Position (Major)
U Saw Valentine	General Manager (Technical & Admin Support)	Sadaaki KURODA	Leader of Japanese Expert Team (Track maintenance)
U Myint Wai	General Manager (Operating) for analyzing accidents	Nobuyuki MATSUO	Duputy Leader (Maintenance planning)
U Aung Wn	General Manager (Mechanical & Electrical) for rolling stocks	Hiroshi KOMATSU	Railway Administration and Management Expert
U Tin Soe	Project Manager, General Manager (Civil)	Yuichi TANIGUCHI	Procurement of Equipment and Materials Expert
U Than Htay	Assistant Project Manager, Deputy General Manager (Civil)	Ryuhei MITANI	Signalling and Telecommunications Expert
U Khin Maung Thein	Assistant Project Manager, Deputy General Manager (Signalling & Telecommunications)	Makoto ISHIKAWA	Rolling Stock Expert
U Min Aung	Counterpart Personnel, Assistant Engineer (Civil)	Masato WAKATSUKI	Track Maintenance Expert
U Myint Lwin	Counterpart Personnel, Assistant Engineer (Signalling & Telecommunications)	Kiyoshi MIYAMOTO	Earth Roadbed Expert
Daw Thi Thi Nwe	Assistant General Manager (Finance)	Mitsuru TAKAMI	Coordinating Expert
Htaung Sian Kan	Deputy General Manager (Admin)	(Hideharu IGAGASHI)	Operation Expert
		Mituso HIGASHI	Railway Management Adviser
			Representative of JICA
			Representative of JICA
			Representative of Embassy of Japan : Observer

The first JCC was held on Aug. 28th, 2013 for authorization of Inception Report, and the 2nd JCC, originally planned to be held on Nov. 28th or 29th, 2013, but postponed with due consideration of various situations of MR, is being held on 27th February, 2014 at Nay Pyi Taw.

4.5 Establishment of Working Group for Service and Safety Improvement

In the Record of Discussion(R/D) agreed between Managing Director of MR, U Thurein Win and Chief Representative, Myanmar office of JICA, on May 28th, 2013, Appendix 1, II .OUTLINE of the Project, 5.Activities(1-5) reads as follows: [To draw the improvement plan of railway facilities through discussion with Working Group for Service and Safety Improvement(tentative name)]

In this regards, MR and JICA Expert Team have established Working Group as shown in Table 4.3.

4.6 Major issues to be tackled with, good schemes for better implementation of the project and lessons obtained through implementation.

Regarding the safety and service improvement project based on analysis of accidents and low service level, the MR Head Office located at Nay Pyi Taw has the initiative to the implementation of the project. Accordingly the additional experts of track maintenance, rolling stock, signal/ telecom, structure maintenance and operation belonging to the MR Head Office were added to the counterpart team of MR.

Table 4.3 " Member of Working Group for Service and Safety Improvement"

Fields	Myanma Railways	Japanese Side (JICA Expert Team)
Project Director	U Saw Valentine,General Manager (Technical & Admin.support)	Sadaaki KURODA(Leader)
Project Manager	U Tin Soe ,General Manager (civil)	Nobuyuki MATSUO (Duputy Leader)
Railway Policy/OM Improvement	U Kyaw Kyaw Myo Assistant General Manager(operating)	Hiroshi KOMATSU
Track	U Than Htay DGM (Civil)	Masato WAKATSUKI Kiyoshi MIYAMOTO
Signalling&Telecommunications	U Han Nyunt ,AGM (S&T)	Ryuhei MITANI
Rolling Stock	U Thet Lwin,DGM(Rolling Stock)	Makoto ISHIKAWA
Train Operation	U Htay Myint Aung ,AGM(Operating)	(Hideharu IGAGASHI)
Structure	U Tin Win ,DGM(Civil)	Mitsuru TAKAMI (Coordination)

5 Interim Reporting of Progress of the Project

5.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level.

5.1.1 Survey of the present status and establishment of an organization to collect information

- (1) With respect to an organization to collect information, the counterpart team was established as shown in Table4.1
- (2) Collection of relevant information relating to train operation and rolling stock.

Two experts visited MR headquarters and three rolling stocks workshops for facts finding in August and September, 2013.

①Interviews



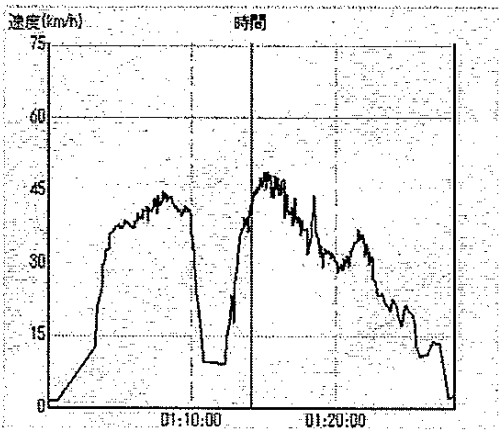
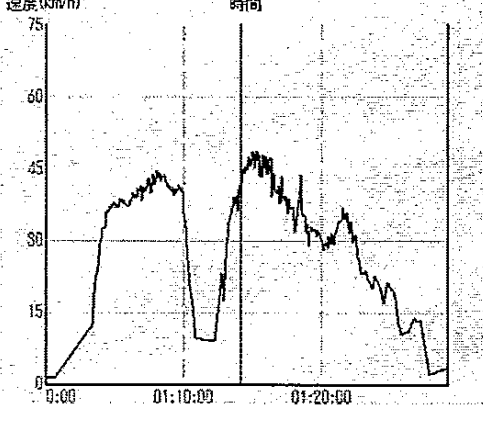
At Headquarters, they interviewed the deputy Directors, Operating and Mechanicals, as follows.

- a) Organization and Correspondence in case of railway accidents
- b) Accidents report and Countermeasures
- c) Train Operation Methods and Driving Crews' Training and Treatments
- d) Restrict condition of sanction speed
- e) Others

Also they introduced Japanese Railways current situations, for example national railway implementations, finance, and so on.



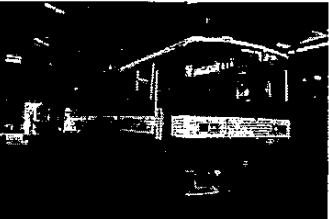
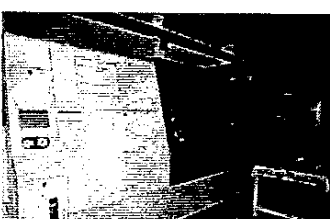
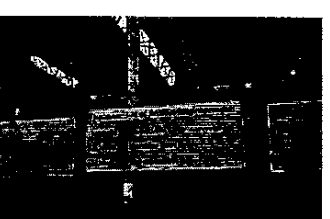

When experts boarded on MR trains between Naypyidaw Station and Pinmana Station two times, they measured Time-Velocity by GPS Logger.

Table5-1: Comparison of Train

September 4 th , AM 8:00-8:32	September 6 th , 17:00-17:30
-Locomotive(2000Hp,DEL) hauling six passenger couches Train	-DMU(adapting air suspension bogies)
	
	

②Surveillance of Rolling stocks Maintenance Workshops

Table 5-2: Maintenance Workshops

Insein Locomotive Workshop	Ywataung Locomotive Workshop	Myitnge Carriage and wagons Workshop
On September 2 nd	On September 3 rd	On September 3 rd
		
		

(3) Present status of safety and service level of MR

Based on the answers to the Questionnaire from the JICA expert team to MR, the paper “Present Situation of Safety and Service Level of MR” was prepared, which is attached as Appendix 8-1.

5.1.2 Guidance and familiarization of analysis technique of the causes of accidents and low service

(1) Compilation of text book

Expert team completed Text book and filed a training program in middle of next February. Table of contents is as follows,

Text book Contents	
Forewords (MR side and Japanese side)	
1. Safety	
1.1 Introduction of Prevention and Research organization in the world railway	
1.2 Past accidents and Countermeasures	
1.2.1 Collision	
1.2.2 Derailment	
1.2.3 Level crossing	
1.2.4 Natural Disasters	
1.2.5 Train Fire	
2. Bottom up of Service Level	
2.1 Speed-up	
2.2 Prevention for Level Crossing Accident	
2.3 Punctuality	
2.4 Conformability	
2.5 Customer Satisfaction	
Afterword	

- (2) Studying and learning with the textbook, and
- (3) Summarization of cause analysis and countermeasures (workshop)

With respect to the subsections (2) and (3), the document “Procedure of Training Program of Cause Analysis of Accidents / Low Service Level and Establishment of Countermeasures” was prepared, which is attached as Appendix 8-2,

(4) Interview Survey

In order to investigate the customer’s evaluation of MR’s passenger services, the interview survey was programmed of which details are shown in the document” guidelines for investigation on customer’s Satisfaction Level, attached as Appendix 8-3

5.1.3 Recommendation on technical standards for service and safety, and

5.1.4 Drawing up short-, medium-, and long-term railway improvement items

These two subjects of the sections 5.1.3 and 5.1.4, will be carried out in the period from June 2014 to Feb 2015, based on the results of implementation of the training program,

5.1.5 Education / training in Japan

This is scheduled to be held in October, 2014.

Concrete program and selection of 11 participants of MR will be finalized according to agreement between MR and JICA Expert Team.

5.1.6 Extent of achievement of target, major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation

(1) Extent of achievement

As described in the Appendix 8-2, the training program consists of

① Presentation by JICA experts of introduction of Japanese and European accidents, establishments of suitable countermeasure to prevent similar accidents, and how to improve service level, ② workshop where MR experts make presentation about MR’s accidents and low service level, their causes, and establishment of measures to prevent the occurrence of similar accidents, and to improve their passenger services, and ③ practical training how to make use of train vibration measurements for improving safety and service level.

This training program will be completed on Feb 28th, 2014.

Further interview survey will be conducted from March 3rd to 7th, in order to identify the passenger’s evaluation of MR passenger transport services.

Still more, JICA experts should make recommendation on technical standards of MR relating to safety and service level, and draw up short-, medium-, and long- term railway facilities improvement plan for safety and service of railway operation.

In this regard, it can be said that the target of this subprogram has been achieved halfway,

(2) Major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation

1) Good schemes applied for better implementation

(a) Close contact between two subprojects

As given in the Inception Report, the Project consists of two subprograms:(1) Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities plan to improve service and safe level, and (2) technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project.

These two subprograms should be executed under close contact so that they can mutually complement each other, because both the subprojects include the class room lecture on how to improve track and track maintenance from the viewpoint of ensuring safety and good service level.

(b) Preparation of textbook and presentation by JICA experts

① In adopting the examples of accidents analysis and service level improvement in the textbook, the following two points were duly taken into consideration.

a) the events likely to occur in MR

b) the items to be tackled with to cope with the future traffic increase in MR

② Presentation of Japanese experiences

a) Not the newest technology, but the practical technologies able to be applied to the coming development of MR were introduced.

b) Calculation procedures were presented so that MR Experts can apply these calculation procedures to quantitative analysis of accidents or low service level.

c) Case study of analysis of derailment was presented so that MR experts could have interests in quantitative analysis of accidents.

(c) Workshop

In programming the workshop contained in the training program, it was so arranged that in the workshop MR experts make presentation of ① cause analysis of accidents and low service of MR themselves, ② countermeasures to prevent the similar accidents and low services, and ③ the procedure/ systems /organization of MR for ensuring safe and good service railway transport.

Through these activities, it is expected that MR experts' management capability of tackling with improvement of safe and service level could be raised up.

Furthermore it can be expected that through this workshop, JICA experts can deepen their understanding of the actual situation of MR relating to ensuring safe and good service railway operation, which would be a good basis for JICA experts to make recommendation on technical standards relating to safety and good services, and to draw up short-, medium-, and long- term facilities improvement plan to be executed in the next stage.

2) Major issues to be tackled with

(a) Technical standards

In improving the technical standards, not only the review of the items of the various standards, but also the explanatory sentences describing why such standard rules or criteria should be specified must be fully prepared.

(b) In the workshop, it is desirable that not only MR accidents and low service level but also Japanese similar ones would be analysed from the various viewpoints through discussion.

(c) The items which MR would have interests were investigated beforehand so that they could be reflected on the contents of the textbook appropriately. This effort should be encouraged.

5.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project

5.2.1 Drawing up a technical transfer plan

The system of track maintenance work currently in practice in Myanmar is a version of the old-fashioned system implemented in the past in Japan. Through this Project, track maintenance workers of MR receive education/training of basic track maintenance works, while aiming at a mechanized maintenance system to use large-scale maintenance machines in the future. This means a conversion from the current gang system to a larger sized maintenance depot system or a re-construction of maintenance system. Bearing in mind this long-term vision, we are preparing a plan for technology transfer focused on the track maintenance OJT for two years. See Table 4.2 for the schedule and record of technology transfer.

5.2.2 Selection /procurement of equipments/tools

Since there were equipments and tools which were not used in Japan among 74 kinds of them provided by JICA, arrival from Japan was delayed. But all the equipments and tools arrived in Yangon in mid-February. They are used by MR track maintenance workers now.

5.2.3 Selection of Pilot Section

Japan side proposed the pilot section consisting of Pilot Section 1 and Pilot Section 2 at the 1st JCC. This is selected by the reason that there are many types of tracks and structures such as straight line, curve, turnouts and bridges, etc in Pilot Section 1 and the vehicle vibration acceleration values are big according to the results of vibration measurement in Pilot Section 2.

We proposed the Pilot Section by the formal letter which was agreed by the Myanmar side, and the Myanmar side wanted to start the track maintenance practice in Pilot Section 2 earlier than that in the Pilot Section 1 because Pilot Section 2 has very bad track conditions.

After that, there was a request of early start of track maintenance practice in the section from 12km200m to 14km550m between Toekyaungkalay Sta. and Ywathargyi Sta. from Myanmar side on 11th December. Thereby, the order of track maintenance practice in the Pilot Section was changed from 16th December.

5.2.4 Implementation of track maintenance work (inspection, planning, work, control)

(1) Compilation of textbook

To use for classroom education and practical training, we compile a text book consisting of three parts, each of them covering the fields of (1) safety of work, (2) track maintenance work and (3) track inspection respectively.

We implement practical training and maintenance work based on this text book and compile (1) standards and (2) manuals for track maintenance work, after modifying, adding or deleting contents of the text book based on review of track maintenance training.

(2) Classroom education and practical training (seminar)

Before implementing actual track maintenance work in the Pilot Section, we had seminars on the particulars related to track maintenance such as inspection, planning and work for the workers in the Training room at Yangon Sta. on 23th October in 2013. This was the first classroom education and an important step to assess the level of local staff, which significantly contribute to the work progress control in the future. Before starting the maintenance work in the Pilot Section, we performed practical training on track maintenance (inspection and work) on yard tracks on 24th October in 2013. As safety is one of the most important concerns for track maintenance workers, we proposed at least wearing protective shoes, helmets and safety vests.

We divided 32 persons selected by MR into 4 group (A,B,C,D) and appointed a leader in charge of each group. There is one person in charge of the whole MR workers.

We implemented classroom education using Powerpoint of track maintenance work. We implemented practical training of track maintenance of which menus include rails exchange, site correction of sleepers and rectification of track irregularities, etc for 4 group. After hand tictampers, generators and jacks which were donated by JITI arrived in Yangon, we implemented classroom and practical training of lifting up of track for its strengthening based on results of survey on 19th-21th December in 2013.

(3) Prior measurement and survey at the Pilot Section

Before implementing track maintenance work for tracks used for commercial services in the Pilot Section, we hit temporary piles and measured track levels. Because of bad climate, we surveyed only some parts of the Pilot Section, but now we are surveying the remaining parts in parallel to working. We prepared a track maintenance plan per 100m unit amount of work and equipments/tools. Before the arrival of equipments/tools from Japan, we mainly executed only elementary kinds of track maintenance work (Spot surfacing, mending alignment and site correction of sleepers and supplement of ballasts).

(4) Implementation of work

We implemented track maintenance as below.

- 26km200m to 27km035m (Up Line) (From 28th October to 13th December in 2013)
- 12km200m to 13km450m(Down Line) (From 16th December to Now)

We have implemented continuous tamping for lifting up track level from 9th January. Further we have implemented measuring of gauge, cross level, longitudinal level and horizontal alignment with measuring equipments on the commercial line and have given training of level surveying.

Records of work are as follows.

Kind of work	Unit	12k200m~ 13k450m	26k200m~ 27k035m
Continuous Tamping	m	826.5	254
Spot Surfacing	m	45.3	1,111
Subtotal	m	1279.5	1,365
Spot Surfacing using ballast chipping at the joint	Nos.	0	53
Insert of sleepers cut into four pieces at the joint	Nos.	0	8
Positioning of sleepers	Nos.	239	161
Exchange sleepers	Nos.	84	38
Insert sleepers	Nos.	9	22
Remove sleepers	Nos.	1	3
Subtotal	Nos.	95	63
Rectification alignment	m	552	915
Supplement and arrangement of ballasts	m	1535.5	1,128.5

(Reference) Results of train vibration acceleration

Kind of Vibration	Items	12k200m~13k450m		26k200m~27k035m	
		Before 11/9	After 2/8	Before 10/23	After 1/11
Right And Left	Number of location More than 0.25g	26	41	27	0
	Average	0.06 g	0.05g	0.04 g	0.04 g
	Standard Deviation	0.05 g	0.04g	0.03 g	0.04 g
Up and Down	Number of location More than 0.25g	999	0	11,501	2,261
	Average	0.07 g	0.04g	0.18 g	0.12 g
	Standard Deviation	0.06 g	0.03g	0.13 g	0.10 g
Train Speed		28 km/h	20 km/h	34 km/h	55 km/h

5.2.5 Education/ training in Japan

This is scheduled to be held around June, 2014.

Concrete program and selection of 22 participants (11×2 times) of MR will be finalized according to agreement between MR and JICA Expert Team.

5.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/ standards

5.2.7 Final summarization and seminars

We are implementing technical transfer now. These two subjects of the sections 5.2.6, and 5.2.7 will be carried out in the period by April 2015, based on the results of implementation of the training program.

5.2.8 Extent of achievement of target, major issues to be tackled with, good schemes for better implementation, lessons obtained thorough implementation

We were considering about the schedule of rainy season and dry season. Temperature in Myanmar is very high beyond expectation. So we cannot help working in the morning. Now the training usually begins at 8 AM and finish 12 AM. It is getting hotter and hotter toward to April. We are thinking that we should begin training earlier in the morning.

6. Recommendation Addressed to Achievement of Overall Goal

6.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level

The overall goal and the project purpose are given in the section 2.1 of Inception Report (IC/R):

- (1) Service and safety level of MR is improved and,
- (2) Administration and maintenance ability is improved for enhancement of service and safety of MR.

In order to achieve the above overall goal and the project purpose, we are now going through the following steps.

- [Step 1]: Identification of present status of safety and service level of MR
- [Step 2]: Compilation of text book which contains the analysis of causes of various accidents having occurred mainly in Japan, and establishment of suitable countermeasures against accident prevention along with the suitable measures for improvement of service level both practiced in Japan Railways.
- [Step 3]: Discussion of the above text book in the class room, and holding the workshop. In the workshop, MR experts present the recent actual events of accidents and low service levels of MR, analyse their causes and establish the suitable countermeasures; these presentation by MR experts will be discussed by both JICA experts and MR experts. Along with the discussion of the text book and execution of the workshop, technology transfer of rolling stock vibration measurement and data analysis which will be the basis for improvement of service and safety level, and interview survey of the customer's satisfaction level about MR's passenger transport will be conducted.
- [Step 4]: Based on the results of the Step 3, recommendation on technical standards relating to administration and maintenance aspect to improve the safety and service level of MR will be proposed by JICA experts, which should be fully examined by the MR experts. Further, railway facilities improvement plan for enhancement of safe and service level of MR should be prepared through discussion with the Working Group established for this purpose.

We are now in the middle of Step 3. Although we are still in the middle of the whole activities for achieving the overall goal and project purpose, we would dare to present the following suggestion for effective achievement of the overall goal and the project purpose.

Relevant technology transfer relating to improvement of safety and service level of railway could be achieved only through mutual and substantial discussion between MR experts and JICA experts to be held in the process of Step 3 and Step 4. In this context, we would like to stress that technology transfer involves efforts in two directions.

Effort in one direction is that of transmitting the experiences of Japanese Railways (JR) from JICA experts to MR experts.

Effort in another direction is that of response of MR experts to transmission of JR's experiences by JICA experts.

These effects in two directions should be realized through mutual and substantial discussion.

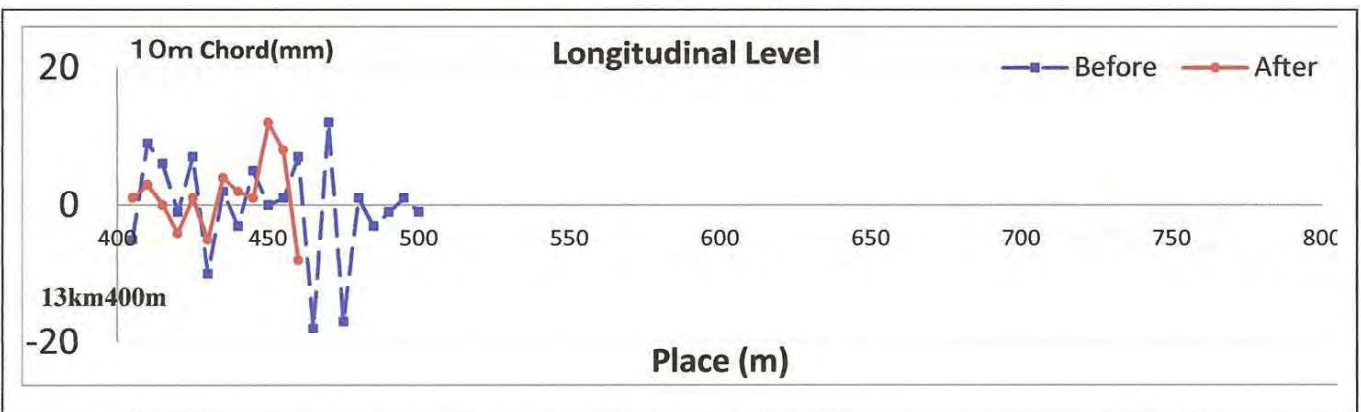
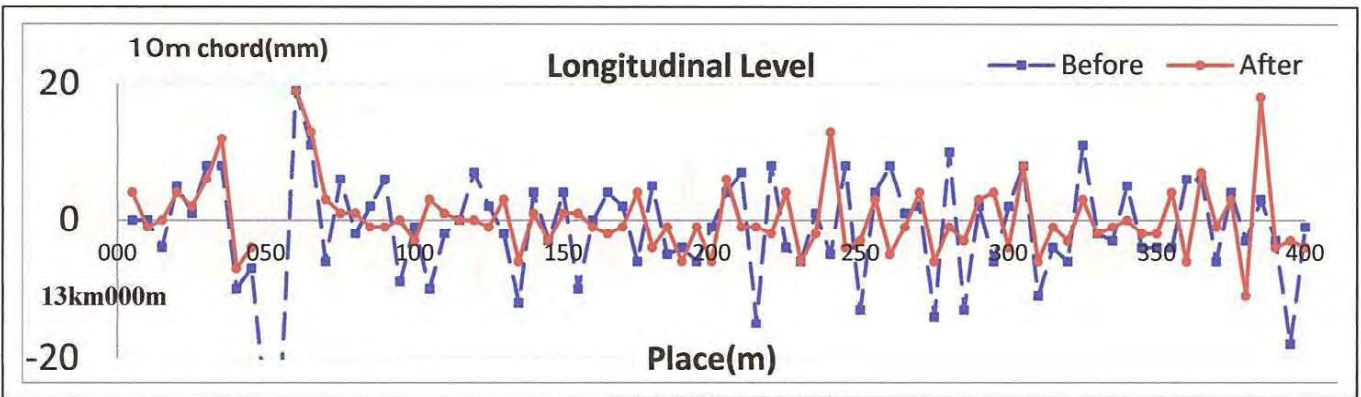
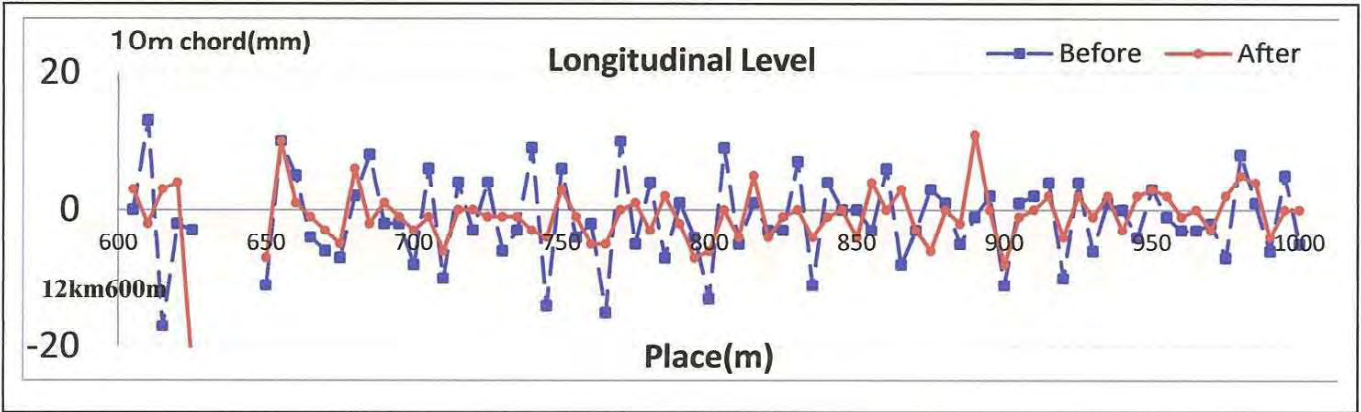
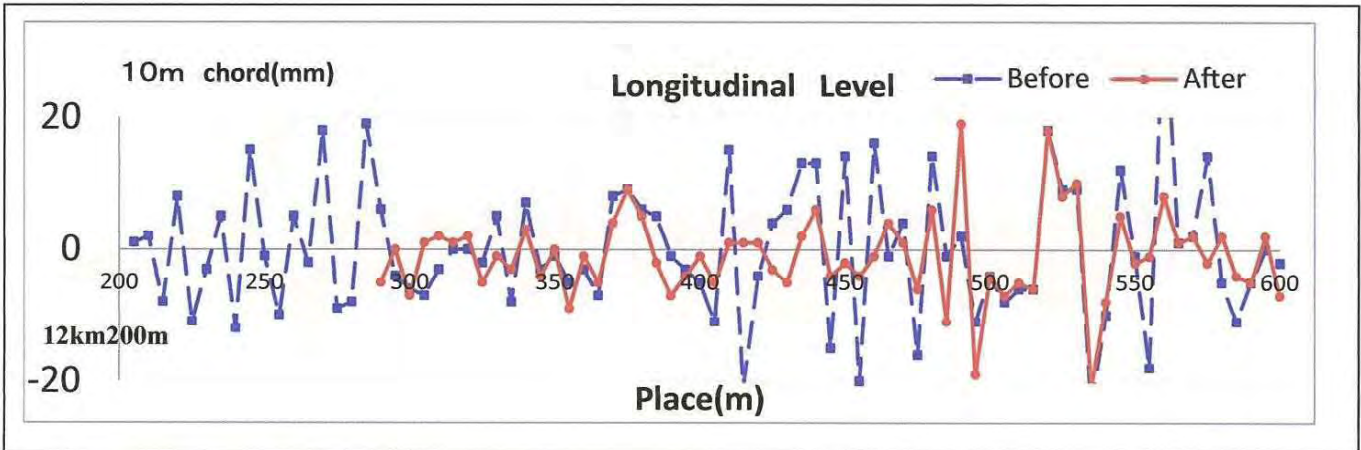
It is our suggestion that Step 3 and 4 should be executed through mutual and substantial discussion among MR experts and JICA experts.

6.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project

The overall goal and the project purpose are the same as the sub project given in the section 6.1.

We are measuring values of some kinds of track irregularities and train vibration for evaluation of track maintenance before and after working on the commercial line.

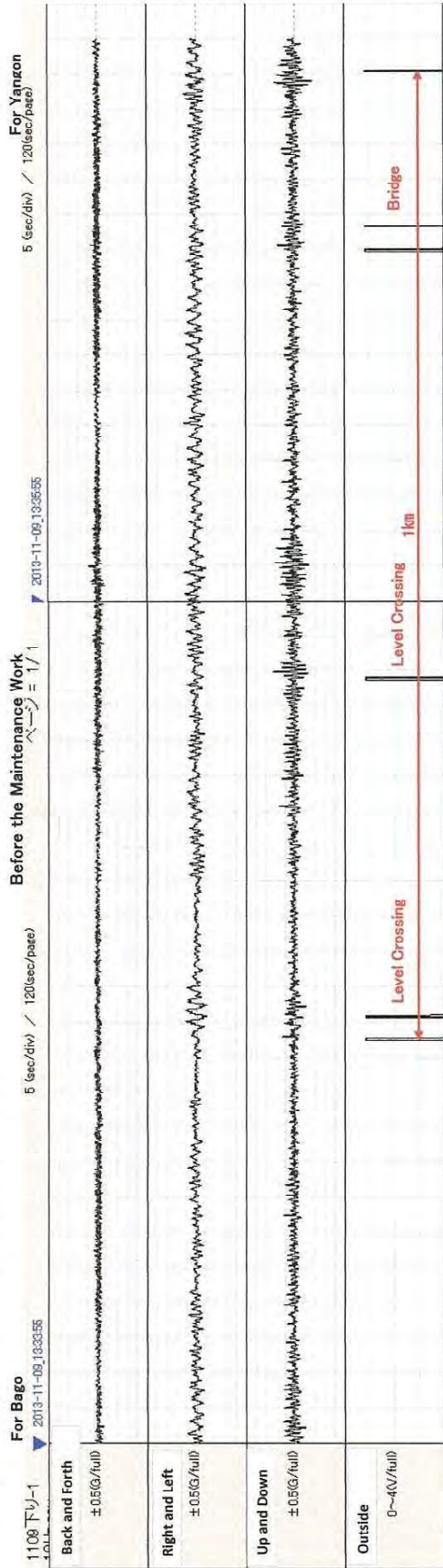
Track irregularities measured by 10m chord include horizontal alignment and longitudinal level, and we compared the measurement values before and after the track maintenance work. Measurement of train vibration is in the vertical and lateral directions and was made in the working section once two weeks.



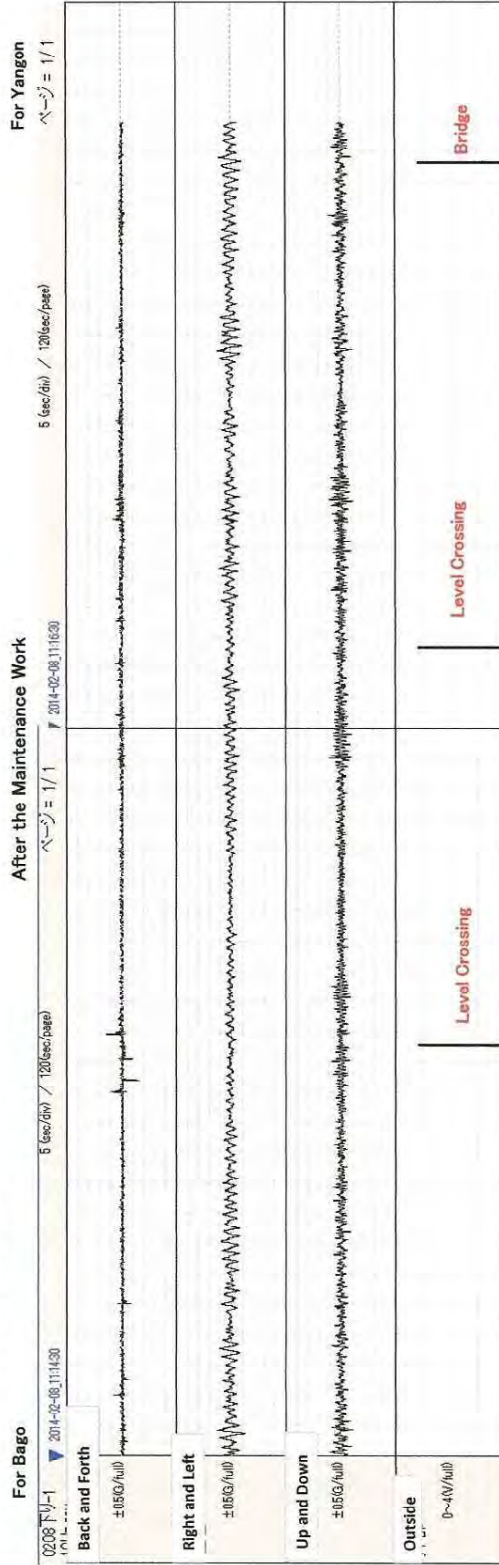
Down Line 12k200m~13k450m,
Comparison of Longitudinal Level Before and After the Maintenance work

Comparison of Vehicle Vibration Acceleration Before and After the Track Maintenance Work (Down Line 12k200m~13k500m)

2013/11/9 Down Line Speed 28km/h, Horizontal axis 1scale :5seconds (39m)



2014/2/8 Down Line Speed 20km/h, Horizontal axis 1scale :5seconds (28m)



7. Implementation Plan for the Next Stage

7.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level

As described in the section 6.1, we are now in the middle of Step 3.

We will complete the Step 3 by March 7, 2014.

From now on we will continue our activities according to Table 3.1 as given below.

(1) Recommendation on technical standards for service and safety, and drawing up railway facilities improvement plan

After the completion of Step 3 mentioned in the section 6.1, JICA experts will 1) propose recommendation on technical standards for safety and improvement of service level, and 2) prepare railway facilities improvement plan through discussion with Working Group for Service and Safety Improvement, based on the results obtained thorough discussion in Step 3, around September 2014. These proposal and improvement plan should be thoroughly confirmed by MR experts. Then the finalizing discussion on these proposal and improvement plan is planned to be held around December, 2014.

(2) Education in Japan

Around October 2014, 11 trainees relating to management, operation, and maintenance in safety and service level improvement aspects will be invited to Japan for two weeks. Concrete proposals should be subject to determination through consultation with MR.

7.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project

74 kinds of equipments/tools from Japan have already arrived in Myanmar. But we haven't used all equipments/tools yet. We are planning to use all equipments/tools in the remaining training schedule. We are thinking that for effective technology transfer of track maintenance, all equipments /tools provided by JICA should be used by MR workers and we are arranging the training program so that they should draw up track maintenance plan by themselves. In order to ensure safe and smooth train operation on the track, MR should allocate more maintenance budget.

Appendix

Appendix-1 PDM

1.1 Latest version

The original PDM is given as Annex 1 of Record of Discussion (R/D) signed on March 25, 2013 between the Managing Director of MR and General Manager of JICA Office in Myanmar.

It was modified as given in Table 6.1 of Chapter 6 of the Inception Report, which is shown below.

1.2 Essence of modification of original PDM

Essence of modification is given in below.

Mainly the description of 「Objectively Verifiable Indicators」 and 「Means of Verification」 corresponding to 「Overall Goal」 and 「Project Purpose」 are modified. The modified descriptions are shown in Table 6-1. The reasons for modification are given as follows.

(1) Overall Goal : Objectively Verifiable Indicators

① Number of annual accidents

Because (a) the Pilot Section is rather short, only 20km, accordingly rehabilitation of track is limited in length, (b) the rehabilitation/modernization of various railway facilities on the Yangon-Mandalay line is not made clear, accordingly it may be difficult to show how much the accidents caused by the deteriorated railway facilities can be reduced, and (c) number of accidents fluctuates considerably year to year mainly due to weather conditions, quantitative expression for reduction of accidents is avoided.

② 「Reduction of Number of Limited Speed Locations」, 「Improvement of Journey Speed」, 「Improvement of Punctuality of Train Operation」

Without the modernization of signaling systems, it may be difficult to raise the train speed, while ensuring the train operation safety. Accordingly 「Reduction of Number of Limited Speed Locations」, 「Improvement of Journey Speed」, and 「Improvement of Punctuality of Train Operation」 are adopted as evaluation items, and also quantitative expressions are avoided.

(2) 「Overall Goal : Means of Verification」,

「Project purpose : Objectively Verifiable Indicators」, 「Project Purpose : Means of Verification」

The meanings are not changed, but the description is modified as given in Table 6-1.

