Republic of India
Ministry of Railways

REPUBLIC OF INDIA

THE PROJECT FOR CAPACITY DEVELOPMENT ON RAILWAY SAFETY

PROJECT COMPLETION REPORT

May 2022

Japan International Cooperation Agency (JICA)

Nippon Koei Co., Ltd.
Japan International Consultants for Transportation Co., Ltd.

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Project Completion Report

Project Title: The Project for Capacity Development on Railway Safety
Term: November 2018 - May 2022

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Submission Date: 25th May, 2022

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Abbreviations

Abbreviation	Official Term
APP	Application
AT	Alumino Thermite
ATC	Automatic Train Control
CRSE	Chief Rolling Stock Engineer
CRS	Commissioner of Railway Safety
DFCCIL	Dedicated Freight Corridor Cooperation of India Ltd.
DEMU	Diesel Electric Multiple Unit
DL	Diesel Locomotive
ECR	East Central Railway
ECoR	East Coast Railway
EL	Electric Locomotive
EMU	Electric Multiple Unit
EDEE	Executive Director Electrical Engineering
GM	General Manager
GPS	Global Positioning System
HQ	Head Quarter
IR	Indian Railway
IRICEN	Indian Railway Institute of Civil Engineering
IT	Information Technology
ICF	Integral Coach Factory
ISO	International Organization for Standardization
JET	JICA Expert Team
JICA	Japan International Cooperation Agency
JR	Japan Railways
JTSB	Japan Transport Safety Board
JCC	Joint Coordination Committee
LHB	Linke Hofmann Busch
LOCO	Locomotive
MOR	Ministry of Railway
NCR	North Central Railway
NR	Northern Railway
PC	Passenger Car
PDCA	Plan-Do-Check-Act
PDM	Project Design Matrix
PO	Plan of Operation
QR	Quick Response
RTRI	Railway Technology Research Institute
R/D	Record of Discussion
RDSO	Research and Design Standard Organization
RCF	Rolling Contact Fatigue
RMPU	Roof-Mounted Packaging Units
SIMS	Safety Information Management System
SCR	South Central Railway
TGMS	Track Geometry Measurement System
TMS	Track Management System
TRC	Track Recording Car
USFD	Ultra Sonic Flaw Detection
UK	United Kingdom

Abbreviation	Official Term
COFMOW	Central organisation for Modernisation of Workshops
OHE	Overhead Equipment
SE/JE	Sectional Engineer/ Junior Engineer
SME	Sectional Mechanical Engineer
SSE	Senior Sectional Engineer

I. Basic Information of the Project

1. Country

Republic of India

2. Title of the Project

The Project for Capacity Development on Railway Safety

3. Duration of the Project (Planned and Actual)

The actual duration of the Project is three (3) years and five (5) months, starting from December 2018 until May 2022, revised from two (2) years until December 2020.

4. Background (from Record of Discussions(R/D))

Based on the minutes of meetings on the Detailed Planning Survey for the Project for Capacity Development for Railway Safety (hereinafter referred to as "the Project") signed on 21st December, 20 17 between Ministry of Railways of Republic of India (hereinafter referred to as "the Counterpart") and the Japan International Cooperation Agency (hereinafter referred to as "JICA"), JICA held a series of discussions with the Counterpart and relevant organizations to develop a detailed plan of the Project.

The purpose of this record of discussions (hereinafter referred to as "the R/D") is to establish a mutual agreement for its implementation by both parties and to agree on the detailed plan of the Project as described in the followings and the Annexes, which will be implemented within the framework of the Note Verbales, the Embassy's Note Verbale No.5/19/18 dated 30 July, 2018 and the Ministry's Note Verbale No. 2/3/2018-JP dated 31 July, 2018, exchanged between the Government of Japan and the Government of Republic of India.

5. Overall Goal and Project Purpose (from Record of Discussions(R/D))

5-1 Overall Goal

Safety of railway network in Concerned Northern Railway and DFCCIL is improved.

5-2 Project Purpose

Technical capability and promotional activity related to safety are improved in the Northern railway and DFCCIL.