(3) Others : Counterpart Training in Japan

Number of trainees is increased.

- Railway Institutional Management Improvement : 11persons × 2weeks
- Track Maintenance : 11persons × 2 × 2weeks

Table 6-1 Modification of PDM (Inception Report)			
Project Design Matrix The Project on Improvement of Service and Safety of Railway Excuting Agency:Myanma Railway(MR) ,Ministry of Rail Transportation		Annex 1 PDM	
		Project Implementation Period : 2013 to 2015 Project Site: Yangon (24months)	
Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal Service and safety level of Myanma Railways is improved.	①Number of annual accidents on Yangon-Mandalay line decreases compared with the present and past records. ②Number of speed restricted locations on Yangon-Mandalay line decreases compared with their present number. ③Journey speed on Yangon-Mandalay line increases compared with the present journey speed. ④Punctuality of express passenger trains on Yangon-Mandalay line is improved compared with the present situation. ⑤Satisfaction level of clients is enhanced. ⑥Number of passenger	·Statistics on safety ·Reporting of accidents cause analysis and discussion of countermeasures are executed. ·Statistics on operation ·Interview/questionnaires to clients ·Statistics on operation	
Project Purpose Administration and maintenance ability is improved for the enhancement of service and safety of Myanma Railways.	①Accident cause analysis and countermeasures to prevent the similar accidents, and means to improve service levels are established and executed ,and inherited by MR ②Administrative and managerial capacity of track maintenance is improved and improved level is kept by MR	·Reflection on organization,management/ operation rules,facilities renewal plans ·Utilization,modification of administration management manuals ·Actual results of maintenance execution, such as the record of maintenance	·Administration staff members are not relocated drastically ·Technical staff members are not relocated drastically
Output			
1. Issues are clarified for the enhancement of service and safety in the administration and maintenance process, and the improvement plan is drawn.	1-1 System for collecting information of track, rolling stock, signal and communication, and operation is established. 1-2 Safety issues are listed based on the investigation and analysis of cause of accident. 1-3 Service issues are listed. 1-4 Service and safety improvement plan is drawn so as to tackle the issues.	1-1 Related management document(s) of System for collecting information 1-2 Listed issues 1-3 Listed issues 1-4 Service and safety improvement plan	The Government support to the Myanma Railways, especially financial support is secured.
2. Technical capability is improved through emergency track maintenance to improve the level of service and safety.	2-1 Technical transfers are made effectively at each measure (targeted numbers of technical staff 30 persons). 2-2 Working manual of emergency track maintenance is prepared. 2-3 Proper equipment and materials are procured both qualitatively and quantitatively. 2-4 Counterpart personnel acquired necessary proficiency through seminars(3 times), trainings(3 times) for technical improvement on the rail maintenance and others.	2-1 Record of technical transfers 2-2 Set of Working manual 2-3 Inventory list of equipment and materials 2-4 Record of seminar and training	

Table 6-1 (continued) (Inception Report)

Annex 1

Activities	Input		Preconditions
	(Japanese side)	(Myanmar side)	
<p>1. Preparation of Railway Service and Safety Improvement Plan</p> <p>1-1 To conduct current situation survey regarding track, rolling stock, signal and communication, and operation, and establish system for collecting information.</p> <p>1-2 To promote familiarization on the investigation and analysis method of accident cause based on the comprehensive factors of track, rolling stock, signal and communication, and operation.</p> <p>1-3 To conduct the investigation and analysis mentioned above.</p> <p>1-4 To provide recommendation based on above analysis on necessary technical standards to improve service and safety level.</p> <p>1-5 To draw the improvement plan of railway facilities through discussion with the "Working Group for service and safety improvement(tentative name) "</p>	<p>1. Dispatch of Japanese Experts</p> <p>Fields of Experts(several person)</p> <ul style="list-style-type: none"> -Railway OM improvement -Technical Standards -Track Maintenance -Procurement of Equipment and Materials/Project Coordination <p>2. Counterpart training in Japan</p> <ul style="list-style-type: none"> -Railway Institutional Management Improvement: 11person ×2weeks -Track Maintenance: 22person (11p×2×2weeks) <p>3. Equipment</p> <p>Necessary handy equipment of emergency track maintenance, such as Tie Tamper.</p>	<p>1. Assignment of Counterpart</p> <ul style="list-style-type: none"> -Project Director: 1person -Project Manager: 1person -Railway Policy/OM Improvement: 1person -Rail Maintenance: 1person -Procurement of Equipment and Materials: 1person -Others: As appropriate <p>2. Provision of facilities for the Project implementation:</p> <ul style="list-style-type: none"> -Project office (in the Myanmar Railways, Lower Myanma Regional Office) -Working tools and furniture for Project Office -Internet connection in the Project office <p>3. Joint Coordination Committee(JCC)</p> <ul style="list-style-type: none"> -Establishment of JCC 	<p>Natural Disaster does not hit the railway facilities fatally.</p>
<p>2. Enhancement of Technical Capabilities of Track Maintenance</p> <p>2-1 To draw the technology transfer plan.</p> <p>2-2 To procure the necessary equipment and materials.</p> <p>2-3 To conduct emergency track maintenance.</p> <p>2-4 To summarize betterment point(s) obtained during emergency track maintenance operation, and to feedback to the successive measures.</p> <p>2-5 To draw the working manual of emergency track maintenance.</p> <p>2-6 To conduct seminars, trainings for technical improvement on the rail maintenance and others.</p>	<p>4. Expense</p> <ul style="list-style-type: none"> -For research, travelling, training, the other activities for Japanese experts 	<p>4. Expense</p> <ul style="list-style-type: none"> -Local cost for personnel -Cost for office rent and quipment. -Expense for the pilot project, such as gravels, sleepers, rail materials and others. -Other expenses: For research, travelling, training, the other activities for counterpart personnel <p>5. Others</p> <ul style="list-style-type: none"> -Status guarantees of Japanese experts, ID card for access into the Myanma Railways properties. -Access to the necessary statistical data and related information -Other necessary local cost 	

- Appendix-2** **Flow Chart of Project Implementation**
 As shown in Fig.2.1 of the main text.
- Appendix-3** **Detailed Implementation Plan**
 As shown in Table 3.1, 3.2 of the main text.
- Appendix-5** **Records of Training in Japan**
 As shown in the section 3.1.6 and 3.2.5(2)
 ①Railway Institutional management Program
 11persons×2weeks, next October
 ②Track maintenance
 11persons×2weeks ×Twice (Total 22 persons), next June
- Appendix-6** **Records of Procurement of required equipments/tools**
 As shown in Table 3.3 of the main text.

Appendix-4 Records of JICA experts dispatching

Assignment	Name	Belongs	2013												2014												2015	
			5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
Leader/ Track maintenance	Sadaaki KURODA	JIC		6/25	7/10				10/20	11/3				2/8	(3/10)		(5/16)	(5/30)			(10/15)	(10/31)			(2/16)	(3/4)		
Deputy leader/ Maintenance Planning	Nobuyuki MATSUI	JIC		6/25	7/10	8/25			10/26				1/26	2/5		(5/4)	(6/17)			(10/15)	(11/15)			(12/20)	(1/20)			
Operation Maintenance	Hiroshi KOMATSU	JIC		6/25	7/13			9/9	10/6		11/25	12/25		2/6	(3/2)	(3/18)		(5/8)	(6/14)	(7/28)	(8/20)	(10/18)			(1/18)	(3/13)		
Procurement of equipment and material	Yuuichi TANIGUCHI	Sumitomo				8/26	9/3	10/24	11/2		1/7	9-11								(10/1)	(10/30)							
Signalling and Telecommunications	Ryuuhei MITANI	JIC				9/2	9/8							2/8	(3/2)					(9/1)	(9/15)			(1/5)	(1/19)			
Rolling Stock	Makoto ISHIKAWA	OC				8/25	9/8							2/8	(3/10)					(9/1)	(9/7)			(1/12)	(1/18)			
Track Maintenance	Masato WAKATSUKI	JIC					9/29	10/12	11/3	11/24		1/19	2/9			(3/9)	(3/23)	(4/14)	(6/12)			(10/20)	(11/9)		(1/5)	(2/18)		
Earth road bed	Kiyoshi MIYAMOTO	OC				8/28								2/2	(3/2)					(9/1)	(9/12)			(1/5)	(1/22)			
Train operation	Hidaharu IGARASHI	JIC				8/25	9/8							2/8	(3/10)					(9/1)	(9/7)			(1/12)	(1/18)			
Coordination	Mitsuru TAKAMI	JIC		6/25	7/13	8/19	10/6								(3/20)	(4/5)									(3/2)	(4/5)		
Track Maintenance(2)	Hisayoshi MITSUI	NSG					9/29	10/13	12/22	1/4																		
Track Maintenance(3)	Shigenori TANAKA	NSG						11/17	12/1																			
Track Maintenance(4)	Takashi ITO	NSG					10/20	11/3																				

Railway Advisor	Mitsuo HIGASHI	JR East/JIC					▨	▨	▨					▨						▨	▨								
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Appendix-7

Minutes of Discussion

1st JCC for " The Project on Improvement of Service and Safety of Railway in Myanmar"

1. DATE 28 August, 2013 10:00am-12:00am
2. PLACE Meeting Room of Myanmar Railway Head Quarter
3. ATTENDANTS

3.1 Myanmar side

Myanma Railways

GM (Inspection)	Mr. Ba Myint
GM (Operating)	Mr. Myint Wai
Deputy GM (Mechanical)	Mr. Thet Lwin
Deputy GM (Goods)	Mr. Thura Aung Myo Myint
Deputy GM (Civil)	Mr. Maung Maung Thwin
Deputy GM (Planning)	Mr. Htaung Sian Kan

3.2 Japan side

JICA Transportation and ICT Division 1

Transportation and ICT Group

Economic Infrastructure Department Mr. K. Imia (Adviser), Mr. T. Chokki

JICA Southeast Asia Division 4

Southeast Asia and Pacific Department Mr. T. Kon (Adviser), Mr. A. Fukuyama

JICA Myanmar Office Mr. M. Morikawa (Project Formulation Adviser)

JICA Expert Team Dr. S. Kuroda (Leader: Track maintenance),

Mr. N. Matsuo (Sub-leader: Maintenance Planning),

Mr. H. Komatsu (Operation maintenance),

Mr. Y. Taniguchi (Procurement of equipment and material),

Mr. K. Miyamoto (Track maintenance 2),

Mr. Ishikawa (Rolling Stock),

Mr. H. Igarashi (Train Operation),

Mr. M. Takami (Coordination),

JICA Railway management

Adviser Mr. M. Higashi

Observer JICA Study Team (MYT-PLAN) Mr. J. Shibata (Project Manager),

Mr. I. Numata (Train Operation)

Sumitomo Corporation Asia Pte. Ltd. Nay Pyi Taw Office

Mr. M. Yamato (General Manager)

Interpreter

Mr. Ye Tun Oo

- 4. SUBJECT** Explanation and Discussion of Inception Report(IC/R)
- 5. HANDOUTS** Inception Report(IC/R)
 Power Point document for explaining Inception Report
 Three kinds of letters
- JICA Expert Team Schedule until October
 - Selection of the Pilot Section
 - Additional Questionnaire
- List of members of JICA Expert Team with face photos

6. GREETING S BY JICA

Before the start of explanation and discussion of IC/R, Mr.Chokki of JICA Headquarters gave an opening address and at the same time delivered the following comment and request for the Project.

- (1). This Project is not a Yen loan project, but a technical cooperation project aiming at technology transfer.
- (2). We should be grateful, if MR could kindly arrange smooth import of related equipments/tools from Japan, and prepare track materials such as rail, ballast etc.,necessaryfor track maintenance OJT in proper timing.

7. MAJOR SUBJECTS

7.1 Presentation of IC/R

IC/R was presented and explained by Dr.Kuroda , leader of JICA Expert Team, and it was accepted by MR in principle.

7.2 The following three letters were explained by Dr.Kuroda.

- (1) The letter proposing the Pilot Section and requesting confirmation of it by MR
- (2) The letter describing the working schedule of JICA experts in August, September and October and requesting the arrangements necessary for JICA experts activities.
- (3) The letter requesting provision of relevant information requested by the additional Questionnaire.

7.3 Major Points of discussion

- (1) MR : ① MR will be responsible for clearance of necessary equipments/tools to be provided by Japan side for the Project.
- : ② MR has already prepared necessary track materials to be used for on-the-job training of track maintenance. JICA experts should make checking the ballast whether right size or not before start the project.
- : ③ Working schedule of JICA experts in August, September and October has already been confirmed. MR will suitably deal with it.

(2) MR : When was the vibration of vehicle running on the proposed Pilot Section measured?
 JICA Expert : it was measured in March, 2013.

MR : In the period from March to August, any specific renewal work has not been executed, accordingly the measurement in March does not raise any specific problems.

(3) MR: JICA Expert Team is proposing the Pilot Section, and is requesting MR to confirm the proposal. Are there any possibilities to modify the proposal?

[Handwritten signature]

[Handwritten signature]

JICA Expert: Pilot Section is selected with due consideration on the kinds of track maintenance work technology to be transferred to MR staff. Difference of opinions between MR and JICA Expert Team, if any, can be adjusted in the first week of September, during which preparatory work such as driving in the posts is carried out.

MR: We would like to have the discussion in the first week of September on the location of the Pilot Section. JICA experts and MR staff will survey the proposed Pilot section together using the rail car.

JICA Expert: At that time, please check the size of ballast.
Please provide us with the specification of ballast.

MR: We will do.

(4) MR: Does proposed Pilot Section include both the up line and the down line?

JICA Expert: It includes both lines.

(5) MR: How many trainees will be involved in job training of pilot project?

JICA Expert: Members of gangs are planned to be trained.

Number of trainees will be about 30. With respect to details, we would like to discuss with MR. We are also planning to make use of the training center of MR.

(6) MR: Is welding work technology included in the kinds of maintenance work to be transferred to MR staff? We would like to get training of welding technology.

JICA Expert: Yes, it is included. Thermit welding is used by MR, so if the quality of Thermit welding used by MR has some problems, we will investigate the problems and make recommendations.

(7) MR: In the period of 1st week of September during which discussion on the location of the Pilot Section will be held, we would like to request JICA experts to examine the equipments/tools possessed by MR gangs.

JICA Expert: Yes, we do. As one countermeasure to improve rail joint portion, we would like to propose one design of fishplate of rail joint.

(8) MR: With respect to equipments/tools to be imported from Japan, tax and import license fee exemptions can be assured. Schedule of technology transfer of track maintenance has already been informed to the relevant track maintenance organizations. The answers to the Additional Questionnaire are being prepared and will be completed soon.

(9) MR: Which rail will be used in the pilot project, new or existing rails?

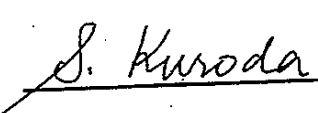
JICA Expert: It will be confirmed while implement the project.

Sept 5, 2013

Nay Pyi Taw



U Thurein Win
Managing Director
Myanma Railways



Dr. S. Kuroda
Leader of JICA Expert Team

Appendix 8-1

Present Situations of Safety and Service Level of MR

1. Accidents (Safety Level)

1.1 Classification of Main accidents in MR

- i) Collisions (including side collisions)
- ii) Averted collisions (nearly collision such as neglect of signal)
- iii) Level crossing accident
- iv) Trains parting
- v) Derailments between sections
- vi) Derailments in station yards

1.2 Present Situations of accident in MR

(1) Number of accidents by kinds (per 1 million train-km)

1) Train-km

Train-kms of passenger trains and freight trains during the 5 years from 2008/2009 to 2012/2013 are shown in Table 1.1-1.

**Table 1.1-1 Train-kms of Yangon – Mandalay Line (unit = 1 million train-km)
(April – March)**

Year	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
Passenger train	2.743062	2.764224	2.750661	2.757071	2.761762
Freight train	0.868153	0.864458	0.893531	1.309607	1.259473
Total	3.611215	3.628282	3.644192	4.066678	4.021235

2) Number of accident

Number of accidents by kinds and number of accidents per 1 million train-km for 2008/2009 to 2012/2013 are shown in Table 1.1-2

Table 1.1-2 Number of accidents by kinds (April – March)

Year	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
Accidents by kinds					
Train Collision	1	1	1	1	
Averted Train Collision	2				
Accident on Level crossing	7	10	4	16	11
Train Parting	82	32	45	41	7
Derailment within Station	62	39	33	51	30

Yard					
Derailment between stations	33	37	15	9	21
Total	187	119	98	118	69
No. of accident par 1 million train-km	51.783	32.794	26.892	29.016	17.159

(2) Analysis of Causes of Accidents

Frequency of accidents by kind of causes and by kind of accidents
(2012.4 - 2013.3)

Kind of accident	Cause	Frequency	total
derailment	spread gauge	* * * * *	6
	unbalance of cross level	* *	21
	driver fault	* * * * * * *	7
	thin flange	* *	2
	unfix of tongue	*	1
	improper set of point	* * *	3
	axle coil broken	* * * * *	5
	side bearer nut broken	* *	2
	coil bracket broken	*	1
	perish of sleeper	* *	2
	crossing nose break	* *	2
	coil pin broken	*	1
	sinkage of track	*	1
	side bearer defect	* *	2
	master plate broken	*	1
	low joint of track	*	1
	less center pivot oil	*	1
	pointmen fault	* * * * *	5
	unmatched of rail	*	1
	booster coil broken	* * *	3
	spread of axle	*	1
	capping of point	*	1
			70
train parting	defective of lock lifter	*	1
	defective of knuckle	*	1
	defective of coupling	* *	2
	low joint of track	* * *	3
	defective of center pivot pin	*	1
	weakness of suspension coil	*	1
			9
level crossing	careless of car driver	* * * * * * * * * * * *	11
			90

Note: * indicates that this accident was caused not by a single cause but jointly with another cause.

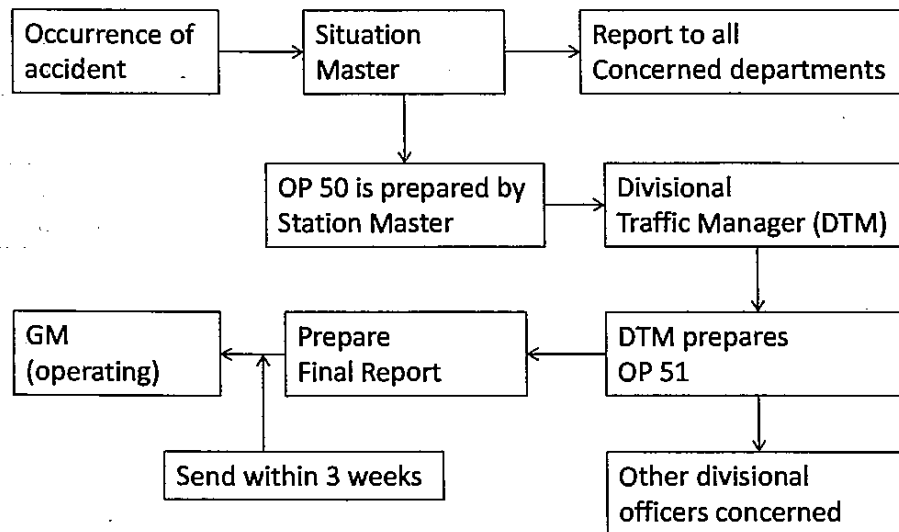
1. With respect to derailment, gauge enlargement, cross level irregularity (twist), improper set of point are the major causes relating to track.
Relating to vehicle, axle coil broken, booster coil broken are the major causes.
Relating to handling procedure, driver fault and pointmen fault are the major causes.
2. With respect to train parting, low joint of track and defective of coupling are the major causes.
3. With respect to level crossing accidents, careless of car drivers are causes of all accidents.

(3) Details of Some accidents

Details of Accident No. 40, No.54

No.	The Date of Occurrence	Location of Occurrence	Kind of Accident	Estimated Cause	Major Damages	Countermeasures Taken
1	4.10.2012 (No. 40)	Yepale – Hanza 11 Up	Train Parting	Weakness of suspension coil Low Joint of track due to the weakness of packing under the sleeper at rail joint	A little	Replaced the coil springs which have standard stiffness, At every periodical overhaul, all the coil springs are checked for the standard stiffness. Coupler and underframe heights are checked. Uplift of rail joint and well packing under the sleeper. Civil department have the insufficient of employees problem.
2	29.12.2012 (No.54)	Minsu – Kywese 23 UP	Derailment	Bolster Coil Broken. Underblance of cross level due to the weakness of packing under the sleepers	Empty	As the prompt response, the coach was checked, not only the body, but also the bearings. The defects were corrected. If the coach is fit to run, it is put into service, if it is required, it is dispatched to workshop for further checking. Recheck the level of adjacent rails. Repaired the cross level of track and well packing under the sleeper. Civil department have the insufficient of employees problem.

1.3 Record and reporting of accidents



Questions: OP 50 is for minor accidents.

How about for major accidents?

1.4 Examples of OP50, OP51 and Final Report in English

1.5 MR has the following General rules, subsidiary rules, working manuals, operation manuals regarding train operation and accident.

- General Rules Part I & II together with Subsidiary Rules of Burma Railways
 - Chapter III Working for Trains General
 - Chapter IV Accidents

1.6 Organization and system in MR to handle with establishment of countermeasures for prevention of accidents or improvement of service level.

1.6.1 Operating department performs the following function for prevention of accidents.

- (1) To issue the general rules, subsidiary rules and instructions when required.
- (2) To analyse the trends of accidents and suggest remedial measures.
- (3) To carefully study the Accident Enquiring Report and follow up the execution of recommendations.
- (4) To monitor the progress of safety work by respective divisions.
- (5) To provide safety equipment according to rules and instructions.
- (6) To ensure training and eye test for staff relating to safety of train operation.

1.6.2 Others

- (1) Accident cause analysis and countermeasures

Anti-accident team led by GM (Operating) has to investigate accident causes, identify the problem, and establish prevention measures. The team carries out detail action and assigned the relevant work to respective division.

- (2) Concerning train accident, train delay, speed restriction and abnormal train vibration, the station master shall send all concerned messages to the section control centers and the central control center. The central control center shall send information to Managing Director and General Manager (operating) at head office.
- (3) There is a general instruction regarding train operation control against the severe weather conditions (heavy rain fall, strong wind etc.). However there is no specific train operation control against the heavy rain fall or strong wind expressed quantitatively.

2. Service Level

2.1 Delay of train operation

2.1.1 Definition and classification of train delay

All trains which do not arrive at stations at the time specified in Time Table is defined as "delayed train". (Train diagram includes substantial amount of surplus time) Delay of train is classified as follows.

- | | |
|--------------------------|-----------|
| (a) 1 to 10 minutes | (Group A) |
| (b) 11 to 30 minutes | (Group B) |
| (c) 31 minutes to 1 hour | (Group C) |
| (d) 1 hour to 3 hours | (Group D) |

(e) Over 3 hours (Group E)

(f) Train cancellation (Group F)

2.1.2 Present situations of delay of express trains at terminals (Yangon, Mandalay, Nay Pyi Taw) on Yangon – Mandalay Line

Delay time of train (only for express passenger trains)

Number of delayed trains, punctuality of train operation, distribution of delay time of express passenger trains at terminals (Yangon, Mandalay, Nay Pyi Taw) are shown in Table 1.1-3

Table 1.1-3 Delay of trains (2012.8~2013.7)

Section	Distance (km)	Number of operated train (A)	Number of delayed train (B)	Punctuality (1-B/A) %	Delay time					Average value(*)
					1~10 min. (C)	10~30 min. (D)	30 min.~1h (E)	1h~3h (F)	more than 3h (G)	
Yangon - Mandalay or Mandalay - Yangon	620	2184	688 (1496) (**)	68	6	197	259	193	33	65 min./ train
Yangon - Nay Pyi Taw or Nay Pyi Taw - Yangon	375	1454	102 (1352) (**)	93	—	62	7	28	5	57 min./ train

(*) Calculation method of average value

Assuming the average of (C) as 5minutes, that of (D) as 20 minutes, that of (E) as 45 minutes, that of (F) as 2h, and that of (G) as 3h, the average value was calculated.

(**) Number of punctual trains

2.1.3 Analysis of causes of train delay

Causes of Delay

(Epress Train on Yangon-Mandaly Line April 2012/ March 2013)

No.	Cause	No. of occurrence	Remark
1	Coach damage	26	
2	Locomotive damage	9	
3	Pilot	6	
4	Locomotive filled water	2	
5	Locomotive exchange	1	
6	Wait for other train accident	1	
7	Electrical cut off	1	
8	Wait for other train	1	
9	Attached by coaches	1	
10	Point damage	1	
	Total	49	

- 1 Coach damages are dominant causes of express train on Yangon-Mandalay Line
- 2 Locomotive damages and pilot damages rank as the 2nd and 3rd largest causes of train delay

2.1.4 Example of details of some delay

(Delay No.9 and No.20)

No.	Date	Train No.	Station (Major Stations Only)	Delayed Time	Cause of Delay	Countermeasures Taken
1	31.7.2012 (No.9)	6 DN	Thazi	1:17	<u>Coach Damages</u> BDTEZ-12214 Wheel No.5 & 6 Roller Bearing Seized	Remove the damaged coach from train set and continued trip. The damaged wheels set were replaced with new ones by Thazi C&W Exaimers. The wheel sets have been inspected at Myitnge Workshop. Ultrasonic flaw detecting was done on each wheel set. Radial clearance of bearing is checked after fitting the roller bearing on journal of axle. The temperature of axleboxes of all coaches are monitored at the end terminal.
2	30.8.2012 (No.20)	12 DN	Taungoo	6:30	<u>Locomotive Damages</u> Taungoo -- Thaungdaingone Mile Post 165/7-8 Locomotive No.DF-1318 Traction Motor No. (6) Ball Bearing Seized	Replaced with another locomotive and continued trip. The damaged traction motor was removed in Taungoo Shed and sent to Insein Locomotive Workshop. Inspections will done and the bearing was refitted. After fitting, the bearing is checked fro proper fitting and functioning

Civil Engineering Department

Yangon – Mandalay Line, delay of Express Passenger Trains (2012 – 2013)

Item No. 9, 31.7.2012, 6DN, Thazi, (Details of Delay No.9)

Cause of train delay responsible by Civil Engineering Department and counter measurement

Item	Cause of Delay	Time	Counter measurement
1 a	Permanent caution 3 Nos	00':06"	cannot able
b	Caution of bridge repairing 1 Nos	00':05"	repairing of bridge as quick as possible
c	Mobile team's track repairing work 5 Nos	00':39"	repairing of track as quick as possible
2	Due to the coach damage	01':17"	

2.1.5 Compensation to passengers due to delay

Myanma Railways doesn't make any compensation to passengers for delay. According to the instruction of Commercial Department, sometimes Myanma Railways refund to passenger who bought ticket, for train cancellation by accident, coach damage and weather etc.

2.1.6 Current time table of Yangon – Mandalay express passenger trains

Express passenger train of Yangon – Mandalay line in 2012/2013.

4DN	6DN	12DN	32DN	8DN	Statin	7Up	31UP	3Up	5UP	11Up
0915	0630	2230	1800	0530	Yangon	2030	0800	1700	1500	0600
0713	0428	2022	1558	0337	Bago	2226	0956	1856	1651	0756
0710	0425	2019	1555	0334		2229	0959	1859	1654	0759
0217	2357	1527	1102	2251	Taungoo	0315	1448	2354	2125	1254
0207	2347	1517	1059	2248		0318	1451	0004	2135	1304
2319	2059	1219	0800	2000	Naypyitaw	0600	1800	0240	0010	1549
2316	2056	1216						0243	0013	1552
2001	1756	0906	-	-	Thazi	-	-	0554	0309	1858
1958	1753	0903						0557	0312	1901
1700	1500	0600	-	-	Mandalay	-	-	0915	0630	2230

2.2 Sanction speed by sections, location of restricted speed, journey speed

2.2.1 Sanction speed and restricted speed

Sanction speeds by sections and the locations of speed restriction which were informed by MR in August, 2013 are shown in Table 1.1-4.

Sanction speeds by sections are determined jointly by Operating Dept and Civil Engineering dept. Major factors deciding the sanction speeds by sections are defective of track, and defective of facing points.

Table 1.1-4 Section Speed and Speed Restriction on Yangon- Mandalay Line

(2013-2014)

Station	Dist km	accumulated distance	Section Speed		Reason of speed Restriction
			Up	Down	
Yangon	0		16 km/h	16 km/h	Due to Diamond crossing and crossing of Circular Railway Line and Main Line Auto Signal
Pazundaung	1.6	1.6	40 km/h	40 km/h	
Thingangyun	5.5	7.1	64 km/h	64 km/h	
Kawche	35	42.1	72 km/h	64 km/h	
Payagyi	49	91.1	64 km/h	64 km/h	
Thaungdainggon	167	258.1	56 km/h	56 km/h	
Taungoo	7	265.1	8 km/h	32 km/h	Br. No. 263 Using gunletted track on single truss Mile 181/1-2 Br. No. 290 up At Bed Block Crack
			56 km/h	56 km/h	
Thagaya	47	312.1	8 km/h	8 km/h	Mile 166/7-5 DN: Fibre cable Earth Work
			56 km/h	56 km/h	
Yeni	17.5	329.6	67 km/h	67 km/h	
Ywadow	37.4	367	64 km/h	64 km/h	
			48 km/h	48 km/h	
Kyidaunggan	8.35	375.35	40 km/h	40 km/h	Mile 250/20-6 DN: Poor Track Condition
			64 km/h	48 km/h	
Yamethin	62.5	437.85	68 km/h	48 km/h	
Shweda	12.3	450.15	48 km/h	48 km/h	
Pyawbwe	8.35	458.5	48 km/h	68 km/h	
Nwarhtoo	23.4	481.9	64 km/h	68 km/h	
Hanza	21	502.9	68 km/h	64 km/h	
Samon	21.4	524.3	64 km/h	68 km/h	
Thabyedaung	11.5	535.8	68 km/h	68 km/h	
Kume Road	8.35	544.15	68 km/h	64 km/h	
Myohaung	65.6	609.75	48 km/h	24 km/h	Br. No. 829 Using gunletted track on single truss
			48 km/h	48 km/h	
Mandalay	4.3	614.05			

2.3 Journey speeds

Journey speed of Yangon – Mandalay express passenger trains calculated based on the time table on that line in 2012/2013 are shown in Table 1.1-5.

Table 1.1-5 Journey speed of express passenger train Yangon – Mandalay Line

Section	Train No.	Travel time (A)	Running distance (km) (B)	Jourey speed (km/h) (B/A)	Average value
Yangon - Mandalay	4DN	16h 15min	620.4	38.2	38.6
	6DN	15h 30min		40	
	12DN	16h 30min		37.6	
	3UP	16h 15min		38.2	
	5UP	15h 30min		40	
	11UP	16h 30min		37.6	
Yangon - Nay Pyi Taw	32DN	10h 00min	374.9	37.5	38.5
	8DN	9h 30min		39.5	
	7UP	9h 30min		39.5	
	31UP	10h 00min		37.5	

2.4 Satisfaction level of passengers

Based on the annex "Guideline for Interview Survey", interview survey will be carried out, and the results will be suitably analyzed.

2.5 Annual passengers number

Total number of passengers on Yangon – Mandalay Line during the 5 years from 2008/2009~2012/2013 are shown in Table 1.1-7.

Table 1.1-7 Total number of passengers on Yangon – Mandalay Line

Year	2008/2009	2009/2010	2010/2011	2011/2012	2012/2013
No. of Passengers (1000)	11,930	11,877	12,203	13,600	9,035

2.6 Riding comfort

MR has never measured train vibrations. Track irregularities are measured by track geometry measuring trolley

Question: Kindly explain details of track geometry measuring trolley.

2.7 Various matters relating to service level

- (1) Regarding train delays, with respect to reporting to the headquarters, analysis of causes, identification of problems and countermeasures, every division and head office of MR hold operating meeting daily. Officers of all concerned department must attend with particulars of

action take by concerned department. The operating department of MR is in charge of these matters.

- (2) Many speed restrictions are caused by track problems. At present Yangon – Mandalay track line has been substituted by PC sleepers and damaged turnout are being renewed. But there is a need to fill the ballast as per specification. Another major cause of speed restriction is due to bridges. Some bridges are constructed in pre-war and some foundations are under repair. To delete the speed restriction, Civil Engineering Department is trying to repair the track and bridges according to the budget allowance. All of speed restrictions and countermeasures are recorded in all concerned departments.
- (3) Regarding improvement of riding comfort (reduction of train vibration, cleaning inside of passenger cabin), with respect to reporting to the headquarters, clarification of causes of vibration, identification of problems, establishment of countermeasures, Civil Engineering and Mechanical Department of MR have to be responsible. Civil Engineering Depot is in charge of the matter in total.
- (4) To improve railway facilities of Yangon – Mandalay line in 2013 – 2014 and in 2014 – 2015, MR laid down the following plan , in order to shorten travel time of express passenger train between Yangon and Mandalay.
 - Removing of short rail having joints.
 - Replacing of ballast and adjusting rail gap.
 - Welding of short rails.
 - Changing and repairing point and crossing.
 - Sand blanketing for bed soil formation.
 - Heavy repair from section to section.One hour will be shortened by that plan.

Appendix 8-2

**Procedure of Training Program of Cause
Analysis of Accidents/ Low Service Level and
Establishment of Countermeasures
Project on Improvement of Service and Safety of
Railway in Myanmar**

1. Purpose:

As one of the activities of technical supporting project, namely "Project on Improvement of Service and Safety of Railway in Myanmar", Training Program, of which purpose is to guide MR staff to and make them be familiarized about the technique to analyse the cause of accidents and low service levels, and establishment of countermeasures, will be held jointly by the MR and JICA. Also through the Workshops to be held as one part of Training Program, a sustainable clue to approach and solve the problem of MR will be found.

2. Participants:

Approximately 20 experts of managers level (Track maintenance, Civil works, Signaling, Rolling stocks and Train Operation) of Divisions or Head office in MR and divided into 4 groups of 5 people.

3. Place :

Designated by MR

4. Timing and tentative schedule:

From the middle of February to the beginning of March, 2014. Refer to the attached schedule table.

The whole training program consists of there parts. The first part is class room lecture of the text book prepared by JICA experts. The second one is workshop. The third one is training of vibration measurement of rolling stock. Details of each part is explained below.

Further it should be mentioned that interview survey to investigate the customer's satisfaction level of MR's passenger transport will be conducted following the training program.

5. Procedures of Training Program

Training program will be carried out from Feb.10 to Feb.28.

The first day of training program (Feb. 10) will be allotted for the opening ceremony, introduction of participants (MR and JICA experts), and orientation of the whole training program. The first day will also include the presentation of analysis of the present situation of

safety and service level of MR by JICA expert.

Class room lecture of the text book will be held from Feb.11 to Feb. 21 between 9:00 – 12:00 in the morning. Workshop will be held from Feb. 11 to Feb.24, mainly between 14:00 – 16:00 in the afternoon. Training of rolling stock vibration measurement will be implemented from Feb. 25 to Feb. 28 . The afternoon of the last day of the training program (Feb. 28), will be allotted for the closing ceremony.

5.1 Class room lecture of text book

JICA experts explain, based on the text book, about the past accidents and countermeasures in the world mainly in Japan (for examples, derailment, train collision, level crossing, natural disaster and so on), and introduce the measures for improvement of the service level (for examples, increasing train speed, punctuality, riding comfortabilities, train protections and so on). The text book contents are as follows.

<Text book Contents>

Forewords (MR side and Japanese side)

1. Safety

1.1 Introduction of Accidents Prevention and Research organization in the world railway

1.2 Past accidents and Countermeasures

1.2.1 Collision

1.2.2 Derailment

1.2.3 Level crossing

1.2.4 Natural Disasters

1.2.5 Train Fire

2. Bottom up of Service Level

2.1 Speed-up

2.2 Prevention for Level Crossing Accident

2.3 Punctuality

2.4 Comfortability

2.5 Customer Satisfaction

Afterword

It should be stressed that the lecture given by the JICA experts should be fully discussed among MR experts and JICA experts.

5.2 Workshops

(1) The purpose of the workshop

The purpose of the workshop is to make MR experts be familiarized with analysis of causes of accidents and low service levels and establishment of countermeasures through making MR staff themselves analyse the causes of actual accidents or low service levels of MR and making themselves establish suitable countermeasures.

In this regard, 16 items relating to accidents and low service levels (train delay and speed restrictions) will be selected from the actual MR's events in 2012/ 2013, and MR experts by themselves try to analyse the causes and to establish the appropriate countermeasures. 16 items to be selected are as follows.

a. Accidents: 10 items

- Derailment (on main line and siding track), each 3 items
- Level crossing, 2 items
- Train separation, 2 items

These 10 items should be selected from Table 1 Yangon – Mandalay line train accidents (2012 – 2013)

b. Service improvement (Train Delay): 3 items

These 3 items should be selected from Table 2 Yangon – Mandalay station Express Passenger Train Delay (2012/ 2013), with due consideration on kind of causes and magnitude of delay time.

c. Service improvement (Speed Limited): 3 items

3 speed restriction locations should be selected from Table 3 Section speed and Speed Restriction on Yangon – Mandalay Line (2012/ 2013).

(2) Presentation of reports by MR experts and discussion

16 items mentioned in (1) above, will be allotted to 4 groups evenly, namely 4 items per one group, and each group will prepare 4 reports for 4 items allocated to him namely one report for each item respectively. The report should describe the outlines of each item, causes analysed and countermeasures established as much as in detail.

In preparing the report, Format A should be used for the report of accident items, Format B for train delay, and Format C for speed restriction.

Each group should present the 4 reports in charge one by one (one report for half of the afternoon, namely about one hour). In presentation of the report, full discussion is expected between the presentators and the remaining MR experts and JCA experts

(3) On the Feb. 21, MR experts (any group) are requested to report the current situations of procedure/ systems/ organizations of reporting (from the field to the Head Quarter), cause analysis (accidents and low service level), establishment of countermeasures, practiced in MR. These matters should be fully discussed among MR experts and JICA experts.

(4) Presentation by MR experts about the following:

“Improvement of technical standards, relating to administration and maintenance aspect to improve safe and service level of MR”

As given in the Inception Report, JICA experts should make a recommendation on technical standards relating to administrative and maintenance aspect to improve safe and service level of MR.

In order for JICA experts to fulfill their duty, their recommendation on technical standards should be prepared with due consideration on MR experts' opinions and ideas.

In this context, if MR experts by themselves try to make some recommendation on the current technical standards of MR, these opinions and ideas will effectively contribute to JICA experts fulfillment of duty. At the same time, such effort by MR experts by themselves will contribute to raising up their administrative and maintenance capability for ensuring safe and good service level of MR.

In this regard on the last day of the workshop namely on Feb. 24, MR's experts (any group) are requested to present a report containing

“Recommendation on technical standards of MR relating to administrative and maintenance aspect to improve the safe and service level of MR”

(5) Closing ceremony

In the afternoon of Feb. 28, closing ceremony will be held, where certificates of completion of training program will be handed over to each participant of MR, and speeches from MR side and JICA side will be delivered.

5.3 Practices for Measurements of Train Vibrations

Targeted for several participants in charge of Track maintenance, rolling stocks and someone interested, JICA experts will instruct measurement and analysis of actual Train Vibrations on Feb. 25, 26, 27 and 28th. Practices will be implemented by using the device [UHA-3 Type]. Practices will include 1) how to use the device to measure the vibration and how to analyses the measured data, 2) measurement of actual MR's express train, and 3) analysis of the measured data.

6. Investigation on Customer Satisfaction Level

After implementation of the training program, interview survey to investigate customers

satisfaction level of MR's passenger train will be carried out from March 3 (preparing meeting) to March 7. The details of the procedure for interview survey are described in the document "Guideline for Investigation on Customers Satisfaction Level"

Table: Tentative Schedule

Date	Item	Contents	Note
Mon. 10 Feb.	AM	Opening Ceremony -Greeting from MR side and Japanese Side -Introduction of MR Participants and JICA Experts Orientation	
	PM	Orientation continued as required Analysis of the Present Situation of Safety and Service Level of MR Lectured by Dr. S. Kuroda	
Tue. 11 Feb	AM	Derailment Accident in Japan and Discussion on Derailment: Lectured by Mr. KURODA	
		Derailment Accident in Japan : Lectured by Mr. MIYAMOTO	
	PM	Workshops: Derailment 2 items	
Wed. 12 Feb		National holiday	
Thu. 13 Feb	AM	Rolling stocks accident : Lectured by Mr. ISHIKAWA Level crossing accidents : Lectured by Mr. MITANI	
	PM	Workshops: Derailment 2 items	
Fri. 14 Feb	AM	Natural disasters : Lectured by Mr. TAKAMI	
	PM	Workshops: Level Crossing 2 items	
Sat. 15 Feb		Holiday	
Sun. 16 Feb		Holiday	

Date	Time	Contents	Note
Mon. 17 Feb.	AM	Brake systems on rolling stocks Lectured by Mr. ISHIKAWA	
		Train Protection System Lectured by Mr. MITANI	
	PM	Workshops: Train separation 2 items	
Tue. 18 Feb	AM	Prevention for Accidents Lectured by Mr. IGARASHI	
		Measures for speed up on Track side: Lectured by Mr. KURODA	
	PM	Workshops: Train delay 2 items	
Wed. 19 Feb	AM	Measures for Punctualities on track side : Lectured by Mr. MIYAMOTO	
		Measures for Riding Comfortabilities on track side: Lectured by Mr. MIYAMOTO	
	PM	Workshops: Train delay 1 item and Speed limited 1 item	
Thu. 20 Feb	AM	Measures for Riding Comfortabilities on rolling stocks side: : Lectured by Mr. ISHIKAWA	
		Maintenance of Long Rail : Lectured by Mr. MIYAMOTO	
	PM	Workshops: Speed limited 2 items	
Fri. 21 Feb	AM	Workshops: Currents situations of Procedure/ system/ organization for reporting, cause analysis and establishment of countermeasures of MR	
	PM	General Discussion	
Sat. 22 Feb		Holiday	
Sun. 23 Feb		Holiday	

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Date	Hour	Contents	Notes
Mon. 24 Feb.	AM	Workshops: Improvement of Technical Standards relating to administrative and maintenance aspect to improve the service and safety of MR	
	PM	Turnout: LECTURED BY MR. MIYAMOTO	
Tue. 25 Feb		General Discussion	
Wed. 26 Feb	AM	General Discussion	
	PM.	Practice for Measurements of Train Vibrations (Lecture on measurement and data analysis)	
Thu. 27 Feb	AM	Joint Coordinating Committee: Practice for Measurements of Train Vibrations (Practical measurement of vibration)	
	PM.	Practices for Measurements of Train Vibrations (Practical measurement of vibration)	
Fri. 28 Feb	AM	Practices for Measurements of Train Vibrations (Analysis of measured data)	
	PM	Closing ceremony -Hand over the Certification, -Greeting from MR side and Japanese Side	
Sat. 1 Sun. 2 Mar		Holiday	
Mon. 3 Mar	AM	10:00 Interview survey preparation meeting	
Tue. 4 Mar		Interview survey	
Wed. 5 Mar		Interview survey	
Thu. 6 Mar		Interview survey	
Fri. 7 Mar		Interview survey	

Table 1 Yangon-Mandalay line Train of Accident(2012/2013)

No	The date of occurrence	Location of occurrence	kind of accident	Estimated Cause	Major Damages	Countermeasures taken
1	5.4.2012	Penewgon-Tawgywe	Train Parting	Defective of knuckle	empty	Mechanical
2	6.4.2012	Yamethin Station Yard	Derailment	Spread gauge	empty	Civil
3	11.4.2012	Taungoo Station Yard	Derailment	Unbalance of cross level and Human Error(Driver fault)	A little	Mechanical+Civil
4	11.4.2012	Yangon Station Yard	Derailment	Thin flange and unfix of tongue	empty	Operating+Mechanical
5	16.4.2012	Magyibin-Tatkon	Derailment	Unbalance of cross level	empty	Civil
6	21.4.2012	Taungoo-Kyedaw	Level Crossing Accident	Careless of car driver	A little damage of Loco	Other
7	22.4.2012	Nyaunglebin-Tawwi	Derailment	Unbalance of cross level	A little	Civil
8	25.4.2012	Ingyinkan-Shweda	Level Crossing Accident	Careless of car driver	A little	Other
9	26.4.2012	Pyawbwe-Shweda	Level Crossing Accident	Careless of car driver	A little	Other
10	27.4.2012	Thategon-Kyauktaga	Derailment	Unbalance of cross level	empty	Civil
11	30.4.2012	Ywapale-Hanza	Train Parting	Defective of Lock lifter	empty	Mechanical
12	30.4.2012	Naypyitaw Station Yard	Derailment	improper Set of Point	empty	Operating
13	1.5.2012	Yangon Station Yard	Derailment	Axle Coil broken	A little	Mechanical
14	16.5.2012	Nyaungyan Station Yard	Derailment	Side bearer nut broken	A little	Mechanical
15	16.5.2012	Kyedaw Kyungon	Derailment	Axle Coil broken	A little	Mechanical
16	19.5.2012	Dabein Tongyi	Derailment	Side bearer nut broken	A little	Mechanical
17	27.5.2012	Swa-Thagaya	Derailment	Unbalance of cross level and Coil bracket broken	A little	Mechanical+Civil
18	24.5.2012	Penewgon-Tawgyweinn	Derailment	Perishing of sleeper and Axle Coil Broken	A little	Mechanical+Civil
19	31.5.2012	Yangon Station Yard	Derailment	Unbalance of cross level	empty	Civil
20	31.5.2012	Airportsiding-Kyungon	Derailment	Spread gauge	empty	Civil
21	13.6.2012	Pyinmana Station Yard	Derailment	Crossing nose broken	A little	Civil
22	17.6.2012	Pyinmana Station Yard	Level Crossing Accident	Careless of car driver	A little	Other

23	19.6.2012	Shanyaw Nyaung Yanug	Derailment	Unbalance of cross level and Coil pin broken	A little	Mechanical+Civil
24	21.6.2012	Ywathaegy-i-edaung gau	Train Parting	Defective of coupling	empty	Mechanical
25	2.7.2012	Ywataw-Pyinmana	Level Crossing Accident	Careless of car driver	A little	Other
26	21.7.2012	Beli-kyauksae	Level Crossing Accident	Careless of car driver	A little	Other
27	25.7.2012	Pyawbwe-Shweda	Derailment	Unbalance of cross level	empty	Civil
28	30.7.2012	Sanyar-Nyaungyan	Derailment	Unbalance of cross level	empty	Civil
29	13.8.2012	Mandalay Station Yard	Derailment	Thin flange of wheel	empty	Mechanical
30	18.8.2012	Myohla-Yeni	Train Parting	Low joint track	empty	Civil
31	18.8.2012	Yeni Station Yard	Derailment	Unbalance of cross level	empty	Mechanical
32	20.8.2012	Kyungon-Yedashe	Derailment	sinkage of track	empty	Mechanical
33	21.8.2012	Bandwegon-Oktwin	Train Parting	Defective of centre pivot pin	A little	Mechanical
34	27.8.2012	Thingangyon-Toegyauungle	Derailment	Spread gauge	empty	Civil
35	1.9.2012	Ywataw Station Yard	Derailment	Careless of Locomotive driver	A little	Mechanical
36	10.9.2012	BeLin Station Yard	Derailment	Unbalance of cross level and defective of side bearer	empty	Mechanical+Civil
37	11.9.2012	Thingangyun Station Yard	Derailment	Careless of Locomotive driver	empty	Mechanical
38	19.9.2012	Konyi Station Yard	Derailment	Unbalance of cross level	empty	Civil
39	22.9.2012	Yaungoo-Kyedaw	Level Crossing Accident	Careless of car driver	A little damage of Loco	Other
40	4.10.2012	Yepale-Hanza	Train Parting	Low joint and weakness of suspension coil	A little	Mechanical+Civil
41	6.10.2012	Thatagon Station Yard	Derailment	Perishing of sleeper and spread gauge	A little	Civil
42	9.10.2012	Thaungdaingon-Taungoo	Derailment	Unbalance of cross level and master plate broken	A little	Mechanical+Civil
43	10.10.2012	Pyinmanar Station Yard	Derailment	Low joint of track and defective of side bearer	empty	Mechanical+Civil
44	10.10.2012	Pyiwin-Pyinman	Derailment	Unbalance of cross level and less centre pivot oil	empty	Mechanical+Civil
45	17.10.2012	Yangon Station Yard	Derailment	improper set of points and lack of track	A little	Operating+Civil

46	18.10.2012	Zeyawadi Station Yard	Derailment	Lack of point men and locomotive driver	empty	Operating+Mechanical
47	12.12.2012	Tawa-Tyaktan	Derailment	Unbalance of cross level	empty	Mechanical+Civil
48	17.12.2012	Yeni Station yard	Derailment	Careless of locomotive driver	A little	Mechanical
49	20.11.2012	Swa-Thagaya	Level Crossing Accident	Careless of car driver	A little	Other
50	22.11.2012	Myohaung Station Yard	Derailment	Unmatched of rail	empty	Civil
51	10.12.2012	Bago Station Yard	Derailment	Unbalance of cross level and improper set of point and lock	A little	Operating+Civil
52	11.12.2012	Ywadow-Pyinmanar	Level Crossing Accident	Careless of car driver	A little	Other
53	18.12.2012	Pyawbwe-Shweda	Derailment	Axle Coil broken and Unbalance of cross level	empty	Mechanical+Civil
54	29.12.2012	Minsu-Kywese	Derailment	Booster Coil Broken and Unbalance of cross level	A little	Mechanical+Civil
55	2.12.2013	Pyawbwe-Shweda	Derailment	Unbalance of cross level	empty	Civil
56	8.1.2013	Pyawbwe-Shanywa	Derailment	Spread gauge	empty	Civil
57	16.1.2013	Ledaunggan-Dabein	Train Parting	Low joint of track and unbalance of coupler	empty	Mechanical+Civil
58	21.1.2012	Thazi Station Yard	Derailment	Lack of point men and locomotive driver	empty	Mechanical+Operating
59	22.1.2013	Pyawbwe Station Yard	Derailment	Lack of point men and locomotive driver	empty	Mechanical+Operating
60	30.1.2013	Thedaw Station Yard	Derailment	spread Axle and Unbalance of cross level	empty	Mechanical+Civil
61	10.2.2013	Ywathargyi-Toegyauungale	Level Crossing Accident	Careless of car driver	A little	Other
62	15.2.2013	Thedaw Station Yard	Derailment	Booster Coil Broken and Unbalance of cross level	A little	Mechanical+Civil
63	15.2.2013	Shewmyo Station Yard	Derailment	Booster Coil Broken	A little	Mechanical
64	18.2.2013	Yedashe Station Yard	Derailment	Axle Coil broken and defective of Crossing nose	A little	Mechanical+Civil
65	25.2.2013	Yaugon Station Yard	Derailment	Lack of point men	empty	Operating
66	8.3.2013	Dabein Station Yard	Derailment	Lack of point men	empty	Operating
67	8.3.2013	Pyimmana-Ywataw	Level Crossing Accident	Careless of car driver	A little	Other
68	26.3.2013	Kyedaw-Taungoo	Derailment	capping of points	empty	Operating
69	29.3.2013	Kyaungon Station Yard	Derailment	Spread gauge	empty	Civil

Table2 Yangon-Mandalay Station Express Passenger Trains Delay(2012/2013)

No	Date	Train No	Station(Major stations only)	Delayed Munutes		Countermeasures taken
1	28.6.12	6DN	Bago	28	Coach damages	Mechanical
2	1.7.12	5UP	Yangon	30	Locomotive damages	Mechanical
3	5.7.12	11UP	Yangon	45	Coach damages	Mechanical
4	17.7.12	6DN	Taungoo	10	Coach damages	Civil & Mechanical
5	22.7.12	5UP	Taungoo	24	Coach damages	Civil & Mechanical
6	26.7.12	112UP	Taungoo	3	Pilot	Civil & Signal
7	30.7.12	12DN	Mandalay	10	Locomotive damages	Mechanical
8	30.7.12	4DN	Mandalay	35	Coach damages	Civil & Mechanical
9	31.7.12	6DN	Thazi	01:17	Coach damages	Civil & Mechanical
10	6.8.12	6DN	Taungoo	4	Coach damages	Civil & Mechanical
11	6.8.12	6DN	Naypyitaw	32	Coach damages	Civil & Mechanical
12	8.8.12	6DN	Taungoo	10	Coach damages	Civil & Mechanical
13	14.8.12	3UP	Taungoo	9	Locomotive Filled water	Mechanical
14	14.8.12	4DN	Thazi	11	Locomotive damages	Civil & Mechanical
15	23.8.12	4DN	Mandalay	01:00	Coach damages	Civil & Mechanical
16	26.8.12	5UP	Thazi	25	Coach damages	Civil & Mechanical
17	27.8.12	12DN	Naypyitaw	5	Coach damages	Civil & Signal
18	29.8.12	5UP	Taungoo	10	Coach damages	Civil & Mechanical
19	29.8.12	4DN	Mandalay	15	Coach damages	Civil & Mechanical
20	30.8.12	12DN	Taungoo	06:30	Locomotive damages	Mechanical
21	3.9.12	5UP	Bago	13	Coach damages	Civil & Mechanical
22	3.9.12	6DN	Taungoo	12	Coach damages	Civil & Mechanical
23	5.9.12	4DN	Mandalay	30	Coach damages	Civil & Mechanical
24	10.9.12	5UP	Thazi	8	Coach damages	Civil & Mechanical
25	24.9.12	5UP	Yangon	10	Locomotive damages	Mechanical

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2en Draft

26	9.10.12	4DN	Mandalay	1:15	Locomotive damages	Civil & Mechanical
27	18.12.12	12DN	Taungoo	45	Coach damages	Civil & Mechanical
28	6.1.13	4DN	Taungoo	12	Locomotive Filled water	Mechanical
29	12.1.13	6DN	Taungoo	24	Coach damages	Civil & Mechanical
30	17.1.13	11UP	Bago	14	Locomotive damages	Mechanical
31	17.1.13	11UP	Thazi	6	Pilot	Signal
32	28.1.13	3UP	Bago	15	Coach damages	Civil & Mechanical
33	31.1.13	4DN	Taungoo	3	Locomotive Exchange	Mechanical
34	3.2.13	3UP	Taungoo	9	Coach damages	Mechanical
35	7.2.13	5UP	Thazi	9	Pilot	Civil & Mechanical
36	10.2.13	12DN	Mandalay	40	Locomotive damages	Mechanical
37	10.2.132	3UP	Taungoo	4	Pilot	Civil & Mechanical
38	14.2.13	3UP	Thazi	25	Wait for other train accident	Other
39	17.2.13	4DN	Taungoo	10	Coach damages	Mechanical
40	21.2.13	6DN	Taungoo	8	Coach damages	Mechanical
41	25.2.13	5UP	Thazi	3	Pilot	Signal
42	28.2.13	11UP	Taungoo	4	Pilot	
43	5.3.13	11UP	Mandalay	01:14	Locomotive damages and Slow down	Mechanical
44	10.3.13	11UP	Taungoo	4	Electrical cut off	Signal
45	10.3.13	6DN	Taungoo	59	Coach damages	Civil & Mechanical
46	11.3.13	5UP	Naypyitaw	9	Coach damages	Civil & Mechanical
47	12.3.13	6DN	Bago	8	Wait for other train	Civil
48	12.3.13	4DN	Yangon	18	Point damage	Signal
49	27.3.13	11UP	Yangon	01:10	Attached by coaches	Mechanical

Table Section Speed and Speed Restriction on Yangon – Mandalay Line

(2013-2014)

Station	Dist km	accumulated distance	Section Speed		Reason of speed Restriction
			Up	Down	
Yangon	0		16 km/h	16 km/h	Due to Diamond crossing and crossing of Circular Railway Line and Main Line Auto Signal
Pazundaung	1.6	1.6	40 km/h	40 km/h	
Thingangyun	5.5	7.1	64 km/h	64 km/h	
Kawche	35	42.1	72 km/h	64 km/h	
Payagyi	49	91.1	64 km/h	64 km/h	
Thaungdainggon	167	258.1	56 km/h	56 km/h	
Taungoo	7	265.1	8 km/h	32 km/h	Br. No. 263 Using gunletted track on single truss Mile 181/1-2 Br. No. 290 up At Bed Block Crack
			56 km/h		
Thagaya	47	312.1	8 km/h	32 km/h	Mile 166/7-5 DN: Fibre cable Earth Work
			56 km/h		
Yeni	17.5	329.6	67 km/h	32 km/h	
			67 km/h		
Ywadow	37.4	367	64 km/h	32 km/h	
			64 km/h		
Kyidaunggan	8.35	375.35	48 km/h	32 km/h	Mile 250/20-6 DN: Poor Track Condition
			48 km/h		
Yamethin	62.5	437.85	40 km/h	32 km/h	
			48 km/h		
Shweda	12.3	450.15	68 km/h	32 km/h	
			48 km/h		
Pyawbwe	8.35	458.5	48 km/h	32 km/h	
			48 km/h		
Nwarhtoo	23.4	481.9	64 km/h	32 km/h	
			64 km/h		
Hanza	21	502.9	68 km/h	32 km/h	
			68 km/h		
Samon	21.4	524.3	64 km/h	32 km/h	
			64 km/h		
Thabyedaung	11.5	535.8	68 km/h	32 km/h	
			68 km/h		
Kume Road	8.35	544.15	68 km/h	32 km/h	
			68 km/h		
Myohaung	65.6	609.75	48 km/h	32 km/h	Br. No. 829 Using gunletted track on single truss
			48 km/h		
Mandalay	4.3	614.05	48 km/h	48 km/h	

Format A

Format : Accident Analysis

Category			
Date-time			Location
Damage	Canceled train		Delayed train
	Injured		Dead
	Damage of rolling stock		Damages of others
Train Components			
Outline			
Cause Analysis			
Counter Measures established			

Format B

Format : Service Improvement Analysis (Train delay)

Category		Date:	Train No.:
Location (Station)		Delayed minutes:	
Outline			
Cause analysis			
Solutions established			

Format C

Format : Service Improvement Analysis (Speed Restriction)

Location	Up Line	Accumulated distance from Yangon (km)
	Down Line	Accumulated distance from Yangon (km)
Restricted speed	Up Line	(km/h)
	Down Line	(km/h)
Reason for speed restriction	Up Line	
	Down Line	
Countermeasures for releasing speed restriction	Up Line	
	Down Line	

Training Program of Cause Analysis of Accidents/Low Service Level and Establishment of Countermeasures:

"PROJECT ON IMPROVEMENT OF SERVICE AND SAFETY OF RAILWAY IN MYANMAR "

List of Participants:

Group	Name	Department	Location	remark
A	Mr. Than Htay	Deputy General Manager/Civil	Head Quarter	
	Mr. Aye Ko	Assistant Mechanical Engineer	Head Quarter	
	Mr. Tinh Lwin Htun	Assistant Engineer / Civil	Division (11)	Replaced Mr.San Ngwe Assistant Engineer/Civil Division(5) Since Feb.13
	Mr. Myo Tint	Assistant Traffic Manager	Division (4)	
	Mr. Htun Wai	Assistant Engineer (Signaling & Telecommunication)	Head Quarter	
B	Mr. Htein Win	Assistant General Manager/Operating	Division (5)	
	Mr. Hla Htut	Divisional Engineer (Signaling & Telecommunication)	Division (6,8,9) Yangon	
	Mr. Thein Myint	Assistant Mechanical Engineer	Head Quarter	
	Mr. Lwan Thu	Divisional Engineer / Civil	Division (5)	
	Mr. Aye Thein	Assistant Traffic Manager	Division (2)	Absent all classes
C	Mr. Min Pan Aung	Divisional Engineer ((Signaling & Telecommunication)	Division (3)	
	Mr. Naing Zaw Oo	Divisional Traffic Manager	Division (10)	
	Mr. Than Win	Assistant Mechanical Engineer	Division (2)	
	Mr. Myint Lwin	Assistant Mechanical Engineer	Division (4)	
	Mr. Tin Moe	Assistant Engineer / Civil	Head Quarter	
D	Mr. Min Min Htway	Divisional Traffic Manager	Division (10)	
	Mr. Soe Thein Aung	Divisional Engineer ((Signaling & Telecommunication)	Division (5,11) Taungoo	
	Mr. San Thar Aung	Divisional Traffic Manager	Head Quarter	
	Mr. Ye Kyaw Htwe	Assistant Mechanical Engineer	Division (5)	
	Mr. Aye Nyein Swe	Assistant Engineer / Civil	Division (3)	

Guideline for Investigation on Customer Satisfaction Level**1. Purpose:**

According to the Inception Report agreed upon between U Thurein Win, Managing Director of MR and Mr. S. Kuroda, Leader of JICA Expert Team in the 1st JCC held on Aug, 28, 2013 at Nay Pyi Taw, interview survey will be conducted as one of the activities of technical supporting project "Project on Improvement of Service and Safety of Railway in Myanmar" to identify the current satisfaction level of customers with respect to passenger services of MR. Guidance will be given to the counterpart with respect to the way of analysis and way of doing the questionnaire survey.

2. Timing of investigation:

- (1) Preparation meeting : March 3rd, 2014
- (2) Interview survey: March 4, 5, 6, 7th, 2014

3. Section of investigation :

Between Yangon Station and Mandalay Station on Yangon-Mandalay Trunk Line

4. Targeted Object and methods for investigation:

Targeted for Myanmar Railway passenger, except foreign travelers, and interviewing on the running trains. In case of a group trip, only one passenger of the group will be interviewed.

5. Sampling number:

Targeted 3 kinds of train and class, "Express Upper", "Express Ordinary" and "Local", and at least 120 passengers will be sampled for each train kind/class.

Table 1 : 5. Sampling number

Train kind/class	Sampling number/Train	Train number /day	days	Total number
Express (Upper)	20	3	2	120
Express (Ordinary)	20	3	2	120
Local	30	2	2	120

6. Details of conduction of interview survey**(1) Establishment of Interview Survey Teams**

Six interview survey teams will be established as shown in Table 1.

(2) Preparation meeting will be held at 10:00 AM on March 3rd, 2014 at MR Head Quarters at Nay Pyi Taw .All members of interview survey teams should participate in the meeting.**(3) Interview survey will be conducted on March 4, 5, 6 and 7th, according to Table 1, using the**

Questionnaire attached.

TABLE(1) :Assignment of Interview Team

(Draft)

		1st day	2nd day	3rd day	4th day	Train travel time
Express Train		12DN	31UP			9~16h
Upper class (20) passengers/train		A,B	A,B			
Ordinary class (20)passengers/train		11UP	32DN			9~16h
Total (40) passengers/train		C,D	C,D			
		32DN	11UP			9~16h
		E,F	E,F			
Local Train	No.1(14DN)			(B-Y)	(B-Y)	3h
(30)passengers/train	No.2(13UP)			A,B,C,D	A,B,C,D	
				(Y-B)	(Y-B)	3h
				A,B,C,D	A,B,C,D	

A,B,C,D,E,F are interview teams, each consisting of one interviewer and one assistant.

Interview time : 3~4 passengers /1 hour

7. Questionnaire item:

Refer to Attached Sheets

8. Analyzing Methods:

- (1) Subjective evaluation items (Q1~16) are scored and the difference of evaluation by train kind and passenger class will be analyzed
- (2) The survey items (Q17~19) are for investigating the fundamental properties of passengers such as gender, age, purpose of travel and occupation.

Please answer the following questions about the Myanmar Railway passenger Services.

Q 1 About riding comfortability.

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q 2 About Train speed

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q 3 About Train Delay

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q 4 About Cleanness in Train Cabin

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q 5 About Cleanness in Train Restroom

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q 6 About Comfortability of Train Seat

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q7 About Attitude of Train staff (Guard)

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q8 About Ticket booking at Station

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q9 About waiting facilities at Station

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q10 About Cleanness in Station Restroom

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q11 About Attitude of Station staff

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q12 About Train Departure Time Table

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q13 About Train Arrival Time Table

		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q14 About Train Frequency

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q15 About Train Fare

No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q16 Do you want to use Railway Service again?

Little bit Want		No Particular Opinion		Rather Do Not Want		Do Not Want
4	—	3	—	2	—	1

Q17 What is the reason for choosing Railway? (Multiple Choice is OK)

- Cheap Fare
- Railway Station Close to departure/arrival place
- A lot of luggage
- Other ()

Q18 How often do you use the Railway service?

- Almost every day
- 2 or 3 times every week
- 1 time every week
- 1 time every month
- 5 or 6 times annually
- 1 to 4 times annually
- For the first time

Q19 What kind of improvement do you want for Railway service? (Please put the priority order in the box)

- Punctuality
- Faster than Bus
- Less rattling and more comfortable
- No accident
- Cleanness in the Cabin

Q20 Please tell us about yourself.

Male Female age _____s' years old

Boarding section

From _____ Station to _____ Station

Purpose of trip

- Business Leaving from/Returning to home Sightseeing
- Other()

Occupation

- Public officials Company employee Commerce or self-employed
- Farmer or fisher Students other ()

List of Member of Interview survey Teams

TEAM	NAME	POST
(A)	1.Mr.Than Shein Oo	Commercial Inspector (leader)
	2.Mr. Khin Mg Htun	Travelling Ticket Inspector
(B)	1.Mr.Thein Win	Commercial Inspector (leader)
	2.Mr.Tin Lwin	Travelling Ticket Inspector
(C)	1.Mr.Aung Naing Myint	Commercial Inspector (leader)
	2.Mr.Kyi Shein	Travelling Ticket Inspector
(D)	1.Mr.Tin Soe	Commercial Inspector (leader)
	2.Mr.Soe Min	Travelling Ticket Inspector
(E)	1.MR.Zaw Lin	Commercial Inspector (leader)
	2.Mr.Myint Mg	Travelling Ticket Inspector
(F)	1.Mr.Htun Pyae Aung	Commercial Inspector (leader)
	2.Mr.Myint Oo	Travelling Ticket Inspector

The Project on Improvement of Service and Safety of Railway in Myanmar



Progress Report
February 27th, 2014 at Nay Pyi Taw

JICA EXPERT TEAM



Japan International Cooperation Agency

1

Table of Content

1. Project Summary
2. Basic Plan of Project Implementation
3. Detailed Methods for the Project Implementation
4. Project Implementation Organization
5. Interim Reporting of Progress of the Project
6. Recommendation Addressed to Achievement of Overall Goal
7. Implementation Plan for the Next Stage



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1. Project Summary

1.1 Project Background

Train operation Safety and Service levels are major issues for MR.

1.2 Circumstances having led to the project

According to the Record of Discussion signed on last March 25th in 2013, between Managing Director, Myanmar Railways, and Chief Representative, Myanmar Office, JICA, agreement was reached upon the detailed contents .

1.3 Purpose of the Project

Administration and maintenance ability is improved for the enhancement of Service and Safety of Myanmar Railways



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2. Basic Plan of Project Implementation

2.1.1 Overall Goal and Project purpose

Output 1

Based on accident analysis, issues are clarified for the enhancement of service and safety in the administration and maintenance process, and the improvement plan is drawn up.

Output 2

Technology transfer of track maintenance technology through implementation of the Pilot Project

2.1.2 Implementation plan

We made implementaion plan to accomplish Output 1 and 2.

2.1.3 Project Section

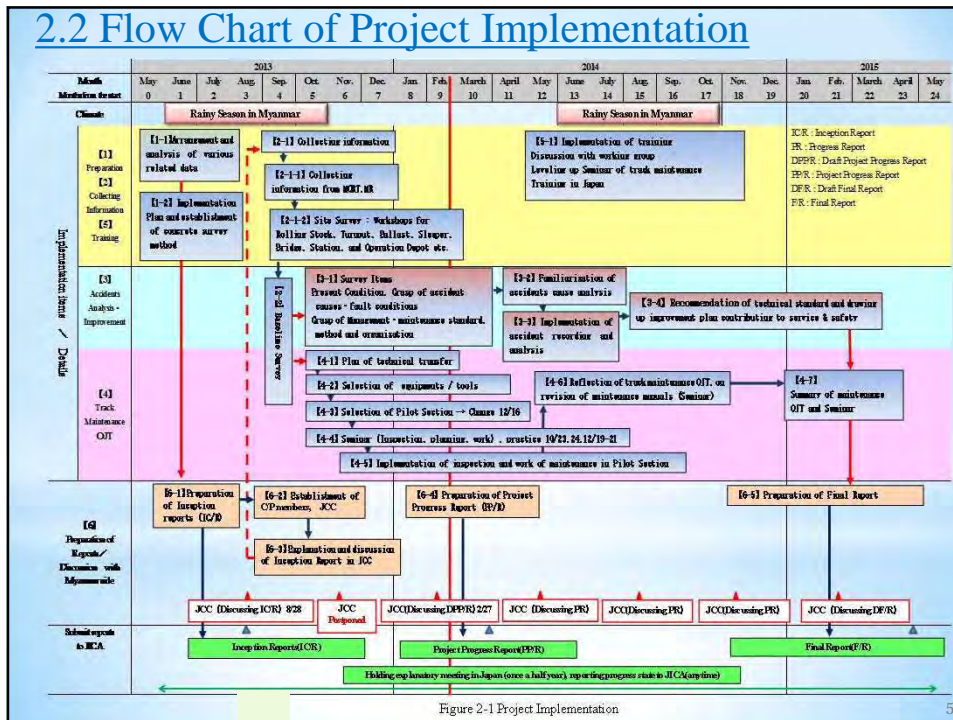
Yangon – Bago Section. Pilot section about 20km



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2.2 Flow Chart of Project Implementation



3 Detailed Methods for the Project Implementation

3.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level.

3.1.1 Preparation of a working plan

3.1.2 Survey of the present status and establishment of organization to collect information

3.1.3 Guidance and familiarization of the technique to analysis the present status and causes of accidents and poor services.

3.1.3-A Safety

3.1.3-B Service level

3.1.4 Recommendation on technical standards relating to administrative and maintenance aspect to improve the service level and safety

3.1.5 Drawing up of short-, medium- and long-term railway facilities improvement plan

3.1.6 Education/training in Japan

3.1.7 Major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation

Schedule of Working Plan

Subject	F Year	2013												2014												2015					Note			
		Month												Month												Month								
		5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		22	23	24
3.1.1 Survey of the present status and Establishment of an organization to Collect information		●	●	●	●	●	●																											
3.1.2 Guidance and familiarization of the analyzing technique of the causes (1) Safety 1) Compilation of text books 2) Studying and learning with text books 3) Summarization of accident analysis and countermeasures (Workshop) (2) Services level 1) Compilation of text books 2) Studying and learning with text books 3) Summarization of cause analysis and countermeasures (Workshop)							■	■	■					★																				[Remark] IC/R Inception Report PR Progress Report PPR Project Progress Report DFPR Draft Project Progress Report DFR Draft Final Report FR Final Report
3.1.3 Recommendation on technical standards for service level and safety (1) Proposal (2) Summarizing																				■	■	■												
3.1.4 Drawing up short-, medium- and long-term railway improvement items (1) Proposal (2) Summarizing																					■	■	■											
Education/training in Japan																																		
Discussion on the report/JCC									▲					▲						▲													[Remark] IC/R Inception Report PR Progress Report PPR Project Progress Report DFPR Draft Project Progress Report DFR Draft Final Report FR Final Report	
Submission of the report (JICA)									▲					▲						▲													[Remark] IC/R Inception Report PR Progress Report PPR Project Progress Report DFPR Draft Project Progress Report DFR Draft Final Report FR Final Report	

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3.2 Technology Transfer of Track Maintenance Technology to improve the level of Service and Safety through Implementation of The Pilot Project

- 3.2.1 Drawing up a plan for technology transfer
- 3.2.2 Procurement of the required equipments / tools
- 3.2.3 Selection of the Pilot Section
- 3.2.4 Implementation of track maintenance (inspection, planning, work and control)
- 3.2.5 Education/Training
- 3.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards
- 3.2.7 Final summarization and seminars
- 3.2.8 Major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation



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Schedule of Track maintenance

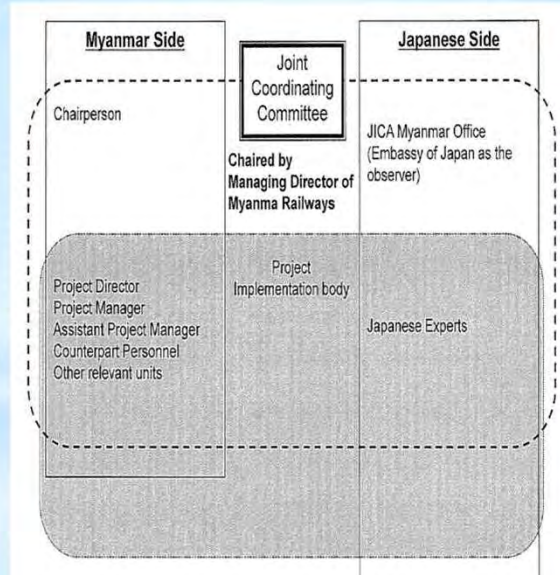
Subject	2013												2014												2015				The degree of achievement (%)	Note				
	F Year												F Year												F Year									
	Month	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3			4			
Start Month	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24									
4.2.1 Drawing up a technical transfer plan (1) Collection of basic information (2) Plan of technical transfer																													100					
4.2.2 Selection/procurement of equipments/tools (1) Selection of equipments/tools (2) Acquisition of import license, tax exemption procedure (3) Import procedure (4) Freight control																													100	100	100	100	10	
4.2.3 Selection of Pilot Section (1) Site witnessing (2) Selection of a section (3) Base line survey																													100	100	100	100	Change pilot section in December	
4.2.4 Implementation of track maintenance work (inspection, planning, work, control) (1) Compilation of text books (2) Classroom education and practical training (seminar) (3) Prior measurement and survey at the Pilot Section Implementation of work: After completing the maintenance work of a 100 m-section in principle, move to the next 100 m-section (with the number of working days depending on the workload of each 100 m-section).																													100	80	10	10	100	Matches with implementation of work
4.2.5 Education/training (1) Seminars on the improvement of track maintenance technologies (2) Education/training in Japan																													20	0				
4.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards																													0					
4.2.7 Final summation and seminars Discussion on the report/JCC Submission of the report (JICA)																													0					

4. Project implementation Organization

- 4.1 Structure of the implementation Organization
- 4.2 Implementation body on the Myanmar side
- 4.3 Implementation body on the Japan side
- 4.4 Establishment of Joint Coordinating Committee (JCC) and Its Functions
- 4.5 Establishment of Working Group for Service and Safety Improvement
- 4.6 Major issues to be tackled with, good schemes for better implementation of the project and lessons obtained through implementation.