6. Implementing Agency

Ministry of Railways

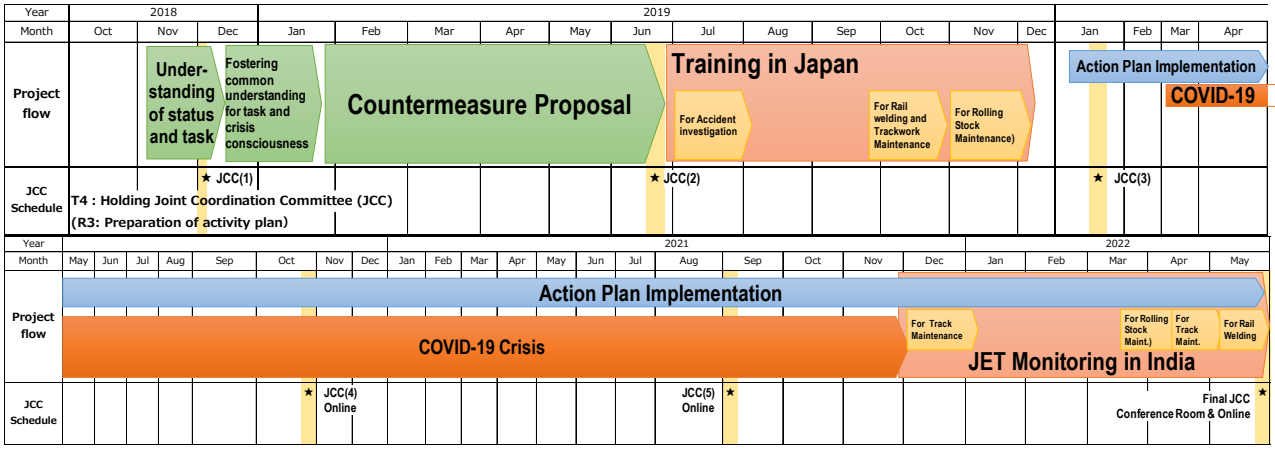
II. Results of the Project

1. Results of the Project

The project agreed on the Record of Discussions dated 14th August 2018 and it commenced in November 2018. Rail Welding (Output 1), Track Maintenance (Output 2), Rolling Stock Maintenance (Output 3) and Accident Investigation (Output 4) groups agreed on their Action Plans and the Plans have been currently implemented since the agreement.

As for Safety management group (Output 5), tried to coordinate for holding the training in Japan, however, arrangements necessary by the Indian Side could not be met during the requested time. Accordingly, In 4th JCC, held in 19th October 2020, it was agreed to exclude this portion from the scope of technical cooperation.

Although COVID-19 pandemic has been affected the progress of the project, JET continuously monitors the progress of the action plan implementation through online meetings in the period between January 2020 and November 2021. After the pandemic has been eased since December 2021, JET resumed monitoring in India. The modified project flow is illustrated in the Figure II-1 below;



Source: JET

Figure II-1 Project Flow

1-1 Input by the Japanese side (Planned and Actual)

1-1-1 Amount of input by the Japanese side

261 million JPY

1-1-2 Dispatch of JET

16 experts. The details of Japanese Experts mobilized in India are summarized in the Annex 1.

1-1-3 Training in Japan

Summary of the training in Japan is shown in the table below.

Table II-1 Summary of Training in Japan

Group/ Sector	Rail Welding	Track Maintenance	Rolling Stock Maintenance	Accident Investigation
Date	12 October – 26 October, 2019	6 October – 19 October, 2019	3 November – 16 November, 2019	29 June – 13 July, 2019
Participants	9 trainees	7 trainees	8 trainees	10 trainees

Source: JET

1-1-4 Provision of equipment

JET have provided Digital Ultrasonic Flaw Detector “SM-20R” and Portable Geometric Recording Trolley “LR-S100” in the Project. The cost and date handed over is summarized in the table below.

Table II-2 List of Equipment provided by Japan side

No.	Name of product	Product ID	Date of handed over	Cost
1	Digital Ultrasonic Flaw Detector (1 Nos.)	SM-20R	22 December 2021	2.7 million JPY
2	Portable Geometric Recording Trolley (1Nos.)	LR-S100	17 May 2022	3.5 million JPY