Structure of project implementation Organization



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Table 4.1 Administrative and Counterpart Personnel for the Project

Fields	Myanma Railways	Japanese Side (JICA Expert Team)
Project Director	U Saw Valentine, General Manager (Technical & Admin.support)	Sadaaki KURODA (Leader)
Project Manager	U Tin Soe ,General Manager (civil)	Nobuyuki MATSUO (Duputy Leader)
Railway Policy/OM Improvement	U Kyaw Kyaw Myo Assistant General Manager(operating)	Hiroshi KOMATSU
Track Maintenance	U Maung Maung Than ,AGM (Civil) U Than Htay(DGM) Civil	Masato WAKATSUKI Kiyoshi MIYAMOTO
Procurement of Equipment & Materials	U Win Htein DGM(Supply)	Yuichi TANIGUCHI
Signalling&Telecommunications	U Myint Lwin,Assistant Engineer(S&T) U Han Nyunt ,AGM(S&T)	Ryuhei MITANI
Rolling Stock	U San Myint (Train Operation) U Thet Lwin,DGM(Rolling Stock)	Makoto ISHIKAWA
Train Operation	U zaw Pe Sein (Divisional Traffic Manager) U Htay Myint Aung,AGM(operating)	(Hideharu IGAGASHI)
Structure	U Tin Win ,DGM(Civil)	Mitsuru TAKAMI (Coordination)

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JCC personnel

Chairman U Thurein Win Managing Director of Myanma Railways			
Myanmar Side		Japanese Side	
Name	Position (Major)	Name	Position (Major)
U Saw Valentine	General Manager (Technical & Admin Support)	Sadaaki KURODA	Leader of Japanese Expert Team (Track maintenance)
U Myint Wai	General Manager (Operating) for analysing accidents	Nobuyuki MATSUO	Dputy Leader (Maintenance planning)
U Aung Win	General Manager (Mechanical & Electrical) for rolling stocks	Hiroshi KOMATSU	Railway Administration and Management Expert
U Tin Soe	Project Manager, General Manager (Civil)	Yuichi TANIGUCHI	Procurement of Equipment and Materials Expert
U Than Htay	Assistant Project Manager, Deputy General Manager (Civil)	Ryuhei MITANI	Signalling and Telecommunications Expert
U Khin Maung Thein	Assistant Project Manager, Deputy General Manager (Signalling & Telecommunications)	Makoto ISHIKAWA	Rolling Stock Expert
U Min Aung	Counterpart Personnel, Assistant Engineer (Civil)	Masato WAKATSUKI	Track Maintenance Expert
U Myint Lwin	Counterpart Personnel, Assistant Engineer (Signalling & Telecommunications)	Kiyoshi MIYAMOTO	Earth Roadbed Expert
Daw Thi Thi Nwe	Assistant General Manager (Finance)	Mitsuru TAKAMI	Coordinating Expert
Htaung Sian Kan	Deputy General Manager (Admin)	(Hideharu IGAGASHI)	Operation Expert
		Mituso HIGASHI	Railway Management Adviser
			Representative of JICA
			Representative of JICA
			Representative of Embassy of Japan : Observer

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Member of Working Group for Service and Safety Improvement

Fields	Myanma Railways	Japanese Side (JICA Expert Team)
Project Director	U Saw Valentine, General Manager (Technical & Admin. support)	Sadaaki KURODA (Leader)
Project Manager	U Tin Soe, General Manager (civil)	Nobuyuki MATSUO (Dputy Leader)
Railway Polioy/OM Improvement	U Kyaw Kyaw Myo Assistant General Manager (operating)	Hiroshi KOMATSU
Track	U Than Htay DGM (Civil)	Masato WAKATSUKI Kiyoshi MIYAMOTO
Signalling & Telecommunications	U Han Nyunt, AGM (S&T)	Ryuhei MITANI
Rolling Stock	U Thet Lwin, DGM (Rolling Stock)	Makoto ISHIKAWA
Train Operation	U Htay Myint Aung, AGM (Operating)	(Hideharu IGAGASHI)
Structure	U Tin Win, DGM (Civil)	Mitsuru TAKAMI (Coordination)

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5 Interim Reporting of Progress of the Project

5.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level.

5.1.1 Survey of the present status and establishment of an organization to collect information

5.1.2 Guidance and familiarization of analysis technique of the causes of accidents and low service

5.1.3 Recommendation on technical standards for service and safety,

5.1.4 Drawing up short-, medium-, and long-term railway improvement items

5.1.5 Education / training in Japan

5.1.6 Extent of achievement of target, major issues to be tackled with, good schemes for better implementation, lessons obtained through implementation



Japan International Cooperation Agency

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5.1.1 Survey of the present status and establishment of an organization to collect information

Appendix8-1 present situation of Safety and Service Level of MR

1. Accident Analysis

- Classification
- Number of accidents by kinds
- Analysis of Causes
- Reporting System
- Organization in charge of handling accidents and countermeasures

2. Service Level

- Train delay analysis(magnitude, frequency, causes)
- Sanction Speeds by section, restricted speed
- Journey speed
- Riding Comfort

16

5.1.2 Guidance and familiarization of analysis technique of the causes of accidents and low service

(1) Preparation of text book

(2) Executing of Training Program

- Introduction of Japanese Experiences by JICA Experts
- Workshop
- Training of Train vibration measurements

(3) Interview Survey

17

Text book Contents

Forewords (MR side and Japanese side)

1. Safety

- 1.1 Introduction of Prevention and Research organization in the world railway
- 1.2 Past accidents and Countermeasures
 - 1.2.1 Collision
 - 1.2.2 Derailment
 - 1.2.3 Level crossing
 - 1.2.4 Natural Disasters
 - 1.2.5 Train Fire

2. Bottom up of Service Level

- 2.1 Speed-up
- 2.2 Prevention for Level Crossing Accident
- 2.3 Punctuality
- 2.4 Conformability
- 2.5 Customer Satisfaction

Afterword

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Training schedule ①

Date	Hour	Contents	Note	Date	Hour	Contents	Note
Mon. 10 Feb.	AM	Opening Ceremony -Greeting from MR side and Japanese Side -Introduction of MR Participants and JICA Experts Orientation		Mon. 17 Feb.	AM	Brake systems on rolling stocks Lectured by Mr. ISHIKAWA Train Protection System Lectured by Mr. MITANI	
	PM	Orientation continued as required Analysis of the Present Situation of Safety and Service Level of MR Lectured by Dr. S. Kuroda			PM	Workshops: Train separation 2 items	
Tue. 11 Feb.	AM	Derailment Accident in Japan and Discussion on Derailment: Lectured by Mr. KURODA Derailment Accident in Japan : Lectured by Mr. MIYAMOTO		Tue. 18 Feb.	AM	Prevention for Accidents Lectured by Mr. IGARASHI Measures for speed up on Track side: Lectured by Mr. KURODA	
	PM	Workshops: Derailment 2 items			PM	Workshops: Train delay 2 items	
Wed. 12 Feb.		National holiday		Wed. 19 Feb.	AM	Measures for Punctualities on track side : Lectured by Mr. MIYAMOTO Measures for Riding Comfortabilities on track side: Lectured by Mr. MIYAMOTO	
Thu. 13 Feb.	AM	Rolling stocks accident : Lectured by Mr. ISHIKAWA Level crossing accidents : Lectured by Mr. MITANI			PM	Workshops: Train delay 1 item and Speed limited 1 item	
	PM	Workshops: Derailment 2 items		Thu. 20 Feb.	AM	Measures for Riding Comfortabilities on rolling stocks side : Lectured by Mr. ISHIKAWA Maintenance of Long Rail : Lectured by Mr. MIYAMOTO	
Fri. 14 Feb.	AM	Natural disasters : Lectured by Mr. TAKAMI			PM	Workshops: Speed limited 2 items	
	PM	Workshops: Level Crossing 2 items		Fri. 21 Feb.	AM	Workshops: Currents situations of Procedure/ system/ organization for reporting, cause analysis and establishment of countermeasures of MR	
Sat. 15 Feb.		Holiday			PM	General Discussion	
Sun. 16 Feb.		Holiday		Sat. 22 Feb.		Holiday	
				Sun. 23 Feb.		Holiday	

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Training schedule ②

Date	Hour	Contents	Note
Mon. 24 Feb.	AM	Workshops: Improvement of Technical Standards relating to administrative and maintenance aspect to improve the service and safety of MR	
	PM	Turnout: Lectured by Mr. MIYAMOTO	
Tue. 25 Feb.		General Discussion	
Wed. 26 Feb.	AM	General Discussion	
	PM	Practice for Measurements of Train Vibrations (Lecture on measurement and data analysis)	
Thu. 27 Feb.	AM	Joint Coordinating Committee: Practice for Measurements of Train Vibrations (Practical measurement of vibration)	
	PM	Practices for Measurements of Train Vibrations (Practical measurement of vibration)	
Fri. 28 Feb.	AM	Practices for Measurements of Train Vibrations (Analysis of measured data)	
	PM	Closing ceremony -Hand over the Certification, -Greeting from MR side and Japanese Side	
Sat. 1 Sun. 2 Mar		Holiday	
Mon. 3 Mar	AM	10:00 Interview survey preparation meeting	
Tue. 4 Mar		Interview survey	
Wed. 5 Mar		Interview survey	
Thu. 6 Mar		Interview survey	
Fri. 7 Mar		Interview survey	

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Participants List

Group	Name	Department	Location	remark
A	Mr. Than Htay	Deputy General Manager/Civil	Head Quarter	
	Mr. Aye Ko	Assistant Mechanical Engineer	Head Quarter	
	Mr. Tinh Lwin Htun	Assistant Engineer / Civil	Division (11)	Replaced Mr.San Ngwe Assistant Engineer/Civil Division(5) Since Feb.13
	Mr. Myo Tint	Assistant Traffic Manager	Division (4)	
	Mr. Htun Wai	Assistant Engineer (Signaling & Telecommunication)	Head Quarter	
B	Mr. Htein Win	Assistant General Manager/Operating	Division (5)	
	Mr. Hla Htut	Divisional Engineer (Signaling & Telecommunication)	Division (6,8,9) Yangon	
	Mr. Thein Myint	Assistant Mechanical Engineer	Head Quarter	
	Mr. Lwan Thu	Divisional Engineer / Civil	Division (5)	
	Mr. Aye Thein	Assistant Traffic Manager	Division (2)	Absent all classes
C	Mr. Min Pan Aung	Divisional Engineer ((Signaling & Telecommunication)	Division (3)	
	Mr. Naing Zaw Oo	Divisional Traffic Manager	Division (10)	
	Mr. Than Win	Assistant Mechanical Engineer	Division (2)	
	Mr. Myint Lwin	Assistant Mechanical Engineer	Division (4)	
	Mr. Tin Moe	Assistant Engineer / Civil	Head Quarter	
D	Mr. Min Min Htway	Divisional Traffic Manager	Division (10)	
	Mr. Soe Thein Aung	Divisional Engineer ((Signaling & Telecommunication)	Division (5,11) Taungoo	
	Mr. San Thar Aung	Divisional Traffic Manager	Head Quarter	
	Mr. Ye Kyaw Htwe	Assistant Mechanical Engineer	Division (5)	
	Mr. Aye Nyein Swe	Assistant Engineer / Civil	Division (3)	

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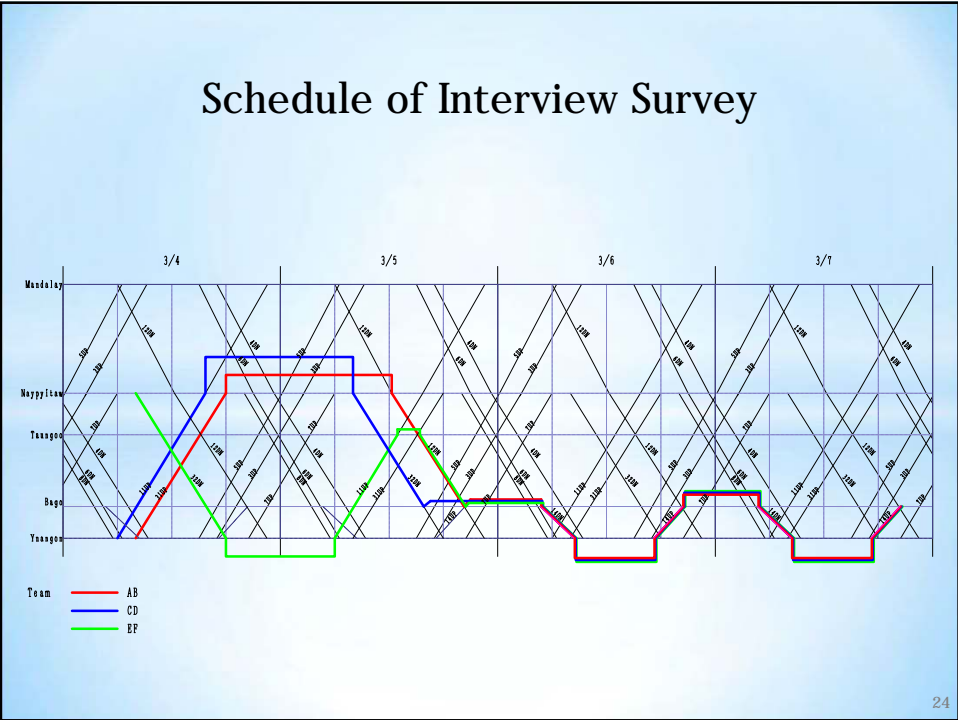
Interview Survey

Train kind/class	Sampling number/Train	Train number /day	days	Total number
Express (Upper)	20	3	2	120
Express (Ordinary)	20	3	2	120
Local	30	2	2	120

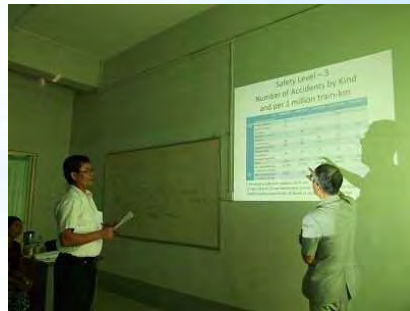
		1st day	2nd day	3rd day	4th day	Train travel time
Express Train		12DN	31UP			9~16h
	Upper class (20) passengers/train	A,B	A,B			9~16h
		11UP	32DN			
	Ordinary class (20)passengers/train	C,D	C,D			9~16h
32DN		11UP				
Total (40) passengers/train		E,F	E,F			
Local Train	No.1(14DN)			(B-Y)	(B-Y)	3h
	(30)passengers/train			A,B,C,D	A,B,C,D	
		No.2(13UP)			(Y-B)	(Y-B)
				A,B,C,D	A,B,C,D	

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Q 1 About riding comfortability.						
No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	-	3	-	2	-	1
Q 2 About Train speed						
No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	-	3	-	2	-	1
Q 3 About Train Delay						
No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	-	3	-	2	-	1
Q 4 About Cleanness in Train Cabin						
No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	-	3	-	2	-	1
Q 5 About Cleanness in Train Restroom						
No Particular Opinion		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	-	3	-	2	-	1



Training of improving safety and service Level



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Video① Training of improvement safety and service level



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5.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project

- 5.2.1 Drawing up a technical transfer plan
- 5.2.2 Selection /procurement of equipments/tools
- 5.2.3 Selection of Pilot Section
- 5.2.4 Implementation of track maintenance work (inspection, planning, work, control)
- 5.2.5 Education/ training in Japan
- 5.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/ standards
- 5.2.7 Final summarization and seminars
- 5.2.8 Extent of achievement of target, major issues to be tackled with, good schemes for better implementation, lessons obtained thorough implementation



Japan International Cooperation Agency

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List of the required equipments/tools

No.	Item	Unit	Manufacturer	No.	Item	Unit	Manufacturer
1	Analog standard gauge	5	KANEKO CO. LTD.	38	Sleeper replacing machine	1	HOSEN KIKI SEIBI CO. LTD.
2	Instrument detection for track	5	GIDOU GREEN	39	Rail carrying machine	9	YOSHIZKE IAKEN KIKI CO. LTD.
3	Mesuring instrument for rail wearing depth	2	HARADA SEIKUSYO	40	Rail carrying tongs	9	YOSHIZKE IAKEN KIKI CO. LTD.
4	Gap gauge	5	TRUSKO NAKAYAMA CO. LTD.	41	Shovel	18	TONBO KOGYO CO. LTD.
5	Taper gauge	5	KANEKO CO. LTD.	42	Single open ended spanner	9	ISHI TEKOU CO. LTD.
6	Thermometer for rail	5	KANEKO CO. LTD.	43	Chisel	5	ISHI TEKOU CO. LTD.
7	Square for rail	5	KANEKO CO. LTD.	44	Rail fork	5	NICH CO. LTD.
8	Trackmaster	1	KANEKO CO. LTD.	45	Disc grinder	5	HITACHI EDCU/HANBAI CO. LTD.
9	Mesuring instrument for train swing	1	SHINYEI TECHNOLOGY CO. LTD.	46	Power wrench	5	MAKITA CO. LTD.
10	Cloth measuring tape (30 m)	5	YAMAYO SOKUTEKI CO. LTD.	47	Low joint maintenance machine	1	L. GETMAR
11	Steel measuring tape (30 m)	5	YAMAYO SOKUTEKI CO. LTD.	48	Spanner for joint bolt	9	ETIMA KIKOU CO. LTD.
12	Square	5	TETUYU KOGYO CO. LTD.	49	Rail grinding machine	1	YOSHIZKE IAKEN KIKI CO. LTD.
13	Slate pencil Chalk	4	NIBON HAKUBOKU KOGYO CO. LTD.	50	Swager for back bolt	1	JOPON POPPAPPEI AND PARTNER LTD.
14	Tie tamper	1	SHIBAUFA ELITEC CORPORATION	51	Hydraulic lining machine	5	TETUYU KOGYO CO. LTD.
15	Beater	18	ISHI TEKOU CO. LTD.	52	Low roller	7	HOSEN KIKI SEIBI CO. LTD.
16	Shovel	18	TONBO KOGYO CO. LTD.	53	Chisel with handle	3	ISHI TEKOU CO. LTD.
17	Bar	35	ISHI TEKOU CO. LTD.	54	Spanner for bed plate / rail brace	7	ISEE KOGYO CO. LTD.
18	Spike hammer	13	ISHI TEKOU CO. LTD.	55	Adz	9	ISHI TEKOU CO. LTD.
19	Panpuller	18	HOSEN KIKI SEIBI CO. LTD.	56	Hand hammer	9	TORASUO NARAYAMA CO. LTD.
20	Jack for rail	40	NICH CO. LTD.	57	Spanner for luck bolt	9	ETIMA KIKOU CO. LTD.
21	Equipment for ballast tamping	5	HITACHI KENGI KAMINO CO. LTD.	58	Engine Drilling Machine	13	NIKOU TANAKA ENDO/YARENG CO. LTD.
22	Generator	1	SHIBAUFA ELITEC CORPORATION	59	Drill 22mm	13	NIKOU TANAKA ENDO/YARENG CO. LTD.
23	Generator	5	HONDA MOTOR CO. LTD.	60	Gauge	9	KAUKU SANGYO
24	Shovel	9	TONBO KOGYO CO. LTD.	61	Electric saw	5	HITACHI EDCU/HANBAI CO. LTD.
25	Dump shovel	9	KATOU SEIKUSYO CO. LTD.	62	Boring machine	3	MAKITA CO. LTD.
26	Shovel with blade divided into multiple	9	KATOU SEIKUSYO CO. LTD.	63	Sleeper carrying tongs	9	KATOU SEIKUSYO CO. LTD.
27	Hoe with blade like nail of wild goose	9	KYOGUWA CO. LTD.	64	Pad remover	9	ORUBA CO. LTD.
28	Hand screen	15	ISEE KOGYO CO. LTD.	65	Light track trolley	5	YOSHIZKE IAKEN KIKI CO. LTD.
29	Hoe with blade of triangle	9	ISEE KOGYO CO. LTD.	66	Gas cutting machine	2	YAMATO SANGYO CO. LTD.
30	Wooden maul	9	KONDO KASHIZAI MOKOUSYO CO. LTD.	67	Rail lifting machine	3	TOBO SANGYO CO. LTD.
31	Basket made by bamboo or plastic	9	SEKISUI IAGAKU KOGYO CO. LTD.	68	Spanner	2	TOPU KOGYO CO. LTD.
32	Jack traverser	10	TOBO SANGYO CO. LTD.	69	Track jack	9	TETUYU KOGYO CO. LTD.
33	Rail sawing machine	3	TETUYU KOGYO CO. LTD.	70	Low elasticity pad	20	NIBON ESURATO CO. LTD.
34	Rail boring machine	3	KOBORI TEKOUSYO CO. LTD.	71	Track shim	20	TETUSO YOSHIZ
35	Core cutter	10	KOBORI TEKOUSYO CO. LTD.	72	Huck bolt	40	SEKISU TEC CO. LTD.
36	Rail bending machine	1	EKEN KIKI CO. LTD.	73	Brushcutter	4	HONDA MOTOR CO. LTD.
37	Rail joint expander	1	TETUYU KOGYO CO. LTD.	74	Chip cutter for Brushcutter	4	HONDA MOTOR CO. LTD.

Record of Work

Kind of work	Unit	12k200m~ 13k450m	26k200m~ 27k035m
Continuous Tamping	m	826.5	254
Spot Surfacing	m	45.3	1,111
Subtotal	m	1279.5	1,365
Spot Surfacing using ballast chipping at the joint	Nos.	0	53
Insert of sleepers cut into four pieces at the joint	Nos.	0	8
Positioning of sleepers	Nos.	239	161
Exchange sleepers	Nos.	84	38
Insert sleepers	Nos.	9	22
Remove sleepers	Nos.	1	3
Subtotal	Nos.	95	63
Rectification alignment	m	552	915
Supplement and arrangement of ballasts	m	1535.5	1,128.5

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Training of Track maintenance used by equipments of MR



Training on the commercial line



Track maintenance by man power



Tamping using by Hand Tie tamper of MR



Mesuearing

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Training of Track maintenance of classroom(10/23), ceremony at Yangon Sta.(11/27)



Training of classroom using by text of Myanmar language



Practice on the track in Yangon Sta.



Donation Ceremony from JITI to MR



Demonstration of Hand Tie Tampers in Yangon Sta.

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Training of track maintenance after the arrival of equipments from Japan



Explanation of Hand Tie Tamper



Track maintenance used by Hand Tie Tamper

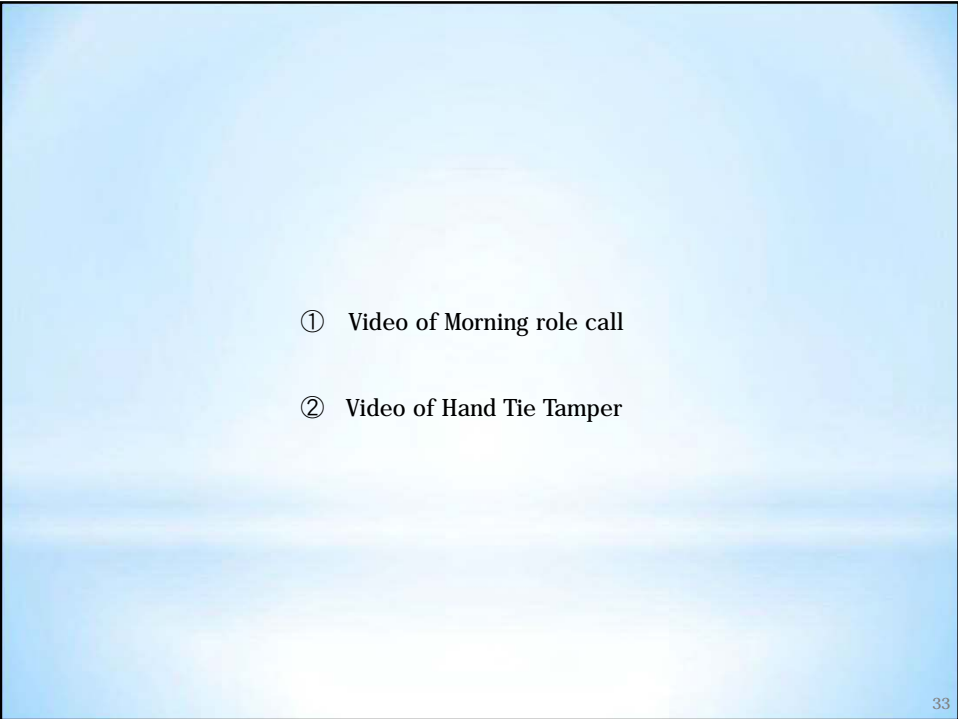


Track maintenance used by jack



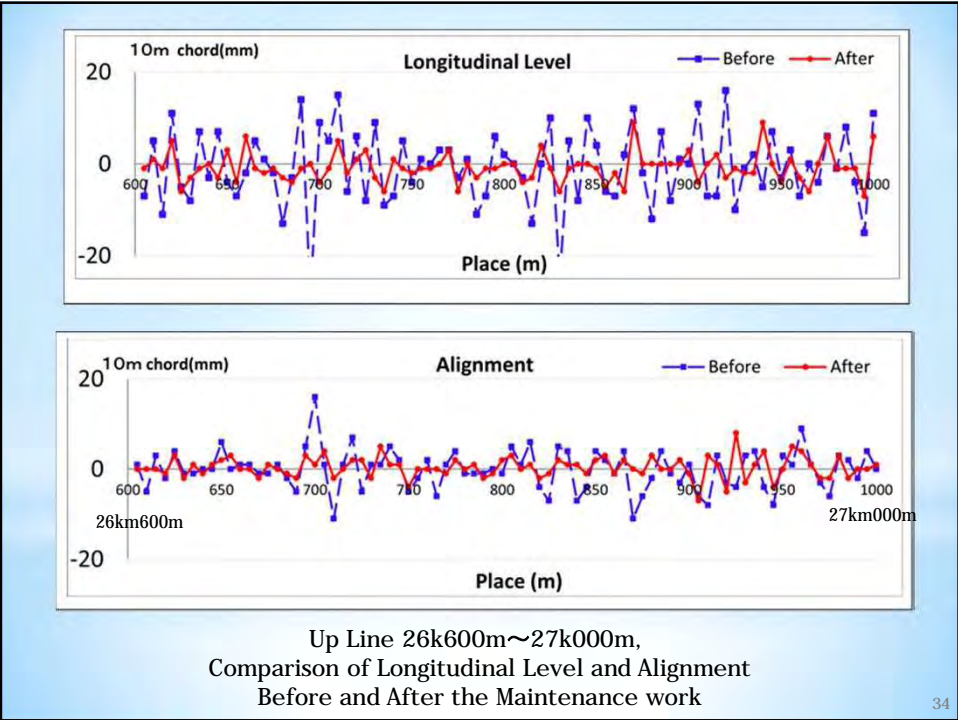
Track maintenance used by standard gauge

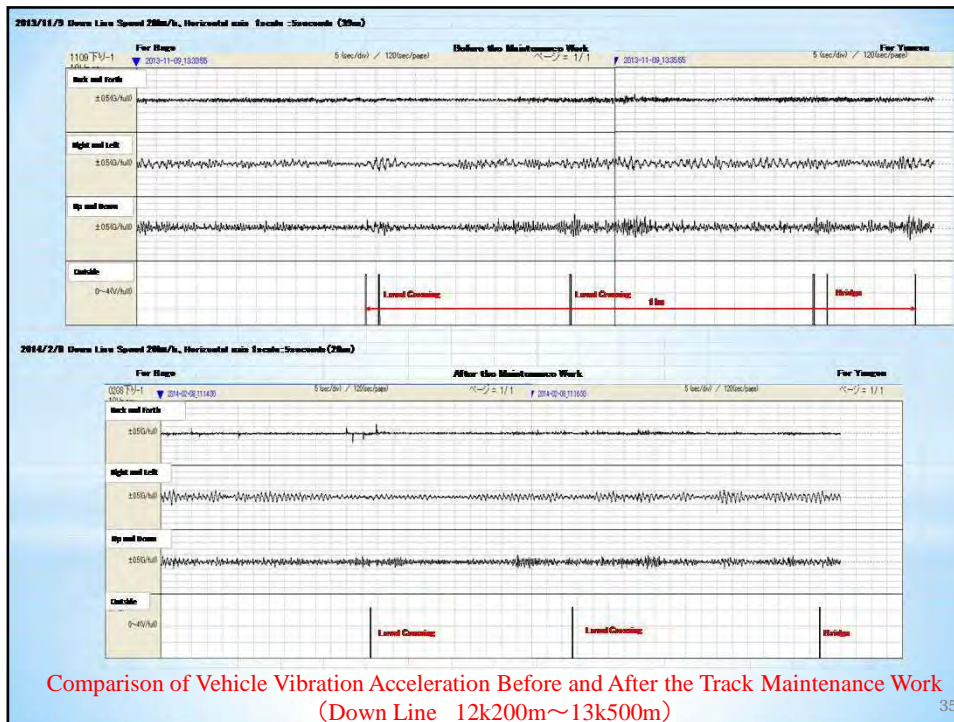
32



① Video of Morning role call

② Video of Hand Tie Tamper





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6 Recommendation Addressed to Achievement of Overall Goal

6.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level

6.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project

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6.1 We would like to stress that technology transfer involves efforts in two directions.

Effort in one direction is that of transmitting the experiences of Japanese Railways (JR) from JICA experts to MR experts.

Effort in another direction is that of response of MR experts to transmission of JR's experiences by JICA experts.

These effects in two directions should be realized through mutual and substantial discussion.

It is our suggestion that Step 3 and 4 should be executed through mutual and substantial discussion among MR experts and JICA experts.

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6.2

The overall goal and the project purpose are the same as the sub project given in the section 6.1.

We are measuring values of some kinds of track irregularities and train vibration for evaluation of track maintenance before and after working on the commercial line.

Track irregularities measured by 10m chord include horizontal alignment and longitudinal level, and we compared the measurement values before and after the track maintenance work. Measurement of train vibration is in the vertical and lateral directions and was made in the working section once two weeks.

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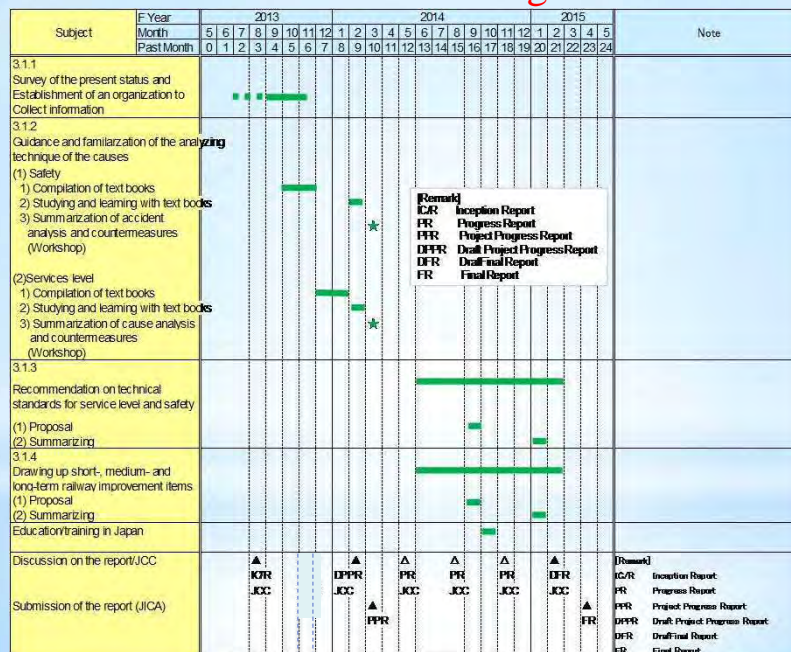
7. Implementation Plan for the Next Stage

7.1 Recommendation of technical standards relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level

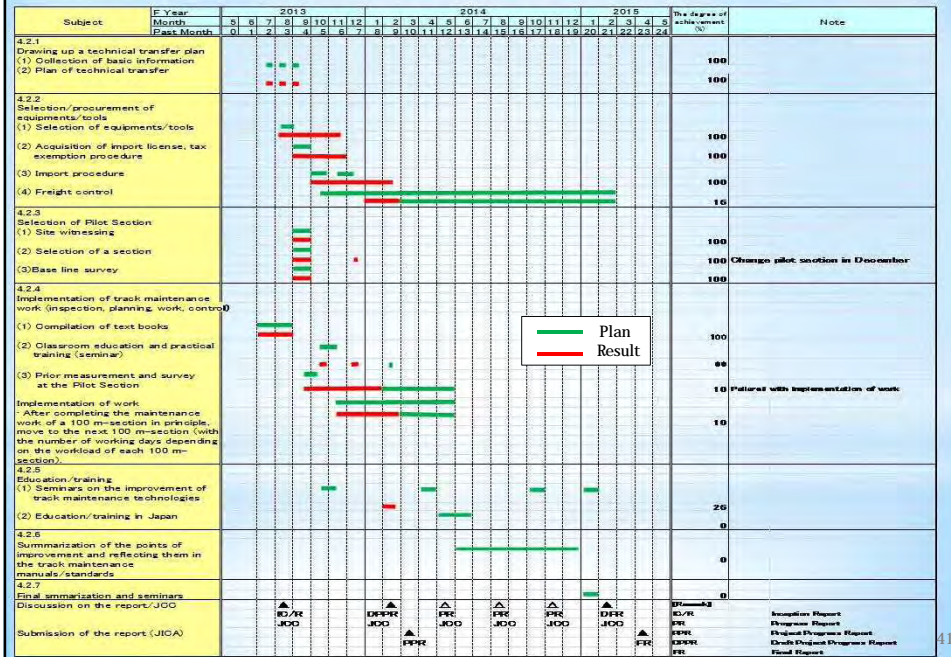
7.2 Technology transfer of track maintenance technology to improve the level of service and safety through implementation of the Pilot Project



Schedule of Working Plan



Schedule of Track maintenance



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Ask a favor of Myanmar Railways from JICA Expert Team

We have two plans of Training in Japan.

- ① Railway institutional management
Implementation time Next October
Span For 2 Weeks
Numbers 11

- ② Training of track maintenance in Japan
(We will implement the same training twice)
Implementation time Next June
Span For 2 Weeks
Numbers 11 × twice(Total:22)

Please elect 33 persons and proceed to get passport and visa.