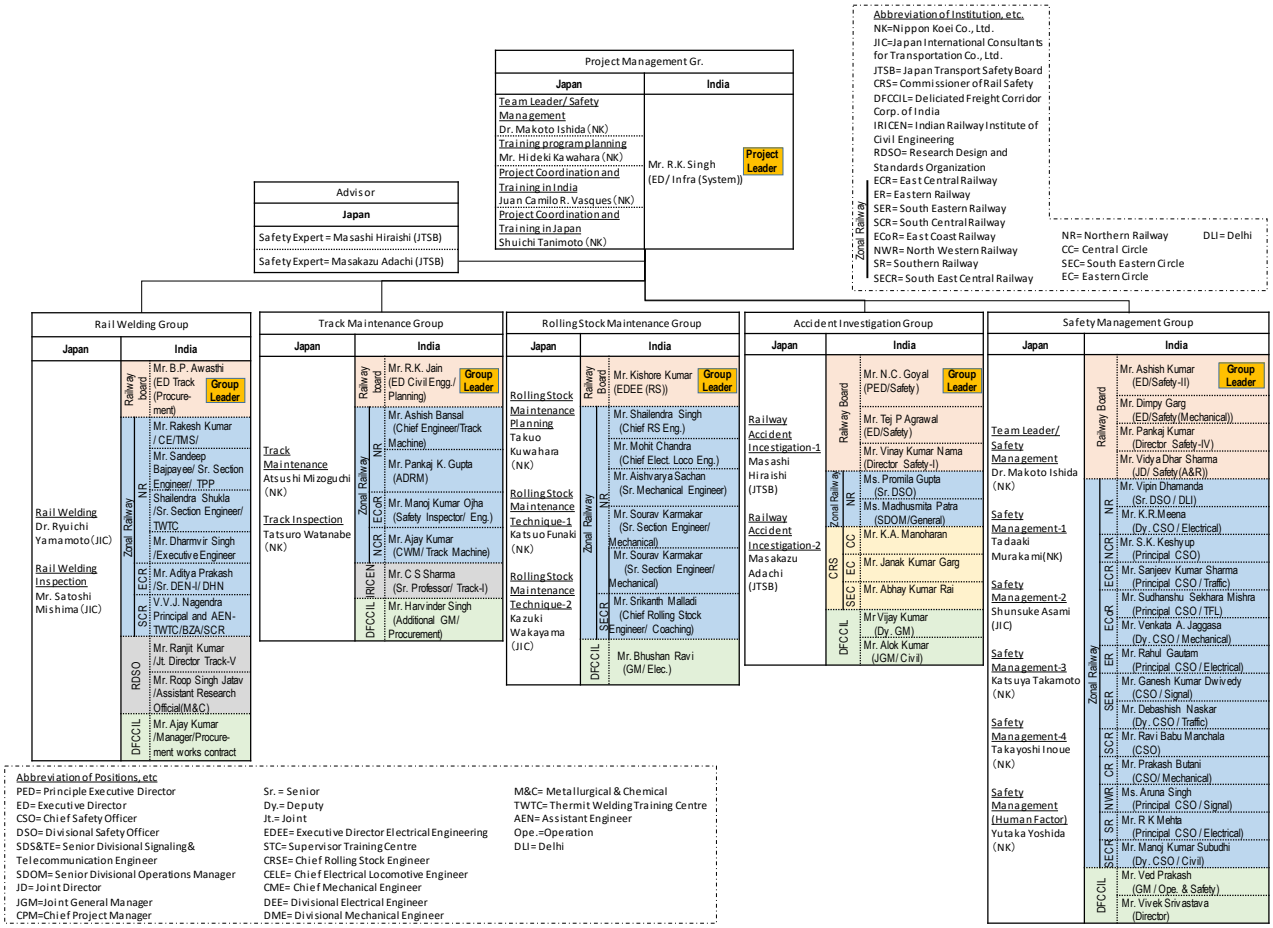
Source: JET

1-2 Input by the Indian side (Planned and Actual)

1-2-1 Appointment of Counterpart

Leaders and members in Rail Welding, Track Maintenance, Rolling Stock Maintenance and Accident Investigation Groups were appointed. Interaction is carried directly to each Team Leader and he manages or requires team members to submit or help accordingly. However, Indian Railways has high personnel rotation having an impact in smooth communication.

As for Safety Management Team, Team members remained unknown after cancellation of training in Japan and Team Leader was only appointed until July 2020. The Figure below shows the current structure of the project focusing on group members.



Source: JET

Figure II-2 C/Ps by Groups (as of January 2020)

1-2-2 Provision of Facilities for Project Operation

MOR has allocated an office space for the JET.

1-3 Activities (Planned and Actual)

1-3-1 Joint Coordination Committee (JCC)

The first JCC was conducted on 4th December of 2018. JICA and JET gave an overview of the project and It was agreed that 20 members of the Safety Management Group and 10 members of the Other Group would be invited to participate in the training in Japan.

The second JCC was on 20th June of 2019. It was confirmed that that the counterparts of all groups. Also, Field survey of each group and the timing of the training in Japan were agreed.