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Thank you for your attention.

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

**PROJECT ON IMPROVEMENT OF
SERVICE AND SAFETY OF RAILWAY IN
MYANMAR**

PROJECT PROGRESS REPORT

May 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

**JAPAN INTERNATIONAL CONSULTANTS FOR
TRANSPORTATION CO., LTD
ORIENTAL CONSULTANTS CO., LTD
SUMITOMO CORPORATION**

Project on Improvement of Service and Safety of Railway in Myanmar

Progress Report, May 2014

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Appendix 2-1 Discussion in the Workshop, Comments, Advice

Appendix 2-2 Train Slow Down During Track Maintenance Work (Practices of JR EAST)

Project on Improvement of Service and Safety of Railway in Myanmar Progress Report, May 2014

1. Preface

Since we started the Project in June 2014, one year has passed and the Project has been implemented effectively under the close cooperation between MR officials concerned and JICA Expert Team.

We, JICA Expert Team, would like to express our sincere appreciation to MR officials concerned for their kindness extended to us during the execution of the Project.

This Progress Report deals with the major activities of the Project implemented around between February and May of this year.

We should be grateful, if MR senior officials concerned review the Report and provide us with the various advices so that the Project will be implemented more fruitfully in the coming period.

2. Major progress of the Project

2.1. Recommendation of technical standard relating to administrative and maintenance aspect and drawing up railway facilities improvement plan to improve service and safety level

2.1.1 Preparation of a working plan

The Project is progressing as scheduled in Table 2.1.

maintenance, Civil works, Signaling, Rolling stocks and Train Operation) of Divisions or Head office of MR participated in the training program.

The whole training program consists of three parts. The first part is class room lecture of the text book prepared by JICA experts. The second one is workshop. The third one is training of vibration measurement of rolling stock.

Further it should be mentioned that interview survey to investigate the customer's satisfaction level of MR's passenger transport was conducted following the training program.

The whole schedule is as shown in Table 2.2

Table: 2.2 Schedule of Training Program and Interview Survey

Date	Hour	Contents	Note
Mon. 10 Feb.	AM	Opening Ceremony -Greeting from MR side and Japanese Side -Introduction of MR Participants and JICA Experts Orientation	
	PM	Orientation continued as required Analysis of the Present Situation of Safety and Service Level of MR Lectured by Dr. S. Kuroda	
Tue. 11 Feb	AM	Derailment Accident in Japan and Discussion on Derailment: Lectured by Mr. KURODA	
		Derailment Accident in Japan : Lectured by Mr. MIYAMOTO	
	PM	Workshops: Derailment 2 items	
Wed. 12 Feb		National holiday	
Thu. 13 Feb	AM	Rolling stocks accident : Lectured by Mr. ISHIKAWA Level crossing accidents : Lectured by Mr. MITANI	
	PM	Workshops: Derailment 2 items	
Fri. 14 Feb	AM	Natural disasters : Lectured by Mr. TAKAMI	
	PM	Workshops: Level Crossing 2 items	
Sat. 15 Feb		Holiday	
Sun. 16 Feb		Holiday	

Date	Hour	Contents	Note
Mon. 17 Feb.	AM	Brake systems on rolling stocks Lectured by Mr. ISHIKAWA	
		Train Protection System Lectured by Mr. MITANI	
	PM	Workshops: Train separation 2 items	
Tue. 18 Feb	AM	Prevention for Accidents Lectured by Mr. IGARASHI	
		Measures for speed up on Track side: Lectured by Mr. KURODA	
	PM	Workshops: Train delay 2 items	
Wed. 19 Feb	AM	Measures for Punctualities on track side : Lectured by Mr. MIYAMOTO	
		Measures for Riding Comfortabilities on track side: Lectured by Mr. MIYAMOTO	
	PM	Workshops: Train delay 1 item and Speed limited 1 item	
Thu. 20 Feb	AM	Measures for Riding Comfortabilities on rolling stocks side: : Lectured by Mr. ISHIKAWA	
		Maintenance of Long Rail : Lectured by Mr. MIYAMOTO	
	PM	Workshops: Speed limited 2 items	
Fri. 21 Feb	AM	Workshops: Currents situations of Procedure/ system/ organization for reporting, cause analysis and establishment of countermeasures of MR	
	PM	General Discussion	
Sat. 22 Feb		Holiday	
Sun. 23 Feb		Holiday	

Date	Hour	Contents	Note
Mon. 24 Feb.	AM	Workshops: Improvement of Technical Standards relating to administrative and maintenance aspect to improve the service and safety of MR	
	PM	Turnout: Lectured by Mr. MIYAMOTO	
Tue. 25 Feb		General Discussion	
Wed. 26 Feb	AM	General Discussion	
	PM.	General Discussion	
Thu. 27 Feb	AM	Joint Coordinating Committee: Practice for Measurements of Train Vibrations (Lecture on measurement and data analysis)	
	PM.	Practices for Measurements of Train Vibrations (Practical measurement of vibration)	
Fri. 28 Feb	AM	Practices for Measurements of Train Vibrations (Analysis of measured data)	
	PM	Closing ceremony -Hand over the Certification, -Greeting from MR side and Japanese Side	
Sat. 1 Sun. 2 Mar		Holiday	
Mon. 3 Mar	AM	10:00 Interview survey preparation meeting	
Tue. 4 Mar		Interview survey	
Wed. 5 Mar		Interview survey	
Thu. 6 Mar		Interview survey	
Fri. 7 Mar		Interview survey	

Class room lecture of the text book was held from Feb.11 to Feb. 21 between 9:00 – 12:00 in the morning. Workshop was held from Feb. 11 to Feb.26, mainly between 14:00 – 16:00 in the afternoon. Training of rolling stock vibration measurement was implemented from Feb. 27 to Feb. 28.

(2) Class room lecture of text book

JICA experts explained, based on the text book, about the past accidents and countermeasures in the world mainly in Japan (for examples, derailment, train collision, level crossing, natural disaster and so on), and introduced the measures for improvement of the service level (for examples, increasing train speed, punctuality, riding comfortabilities, train protections and so on).

There were various discussions between JICA lecturers and MR participants. Major advices to MR by JICA experts based on the discussion are given below.

- 1) Level Crossing Accident Prevention
 - (a) MR has many level crossing accidents. Knowing that JR has also not a few level crossing accidents, they are interested in how JR tries to prevent level crossing accidents.
 - (b) There are many illegal level crossings in MR, some of which are necessary for the nearby residents. MR is worried about how to secure the budget for protection devices of these level crossings.
 - (c) MR is interested in how JR group gives guidance to school children about the safe way to cross the level crossing.
 - (d) MR experts realize the significance of installing alarm signals at the level crossing, and on the other hand they are worried about how to secure the maintenance budget for them. They are also anxious about how to secure electric power sources necessary for installing various protection devices for level crossing.
 - (e) In order to decrease the level crossing accidents, not only the installment of protection devices, but also the guidance to road vehicle drivers about the safe way to cross the level crossing and efforts to eliminate the level crossings (such as by grade separation, by unification) are significant.

- 2) ATP
 - (a) In introducing ATP, there are many issues to be solved such as securing constant braking distance.
 - (b) MR experts have understood the history and the reason how and why JR has introduced the ATP.
 - (c) MR experts have understood that safety sidings, automatic warning devices for obstructing construction gauges, emergency protection devices etc. are also significant devices for preventing derailment and double accidents.

- 3) Natural disasters
 - (a) In case of abnormal weather including heavy rainfall, inspectors are stationed at the bridges, and inform the train drivers of the dangerous situations as required. MR wants to install the warning signals on the track side, but the budget issue makes it difficult.

- 4) Rolling stock
 - (a) In MR, both vacuum brake and compressed air brake are adopted. Vacuum brake should be replaced by compressed air brake. MR is adopting vacuum brake even in new production passenger coaches; it is not recommendable.
 - (b) Continuous braking is not working; only locomotive is braked, but passenger coaches are not braked. It is not recommendable.
Continuous braking is necessary for speed up
 - (c) Derailment mechanism
MR should be familiar with how to analyse the derailment mechanism.
 - (d) Bogie
Spring system of bogie is closely related with riding comfort of vehicles. MR should investigate the vibration of bogies and try to improve the spring system of the bogie.

- 5) Measures for Riding Comfortability on the track side
 - (a) To grasp the track condition precisely, inspection device should be applied.
Allowances for track irregularities should be set for two levels: one for emergency repair, and the other for regular repair.
 - (b) At present, track repairing power is not so strong, By and by mechanical repair machines such as MTT, Ballast regulator should be introduced for strengthening the repairing power.
 - (c) Shortage of track ballast is conspicuous. It should be understood that ballast at the end of sleeper, below the bottom of sleeper, and on the sides of sleeper all contribute to the

lateral resistance of track, which is important for securing stable track, especially significant for preventing buckling of long welded rail track.

It should be also recommended to improve the quality control of ballast production.

- (d) Low joints of track are conspicuous in many sections, which cause progress of track deterioration and large vehicle vibration. Adoption of long welded rail is the best solution.

However, in the sharp curve sections and on the long bridges sections, jointed rail will be remained. In such cases, strengthening of rail joint by such methods as adoption large rail joint sleeper, end hardened rail, are recommended.

- (e) Maintenance of turnout is in poor conditions .Maintenance manual should be reviewed and training of turnout maintenance should be intensified.
- (f) It is recommended to fill the gap between guard rail and running rail at the level crossing track by rubber material, so that the waste/ garbage/ soil filling the gap will be jumped out while vehicle wheel flanges are running through the gap.
- (g) In the track sections before and after the bridges or turnouts, horizontal track alignments is in many cases poor, causing large vehicle vibration. These poor alignments should be rectified.

6) Measures for Punctualities on track side

Items (a) – (g) described in 5) above all contribute to improving punctualities. Further, it should be recommended to implement periodical checking of rail ultra sonic inspection so as to find out the initiation of the rail breakage in advance.

7) Maintenance of long welded rail

Adopting of long welded rail is one of the best solutions for improving riding comfort, speeding up and safety.

However, in order to make long welded rail display its splendid role, smooth finishing of rail welded part, ultra sonic inspection of welded part are significant.

Also in maintaining long welded track, track work executed during the hot temperature should be carefully planned or sometimes limited to avoid track buckling accidents.

Maintenance manuals for long welded rail track should be established, and training of maintenance of long-welded track should be strengthened.

(3) Workshops

1) Items selected for presentation by MR experts

The purpose of the workshop is to make MR experts be familiarized with analysis of causes of accidents and low service levels and establishment of countermeasures through making MR staff themselves analyse the causes of actual accidents or low service levels of MR and making themselves establish suitable countermeasures.

In this regard, 25 items relating to accidents and low service levels (train delay and speed restrictions) were selected from the actual MR's events in 2012/ 2013, and MR experts by themselves tried to analyse the causes and to establish the appropriate countermeasures. The 25 items selected are given in Table 2-3.

Table 2.3 Presentation by MR experts in Workshop

Topics		No. of presentations
Accident		10
Derailment	Between stations	3
	In the station yards	3
Train Parting		2
Level crossing accident		2
Service Level		8
Train delay		5
Speed restriction		3
Others		7
Existing situation of Y – M Line		1
Review of Technical standards (track, signal/ telecom, operation)		3
Review of inspection / maintenance of rolling stock		1
Current issues of MR		1
General questions to JICA experts		1
Total		25

- 2) Discussion between MR experts and JICA experts on presentation by MR experts
 For each presentation of MR experts, JICA experts made comments on method of cause analysis and establishment of countermeasures presented by MR experts. JICA experts also presented advices to MR regarding major issues identified through discussion in the workshop.
 These comments and advices were prepared for each of all presentations which are classified according to kinds of items for presentation.
 They are given in Appendix 2-1.

Summarizing the advices of JICA experts on major issues of MR identified through discussion in the Workshop, the following advices can be provided according to the kinds of accidents/ low service levels.

- (a) Derailment (between stations & in the station yards)
- (i) Not only the track cross level irregularity, but also track twist should be measured and controlled because twist is more related with derailment than level crossing irregularity.
 - (ii) At present in MR, inspection of track conditions is executed by eye-sight. Measurement devices including string should be used to grasp the track irregularities precisely. For example, extent of twist cannot be evaluated by eye-sight inspection.
 - (iii) Derailments due to gauge-widening caused by rotten wooden sleeper or derailment due to large cross level have occurred in the station yard.
 - ① These events makes us have a question why such situations could not have been found out by regular inspection before occurrence of derailment. Then regular track inspection must be executed according to the rules. This may require training of inspectors.
 - ② These events also make us estimate that the similar track conditions may exist in other siding tracks of the station concerned or in the other situations. Overall examination of important sidings of the station concerned and other stations are recommended.
 - (iv) Regarding installment of drainage pipes for roadbed sinkage prevention, spacing

- of drainage pipes and maintenance of drainage pipes should be examined.
- (v) For prevention of derailment caused by spring coil breakage, specification of material of coil, inspection system of coil (magnetic powder, endurance test etc.), periodical replacement according to age, quality control of coil production should be examined.
 - (vi) The vehicle should be designed and maintained so that brake should be continuously applied to every wheel axle, in order to avoid train buckling (causing decrease of wheel load, increase of wheel lateral pressure leading to derailment) due to sudden braking of locomotive.
 - (vii) In order to confirm the precise completion of track work, encouragement of practice of confirmation by finger-pointing is recommended.
- (b) Train parting
- i) Improvement of track and rolling stock which is important for reducing impact load applied to coupler, is the basic countermeasures for accidents like this. However, it may take time for execution of the above recommendation. In this regards, retaining device for lock of coupler is effective.
 - ii) Braking system should be improved (compressed air brake is better than vacuum brake) so as to ensure continuous braking, by which the parted parts will automatically stop, preventing the dangerous situations.
- (c) Level crossing accident
- i) ①First the basic information about the level crossing concerned (No. of trains per day, train speed, traffic volume of road vehicles, length, width, visibility distance from the train driver and from the road vehicle driver etc.) should be collected. Then according to these basic information, all level crossings should be classified according to their importance. According to the classification, suitable protection devices should be planned.
②The guidance to stop once before crossing the level crossing should be given to road vehicle drivers.
③All illegal level crossings should be classified into two groups based on basic information of level crossing: the one to be remained and the other to be abolished.
 - ii) Air brake should be adopted instead of vacuum brake. Further braking forces should be applied to all wheel axles by continuous braking system, which will ensure standard braking distance of train necessitated at the level crossing.
- (d) Train delay
- i) Slow down during track maintenance occupies the large share of total delay time. How to decrease the slow down during track maintenance must be examined. Track maintenance needing train slow down should be limited by rules
 - ii) Inventory control of spare parts for rolling stock and signaling system should be improved so as to provide necessary spare parts timely.
 - iii) With respect to bridge repair, firstly present situations of bridges should be fully grasped, through investigation of endurance of the bridges etc.
- (e) Recommendation on how to decrease train speed down during the track maintenance work
- According to the statistics in 2012/2013 regarding the delay of the express trains of Yangon – Mandalay line at the terminal stations of Yangon, Nay Pyi Taw and Mandalay, the average delay time at Yangon and Mandalay is 65 minutes, and that at Nay Pyi Taw is 57 minutes, indicating large delay time.

According to the results of the analysis of train delay by MR experts presented in the Workshop, delay due to train speed down during the track maintenance work occupies a large share of the total delay time (50 – 24 %).

In MR, trains are slowing down the speed during almost all medium/ large track maintenance works.

At present in Myanmar, large train delays have not yet caused any social problems. However, along with socio – economic development of the country, most socio – economic activities will be implemented on time table basis. Then large train delay will cause various social and business problems. Further, in order to compete favourably with road vehicles, punctuality of train trip should be ensured.

Then, how to decrease train delay due to slow down during the track maintenance which occupies a large share of total train delay time should be seriously studied.

JR practices regarding this issue is attached as Appendix 2-2 for the reference of MR.

In case of JR, all track maintenance work are executed in principle in the blocked time-interval. As all track works will be completed in the blocked time-interval, any train speed slow down will not be implemented after the track work.

In case of large scale track maintenance work (such as continuous replacement of rails, or sleepers, or ballast), sometimes the whole work cannot be completed in the given blocked time-interval. In such cases, a part of work, namely preparatory work is implemented before the start of blocked time-interval accompanied by train speed slow down. That is, some limited track work specified by the regulations can be implemented outside the blocked time-interval accompanied by slowing down of train.

Small scale spot track maintenance work can be executed not in the blocked time-interval, but in the regular interval between two consecutive trains. Even in that case, all track works will be completed in the interval, thus without necessitating slow down of train after the work.

It is recommended that MR tries to reduce the train delay time due to slowing down of train during track maintenance, referring to JR practices.

(f) Speed restriction

Poor track conditions, unstable embankment, old aged bridges are major locations necessitating speed restrictions. These locations should be rectified step by step.

In removing the speed restriction locations, priority should be given based on the overall evaluation of ①increase of journey speed, ②rectification cost, ③degree of danger of the situations concerned, etc.

(g) Others

- i) No.1 Outline of Y – M line explaining present situation of Y–M line including poor conditions of track and their countermeasures
 - Modernization of Y – M line is being planned with the financial support of JICA Yen loan. Modernization should be executed with full cooperation of MR experts
 - Track conditions are being grasped through riding on the vehicles. It is recommended to grasp track conditions with use of vibration measurement device.
- ii) No.2 Present issues of MR. Major issues of MR are presented by this presentation paper.
It is praiseworthy that MR staff himself tries to identify major issues of MR.
- iii) No.3 Review of technical standards of track, signaling a& operation
Major technical standards of track, signaling and operation were reviewed and presented.
These presentation are useful for JICA Experts to review these technical

standards in order for them to present recommendations on these technical standards from the viewpoint of improving safety and service level of MR.

(4) Comments of training program by MR participants

In order to find out the major response of MR experts to the Training Program (the lectures by JICA experts and Workshop), the following four questions were asked to each MR participant.

Question 1 According to your opinion, what information/ matters/ Japanese examples were especially useful for improvement of safety and service level of MR?

Question 2 Are there any other information/ matters/ Japanese experiences you would like to know more?

Question 3 Do you think the way/ method by which JICA expert team organized the workshop was satisfactory to you?

Question 4 Do you have any advice how to improve the way/ method of workshop?

The answers to each question by MR participants are as shown in Table 2.4.

- 1) With respect to Question 1, namely lectures in which MR participants were especially interested, 63% of participants felt interest in all lectures; 53% of participants felt in level crossing accident prevention, and each of signal & train operation, track, brake system, natural disaster prevention attracted interest of 16 – 20 % of participants.
- 2) With respect to Question 2, namely about any other topics in which participants want to know, nearly 40% of participants want to know Japanese railway as a whole; other topics about which participants want to know are distributed evenly among rolling stock, signal/ telecom., track, management, station yard planning, operating system, various guided transport systems.
- 3) With respect to Question 3, namely about the execution method of workshop, all participants were satisfactory.
- 4) With respect to Question 4, namely about any advice to improve the method of workshop, there were various useful comments which will be a good basis for workshops which JICA will hold in the future.

Table 2.4 Comments on Training Program by MR Participants

Question	Comments	No. of the same comment: (#1)
1 According to your opinion, what information/matters /Japanese examples were especially useful for improvement of safety and service level of MR?	1.All lectures were useful *Japanese experiences on improvement of safety/ service level are useful for drawing MR's improvement plan *MR can learn research, facilities, regulation, management, especially spirit from JR	9
	2.Level Crossing Accident Prevention *countermeasures against level crossing accidents, level crossing protection facilities	10
	3.Signal and train operation *train protection radio, signal failure prevention, signal visibility, electric point, block system,	5
	4.Track and turnout	3
	5.Brake system	3
	6.Natural disaster prevention, earthquake detection system	3
2 Are there any other information/matters/Japanese experiences you would like to know more?	1.want to know more about various matters of Japanese railways	7
	2.Want to know more about maintenance, technology of rolling stock,	2
	3.Want to know more about signalling and telecommunication system of Japanese railways	2
	4.Want to know about effective design of station yard, planning principle of diagram of station yard	1
	5.Want to know standard construction method, maintenance, organization of railway	1
	6.Want to know how JR Group increase their income	1
	7.Want to know more about track inspection and maintenance	1
	8.Shinkansen, Maglev, Metro, Monorail, train operation system (TDCS, OC, CTC, ATC, JTSS etc.	1
	9.No specific opinions	3
3 Do you think the way/method by which JICA expert team organized the workshop was satisfactory to you?	.All participants are satisfactory :*Want to have more free discussion, more workshops, more discussion on signal&telecom *Made up his mind to apply what he learned in the workshop to improvement of MR *Learned how to analyse the causes of accidents, how to establish the countermeasures	19
4 Do you have any advice how to improve the way/method of workshop?	1.Senior staff of MR should attend the workshop at least 5 days	1
	2.To hold workshop once a month chaired by GM(civil), joined by other departments, on track maintenance	1
	3.Participants of workshop should visit various facilities, institutes, field sites of Japanese railways	1
	4.To make small groups consisting of experts of various fields hold workshop and discuss accidents	2
	5.Should have more workshop	3
	6.Should have not only lectures, but also visual material such as videos	1
	7.Should use interpreters of English-Myanmar language to understand more precisely workshop	1
	8.Participants should know the contents of presentation beforehand to make discussion more fruitfully	4
	9 Should have more discussion on track maintenance with JICA experts	1
	10.Others	4

(*1)With respect to Question 1, if one participant has plural comments, say comment on Item 5 Brake system and comment on Item 4 Track and turnout, his comment on each item is counted as one comment for each item.

(5) Training for measurement of train vibration

In order to make MR experts familiarize how to apply the vibration measurement of train to control of track maintenance and improvement of vehicle performance, JICA experts instructed measurement and analysis of actual Train Vibrations on Feb. 27, and 28th. Trainings were implemented by using the device [Digital Vibration Measurement Device W0031]. Trainings included 1) how to use the device to measure the vibration and how to analyse the measured data, 2) measurement of actual MR's express train, and 3) analysis of the measured data.

The details of the training of measurement of train vibration are given below.

1) Training method of vehicle vibration measurement

(a) Measurement method

In the morning of 27th, Feb., JICA experts explained how to measure the vehicle vibration acceleration by using a measurement device with use of a guidance paper.

The device used for training is Digital Vibration Measurement Device W0031, the one which is used for measuring vehicle vibrations on the track before and after track maintenance work in the Pilot Section located between Yangon and Bago.

The device should be placed above the center of the bogie, and by connecting it to PC, measured vibration acceleration (longitudinal, lateral, vertical) can be expressed as waveforms on the screen of PC, together with the locations and train speeds corresponding to the vibration measurement values.

(b) Actual measurement of vehicle vibration

In the afternoon of 27th, Feb., vibration of two trains were measured between Nay Pyi Taw and Pyinmana.

The one is express passenger train, and the other is DC train of Japanese production.

In addition to vibration measurement, positions and times corresponding to vibration measurement values were obtained by use of GPS logger.

MR participants received training through watching how JICA experts implement vibration measurement by using the device.

(c) Analysis of the measured data

In the morning of 28th, Feb., the measured data were plotted on the riding comfort index curves prepared by JR group with the use of data analysis software programmed by JR group.

2) Recommendation

(a) At present, large vehicle vibration caused by poor track conditions are monitored by inspectors through subjective sensual feelings while riding on the train.

In place of such subjective sensual feelings, vehicle vibration measurement device should be used to evaluate objectively and precisely the vehicle vibration caused by poor track conditions.

After setting some suitable criterial values for vibration acceleration, the locations of the track where the vehicle vibration accelerations exceed the criterial values should be identified, and such locations should be rectified within allowable time limit.

Control of track conditions through vehicle vibration measurement is very effective for maintaining track for safe and comfortable train operation.

(b) Analysis of the vehicle vibration data is also useful for identifying the various issues of vehicle performance.

The "Vibration Measurement Report" attached indicates a good example how the analysis of vibration data can lead to improvement of rolling stock performance.

(c) Use of measurement device provided by JICA.

JICA provided UHA-3 Type vibration measurement device. However in the training, the UHA-3 type was not used, but the one which is used for measurement of vibration before and after the track maintenance work in the Pilot section was used. The reason why UHA-3 type was not used is because UHA-3 type cannot apply the

data analysis software which can plot the measured data on the riding comfort index curves prepared by the JR Group.

However, UHA-3 type can print out the analogue wave forms of longitudinal, horizontal and vertical vibration acceleration on the recording chart, together with the information of kilometrage distance and train speed.

Then by drawing manually the lines of allowable values for vibration acceleration on the waveforms on the recording chart, we can identify the locations of track where vibration accelerations exceed the allowable limits.

In this way we can maintain the track efficiently based on these locations so as to ensure safe and comfortable train operation.

It is recommended that MR should try to use UHA-3 type for measuring the train vibration of the lines periodically and identify the locations of the track where the vibration acceleration values exceed the allowable limits by drawing the threshold lines on the waveform chart.

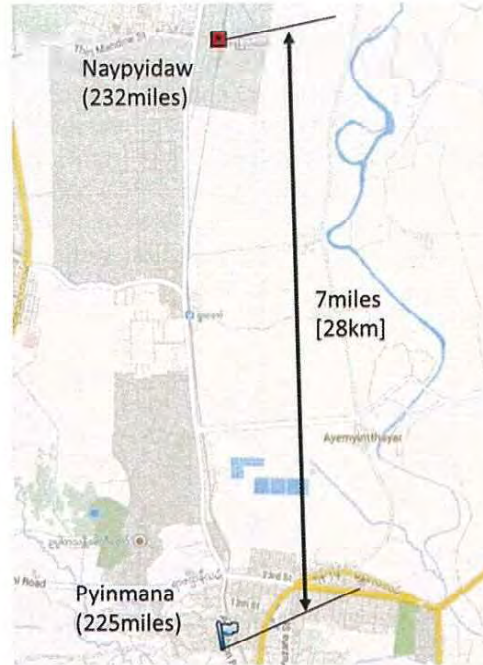
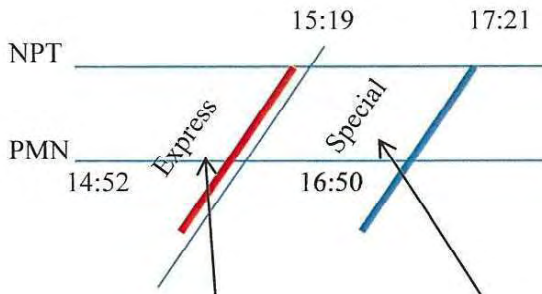
Vibration Measurement Report

1. Purpose

To observe difference of vibration between vehicles produced in Japan and Myanmar-made vehicle by using vibration meter and also to analyze the waveform.

2. Measured Section and Train Schedule

Date 27th February, 2014

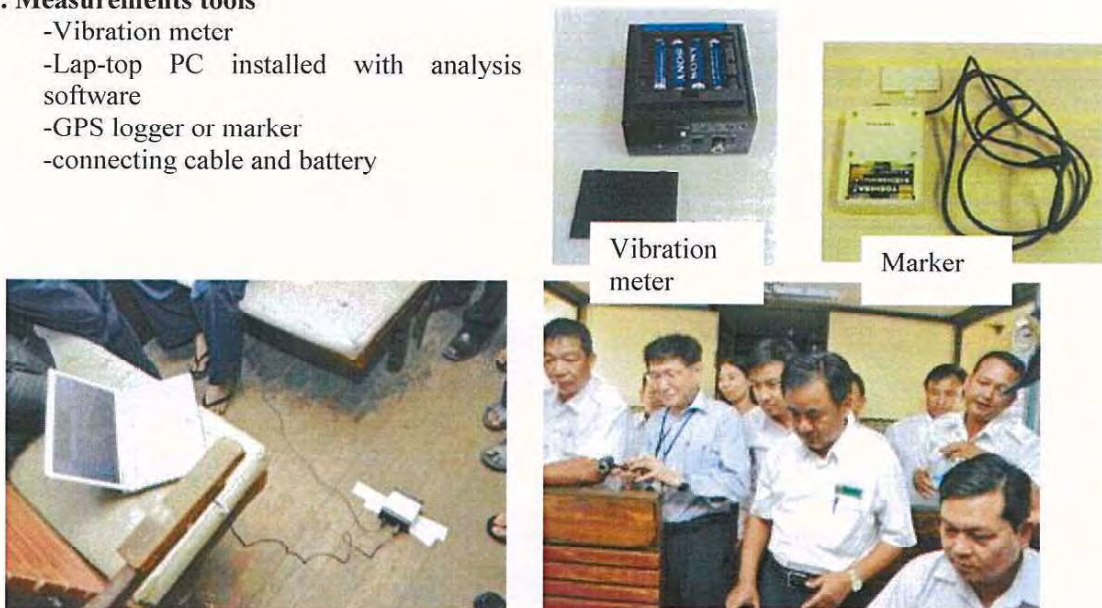


Myanmar Passenger Coach Train
and its bogie

Japanese DC (KIHA 141-8)
and its bogie(DT21)

3. Measurements tools

- Vibration meter
- Lap-top PC installed with analysis software
- GPS logger or marker
- connecting cable and battery



Picture: on Myanmar Passenger Coach

4. Result

Results of vibration measurement are shown in Fig.1 and Fig.2

Sections A, B, C, D shown in Fig.1 and Fig.2 were expanded and are shown in Fig.3 and Fig.4. Result of the ride comfort, which is analyzed by software of Railway Technical Research and Institute, are shown in Fig.5 and Fig.6.

- Amplitude of vibration is higher in passenger coach than in diesel car, especially with respect to vertical direction. (red line)
- It is estimated that resonance is happening, causing big vibration, and vibration frequency can be estimated about 2 Hz from the chart. Source of the vibration is deemed to be the low joint of rail.

5. Note

- Obviously Japanese DC is more comfortable than Myanmar PC
- It might be possible to improve the riding comfort by rolling stocks improvement.

6. Recommendation

- To avoid the resonance, two measures are considered.
One is to change the frequency of vibration system of the vehicle.
The other is to increase the damping power.
- Changing frequency is possible by changing the spring factor of vibration system.
However range of frequency cannot be changed widely, therefore resonance will happen in other train speed.
- Oil damper is installed to stabilize the vibration, however it is deemed that designed damping force is too small or oil damper is not properly working because of oil leakage or other reasons.
It is recommended to confirm the specification of oil damper whether it has sufficient damping power and confirm the maintenance procedure of oil damper whether it is properly maintained.

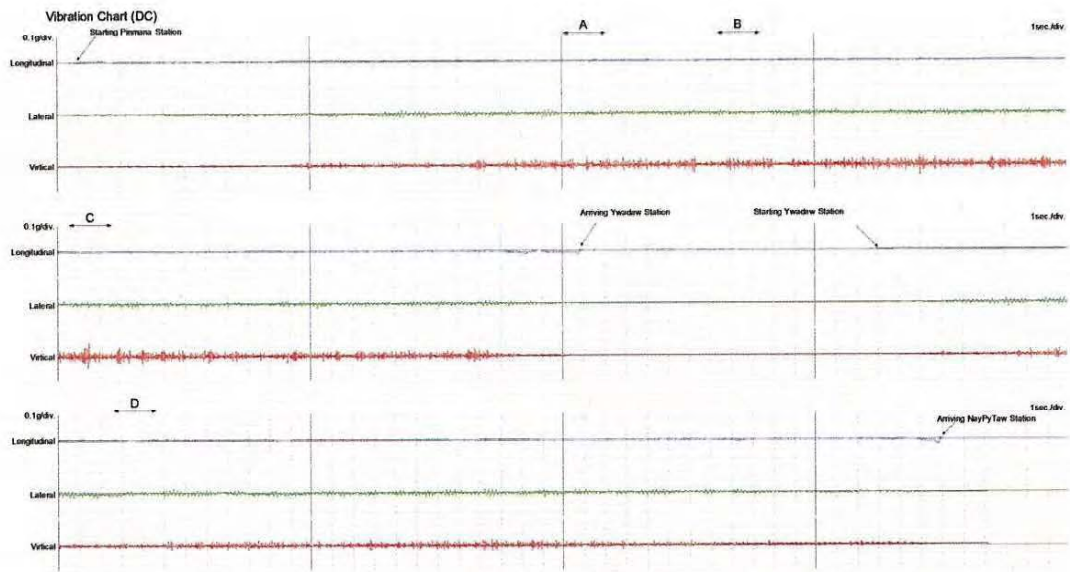


Fig.1: Vibration Data of Japanese DC

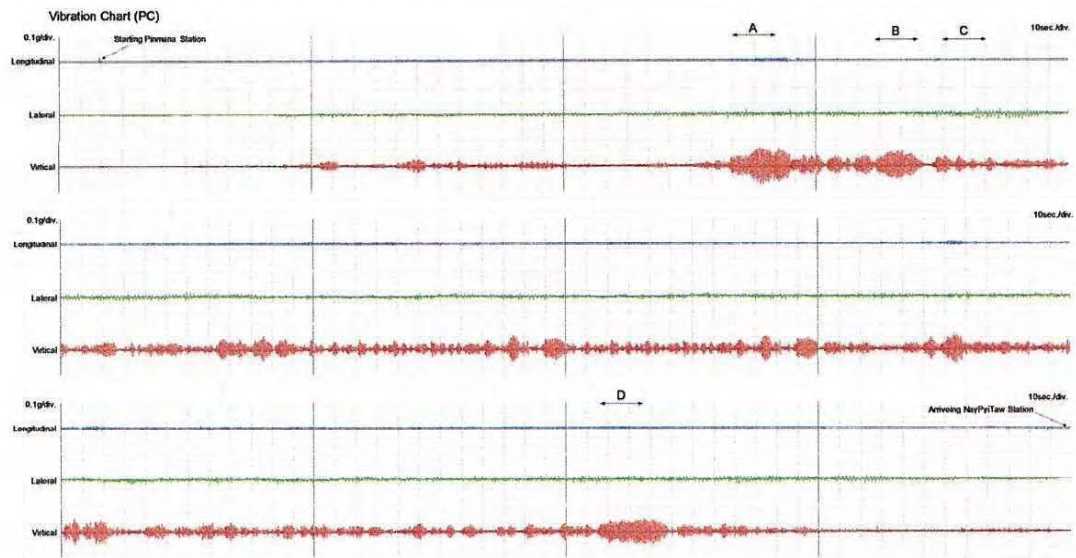


Fig.2: Vibration Data Myanmar PC

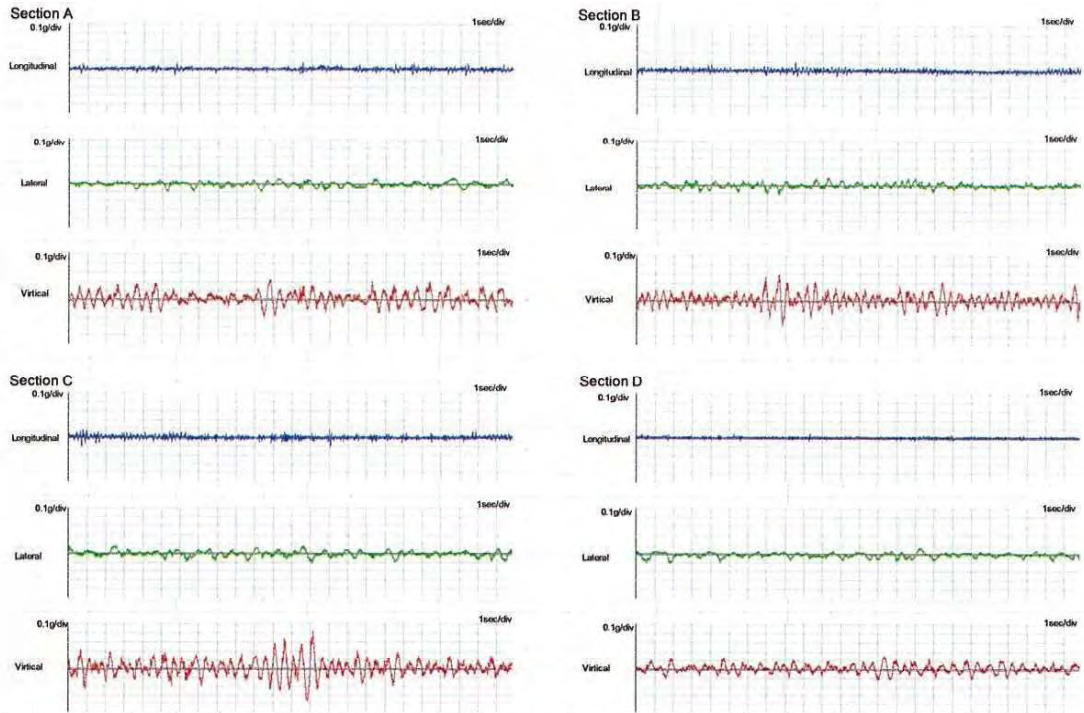


Fig3: Vibration Data of Japanese DC (Expanded Section)

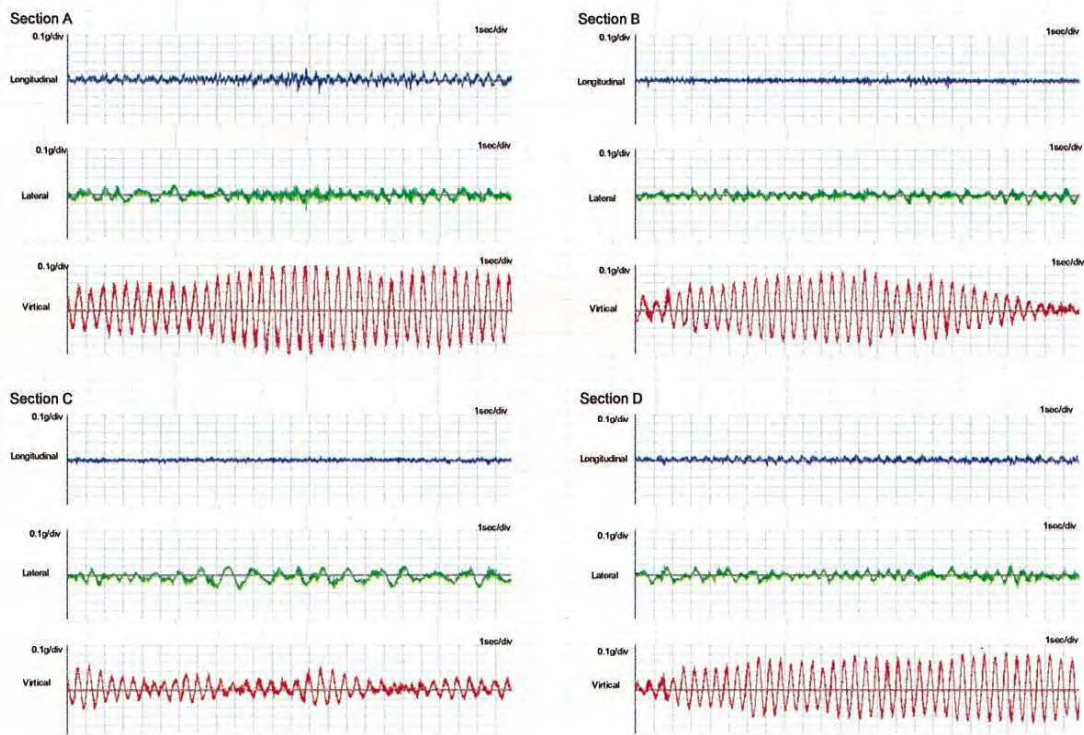


Fig.4: Vibration Data of Myanmar PC (Expanded Section)

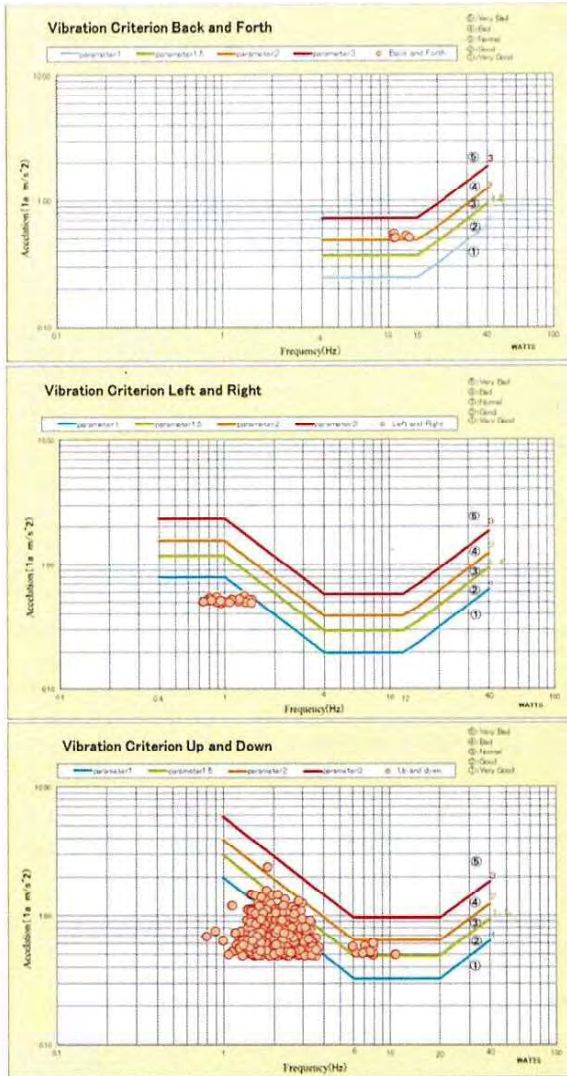


Fig5: Vibration Criterion Japanese DC

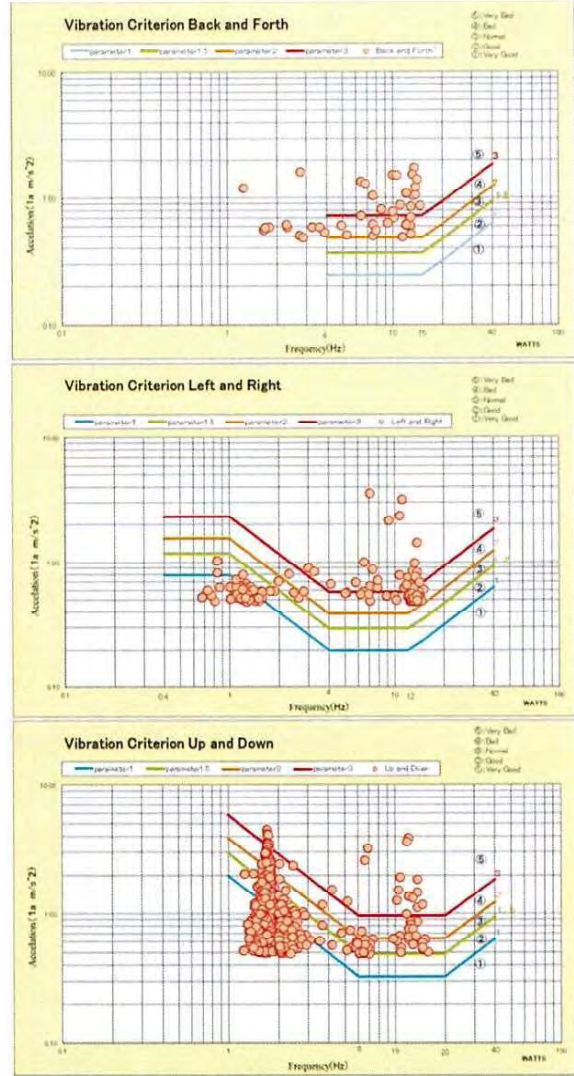


Fig6: Vibration Criterion Myanmar PC

(6) Investigation on customer satisfaction level

After implementation of the training program, Interview Survey to investigate customers satisfaction level of MR's passenger train was carried out from March 3 (preparing meeting) to March 7. The details of the interview survey and the analysis of the results are given in the following report.

Report on Result of Investigation on Customer Satisfaction Level

1. Purpose:

As one of the activities of technical supporting project "Railway Safety and Service Improvement Project", to give guidance to the counterpart with respect to the way of analysis and way of doing the questionnaire survey and the baseline survey of Myanmar Railways.

2. Investigation days and Section of investigation:

March 4 to 7, 2014

Between Yangon Station and Nay Pyi Taw Station on Yangon-Mandalay Trunk Line

3. Targeted Customer and methods for investigation:

Targeted for Myanmar Railway passengers, except foreign travelers, and interviewing on the running trains. In case of a group trip, only one passenger of the group was interviewed.

4. Sampling number:

Targeted 3 kinds of train and class, "Express Upper", "Express Ordinary" and "Local", and at least 120 passengers were sampled for each train kind/class.

Table1 : 5. Sampling number

Train kind/class	Sampling Number/Train	Train number /day	days	Target number	Actual Number
Express (Upper)	20	3	2	120	120
Express (Ordinary)	20	3	2	120	122
Local	30	2	2	120	123

5. Questionnaire item:

Refer to Attached Appendix ①

6. Analyzing Methods:

- A) Subjective Evaluation items (Q1~16) are scored and the difference of evaluation by Train kind and passenger class was analyzed
- B) The survey items (Q17~20) are for investigating the fundamental properties of passengers such as gender, age, purpose of travel and occupation.
- C) The boarding sections of passengers are plotted on the graph for each train.
- D) Due to lack of explanation, Q19 was not properly investigated. So it was excluded from analysis.

7. Result

Refer to Attached Appendix ②

8. Discussions

In general, evaluations were almost negative. Because it was assumed in advance that a negative evaluation is prevailing, evaluation levels were set at four-levels, "No particular opinion," "little bit dissatisfied", "dissatisfied" and "very dissatisfaction". The propose of this was to clarify the "level of dissatisfaction".

All questions were classified into 7 categories and comments were added as follows.

A) Riding Comfort and Train Diagram (Q 1,2,3,12, 13,14)

Passengers of every class evaluate each question very strictly. Especially about "Q1 Riding Comfortability", passengers of local train indicate displeasure more than Express passengers, even though their traveling time and distance are shorter than those of Express

train passengers. By contrast, about “Q3 Train delay”, passengers of local train indicate tolerant evaluation slightly.

Further MR should recognize that passengers of more than 90% are anxious for the increased frequency of train.

B) Facilities of Train or Station (Q4,5,6,9,10)

Compared to evaluation in A above, some more passengers evaluate these items as “nothing in Particular”. That evaluation might tend to be relatively tolerant. However, MR should recognize that passengers desire to improve them. So it can be said “Facilities are not comfortable” in general; significant improvement in facilities may be expected. It is necessary to start the improvement as early as possible.

C) Staff of MR (Q7,11)

Compared to evaluation of other questions, evaluation for station staff and train conductor is clearly severe for each class. The reason why passengers evaluated such that, may be because it is related with problems peculiar to State-owned company. MR should recognize that it is necessary to raise awareness of staff in this regard.

Improvement in this field does not require a large investment, however, as it requires a long time to achieve the target, MR should begin as soon as possible. Mind innovation of staff can expect a lot of effects. It is recommended to learn from Customer Serves Training practiced in Hotel, Air Line, and Amusement park.

D) Ticketing and fare/ charge(Q8,15)

Express passengers evaluated them relatively tolerantly, but local passengers’ evaluations are severe. For the passengers to use railway frequently, increase of number of passengers can be expected by providing them with a discount ticket, such as monthly pass and commuting tickets.

E) Use again train? (Q16)

Local passengers’ evaluations are severe in the same way as that for D above.

F) Reason why they chose the Train (Q17)

It can be understood clearly and easily that passengers of Express and local trains have different reasons for choosing Train. As also mentioned in D above, it can be a solution for increasing the number of passengers of frequent use to provide them with a discount ticket. It is necessary for MR improve services in the future by these measures according to each class. It is rather strange that more than 95 % of local train passengers are not satisfied with the fare/ charge but 70% of them indicated that reason why they chose the train is cheapness in fare. It needs more detailed investigation.

G) Frequency of Train using (Q18)

In the same way as F above, there is a clear difference between Express and local passengers. The Marketing Strategy should be established depending on the travel behaviors of passengers. For example, long-distance passengers are less frequent users, but short distance guests use trains frequently.

H) Passengers’ Personalities

a. male or female

Majority was male in Express train but female was majority in local train. This information may be useful in considering the target of service improvements in the future.

b. Generation

Any class has a similar composition of generations.

c. Propose

Any class has a similar composition of trip purposes.

d. Occupations

Reflecting that many passengers working in the market are using local trains, obvious difference of occupation can be observed between the express train and local train. In case of Express train, Occupation and “Male or Female” are correlated closely.

e. Boarding Section

The data is just a reference level. Due to small number of samples per one train, statistical analysis is difficult. At least more than 100 samples per train will be necessary for meaningful analysis. Further the survey section should be similar to each other for accurate analysis. In the future, extensive Origin and Destination (OD) Research should be done by MR.

9. Recommendations

- A) MR should recognize that severe evaluation results were indicated for all of the items and should consider a good improvement plan as soon as possible. Of course by giving the order of priority to each item, MR must start improvement from something easy and necessary.
- B) MR should accept these results frankly and also periodically implement this kind of investigation by themselves, and remind themselves that the transportation market is in the severe competitive situations. Namely the long distant trains compete with bus or aeroplane, and short or middle distant trains compete with the mobile car.
- C) All subjects need improvement, but improvement should be started from the field where a lot of passengers are involved. By doing so, not only large effect and impact can be expected, but also improvement results can be disseminated to the media

Finally, we express our thanks to every person who cooperated with executing the survey and also to the executives of MR who supported our activities.

Pictures: Ongoing invitation



Express Upper Class on Mar. 4



Express Ordinary Class on Mar. 4



Local on Mar. 7

Appendix ①

Please answer the following questions about the Myanmar railway passenger Services.

Q1 About riding comfortability.

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q2 About Train speed

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q3 About Train Delay

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q4 About Cleanness in Train Cabin

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q5 About Cleanness in Train Restroom

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q6 About Comfortability of Train Seat

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q7 About Attitude of Train staff (Guard)

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q8 About Ticket booking at Station

Nothing in Particular		Little bit Dissatisfaction		Dissatisfaction		Very Dissatisfaction
4	—	3	—	2	—	1

Q9 About waiting facilities at Station

Nothing in Particular		Little bit		Dissatisfaction		Very Dissatisfaction
-----------------------	--	------------	--	-----------------	--	----------------------

- | | | | | | | | |
|--|---|---|-----------------|---|---|---|---|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Dissatisfaction | | | | |
- Q10 About Cleanness in Station Restroom
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q11 About Attitude of Station staff
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q12 About Train Departure Time Table
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q13 About Train Arrival Time Table
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q14 About Train Frequency
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q15 About Train Fare/ Charge
- | | | | | | | | |
|--|---|---|-------------------------------|---|-----------------|---|----------------------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | | | Little bit
Dissatisfaction | | Dissatisfaction | | Very Dissatisfaction |
- Q16 Do you want to use Railway Service again?
- | | | | | | | | |
|--|---------------------|---|--------------------------|---|--------------------|---|----------|
| | 4 | — | 3 | — | 2 | — | 1 |
| | Little bit
Agree | | Nothing in
Particular | | Rather
Disagree | | Disagree |
- Q17 What is the reason for choosing Railway? (Multiple choice is OK)
- Cheap Fare/ charge
 - Railway Station Close to departure/arrival place
 - A lot of luggage
 - Other ()
- Q18 How often do you use the Railway service?
- Almost every day
 - 2 or 3 times every week

- 1 time every week
- 1 time every month
- 5 or 6 times annually
- 1 to 4 times annually
- the first time

Q19 What kind of improvement do you want for Railway service? (Please put the priority order in the box)

- Punctuality
- Faster than Bus
- Less rattling and more comfortable
- No accident
- Cleanness in the Cabin

Q20 Please tell us about yourself.

Male Female age _____s' years old

Boarding section
From _____ Station to _____ Station

Purpose of trip

- Business Leavening from/Returning to home Sightseeing
- Other()

Occupation

- Public officials Company employee Commerce or self-employed
- Farmer or fisher Students other ()

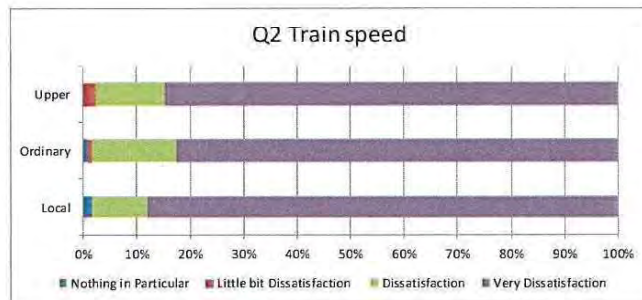
Q1 Riding comfortability

	Local	Ordinary	Upper
Nothing in Particular	2	2	0
Little bit Dissatisfaction	2	2	2
Dissatisfaction	9	25	25
Very Dissatisfaction	113	89	89



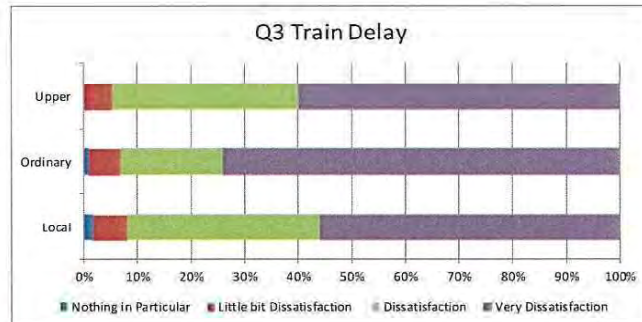
Q2 Train speed

	Local	Ordinary	Upper
Nothing in Particular	2	1	0
Little bit Dissatisfaction	0	1	3
Dissatisfaction	13	18	15
Very Dissatisfaction	109	95	100



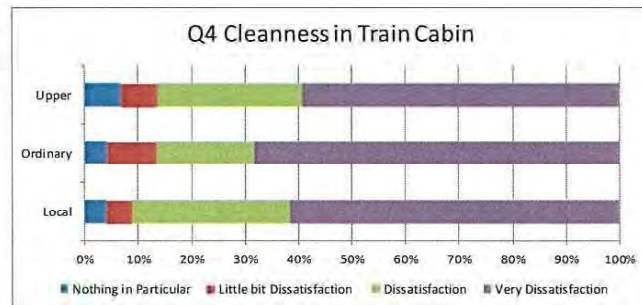
Q3 Train Delay

	Local	Ordinary	Upper
Nothing in Particular	2	1	0
Little bit Dissatisfaction	8	7	6
Dissatisfaction	45	22	40
Very Dissatisfaction	70	86	69



Q4 Cleanness in Train Cabin

	Local	Ordinary	Upper
Nothing in Particular	5	5	8
Little bit Dissatisfaction	6	11	8
Dissatisfaction	37	22	32
Very Dissatisfaction	77	82	70

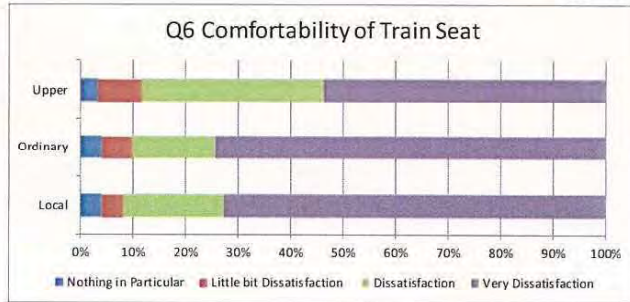


Q5 Cleanness in Train Restroom

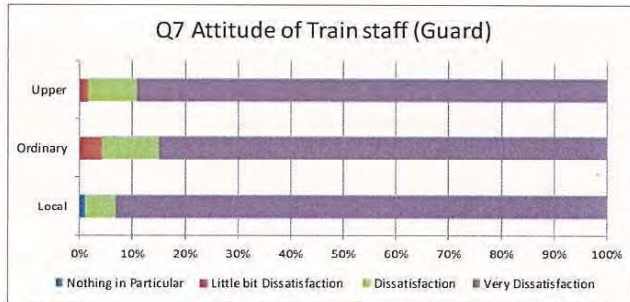
	Local	Ordinary	Upper
Nothing in Particular	5	3	4
Little bit Dissatisfaction	8	8	10
Dissatisfaction	43	27	33
Very Dissatisfaction	68	81	70



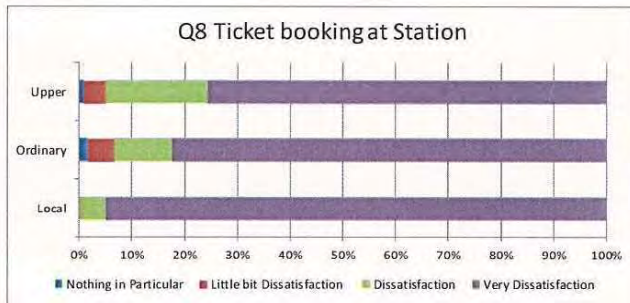
	Local	Ordinary	Upper
Nothing in Particular	5	5	4
Little bit Dissatisfaction	5	7	10
Dissatisfaction	24	19	41
Very Dissatisfaction	91	90	64



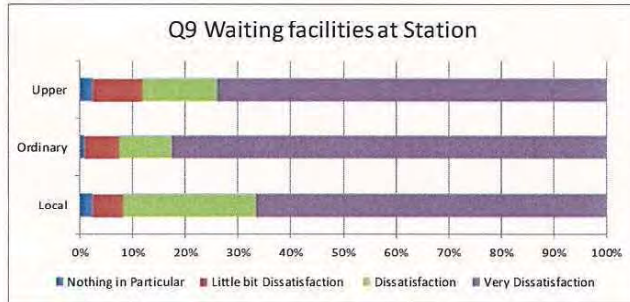
	Local	Ordinary	Upper
Nothing in Particular	1	0	0
Little bit Dissatisfaction	0	5	2
Dissatisfaction	6	13	11
Very Dissatisfaction	96	102	106



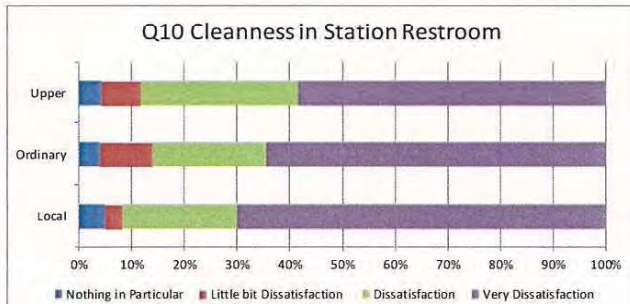
	Local	Ordinary	Upper
Nothing in Particular	0	2	1
Little bit Dissatisfaction	0	6	5
Dissatisfaction	6	13	23
Very Dissatisfaction	114	98	90



	Local	Ordinary	Upper
Nothing in Particular	3	1	3
Little bit Dissatisfaction	7	8	11
Dissatisfaction	30	12	17
Very Dissatisfaction	80	100	88

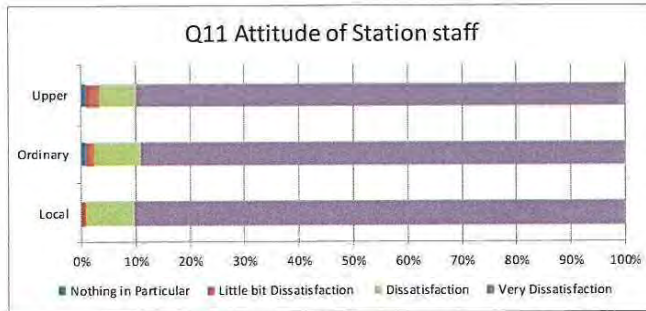


	Local	Ordinary	Upper
Nothing in Particular	6	5	5
Little bit Dissatisfaction	4	12	9
Dissatisfaction	26	26	35
Very Dissatisfaction	84	78	69



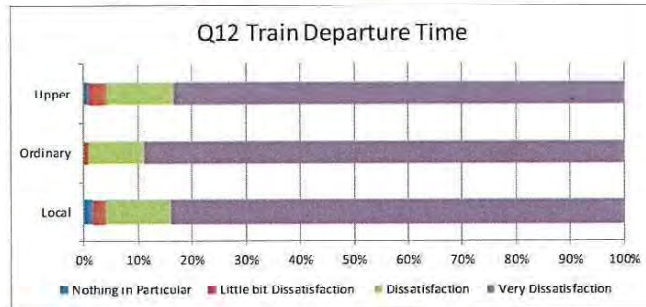
Q11 Attitude of Station staff

	Local	Ordinary	Upper
Nothing in Particular	0	1	1
Little bit Dissatisfaction	1	2	3
Dissatisfaction	11	10	8
Very Dissatisfaction	112	106	106



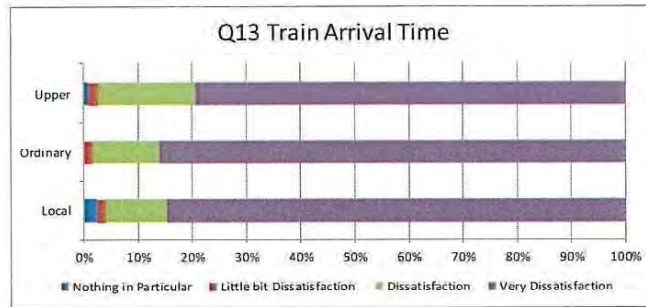
Q12 Train Departure Time

	Local	Ordinary	Upper
Nothing in Particular	2	0	1
Little bit Dissatisfaction	3	1	4
Dissatisfaction	15	12	15
Very Dissatisfaction	104	104	99



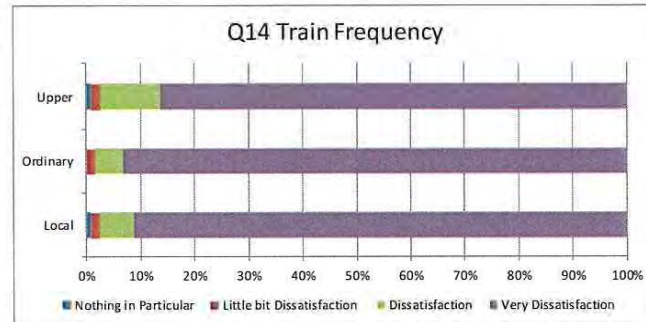
Q13 Train Arrival Time

	Local	Ordinary	Upper
Nothing in Particular	3	0	1
Little bit Dissatisfaction	2	2	2
Dissatisfaction	14	14	21
Very Dissatisfaction	106	99	92



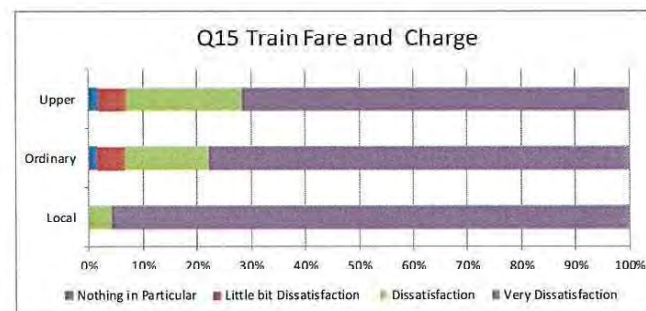
Q14 Train Frequency

	Local	Ordinary	Upper
Nothing in Particular	1	0	1
Little bit Dissatisfaction	2	2	2
Dissatisfaction	8	6	13
Very Dissatisfaction	113	111	101



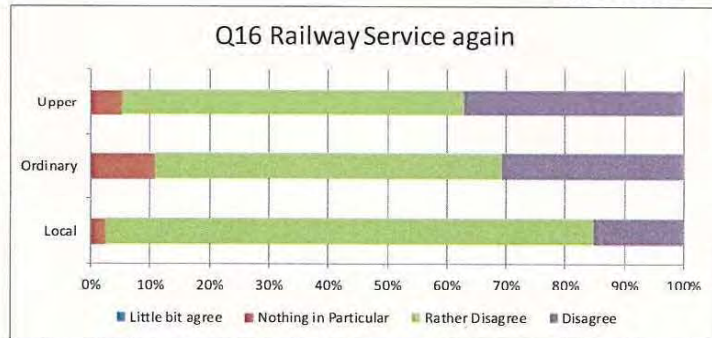
Q15 Train Fares and Charge

	Local	Ordinary	Upper
Nothing in Particular	0	2	2
Little bit Dissatisfaction	0	6	6
Dissatisfaction	5	18	24
Very Dissatisfaction	116	91	81



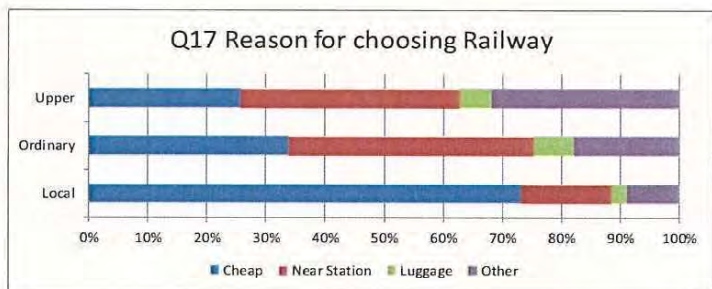
Q16 Railway Service again

	Local	Ordinary	Upper
Little bit agree	0	0	0
Nothing in Particular	3	12	6
Rather Disagree	98	65	65
Disagree	18	34	42



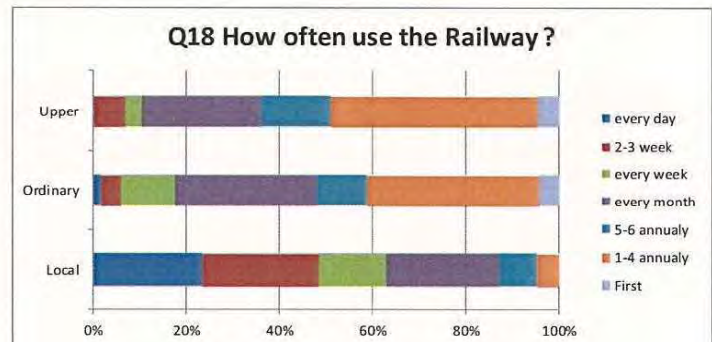
Q17 Reason for choosing Railway

	Local	Ordinary	Upper
Cheap	90	40	29
Near Station	19	49	42
Luggage	3	8	6
Other	11	21	36



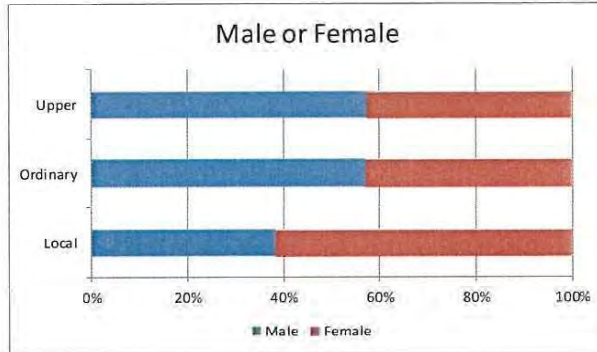
Q18 How often do you use the Railway service ?

	Local	Ordinary	Upper
every day	29	2	0
2-3 week	31	5	8
every week	18	14	4
every month	30	36	29
5-6 annually	10	13	17
1-4 annually	6	44	51
First	0	5	5



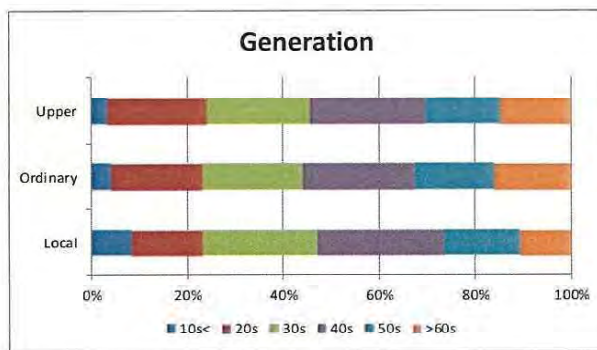
Male or Female

	Local	Ordinary	Upper
Male	45	69	67
Female	73	52	50



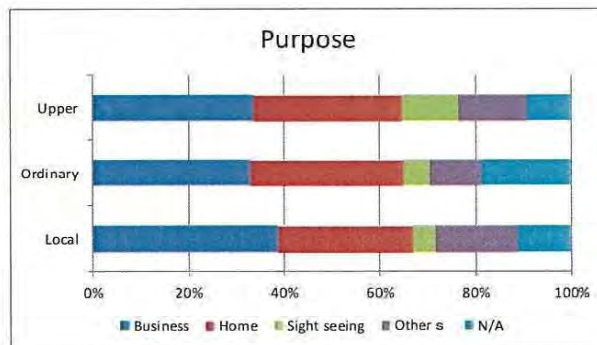
Generation

	Local	Ordinary	Upper
10s<	10	5	4
20s	18	23	24
30s	29	25	25
40s	32	28	28
50s	19	20	18
>60s	13	19	17



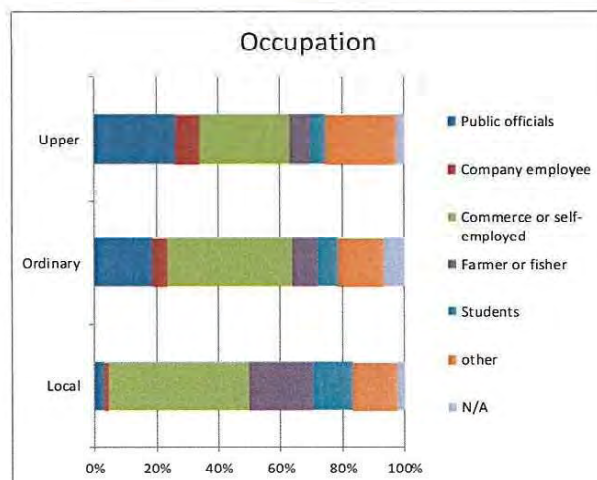
Purpose

	Local	Ordinary	Upper
Business	48	40	40
Home	35	39	37
Sight seeing	6	7	14
Others	21	13	17
N/A	14	23	11

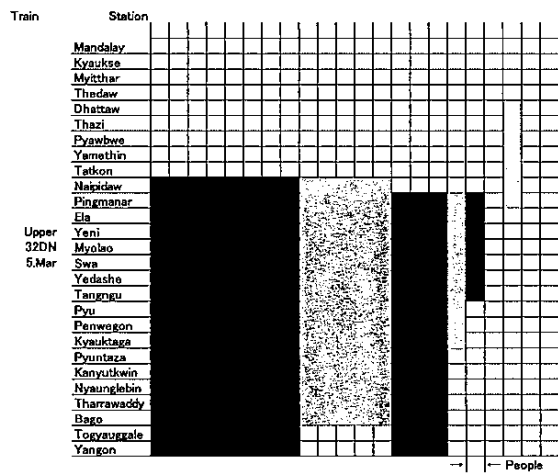
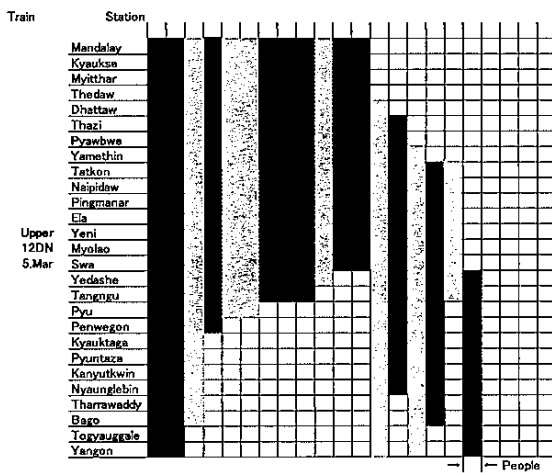
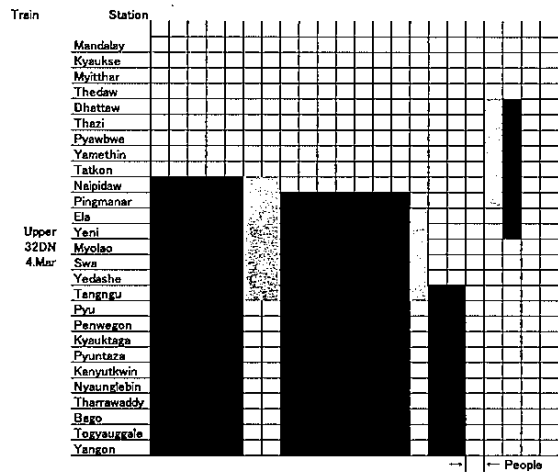
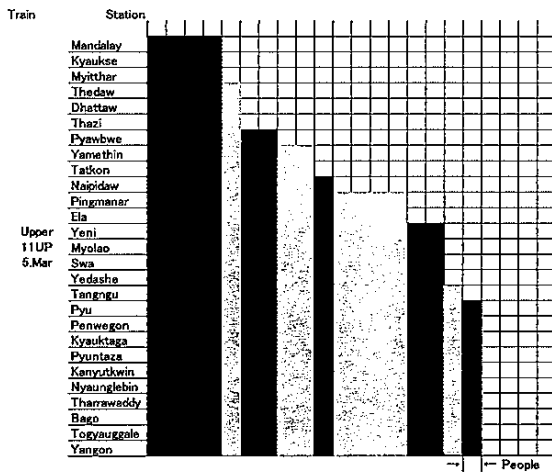
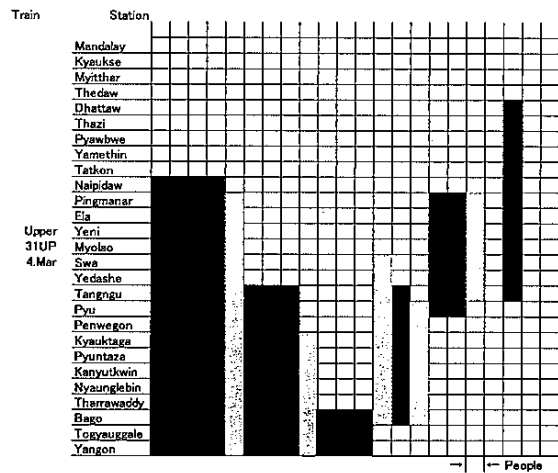
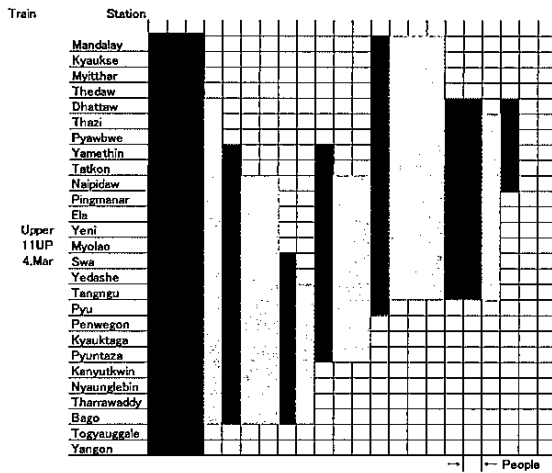