The third JCC was on 15th January of 2020. JET explained the outline of the field survey result and the provisional field support process for the Action Plan. The Indian side presented the progress of this project and the action plans categorized by short and long

term (except for Safety Management group). The Indian side confirmed that it will implement the action plan and JICA will provide technical support.

The fourth JCC was on 19th October of 2021. The Indian and Japanese sides agreed to amend the RD with the following contents. i.e., (1) Project duration extended from 2 years (2018.11-2020.10) to 3 years and 2 months (2018.11-2021.12). (2) Safety Management group training in Japan and related activities will not be conducted. The activities of Safety Management group will be terminated because it is difficult to continue the activities in the situation where it is not possible to visit Japan.

The fifth JCC was on 16th September 2021. Both sides agreed the progress of the Project has been affected by COVID situation and agreed to extend the Project period up to February 2022.

Final JCC was 25th May 2022. Indian side explained all the activity achievement according to the action plan and JET confirmed the activity progress with feedback and recommendations in the meeting.

Following subsection explains the activity in this technical cooperation by group:

1-3-2 Rail Welding Group Activities

- December'18: First JCC.
- January'19: Document received from Mr. B.P. Awasthi. Ministry of Railways (MoR) also requested the various document from Japan side.
- February'19: Document review by the Japan Team and co-ordination from various counterparts for necessary documents. Draft site survey schedule proposed.
- March'19: Finalization of Team Leaders received from MoR.
- May'19: List of the team members received. Manual for Welding (Japanese version) was handed over along with English version of presentation.
- June'19: On 11th June, video conference with Dr. Makoto Ishida took place and different types of welding techniques were explained. Mr. B.P. Awasthi handed us the various welding techniques and its manual to JET team.
- August' 19: JICA Experts Team (JET) dispatched experts from 20th August until 27th August 2019 and found issues. JET has drafted training program in Japan and discussed with C/Ps during the stay in India and finalized the program.
- October' 19: Indian side nominated 9 people out of 10 for training in Japan from 14th October until 25th October. Action Plan has been drafted by those who participated in the training and the action plan progress is being monitored as the attachment.
- April '20~:COVID-19 Pandemic has started

- December ‘20: Action Plan Approved
- February ’21: Online Progress Meeting held without progress report
- March ’22: New Team Leader appointed
- May ’22: Development of double probe technique in India conducted by JET

1-3-3 Track Maintenance Group Activities

- December’18: First JCC.
- March’19: Finalization of Team Leaders received from MoR. Due to transfer of Mr. R.C Thakur position was intermittently handled by Mr. Vipul Kumar (ED Track (Mod.)). Work Plan submitted. List of Team Members received.
- April’19: Comments on Work Plan received. Preparation of questionnaire by Japanese side.
- May’19: New ED CE (P) Mr. R.K. Jain appointed. Meeting to update on progress of study and shared list of team members.
- June’19: Questionnaire explained and submitted. Response on questionnaire along with documents received.
- August’ 19: JET dispatched experts from 28th July until 10th August, 2019 and found issues. JET has drafted training program in Japan and discussed with C/Ps during the stay in India and finalized the program.
- October’ 19: Indian side nominated 7 people out of 10 for training in Japan from 7th October until 18th October. Action Plan has been drafted by those who participated in the training and the action plan progress is being monitored as the attachment.
- November’19: Action Plan was approved by CRB.
- February ’20: New Team Leader appointed
- April ’20~:COVID-19 Pandemic has started
- August ‘20: Request Letter has dispatched from Indian side for sharing experience of data management and the portable track irregularity measurement device
- October ’20: Online seminar for assistance of Action Plan Implementation has conducted
- Jan, Mar, Apr’21: Progress Meeting conducted
- May ‘21: Portable Track Geometry Recording Trolley (LS-100) production completed
- August ‘21: New Team Leader appointed
- December ’21: Geometric Recording Trolley handed over to Indian side with manual
- April ’22: Monitoring of the activity of “LS-100” conducted