Occupation

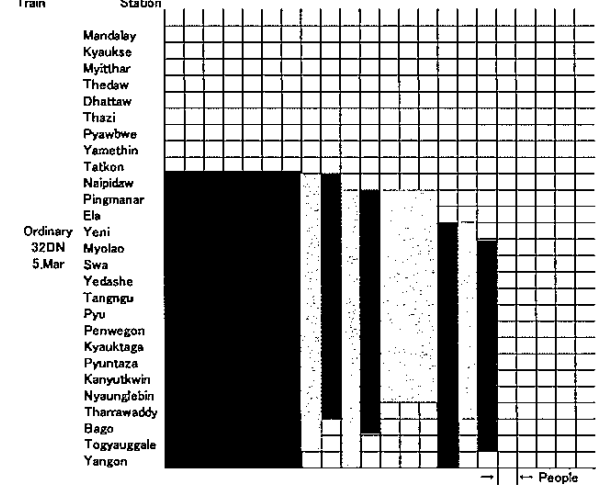
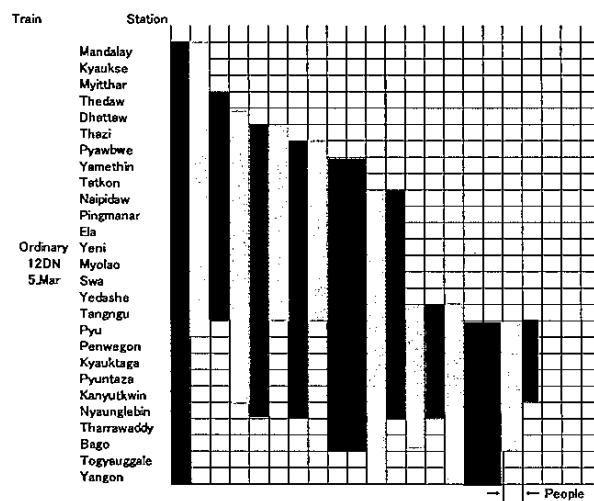
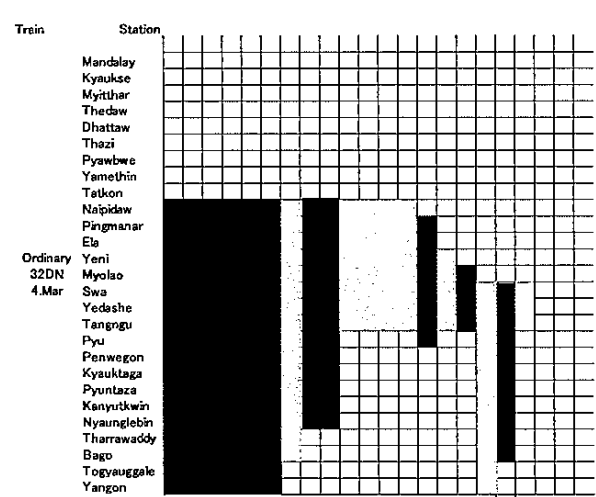
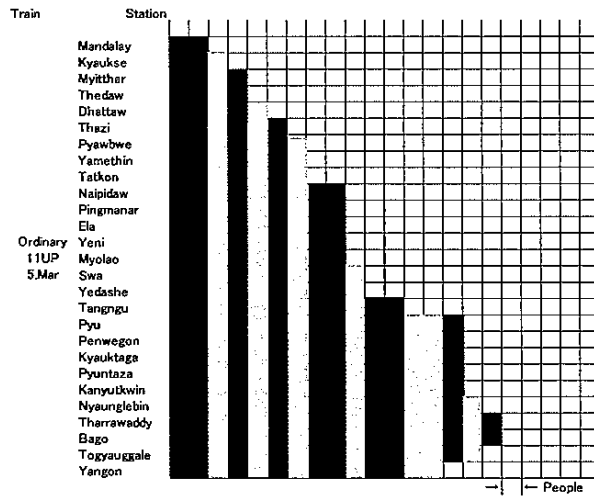
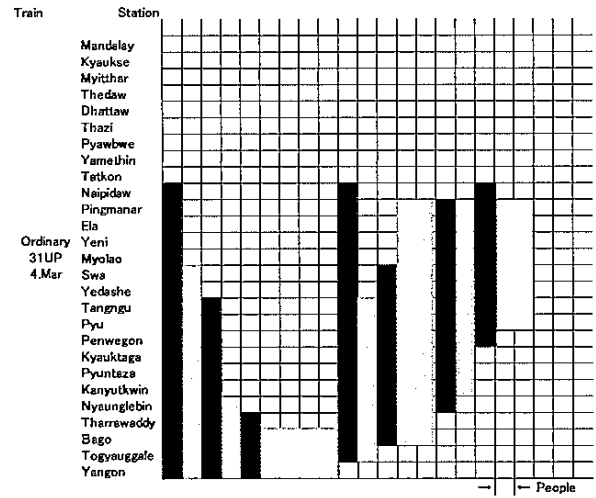
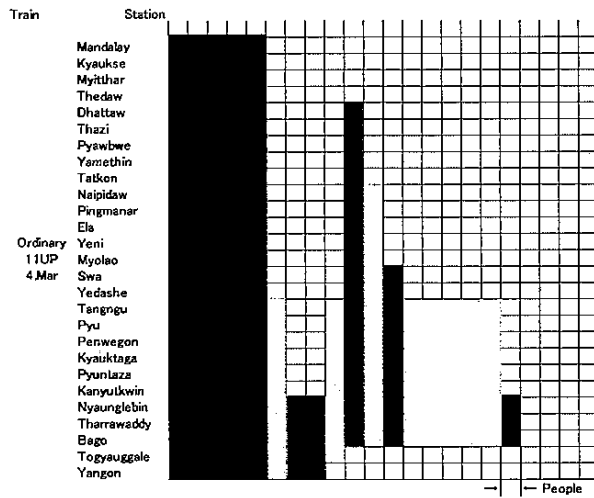
	Local	Ordinary	Upper
Public official	4	23	31
Company em	2	6	10
Commerce o	57	49	34
Farmer or fish	26	10	8
Students	16	8	6
other	18	18	27
N/A	3	8	3



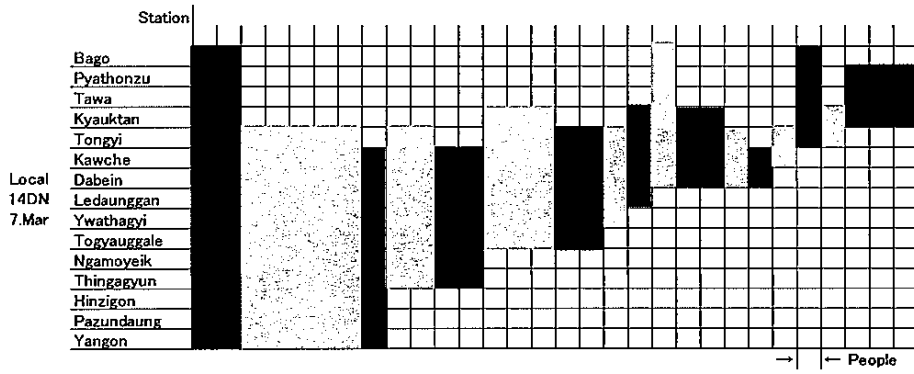
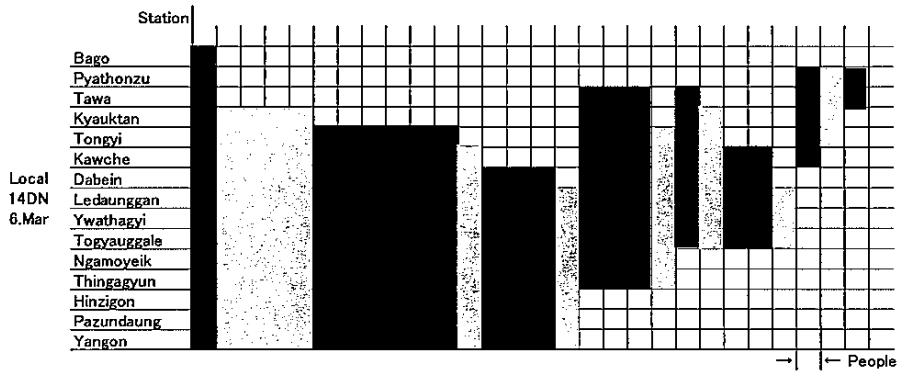
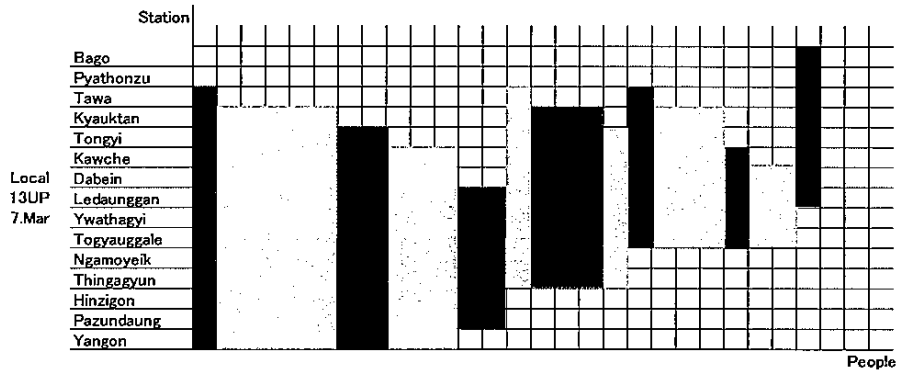
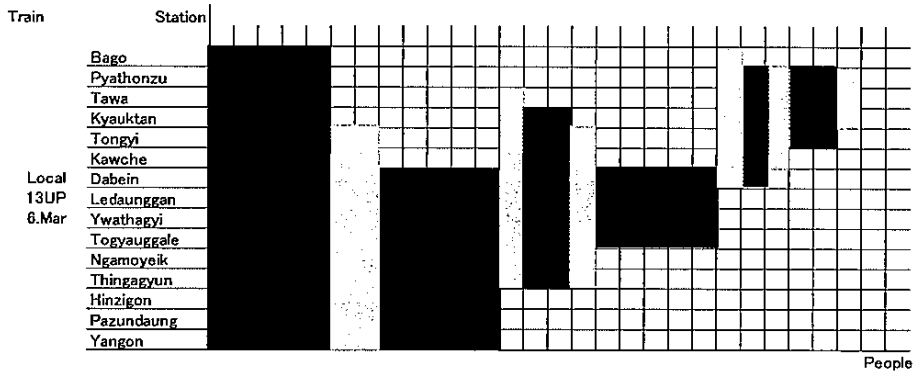
Train Ridership (Express Upper Class)



Train Ridership (Express Ordinary Class)



Train Ridership (Local)



2.1.4 Recommendation on technical standards relating to administrative and maintenance aspect to improve the service level and safety

Relevant technical standards in the fields of civil, signal/ telecommunication, operation, rolling stock engineering have been supplied by MR. Preparation of recommendations on these technical standards have been just started.

2.1.5 Drawing up of short-, medium-, and long-term railway facilities improvement plan

The activity has just been started. The improvement plans will be prepared through discussion in the Working Group consisting of MR senior officials concerned and JICA experts. The plan will take into account MP and FS by JICA study Team

2.1.6 Education/ training in Japan

11 officers for MR will be invited to Japan for two weeks in October, 2014.

The training program is going to be proposed. Kindly review the program after submission; we are pleased to modify the program with due consideration on suggestions/ advices of MR.

2.2 Technology Transfer of Track Maintenance Technology to improve the level of Service and Safety through Implementation of The Pilot Project

2.2.1 Drawing up a plan for technology transfer

The system of track maintenance work currently in practice in Myanmar is a version of the old-fashioned system implemented in the past in Japan. Through this Project, track maintenance workers of MR shall receive education/training of basic track maintenance works, while aiming at a mechanized maintenance system to use large-scale maintenance machines in the future. This means a conversion from the current gang system to a larger sized maintenance depot system or a re-construction of maintenance system. Bearing in mind this long-term vision, we prepare a plan for technology transfer focused on the track maintenance OJT for two years.

See Table 2.2 for the schedule (planning and result) of technology transfer.

Table 2.2 Tentative Schedule (Track Maintenance)

Subject	F Year		2013												2014												2015					The degree of achievement (%)	Note			
	Month	Past Month	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5									
			0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24									
4.2.1 Drawing up a technical transfer plan (1) Collection of basic information (2) Plan of technical transfer																																	100			
																																	100			
4.2.2 Selection/procurement of equipments/tools (1) Selection of equipments/tools (2) Acquisition of import license, tax exemption procedure (3) Import procedure (4) Freight control																																		100		
																																		100		
																																		100		
																																		36		
4.2.3 Selection of Pilot Section (1) Site witnessing (2) Selection of a section (3) Base line survey																																		100		
																																		100	Change pilot section in March	
																																		100		
4.2.4 Implementation of track maintenance work (inspection, planning, work, control) (1) Compilation of text books (2) Classroom education and practical training (seminar) (3) Prior measurement and survey at the Pilot Section Implementation of work After completing the maintenance work of a 100 m-section in principle, move to the next 100 m-section (with the number of working days depending on the workload of each 100 m-section).																																			100	
																																			66	
																																			47	Pallarell with Implementation of work
																																			42	
4.2.5 Education/training (1) Seminars on the improvement of track maintenance technologies (2) Education/training in Japan																																			25	
																																			0	
4.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards																																			0	
4.2.7 Final smmarization and seminars																																			0	
Discussion on the report/JCC Submission of the report (JICA)																																				

2.2.2 Procurement of the required equipments / tools

74 kinds of equipments/tools were imported to Myanmar from Japan and maintenance staffs are using them now. 74 kinds of equipments/tools are explained in the 2nd JCC Report

2.2.3 Selection of Pilot Section

In the 46.5 mile section (74.8 km long) between Yangon and Bago, we implement track maintenance as a means of technical transfer in the approximately 20 km-long Pilot Section, which was selected through a site survey to allow experiencing maintenance of different track structures, such as defective, sound, straight and curved tracks, turnouts in station yards and bridges, so that the effect of technical transfer is readily obtainable.

Japan side proposed the pilot section consisting of Pilot Section 1 and Pilot Section 2 at the 1st JCC. This is selected by the reason that there are many types of tracks and structures such as straight line, curve, turnouts and bridges, etc in Pilot Section 1 and the vehicle vibration acceleration values are big according to the results of vibration measurement in Pilot Section 2.

We proposed the Pilot Section by the formal letter which was agreed by the Myanmar side, and the Myanmar side wanted to start the track maintenance practice in Pilot Section 2 earlier than that in the Pilot Section 1 because Pilot Section 2 has very bad track conditions.

After that, there was a request of early start of track maintenance practice in the section from 12km200m to 14km550m between Toekyaungkalay Sta. and Ywathargyi Sta. from Myanmar side on 11th December. Thereby, the order of track maintenance practice in the Pilot Section was changed from 16th December.

At the end of March, we were requested by MR to include not only Yangon-Mandalay line but also Dagon University line and Thilawa line branching at Toekyaungkalay Sta. Now we are implementing training on these branch lines. At first, we selected the Pilot Section of 20km, but as track maintenance training progresses, Pilot Section was requested to be enlarged and implementation priority order of training sections was changed under mutual agreement.

2.2.4 Implementation of track maintenance (inspection, planning, work and control)

Implementation items of track maintenance training are as shown below. Contents are the same as those indicated in the 2nd JCC Report. So kindly refer to the 2nd JCC Report.

- (1) Compilation of text book
- (2) Classroom education and practices (seminars)
- (3) Implementation of prior measurement and surveys of the Pilot Section
- (4) Implementation of inspection, planning and work in the Pilot Section
 - 1) Ballast compacting work (use of hand tie-tampers, beaters or shovels)
 - ① Inspection of track irregularities and conditions
 - ② Correction of track irregularities
 - 2) Ballast sieving
 - ① Inspection of ballast
 - ② Execution of work
 - 3) Rail renewal work
 - ① Inspection of rail
 - ② Rail renewal work
 - 4) Rail joint work (rework on rail clearance (rail joint clearance), correction of rail joint depression)
 - ① Inspection of rail joint
 - ② Clearance correcting work
 - ③ Fail joint correcting work
 - 5) Track realignment work
 - ① Inspection of track displacement
 - ② Irregular alignment correcting work
 - 6) Turnout maintenance work
 - ① Inspection of turnout
 - ② Repair and renewal of turnouts

7) Inspection and maintenance of bridge sections

① Inspection

② Maintenance work

8) Correction of track gauge

① Inspection

② Correction work

9) Welding of rails (preparation of long-rails and a measure to strengthen rail joints)

10) Improvement of formation

① Inspection of ballast and roadbed

② Although a standard width of formation is specified in Myanmar, we found through site surveys that sufficient widths are not maintained. To fully exert the effect of aforementioned ballast compacting work, we guide MR to expand the width of formation where it is insufficient.

11) Control and evaluation of track conditions

At the beginning, the members of track maintenance training were about 30 workers living in Yangon suburbs. At the middle of May, the members from Bago went back to their own depots, and are implementing maintenance of track by themselves now. New members from Division 5, 8 and 9 have been added and are now tackling with track maintenance. We are expecting that in the near future they will improve or maintain Yangon – Mandalay line and other lines as leaders of track maintenance groups.

2.2.5 Education/training

In Myanmar, a rainy season starts every year at the end of May. As the track maintenance work in a rainy season is apprehended to adversely affect track beds, we are going to implement education/training from the end of May to October, 2014..

(1) Seminars to improve track maintenance technologies

We assess the level of track maintenance technologies of MR employees and compile appropriate text books. Thereafter, we hold seminars to improve track maintenance technologies for those participated in the maintenance of pilot section (approximately 20 members) three times: at the start of track maintenance OJT, after completion of track maintenance and at the final summarization of track maintenance OJT.

(2) Education/training in Japan

We implement a two-week education/training program twice in Japan (1st group is from 9th to 20th in June and 2nd group is 23th in June to 4th in July.) each for approximately 11 trainees including some MTT operators, in which education/training on track technologies (centering on lectures and practical training) will be performed under the cooperation of JR East and Japan Railway Track Consultants, at the Integrated Education/Training Center (Shin-Shirakawa), JR

East. MTT operators are included in the above program to prepare for introduction of MTTs into track maintenance in the future.

Trainees will practice actual work at the side tracks, and observe the nighttime work to use MTTs in the suburbs of Tokyo.

We will discuss the detailed contents of curriculum with MR so as to make training to meet the needs of MR engineers, and will also discuss with MR about suitable timing of training in Japan.

2.2.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards

We summarize the points of reflection through the whole of maintenance work and compile the maintenance manuals to meet the present status of the track maintenance in Myanmar in consideration of the local organizations, working conditions and climates. The essentials of maintenance manuals will be easy to use, while including the steps of work and handling of machines/materials for track maintenance.

2.2.7 Final summarization and seminars

In closing the above technical transfer course on track maintenance work, we will open seminars for the trainees participated in the program and track maintenance members for other sections selected through consultation with MR. As this is the final step for MR employees to receive technology transfer, which is expected to evolve as a model shop to every section of the country in the future, we will avail ourselves of this opportunity to totally wipe unknowns out of MR members regarding the whole of track maintenance work.

2.2.8 Others

To implement the Project more smoothly, some JICA track experts were added to the original JICA experts.



Distribution of safety shoes to new members



Morning assembly



Sign Board in Toekyaungkalay Sta.



Temporary Dormitory for trainee



Track Raising of turnout



Exchanging sleeper of turnout



Motor Raising of turnout



After track maintenance

3. Concluding remarks

We are still halfway in the whole completion of the Project, and have various significant activities to be executed in the coming period.

We would like to continue our activities effectively with the cooperation from MR officials concerned.

Table 1 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments Major issues of MR and Advice By JICA Experts
Derailment between stations	<ol style="list-style-type: none"> 1. Cause Analysis 2. Establishments of countermeasure 	<ol style="list-style-type: none"> 1. Comments on Method of Cause Analysis 2. Comments on Establishments of countermeasures 3. Major issues of MR made clear through discussion, and advice
No.1 Magyinbin – Takton	<ol style="list-style-type: none"> 1. Caused by large cross level irregularity 2. Intensification of track inspection and maintenance of track 	<ol style="list-style-type: none"> 1. <ul style="list-style-type: none"> • Twist of track should be checked. • Why the regular inspection cannot find this large cross level irregularity should be examined. 2. Twist of the track should be checked. Why the regular inspection cannot find out this large cross level irregularity should be examined and inspection system should be revised as required. 3. <ul style="list-style-type: none"> • Twist of the track should be checked regularly. • Inspection of track irregularity should be executed not by eye-sight but by measurement by string or measuring devices.
No.2 Nyaunglaybin – Tawwi	<ol style="list-style-type: none"> 1. Caused by large cross level irregularity caused by roadbed settlement. 2. Placement of sand layer and installment of drainage pipe for roadbed sinkage prevention 	<ol style="list-style-type: none"> 1. The same comment as that for No.1 derailment 2. <ul style="list-style-type: none"> • Twist of the track should be inspected. • Measurement of track irregularity not by eye-sight, but by measuring devices Spacing of drainage pipe should be smaller. 3. <ul style="list-style-type: none"> • Twist track should be checked. • Measurement of track irregularity should be executed by measuring device • spacing of drainage pipe and maintenance of drainage pipe should be examined.
No. 3 Kyedaw – Kyungon	<ol style="list-style-type: none"> 1. Breakage of coil spring of wheel axle 2. Replacement of coil spring, & intensification of coil spring inspection 	<ol style="list-style-type: none"> 1. Shock by bad track and fatigue of metal should be examined. 2. <ul style="list-style-type: none"> • Inspection such as magnetic powder inspection should be considered. • specification of material of coil, quality control of coil production should be examined, 3. Specification of coil, inspection system of coil (magnetic powder, endurance test etc.), periodical replacement according to ages, quality control of coil production should be examined.

Table 2 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments and Advice By JICA Experts
Derailment in station yards	<ol style="list-style-type: none"> 1. Cause Analysis 2. Establishments of countermeasure 	<ol style="list-style-type: none"> 1. Comments on Cause Analysis 2. Comments on Establishments of countermeasure 3. Major issues of MR made clear through discussion, and advice
No.1 (Nay Pyi Taw station)	<ol style="list-style-type: none"> 1. Clamp to fix tong-rail was not fixed completely, and the tong-rail shifted during the movement of wagon, resulting in derailment. Human error not to fix clamp completely. 2. Training and punishment 	<ol style="list-style-type: none"> 1. Cause analysis to judge as the human-error is proper. 2. In addition to training and punishment, practice of confirmation by finger-pointing should be encouraged 3. Review of Work manual, intensification of training and encouragement of practice of confirmation by finger-pointing are recommended.
No.2 (Taungoo station)	<ol style="list-style-type: none"> 1. Caused by combination of ① rapid growth of cross level irregularity due to the mud pumping roadbed and ② sudden braking of locomotive. 2. Maintenance of cross level and training of locomotive drivers, 	<ol style="list-style-type: none"> 1. Analysis of causes by combination of cross level and sudden braking of locomotive (causing decrease of wheel load or increase of lateral pressure of wheel) is appropriate. 2. In addition to cross level maintenance and training of loco. drivers, twist of track should be checked. Further overall examination of similar track conditions in the station concerned and other stations should be executed. 3. <ul style="list-style-type: none"> • Twist of the track should be maintained. • Brake should be applied to every wheel axle. The vehicle should be designed and maintained in this way.
No.3 (Yamethin station)	<ol style="list-style-type: none"> 1. Gauge widening due to decrease of rail supporting force of dog spike because of deterioration of wooden sleeper. 2. Strengthening of the track concerned and review of inspection system 	<ol style="list-style-type: none"> 1. Why regular inspection could not find the dangerous situation should be examined. 2. Overall examination of the similar track conditions should be executed for the station concerned and other stations. 3. <ul style="list-style-type: none"> • Why regular inspection could not find out the track condition concerned should be examined. • Overall examination of important sidings of the station concerned and other stations should be executed.

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Table 3 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments, Major issues of MR, and Advice By JICA Experts
Train Parting	<ol style="list-style-type: none"> 1. Method of Cause Analysis 2. Establishments of countermeasures 	<ol style="list-style-type: none"> 1. Comments on Method of Cause Analysis 2. Comments on Establishments of countermeasures 3. Major issues of MR made clear through discussion, and advice
No.1 Express Train (7 up) Train parting between BDUEZ 12723 and BBEZ 10571	<ol style="list-style-type: none"> 1. Spacer pin for locking of coupler was removed, and in place of it, temporary galvanized wire tie was used, and it was broken. Then coupler was unfastened 2. Checking and replacement of coupler parts. 3. improvement of maintenance standards of coupler 	<ol style="list-style-type: none"> 1. Spacer pin was installed by modification because decoupling occurs frequently. Normally coupler may not be unfastened , even if space pin comes out. Initial cause of the accident is different. 2. If the braking system is well arranged, after parting, the parted parts will automatically stop, preventing the dangerous situations. 3. Braking system should be improved (compressed air brake is better than vacuum brake) so as to ensure continuous braking.
No.2 Express train (3 up) Train parting between BDTEZ 12508 and BDTEZ 12557	<ol style="list-style-type: none"> 1. Coupler was unlocked and knuckle was open due to impact load of track 2. Fix completely the coupler parts. 	<ol style="list-style-type: none"> 1. There is no accident like this in Japan. 2&3 Improvement of track and rolling stock which is important for reducing impact load applied to coupler, is the basic countermeasures for accidents like this. <p>However, it may take time for execution of the above recommendation. .In this regards, retaining device for lock of coupler is effective.</p>

Table 4 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments, Major issues of MR, and Advice By JICA Experts
Level crossing accident	<ol style="list-style-type: none"> 1. Method of Cause Analysis 2. Establishments of countermeasures 	<ol style="list-style-type: none"> 1. Comments on Method of Cause Analysis 2. Comments on Establishments of countermeasures 3. Major issues of MR made clear through discussion, and advice
No. 1 Illegal level crossing. collision with motor cycle (Ingyigan - Shwedat)	<ol style="list-style-type: none"> 1. Accident cause is "nothing to protect level crossing" 2. To provide protection devices to all illegal level crossings 	<ol style="list-style-type: none"> 1. The guidance to stop once before crossing the level crossing should be given to road vehicle drivers. 2. Before planning protection devices for all illegal level crossings, they should be classified into two groups: the one to be remained as level crossing and the other to be abolished. Then depending on the importance of illegal level crossings to be remained, appropriate protection devices should be provided. 3. ①First the basic information about the level crossing concerned (No. of trains per day, train speed, traffic volume of road vehicles, length, width, visibility distance from the train driver and from the road vehicle driver etc.) should be collected. Then according to these basic information, all level crossings should be classified according to their importance. According to the classification, suitable protection devices should be planned. ②The guidance to stop once before crossing the level crossing should be given to road vehicle drivers. ③All illegal level crossings should be classified into two groups based on basic information of level crossing: the one to be remained and the other to be abolished. The remained ones should be provided with appropriate protection devices.
No. 2 Illegal level crossing. collision with motor cycle (Taungoo - Kyae Daw)	<ol style="list-style-type: none"> 1. Poor vacuum brake train. Braking was very bad. 2. Full vacuum brake train should be prepared. Guidance of traffic rules to road vehicle drivers. 	<ol style="list-style-type: none"> 1. The same comment as that for the No. 1 Accident. 2. In addition, suitable protection devices should be provided. 3. In addition to the comments ①,②,③for No.1 Accident, air brake should be adopted instead of vacuum brake. Further braking forces should be applied to all wheel axles by continuous braking system.

Table 5 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments, Major issues of MR, and Advice By JICA Experts
Train Delay	<ol style="list-style-type: none"> Method of Cause Analysis Establishments of countermeasures 	<ol style="list-style-type: none"> Comments on Method of Cause Analysis Comments on Establishments of countermeasures Major issues of MR made clear through discussion, and advice
No. 1 Y-M Line Express (11 up) Total delay 118 minutes Make up time 48 min. Final delay 70min.	<ol style="list-style-type: none"> Brake down of total delay Slow down during track maintenance 47% Locomotive failure 27% Slow down on bridge 11% Signal failure 3% Others 12% Bridge repair, improvement of locomotive repair system, track maintenance improvement, preparation of parts for signals. 	<ol style="list-style-type: none"> Break down of total delay time is praise-worthy. Slow down during track maintenance occupies the large share. How to decrease the slow down during track maintenance must be examined. Track maintenance needing train slow down should be limited by rules.
No.2 Y - M line Express (5up) Total delay 118min. Make up time 33 min, Final delay 85min.	<ol style="list-style-type: none"> Break down of total delay Slow down during track maintenance 50% Coach failure 21% Slow down on bridges 13% Locomotive failure 7% Others 9% Repair of loco, coach, bridges 	<ol style="list-style-type: none"> Brake down of total delay time is praiseworthy. The same comment as that for Accident No.1 The same advice as that for Accident No..1 In addition, parts relating to braking system should be appropriately prepared. Maintenance standards for braking system should be reviewed.
No.3 Y-M Line Express (11up) Total delay 55min Make up time 45min Final delay 10min	<ol style="list-style-type: none"> Break down of total delay time Slow down during track maintenance 40% Slow down on bridges 29% Signal failure 7% Others 24% Preparation of signal parts, repair of bridges, double tracking on gauntlett bridge 	<ol style="list-style-type: none"> Brake down of total delay time is praiseworthy. The same comment as that for Accident No.1 The same advice as that for Accident No.1.

<p>No.4 Y - M line Express (5up) Total delay 81min. Make up time 31 min, Final delay 50min.</p>	<p>1. Break down of total delay time Slow down during track maintenance 28% Slow down on bridges 28% Coach failure 37% Others 7% 2. Bridge repair, and coach repair</p>	<p>1. Brake down of total delay time is praiseworthy. 2. The same comment as that for Accident No.1 3. The same advice as that for Accident No.1.</p>
<p>No.5 Y-M Line Express (11up) Total delay 118 min Make up time 33 min Final delay 85min</p>	<p>1. Break down of total delay time Slow down during track maintenance 24% Slow down on bridges 11% Loco failure 27% Signal failure 13% Others 25% 2. Bridge repair, preparation of signal parts, improvement of maintenance system and preparation of parts for locomotive and how to decrease the slow down during track maintenance.</p>	<p>1. Brake down of total delay time is praiseworthy. 2. Appropriate countermeasures 3. <ul style="list-style-type: none"> ▪ Track maintenance needing train slow dawn should be limited by rules. ▪ Inventory control of spare parts for rolling stock and signaling system should be improved ▪ With respect to bridge repair, firstly present situations of bridges should be fully grasped, through investigation of endurance of the bridges etc. </p>

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Table 6 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments, Major issues of MR, and Advice By JICA Experts
Speed restriction	<ol style="list-style-type: none"> 1. Method of Cause Analysis 2. Establishments of countermeasures 	<ol style="list-style-type: none"> 1. Comments on Method of Cause Analysis 2. Comments on Establishments of countermeasures 3. Major issues of MR made clear through discussion, and advice
No.1 (gauntlet bridge and poor track condition)	<ol style="list-style-type: none"> 1. Speed restriction by gauntlet bridge No. 263, 829, and poor track conditions 2. Double tracking of gauntlet bridges, rectification of poor track conditions 	<ol style="list-style-type: none"> 1. No specific comments 2. No specific comments 3. In removing speed restriction locations, priority of rectification should be given, based on overall evaluation on ①increase of journey speed, ②rectification cost, ③degree of danger of the situations concerned, etc.
No. 2 (unstable embankment)	<ol style="list-style-type: none"> 1. Explanation of speed restriction in the sections of Y-M Line Major causes of speed restriction are unstable embankment 2. No specific countermeasures were presented 	<ol style="list-style-type: none"> 1. No specific comments 2. No specific comments 3. Countermeasures for making embankment stable should be established.
No.3 Up & down line at 375km35	<ol style="list-style-type: none"> 1. Speed restriction at the location 375km35 (up & down line). Major causes are improper track conditions (shortage of sleeper, ballast) 2. Track improvement by supplying sleeper and ballast 	<ol style="list-style-type: none"> 1. No specific comments 2. No specific comments 3. In removing the speed restriction at the poor track locations, priority should be given based on the overall evaluation of ①increase of journey speed, ②degree of poor condition of track (degree of danger), ③rectification cost

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Table 7 Discussion in the Workshop, Comments, Advice

Classification	Presentation by MR Experts	Comments, Major issues of MR, and Advice By JICA Experts
Others	<ol style="list-style-type: none"> 1. Method of Cause Analysis 2. Establishments of countermeasures 	<ol style="list-style-type: none"> 1. Comments on Method of Cause Analysis 2. Comments on Establishments of countermeasures 3. Major issues of MR made clear through discussion, and advice
No.1 Outline of Y-M line	<ol style="list-style-type: none"> 1 & 2 <p>Present situation of Y-M line including poor conditions of track and their countermeasures</p>	<ol style="list-style-type: none"> 1. The paper is well prepared. The major issues are well analysed. 2. Countermeasures should be more concretely established 3. <ul style="list-style-type: none"> • Modernization of Y - M line is being planned with the financial support of JICA Yen loan. Modernization should be executed with full cooperation of MR experts. • Track conditions are being grasped through riding on the vehicles. It is recommended to grasp track conditions with use of vibration measurement device.
No. 2 Present issues of MR	<ol style="list-style-type: none"> 1 & 2 <p>Major issues of MR are presented by this presentation paper</p>	<ol style="list-style-type: none"> 1 & 2 & 3 <p>It is praiseworthy that MR staff himself tries to identify major issues of MR.</p>
No. 3 Inspection and maintenance system of rolling stock	<ol style="list-style-type: none"> 1 & 2 <p>Inspection and maintenance system of rolling stock is explained in the presentation paper.</p>	<ol style="list-style-type: none"> 1 & 2 & 3 <p>No specific comments</p>
No.4 Review of technical standards of track, signaling & operation	<p>Major technical standards of track, signaling and operation were reviewed and presented.</p>	<ol style="list-style-type: none"> 1 & 2 & 3 <p>These presentation are useful for JICA Experts to review these technical standards in order for them to present recommendations on these technical standards from the viewpoint of improving safety and service level of MR.</p>

Appendix: 2-2

Train Speed Slowing Down During Track Maintenance Work (Practices of JR East)

1. All track maintenance works should be implemented in principle in the blocked time-interval. Namely time for track work and time for train operation should be separated.
2. In case of large scale track work, sometimes the whole work cannot be completed in the given blocked time-interval.
In such case, a part of work, limited to the preparatory work, is implemented before the start of the blocked time-interval. In this case, the work is implemented accompanied by train slow down.
The kinds of work accompanied by train slow down are given as follows;
 - (1) Rail fastening removing work
See Table 1 (a), 1 (b)
 - (2) Ballast removing work
See Table 2
 - (3) Fook bolt removing work
See table 3
 - (4) In case of removing derailment prevention guard/ rail, safety guard rail, bridge guard rail
See table 4
3. Small scale spot track maintenance work can be executed not in the blocked time-interval, but in the regular interval between two consecutive trains. In that case, all the track works should be completed in the interval, so as not to necessitate the train slow down.