1-3-4 Rolling Stock Maintenance Group Activities

- December'18: First JCC.
- March'19: Finalization of Team Leaders received from MoR.
- April'19: List of Team Members received from MoR. List of places to visit by Japanese visit discussed with Mr. Kishore Kumar and draft questionnaire discussed.
- May'19:
  - List of places to be visited by Japanese experts provided by Mr. Kishore Kumar
  - Final questionnaire from JET submitted to Mr. Kishore Kumar.
- June'19: Discussion on places to visit with type of maintenance activities. JET will now prepare site visit schedule of Japanese experts.
- The questionnaire to understand the Indian conditions and know how on process of RS Maintenance was submitted to Mr. Kishore Kumar on 30th May'19.
- August' 19: JET dispatched experts from 21st July until 2nd August 2019 for EMU and PC, 18th August until 31st August, 2019 for EL, DL, FC&DEMU and found issues. JET has drafted training program in Japan and discussed with C/Ps during the stay in India and finalized the program.
- October' 19: Indian side nominated 8 people out of 10 for training in Japan from 5th November 2019 until 15th November 2019. Action Plan has been drafted by those who participated in the training and the action plan progress is being monitored as the attachment.
- December'19: Action Plan was approved by CRB.
- January'20: 3rd JCC Meeting was held on 15th January 2020.
- April '20~: COVID-19 Pandemic has started
- Dec '20, Mar and Jul '21: Progress Meeting conducted with the report
- April '22: Monitoring progress of action plan conducted

1-3-5 Accident Investigation Group Activities

- March'19: JET dispatched experts from 25th February until 1st March 2019 and found issues. JET has prepared training program in Japan beforehand the trip and discussed the contents and finalized the program.
- July'19: Indian side nominated 10 people in Japan from 1st July until 12th July 2019. Action Plan has been drafted by those who participated in the training and the action plan progress is being monitored as the attachment.
- October'19: Action plan was approved. Being inquired about the kind of support that may be required by JET, Indian Team expressed no concerns at the moment, and only if required would summon JET for proper assistance.
- January'20: 3rd JCC Meeting was held on 15th January 2020.
- April '20: As requested in the training in Japan, translated accident reports from

Japanese Railways were shared with Indian C/Ps

- April ’20~: COVID-19 Pandemic has started
- Dec ’20: Progress Meeting conducted; Indian C/P reports the implementation status. JET request progress report to Indian C/P
- April ‘21: JTSB/JET shared presentation material which includes case study of the actual accident investigation
- December ’21: JTSB reviewed the Accident Investigation Report prepared by CRS and IR and JTSB also made a comment on the online meeting.

1-3-6 Safety Management Group Activities

- December’18: First JCC.
- January’19: Explanation of draft work plan by Japan. Information exchange on expected inputs by both sides.
- April’19: Appointment of Team Members. Provision of “The Guideline for Procedure of Safety Management by Transport Operator (Abstract) - To the further improvement in the safety of transportation by MLIT, Japan” and questionnaire. Questionnaire on “Safety Scenario on Indian Railways” presentation and Submission of tentative dates for site visit.
- May’19: Received both answers to both questionnaires. Team leader gave his approval on proposed dates for site inspection which will include joining safety seminar to be held in Lucknow at the end of July ’19.
- June’19: Confirmation on detailed schedule for site visit.
- July’19: JET dispatched experts from 29th July until 6th August, 2019 and found issues. JET has drafted training program in Japan and discussed with C/Ps during the stay in India and finalized the program.
- September’19: Approval for Training members was not possible due to internal circumstances inside Ministry of Railways. The training was cancelled.
- January’20: 3rd JCC Meeting was held on 15th January 2020. The training in March 2020 was proposed.
- March ‘20: The training was cancelled.
- April ’20~: COVID-19 Pandemic has started
- 29th, 30th of July and 2nd August 2021: Webiner for DFCCIL conducted

In 4th JCC, it was agreed that in view of limited possibility of the team visiting Japan in near future it would be decided to exclude this portion from the scope of technical cooperation.

JET have shared the materials in the letter L-JET-MOR-2012-01 dated 25th December

2020. In spite of the activity of Safety Management group have concluded by December 2020, JET proposed the webinar for DFCCIL to provide know-how to create action plan and prevent accident after the commencement of the operation of DFC by using the material. The webinar has carried out in 29th, 30th of July and 2nd August 2021, according to the outline below-

Table II-3 Outline of the Web Seminar for "Safety Management Planning in Railways"

Dates	Jul 28, 29, Aug 1. Total 3 days
Modality	3 hours sessions
Nominations	Over 12 people
Certification	7 people
Contents	7 conferences 2 workshops
Topics	- History of Occupational safety - Safety plan overview - Railway Safety and Human Factors - Safety Education - Preventing workplace accidents - Safety meeting

Source: JET

As a result, 7 DFCCIL staffs presented at the webinar through 3 days entire sessions, out of 18 DFCCIL attendance.

1-4 Achievement of Output

T1 Preparation of project work plan and task plan

It was delivered in December 2018 to MoR.

T2 Discussion the project work plan with Counterpart, contents settlement

The work plan has been continuously revised according to the comments from Indian Counterparts. Final version was officially delivered in December 2019.

T3 Understanding of identified issues and particularities of the Counterpart

As explained in II 1-2.

T4 Holding Joint Coordination Committee (JCC)

The First and the Second JCC meeting have conducted on 4th of December 2018 and 20th of June 2019, respectively. Third JCC was conducted on 15th of January 2020, fourth JCC was conducted on 19th of October 2020, fifth JCC was conducted on 16th of September 2021 and final JCC (sixth JCC) was conducted on 25th of May 2022.

T5 Understanding of railway accidents and operation management status in IR

In connection with the Technical Cooperation, JET collected IR accident investigation reports prepared by CRS and IR Safety Directorates. Site visits and the trainings in Japan helped to deepen the understanding by comparison.

T6 Establishment of Reference Indicators and its target values

As shown in the attached Project Design Matrix, “Objectively Verifiable Indicators”.

Output 1 Activities for Rail welding and Inspection

O1-1 Status check of rail welding and welding inspection in India and

O1-2 Discussion of the contents for rail welding and inspection training.

As for O1-1 and O1-2, JET conducted site survey from 20 August until 27th August 2019. The findings and reflected training program contents as follows;

Table II-4 Issues Observed in India and the proposed training program according to issues (Rail Welding Group)

Issues Observed in India	Training Program in Japan
1. Qualifications • Evaluation of trainee’s skill	• Lecture of Current Rail Welding in Japan
2. Process- Skill • AT welding: The leakage of molten steel • FB welding: Grinding should take place after straightening work	• AT Welding (Demo.) • FB Welding Line observation • Gas Pressure Welding (Demo.) • Rail Welding and Replacement work observation
3. Inspection • Observation of fracture surface • AT Welding: Not used USFD Testing by Double probe Method	• Rail Ultrasonic Detection Inspection car taken a ride • Lecture on Rail Flaw Detection & Education • Ultrasonic Detection Practice

Source: JET

O1-3 Carry out rail welding and inspection training in Japan and support action plan preparation

The training for rail welding has been carried out according to the schedule as follows. 9 trainees were dispatched to Japan out of 10 candidates from India as listed in Table II-6. The action plan has been drafted by Indian C/Ps during the training.

Table II-5 Commenced Training Program in Japan (Rail Welding Group)

Date		AM	Place	PM	Place
15 Oct	Tue	**Arrival in Japan**			
16 Oct	Wed	**Visit** West Japan Railway Company	West Japan Railway Company Head Office	**Visit** Raiiltech Head Office **Lecture** Rail Flaw Detection & Education for Shinkansen New Visitors **Observation** Rail Ultrasonic Detection Insepection car	Railtech Head Office
17 Oct	Thu	Move from Tokuyama to Shin Osaka		off	
18 Oct	Fri	**Observation** Flashu Butte Welding Line	Railtech (Mukomachi)	**Visit** Rail Welding Technical Management Room	Railtech Takatuki Track Maintenance Office (Mukomachi City)
19 Oct	Sat	off		off	
20 Oct	Sun	off		off	
21 Oct	Mon	**Lecture** Current Rail Welding in Japan: Certification of Welding Operator	Railtech (Mukomachi)	**Plactical Skill Training** Aluminothermic Welding	Railtech (Mukomachi)
22 Oct	Tue	**Plactical Skill Training** Aluminothermic Welding / Demonstration of Gas Pressure Welding	Railtech (Mukomachi)	**Plactical Skill Training** Ultrasonic Detection **Observation** Rail Replacement Work	Railtech (Mukomachi)
23 Oct	Wed	Return to the Hotel at 5:30		off	
24 Oct	Thu	Move from Shin Osaka to Tokyo		**Visit** Tokyo Keiki Techno	Tokyo Keiki Techno (Tokyo)
25 Oct	Fri	Action Plan Preparation	JAICA Tokyo	Presentation and Discussion on Action Plan Closing Party	JAICA Tokyo
26 Oct	Sat	Depature from Japan			

Source: JET

Table II-6 Trained C/P Members (Rail Welding Group)