Table 1-(a) In case of removing rail fastening device(*1)

Kind of sleeper	Track structure				allowable rate of sleepers of which fastenings can be removed (*3)(*4)	restricted speed (km/h)	allowable temperature change from the rail installing temperature
	tangent or curve	rail (kg/m)	no. of sleeper /25m	with or without tie-plate			
PC sleeper	Tangent & $R \geq 600m$	60, 50 long rail (*2)	≥ 38	/	1/3	≤ 55	+14°C -20°C
					1/2	≤ 45	+12°C -18°C
	Tangent & $R \geq 600m$	60, 50 $l \leq 25m$ (*2)	≥ 39	/	1/3	≤ 55	up to rail gap =0mm
					1/2	≤ 45	
$600m > R \geq 400m$				1/3	≤ 45		
				1/2	≤ 30		
Wodden sleeper	Tangent & $R \geq 600m$	60, 50, 40 long rail (*2)	≥ 43	with	1/3	≤ 50	+8°C -10°C
			≥ 30	with	1/2	≤ 40	
				without	1/3	≤ 45	
				without	1/2	≤ 30	
		60, 50 $l \leq 25m$ (*2)	≥ 44	with	1/3	≤ 50	up to rail gap =0mm
				without	1/2	≤ 40	
				without	1/3	≤ 30	
				without	1/2	≤ 40	
	40, 37 $l \leq 25m$ (*2)	≥ 39	with	1/3	≤ 45		
			without	1/2	≤ 30		
			without	1/3	≤ 30		
			without	1/2	≤ 30		
	$600m > R \geq 400m$	60, 50, 40, 37, 30 $l \leq 25m$ (*2)	≥ 44	with	1/3	≤ 45	up to rail gap =0mm
			≥ 39		1/3	≤ 40	
≥ 34			1/3		≤ 35		
			1/3		≤ 35		

(*1) Rail fastening removal work and ballast removal work should be executed separately.

(*2) l (m)=rail length. In case $25m \leq l < 200m$, this rail is considered to be long rail.

(*3) In case of deteriorated sleeper, rail fastening devices of that sleeper are considered to have been removed.

(*4) In the section where 30kg/m rail is used, allowable rate of sleeper of which rail fastening devices can be removed should be 1/3.

Table 1-(b) In case of removing rail fastening device

Kind of sleeper	Track structure				allowable rate of sleepers of which fastenings can be removed (*1)	restricted speed (km/h)	allowable temperature change from the rail installing temperature
	tangent or curve	rail (kg/m)	no. of sleeper /25m	with or without tie-plate			
Bridge sleeper	Tangent & $R \geq 600m$	60, 50 long rail (*2)	≥ 63	with	1/3	≤ 50	-13°C
	Tangent & $R \geq 600m$	60, 50 $l \leq 25m$ (*2)	≥ 63	with	1/3	≤ 50	/
				without	1/2	≤ 40	
		40, 37 $l \leq 25m$ (*2)	≥ 46	with	1/3	≤ 45	
				without	1/2	≤ 35	
	30 $l \leq 25m$ (*2)	≥ 41	with	1/3	≤ 40		
			without	1/2	≤ 30		
	$600m > R \geq 400m$	60, 50, 40, 37, 30 $l \leq 25m$ (*2)	≥ 63	with	1/3	≤ 45	/
					1/3	≤ 40	
					1/3	≤ 35	

(*1) In case of deteriorated sleeper, rail fastening devices of that sleeper are considered to have been removed.

(*2) l (m)=rail length. In case $25m \leq l < 200m$, this rail is considered to be long rail.

Table 2 In case of removing ballast (*1)

Kind of work (*4)	Track structure				restricted speed (km/h)	allowable temperature change from the rail installing temperature
	rail length	tangent or curve	rail (kg/m) (*3)	no. of sleeper /25m		
scraping out the shoulder ballast (Fig 1)	long rail (*2)	Tangent & $R \geq 600m$	60 50	≥ 38	≤ 50	+13°C -14°C
	$l \leq 25$ (*2)	Tangent & $R \geq 600m$	60	≥ 43	≤ 50	Up to rail gap =0mm
			50	≥ 39	≤ 40	
			40		≤ 40	
			37	≥ 34	≤ 40	
	600m > R \geq 400m	60	≥ 43	≤ 35		
50 40 37		≥ 39	≤ 30			
removal of whole surface ballast (above the sleeper bottom) (Fig 2)	tumout		60 50 40 37 30		≤ 35	

(*1) Rail fastening removal work and ballast removal work should be executed separately.

(*2) l (m)=rail length. In case $25m \leq l < 200m$, this rail is considered to be long rail.

(*3) The rule applied to the section of 30kg/m should be established separately.

(*4) Standard methods to scrape out the ballast are shown in Fig 1. and 2.

Table 3 Fook Bolt Removal Work

Restricted speed	Remark
According to Table 1 (b)	<ol style="list-style-type: none"> 1. Limited to sleepers of which rail fastening are removed. 2. Not applied to the section where 30kg/m rail is used.

Table 4. In case of removal of derailment prevention guard, derailment prevention rail, safe guard rail, guard rail on the bridge

Restricted speed (km/h)	Remark
Tangent & curve ≤ 45	Only applied to trains to which freight wagons are attached.

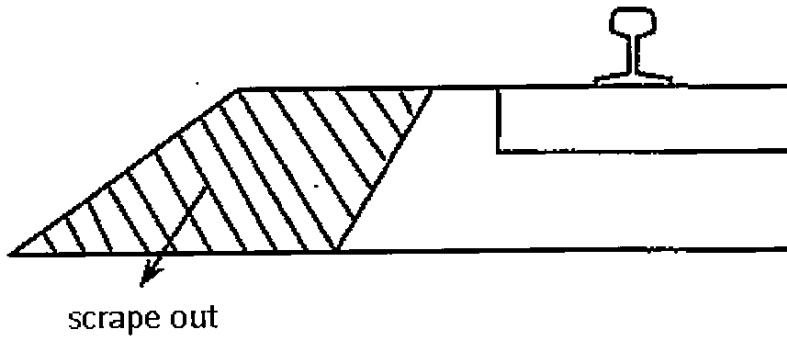


Fig 1 Shoulder ballast



Fig 2 Whole surface ballast (turnout) (above this bottom of sleeper)

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

**PROJECT ON IMPROVEMENT OF
SERVICE AND SAFETY OF RAILWAY IN
MYANMAR
PROGRESS REPORT**

May 2014

JAPAN INTERNATIONAL COOPERATION AGENCY
JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO., LTD
ORIENTAL CONSULTANTS CO., LTD
SUMITOMO CORPORATION

1

**This PR Explains major activities
between around Feb. and May, 2014**

2

Two Subprograms of the Project

1. Recommendation of technical standards relating to administrative and maintenance aspects and drawing up railway facilities improvement plan to improve service and safety level, based on cause analysis of accidents/ low service level.
2. Technology Transfer of Track Maintenance Technology to improve the level of Service and Safety through Implementation of the Pilot Project

3

Major Progress of Subprogram 1

4

Table of working plan schedule

Subject	2013												2014												Note	
	2013												2014													
	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4		5
Month	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	
Post Month	0	1	2	3	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	20	21	22	23	24
3.1.1 Survey of the present status and Establishment of an organization to Collect Information																										
3.1.2 Guidance and familiarization of the analyzing technique of the causes (1) Safety 1) Completion of text books 2) Studying and learning with text books 3) Summarization of accident analysis and countermeasures (Workshop) (2) Services level 1) Completion of text books 2) Studying and learning with text books 3) Summarization of cause analysis and countermeasures (Workshop)																										
3.1.3 Recommendation on technical standards for service level and safety (1) Proposal (2) Summarizing																										
3.1.4 Drawing up short-, medium- and long-term railway improvement items (1) Proposal (2) Summarizing Education/training in Japan																										
Discussion on the report/JCC Submission of the report (JICA)																										

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Major activities of Subprogram 1 between February and May

1. Training program of cause analysis of accidents/
Low service level and establishment of
countermeasures
 - (1) Class room lecture of textbook
 - (2) Workshop
 - (3) Comments on training program by MR
participants
 - (4) Training for measurement of Train Vibration
2. Investigation of customer satisfaction level

6

Training Program & Interview Survey

		February														March													
		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	1	2	3	4	5	6	7		
Training Program	Lecture by text book (Morning)	←-----→														▼ 2nd JCC													
	Workshop (Afternoon)	←-----→																											
	Vibration Measurement																			←-----→									
Interview Survey		←-----→																											

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(1) Class room lecture of text book

JICA experts explained, based on the text book, about the past accidents and countermeasures in Japan (for examples, derailments, train collision, level crossing, natural disaster and so on), and introduced the measures for improvement of the service level (for examples, increasing train speed, punctuality, riding comfortabilities, train protections and so on).

There were various discussions between JICA lecturers and MR participants. Major advices to MR by JICA experts based on the discussion are given below.

8

1) Level Crossing Accident Prevention

In order to decrease the level crossing accidents, not only the installment of protection devices, but also the guidance to road vehicle drivers about the safe way to cross the level crossing and efforts to eliminate the level crossings (such as by grade separation, by unification) are significant.

2) ATP

In introducing ATP, there are many issues to be solved such as securing constant braking distance. In addition, safety sidings, automatic warning devices for obstructing construction gauges, emergency protection devices etc. are also significant devices for preventing derailment and double accidents.

3) Rolling Stock

- Vacuum brake should be replaced by compressed air brake
- Continuous braking is necessary for safety and speed up
- Spring system of bogie is closely related with riding comfort of vehicles. MR should investigate the vibration of bogies and try to improve the spring system of the bogie

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4) Track

- To grasp the track condition precisely, inspection device should be applied.
- By and by mechanical repair machines such as MTT, Ballast regulator should be introduced for strengthening the repairing power
- Shortage of track ballast is conspicuous. It should be understood that ballast contributes to the lateral resistance of track, which is important for securing stable track, especially significant for preventing buckling of long welded rail track.
- Low joints of track are conspicuous in many sections, which cause progress of track deterioration and large vehicle vibration. Adoption of long welded rail is the best solution.
- Adopting of long welded rail is one of the best solutions for improving riding comfort, speeding up and safety. Maintenance manuals for long welded rail track should be established, and training of maintenance of long-welded track should be strengthened.

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(2)Workshop

1)Purpose of the Workshop

The purpose of the workshop is to make MR experts be familiarized with analysis of causes of accidents and low service levels and establishment of countermeasures through making MR staff themselves analyse the causes of actual accidents or low service levels of MR and making themselves establish suitable countermeasures.

- In this regard, 25 items relating to accidents and low service levels (train delay and speed restrictions) were selected from the actual MR's events in 2012/ 2013. The 25 items selected are given in Table 2-3.

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Table 2.3 Presentation by MR experts in Workshop

Topics		No. of presentations
Accident		10
Derailment	Between stations	3
	In the station yards	3
Train Parting		2
Level crossing accident		2
Service Level		8
Train delay		5
Speed restriction		3
Others		7
Existing situation of Y – M Line		1
Review of Technical standards (track, signal/ telecom, operation)		3
Review of inspection / maintenance of rolling stock		1
Current issues of MR		1
General questions to JICA experts		1
Total		25

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2) Advices by JICA Experts

Summary of advices of JICA experts on major issues of MR identified through discussion in the Workshop

(a) Derailment (between stations & in the station yards)

- i. Not only the track cross level irregularity, but also track twist should be measured and controlled
- ii. Measurement devices including string should be used to grasp the track irregularities precisely.
- iii. For prevention of derailment caused by spring coil breakage, specification of material of coil, inspection system of coil, periodical replacement according to age, quality control of coil production should be examined.
- iv. The vehicle should be designed and maintained so that brake should be continuously applied to every wheel axle, in order to avoid train buckling (causing decrease of wheel load, increase of wheel lateral pressure leading to derailment) due to sudden braking of locomotive.

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(b) Train Parting

- i. Improvement of track and rolling stock which is important for reducing impact load applied to coupler, is the basic countermeasures for accidents like this.
- ii. Braking system should be improved so as to ensure continuous braking, by which the parted parts will automatically stop, preventing the dangerous situations.

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(c) Level crossing accident

① First the basic information about the level crossing concerned (No. of trains per day, train speed, traffic volume of road vehicles, length, width, visibility distance from the train driver and from the road vehicle driver etc.) should be collected. Then according to these basic information, all level crossings should be classified according to their importance. According to the classification, suitable protection devices should be planned.

② The guidance to stop once before crossing the level crossing should be given to road vehicle drivers.

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(d) Train delay

- i. Slow down during track maintenance occupies the large share of total delay time. How to decrease the slow down during track maintenance must be examined. Track maintenance needing train slow down should be limited by rules.
- ii. Inventory control of spare parts for rolling stock and signaling system should be improved so as to provide necessary spare parts timely.
- iii. With respect to bridge repair, firstly present situations of bridges should be fully grasped, through investigation of endurance of the bridges etc.

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(e) Recommendation on how to decrease train speed down during the track maintenance work

- According to the statistics in 2012/2013 regarding the delay of the express trains of Yangon – Mandalay line, the average delay time at Yangon and Mandalay is 65 minutes, and that at Nay Pyi Taw is 57 minutes. According to the analysis of train delay by MR experts presented in the Workshop, delay due to train speed down during the track maintenance work occupies a large share of the total delay time (50 – 24 %).

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In MR, trains are slowing down the speed during almost all medium/ large track maintenance works.

Large train delays will cause social problems, along with socio – economic development of the country.

Further, in order to compete favourably with road vehicles, punctuality of train trip should be ensured.

Then, how to decrease train delay due to slow down during the track maintenance should be seriously studied.

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- In case of JR, all track maintenance work are executed in principle in the blocked time-interval. Any train speed slow down will not be implemented after the track work.
- In case of large scale track maintenance work, sometimes a part of work, namely preparatory work is implemented before the start of blocked time-interval accompanied by train speed slow down.
- Small scale spot track maintenance work can be executed not in the blocked time-interval, but in the regular interval between two consecutive trains. Even in that case, all track works will be completed in the interval, thus without necessitating slow down of train after the work.
- It is recommended that MR tries to reduce the train delay time due to slowing down of train during track maintenance, referring to JR practices

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(f) Speed Restrictions

- Poor track conditions, unstable embankment, old aged bridges are major locations necessitating speed restrictions. In removing the speed restriction locations, priority should be given based on the overall evaluation of ① increase of journey speed, ② rectification cost, ③ degree of danger of the situations concerned, etc

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(3) Comments on training program by MR participants

Comments on Training Program by MR Participants

Question	Comments	No. of the same comments (*1)
1 According to your opinion, what information/matters /Japanese examples were especially useful for improvement of safety and service level of MR?	1.All lectures were useful *Japanese experiences on improvement of safety/ service level are useful for drawing MR's improvement plan *MR can learn research, facilities, regulation, management, especially spirit, from JR	9
	2.Level Crossing Accident Prevention *countermeasures against level crossing accidents, level crossing protection facilities	10
	3.Signal and train operation *train protection radio signal failure prevention, signal visibility, electric point, block system,	5
	4.Track and turnout	3
	5.Brake system	3
	6.Natural disaster prevention, earthquake detection system	3
2 Are there any other information/matters/Japanese experiences you would like to know more?	1.want to know more about various matters of Japanese railways	7
	2.Want to know more about maintenance, technology of rolling stock.	2
	3.Want to know more about signalling and telecommunication system of Japanese railways	2
	4.Wat to know about effective design of station yard, planning principle of diagram of station yard	1
	5.Want to know standard construction method, maintenance, organization of railway	1
	6.Want to know how JR Goup increase their income	1
	7.Want to know more about track inspection and maintenance	1
	8.Shinkansen, Maglev, Metro, Monorail, train operation system (TDCS, OC, CTC, ATC, JTSS etc.	1
	9.No specific opinions	3

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Question	Comments	No. of the same comments (*1)
3 Do you think the way/method by which JICA expert team organized the workshop was satisfactory to you?	All participants are satisfactory *Want to have more free discussion, more workshops, more discussion on signal & telecom *Made up his mind to apply what he learned in the workshop to improvement of MR *Learned how to analyse the causes of accidents, how to establish the countermeasures	19
4 Do you have any advice how to improve the way/method of workshop?	1.Senior staff of MR should attend the workshop at least 5 days	1
	2.To hold workshop once a month chaired by GM(civil) joined by other departments, on track maintenance	1
	3.Participants of workshop should visit various facilities, institutes, field sites of Japanese railways	1
	4.To make small groups consisting of experts of various fields hold workshop and discuss accidents	2
	5.Should have more workshop	3
	6.Should have not only lectures, but also visual material such as videos	1
	7.Should use interpreters of English-Myanmar language to understand more precisely workshop	1
	8.Participants should know the contents of presentation beforehand to make discussion more fruitfully	4
	9.Should have more discussion on track maintenance with JICA experts	1
	10.Others	4

(*1) With respect to Question 1, if one participant has plural comments, say comment on Item 5 Brake system and comment on Item 4 Track and turnout, his comment on each item is counted as one comment for each item.

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(4) Training for measurement of train vibration

In order to make MR experts be familiarized with how to apply the vibration measurement of train to control of track maintenance and improvement of vehicle performance, JICA experts instructed measurement and analysis of actual Train Vibrations on Feb. 27, and 28th. Trainings were implemented by using the device [Digital Vibration Measurement Device W0031]. Trainings included 1) how to use the device to measure the vibration and how to analyses the measured data, 2) measurement of actual MR's express train, and 3) analysis of the measured data.

23

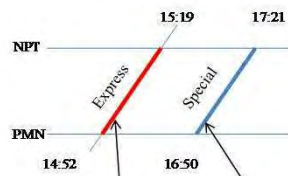
- Recommendation

- (a) At present, large vehicle vibration caused by poor track conditions are monitored by inspectors through subjective sensual feelings while riding on the train. In place of such subjective sensual feelings, vehicle vibration measurement device should be used to evaluate objectively and precisely the vehicle vibration caused by poor track conditions
- (b) Analysis of the vehicle vibration data is also useful for identifying the various issues of vehicle performance.

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Measured Section and Train Schedule

Date 27th February, 2014



Myanmar Passenger Coach Train and its bogie

Japanese DC (KIHA 141-8) and its bogie (DT21)

25

3. Measurements tools

Vibration meter

-Lap-top PC installed analysis software

-GPS logger or marker

-connecting cable and batter



Picture: on Myanmar Passenger Coach

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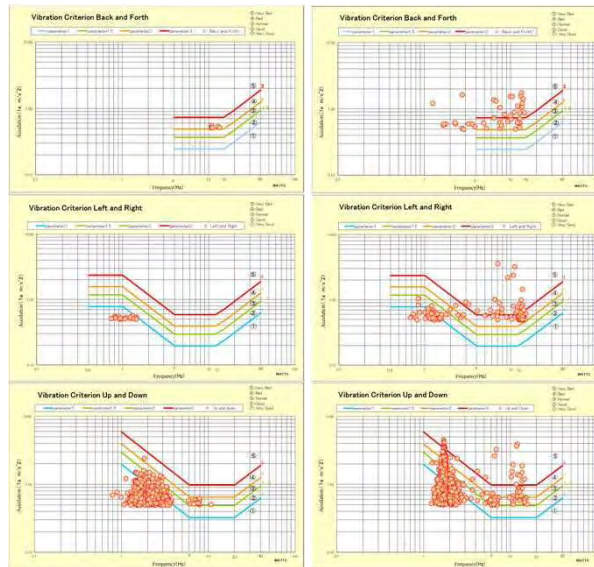


Fig5: Vibratio Criterion Japanese DC

Fig6: Vibration Criterion Myanmar PC

2. Investigation on customer satisfaction level

After implementation of the training program, Interview Survey to investigate customers satisfaction level of MR's passenger train was carried out from March 3 (preparing meeting) to March 7. The details of the interview survey and the analysis of the results are given in the following report.

Report on Result of Investigation on Customer Satisfaction Level

Table Sampling number

Train kind/class	Sampling Number/Train	Train number/day	days	Target number	Actual Number
Express (Upper)	20	3	2	120	120
Express (Ordinary)	20	3	2	120	122
Local	30	2	2	120	123

Questionnaire item:

Refer to Attached Appendix ①

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Pictures: Ongoing invitation



Express Upper Class on Mar. 4



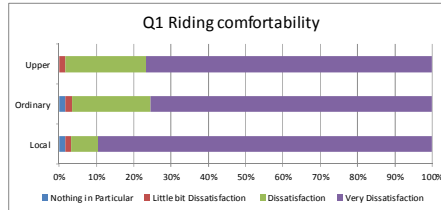
Express Ordinary Class on Mar. 4



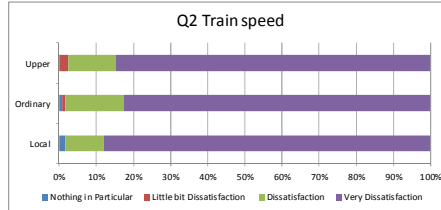
Local on Mar. 7

30

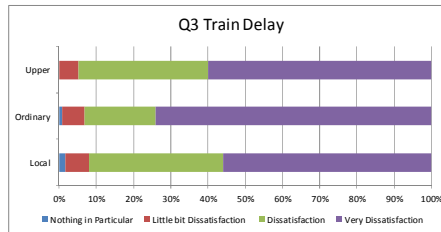
Q1 Riding comfortability			
	Local	Ordinary	Upper
Nothing in Particular	2	2	0
Little bit Dissatisfaction	2	2	2
Dissatisfaction	9	23	25
Very Dissatisfaction	113	89	69



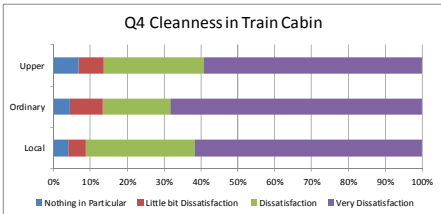
Q2 Train speed			
	Local	Ordinary	Upper
Nothing in Particular	2	1	0
Little bit Dissatisfaction	0	1	3
Dissatisfaction	13	18	15
Very Dissatisfaction	109	95	100



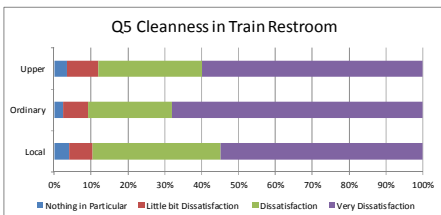
Q3 Train Delay			
	Local	Ordinary	Upper
Nothing in Particular	2	1	0
Little bit Dissatisfaction	6	7	6
Dissatisfaction	45	22	40
Very Dissatisfaction	70	86	69



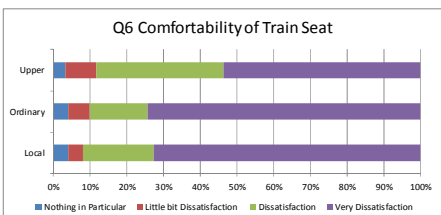
Q4 Cleanliness in Train Cabin			
	Local	Ordinary	Upper
Nothing in Particular	5	5	8
Little bit Dissatisfaction	6	11	8
Dissatisfaction	37	22	32
Very Dissatisfaction	77	82	70



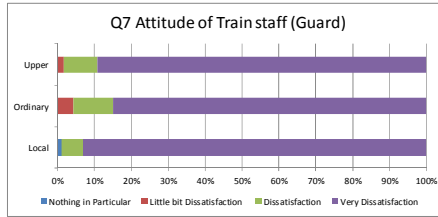
Q5 Cleanliness in Train Restroom			
	Local	Ordinary	Upper
Nothing in Particular	5	3	4
Little bit Dissatisfaction	8	8	10
Dissatisfaction	43	27	33
Very Dissatisfaction	68	81	70



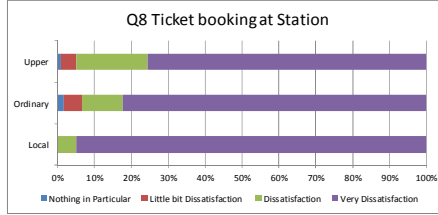
Q6 Comfortability of Train Seat			
	Local	Ordinary	Upper
Nothing in Particular	5	5	4
Little bit Dissatisfaction	5	7	10
Dissatisfaction	24	19	41
Very Dissatisfaction	91	90	64



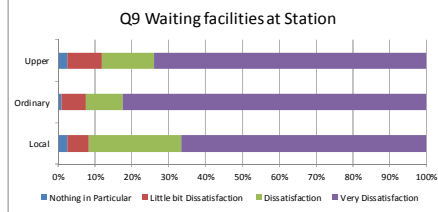
Q7 Attitude of Train staff (Guard)			
	Local	Ordinary	Upper
Nothing in Particular	1	0	0
Little bit Dissatisfaction	0	5	2
Dissatisfaction	6	13	11
Very Dissatisfaction	96	102	106



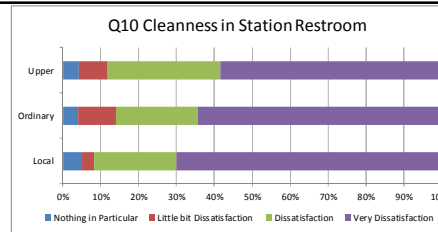
Q8 Ticket booking at Station			
	Local	Ordinary	Upper
Nothing in Particular	0	2	1
Little bit Dissatisfaction	0	6	5
Dissatisfaction	6	13	23
Very Dissatisfaction	114	98	90



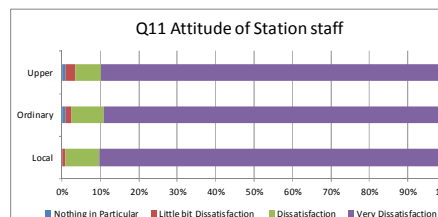
Q9 Waiting facilities at Station			
	Local	Ordinary	Upper
Nothing in Particular	3	1	3
Little bit Dissatisfaction	7	8	11
Dissatisfaction	30	12	17
Very Dissatisfaction	80	100	88



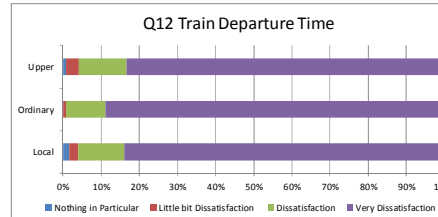
Q10 Cleanliness in Station Restroom			
	Local	Ordinary	Upper
Nothing in Particular	6	5	5
Little bit Dissatisfaction	4	12	9
Dissatisfaction	26	26	35
Very Dissatisfaction	84	78	69



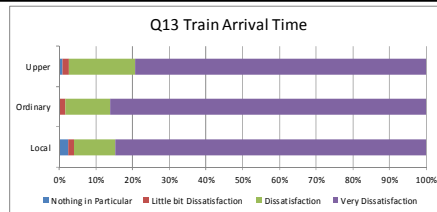
Q11 Attitude of Station staff			
	Local	Ordinary	Upper
Nothing in Particular	0	1	1
Little bit Dissatisfaction	1	2	3
Dissatisfaction	11	10	8
Very Dissatisfaction	112	106	106



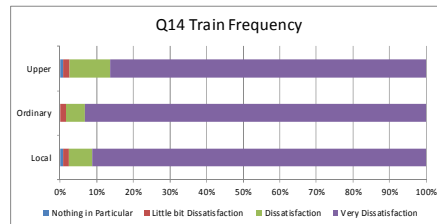
Q12 Train Departure Time			
	Local	Ordinary	Upper
Nothing in Particular	2	0	1
Little bit Dissatisfaction	3	1	4
Dissatisfaction	15	12	15
Very Dissatisfaction	104	104	89



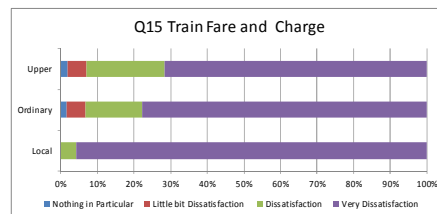
Q13 Train Arrival Time			
	Local	Ordinary	Upper
Nothing in Particular	3	0	1
Little bit Dissatisfaction	2	2	2
Dissatisfaction	14	14	21
Very Dissatisfaction	106	99	92



Q14 Train Frequency			
	Local	Ordinary	Upper
Nothing in Particular	1	0	1
Little bit Dissatisfaction	2	2	2
Dissatisfaction	8	6	13
Very Dissatisfaction	113	111	101

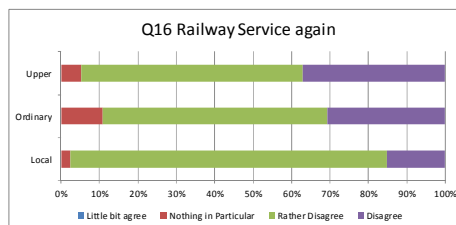


Q15 Train Fares and Charge			
	Local	Ordinary	Upper
Nothing in Particular	0	2	2
Little bit Dissatisfaction	0	6	6
Dissatisfaction	5	18	24
Very Dissatisfaction	116	91	81

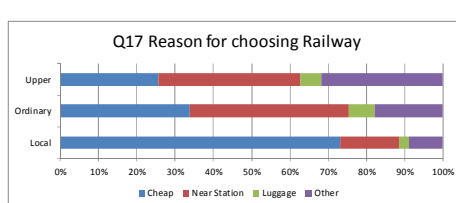


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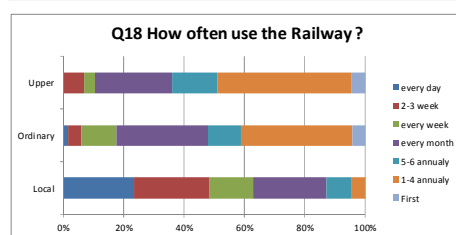
Q16 Railway Service again			
	Local	Ordinary	Upper
Little bit agree	0	0	0
Nothing in Particular	3	12	6
Rather Disagree	98	65	65
Disagree	18	34	42



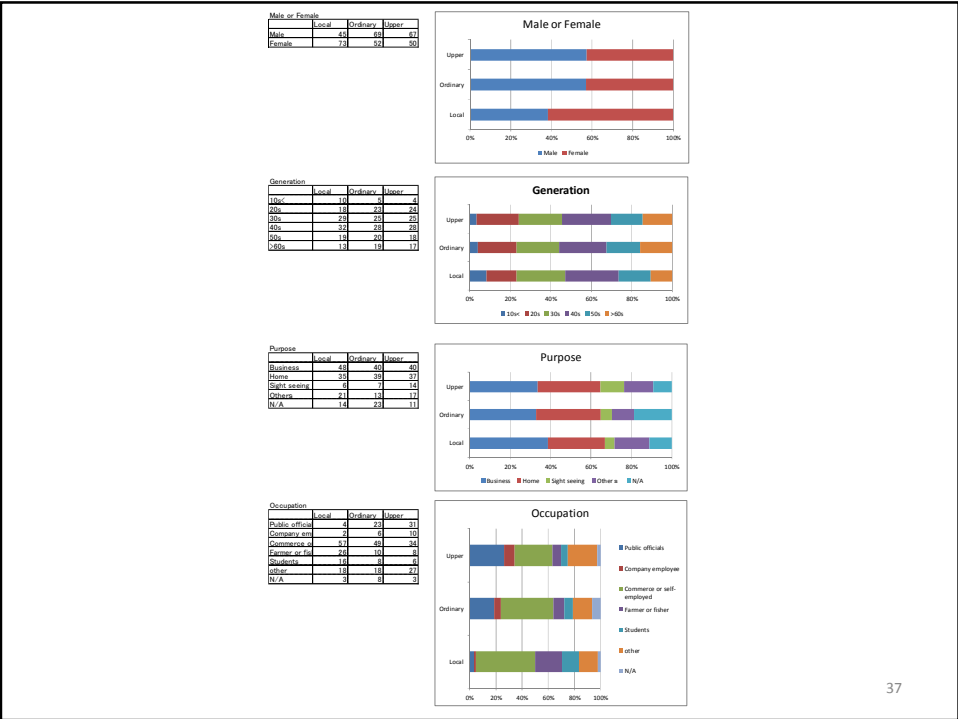
Q17 Reason for choosing Railway			
	Local	Ordinary	Upper
Cheap	90	40	29
Near Station	19	49	42
Luggage	3	6	6
Other	11	21	36



Q18 How often do you use the Railway service ?			
	Local	Ordinary	Upper
every day	29	2	0
2-3 week	31	5	8
every week	18	14	4
every month	30	36	29
5-6 annually	10	13	17
1-4 annually	6	44	51
First	0	5	5



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2.1.4 Recommendation on technical standards relating to administrative and maintenance aspect to improve the service level and safety
 Relevant technical standards in the fields of civil, signal/ telecommunication, operation, rolling stock engineering have been supplied by MR. Preparation of recommendations on these technical standards have been just started.

2.1.5 Drawing up of short-, medium-, and long-term railway facilities improvement plan
 The activity has just been started. The improvement plans will be prepared through discussion in the Working Group consisting of MR senior officials concerned and JICA experts. The plan will take into account MP and FS by JICA study Team

2.1.6 Education/ training in Japan
 11 officers for MR will be invited to Japan for two weeks in October, 2014. The training program is going to be proposed soon. Kindly review the program after submitted; we are pleased to modify the program with due consideration on suggestions/ advices of MR.

Major Progress of Subprogram 2

Table of working plan schedule(Track Maintenance)

Subject	FY Year Month Part Month	2013												2014												2015												The Degree of Achievement %	Note
		1			2			3			4			5			6			7			8			9			10			11			12				
		1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3								
42.1 Drawing up a technical transfer plan (1) Collection of basic information (2) Plan of technical transfer.																																				100			
42.2 Selection/procurement of equipment/tools (1) Selection of equipments/tools (2) Acquisition of import license, tax exemption procedure (3) Import procedure (4) Freight control																																			100				
42.3 Selection of pilot section (1) Site witnessing (2) Selection of a section (3) Exact line survey																																			100	Change pilot section to March			
42.4 Implementation of track maintenance work (inspection, electric work, etc.) (1) Compilation of text books (2) Classroom education and practical training (seminar) (3) Prior measurement and survey at the pilot section Implementation of work After completing the maintenance work of a 100 m-section in principle, move to the next 100 m-section (only the number of working days depending on the workload of each 100 m- section).																																			100	4.7 Followed with legitimization of work.			
42.5 Education/training (1) Seminars on the improvement of track maintenance technologies (2) Education/training in Japan																																			25				
42.6 Summarization of the points of improvement and reflecting them in the track maintenance manuals/standards																																			0				
42.7 Final summation and estimates Discussion on the report/JCC Submission of this report (JICA)																																			0				

Major activities of Subprogram 2 between February and May

▪ Selection of Pilot Section

We were requested by MR to include not only Yangon-Mandalay line but also Dagon University line and Thilawa line branching at Toekyaungkalay Sta. Now we are implementing training on these branch lines.

▪ Substitution of trainee

The members from Bago went back to their own depots, and are implementing maintenance of track by themselves now. New members from Division 5, 8 and 9 have been added and are now tackling with track maintenance.

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Major activities of Subprogram 2 between February and May

▪ Education/training in Japan

We are preparing for implementation two-week education/training program twice in Japan.

1st group is from 9th to 20th in June

2nd group is from 23th in June to 4th in July.

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Training Photo



Distribution of safety shoes to new members



Morning assembly

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Training Photo



Sign Board in Toekyaungkalay Sta.



Temporary Dormitory for trainee

44

Training Photo



Track Raising of turnout



Exchanging sleeper of turnout

45

Training Photo



Motor Raising of turnout



After track maintenance

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