Sr.	Institution		Name	Position
2	Zonal Railway	NR	Mr. Rakesh Kumar	Chief Engineer/TMS
3			Mr. Sandeep Bajpayee	Sr. Section Engineer/ TPP
4			Shailendra Shukla	Sr. Section Engineer/ TWTC
5			Mr. Dharmvir Singh	Executive Engineer
6		ECR	Mr. Aditya Prakash	Sr. Divisional Engineer-I
7		SCR	V.V.J. Nagendra	Principal and Assistant Engineer
8	RDSO		Mr. Ranjit Kumar	Jt. Director Track-V
9			Mr. Roop Singh Jatav	Assistant Research Official (M&C)
10	DFCCIL		Mr. Ajay Kumar	Manager/ Procurement works contract

Note: RDSO= Research Design and Standards Organization, DFCCIL= Deliciated Freight Corridor Corp. of India
NR= Northern Railway, ECR= East Central Railway, SCR= South Central Railway
Source: JET

The draft action plan has been drafted as summarized in Table II-7 by Indian C/Ps during the training.

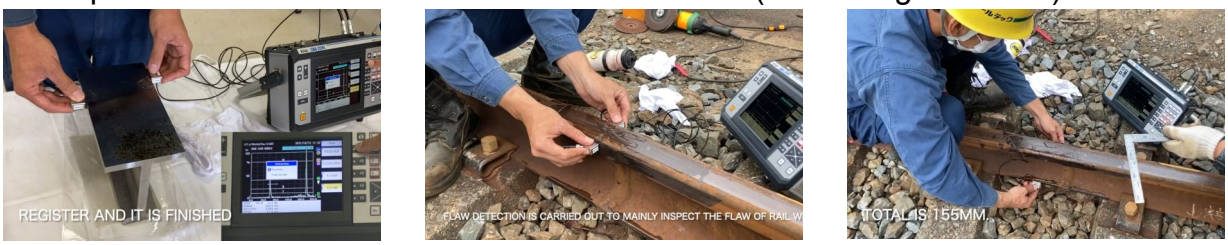
Table II-7 Draft Action Plan prepared by Indian C/Ps (Rail Welding Group)

Term	No.	Item
Short (-1 yr)	1	Introductions of fixtures and gauges being used for A.T welding in JAPAN, may be explored with due customisation to fit Indian conditions.
	2	To achieve the preheating temperature of 900 to 1000 degree centigrade within 2 to 3 minutes for AT welding, necessary modification in preheating system may be required. Necessary instrumentation for measuring the temperature can also be provided by the JAPAN.
	3	Weld trimmer to be modified to trim the risers in AT welding. Grinding of weld collar can be introduced for surface cleaning. It will prevent corrosion of welded joint and enhance the life of weld.
	4	Introduction of rough grinding just after trimming, followed by water cooling of AT welded joints in Indian Railway, to increase the hardness of Heat affected zone.
	5	Introduction of Rail top surface measuring gauge for plotting of top surface of weld.
	6	Use of Rail tensor in AT welding shall be made mandatory.
	7	Packing of five adjacent sleepers (both rail) on both sides of the joint preferably by off track tampers just after the A.T weld, shall be made mandatory.
	8	USFD examination of AT welds by double probe method shall be explored with customisation to suite Indian conditions. Procurement of USFD equipment from TOKYO-KIEKI may be explored.
Medium (1-3yrs)	1	Introduction of dedicated vehicle for each welding team with suitable power pack for operation of various welding related machines.
	2	Introduction of specifically designed uniform with provision to carry small gauges and equipment's.
	3	Procurement of rail tensors and Off-Track tampers from Japan can be explored.
	4	Ultrasonic testing of rails / welds by the vehicular USFD system as being done by JR West may also be introduced on trial basis.
Long (3-5yrs)	1	At least One Flash Butt welding plant on Indian Railway can be upgraded to the standard of Mukoumachi Railtech F.B.W plant. In this regard possibility of Japanese collaboration may be explored.
	2	Introduction of Gas Pressure Welding for in-situ cess welding can be explored. In this regard possibility of Japanese collaboration may be explored.

Note: Short, medium and long term are defined until one (1), one (1) to three (3) and three (3) to five (5) years, respectively.
Source: JET

O1-4 Support the execution of Carry out rail welding and inspection Training in Japan and Support action plan preparation

JET made a video explaining the preparation of double probe rail flaw detection technique and send it to Indian C/Ps in October 2021 (see the figure below).



Sensitivity adjustment | Rail head flaw detection | Rail base flaw detection

Source: JET

Figure II-3 Training Video on Double Probe rail flaw detection technique

By using the video and portable ultrasonic rail flaw detector (SM-20R), JET made a training in Lucknow in 18th and 19th May 2022.

Trial of rail flaw detection by Indian rail | Probes used by IR | Probes of SM-20R

Source: JET

Figure II-4 Training conducted in Lucknow

The main points discussed during the training are as follows:

- The difference between Single probe and Double probe technique, the type and characteristics of rail defects that must be detected.
- The surface of the sides of the rail bottom. Concerns are stated from the Indian side about whether the probe could not be fit to the surface properly. That is because the dimension of the probe used in India is larger than Japan's one. However, Indian side understood that Japanese probe is suitable on the sides of the rail bottom.

According to the discussion above, it was concluded the Indian side will further examine the performance of the double probe technique, including the possibility of the probes and ultrasonic flaw detector used in India. At the end of the rail welding activity, SM-20R was handed over to Indian C/Ps. The hand over ceremony was carried out in Delhi on 17th May 2022.

Source: JET

Figure II-5 Photo of the hand over ceremony

The progress of the action Plan implementation and the achievement as of May 2022 is as follows;

Table II-8 Achievement of Action Plan (Approved by Railway Board) as of May 2022 (Rail Welding Group)

ID	Item	Achievement
Short Term Plans		
S-1	**Introductions of Fixtures and gauges being used for A.T welding in JAPAN,** may be explored with due customization to fit Indian conditions	**Implemented.** ・ Developed by TPP/LKO
S-2	**Modification in preheating system.** To achieve the preheating temperature of 900 to 1000 degree centigrade within 2 to 3 minutes for AT welding, necessary modification in preheating system may be required. Necessary instrumentation for measuring the temperature can also be provided by the JAPAN.	**Partially implemented.** ・ Using Three Piece Prefabricated mould and Compressed Air Petrol Preheating, Indian Railway is achieving Good Quality AT welds with Preheating temperature in the Range of 750-780 degree centigrade. (Preheating time 5 minutes).
S-3	**Weld trimmer to be modified to trim the risers in AT welding**	**Under implementation.** ・ Under development at TPP/LKO
S-4	**Grinding of weld collar can be introduced for surface cleaning.** It will prevent corrosion of welded joint and enhance the life of weld	**Implemented.**
S-5	**Rough grinding after trimming and water cooling** Introduction of rough grinding just after trimming, followed by water cooling of AT welded joints in Indian Railway, to increase the hardness of heat affected zone.	**Under implementation.** ・ Trials are being conducted at TPP Lucknow.
S-6	**Introduction of Rail top surface measuring gauge** for plotting of top surface of weld	**Under implementation.** ・ Till development of this Gauge, manual measurement are being taken.
S-7	**Use of Rail tensor in AT welding shall be made mandatory**	**Partially implemented.**
S-8	**Ballast tamping after welding works** Packing of five adjacent sleepers (both rail) on both sides of the joint preferably by off track tampers just after the A.T weld, shall be made mandatory	**Implemented.**

ID	Item	Achievement
S-9	**Double probe for Ultrasonic Flaw Detection** USFD examination of AT welds by double probe method shall be explored with customization to suite Indian conditions. Procurement of USFD equipment from TOKYO-KIEKI may be explored.	Tokyo Keiki SM-20R weld tester was brought in RDSO by JICA team for demonstration and training on 18.05.2022. ・ The defect in AT weld collar is not detectable by the double probing of the flange due to limited accessibility of direct beam of USFD in Rail flange area only. ・ There is no method of detection of lack of fusion in web area/portion of AT weld using this method. ・ Further Trials will be conducted.
Middle Term Plans		
M-1	**Dedicated truck for maintenance gang** Introduction of Dedicated vehicle for each welding team with suitable power pack for operation of various welding related machines	**Partially implemented.** ・ Dedicated Vehicles have been provided to Welding team. ・ Power Pack for Rail grinding is available on this Vehicle. ・ Power pack for weld trimmer is yet to be developed.
M-2	**Introduction of working uniform** Introduction of specifically designed uniform with provision to carry small gauges and equipment	**Implemented.** ・ Developed at TPP LKO
M-3	**Rail tensors and Off track tampers procurement** Procurement of rail tensors and Off Track tampers from Japan can be explored	・ Rail tensors are being used for AT welding on IR. ・ Off Track Tampers are available with Indian Railway.
M-4	**Introduction of Dedicated USFD vehicle** Ultrasonic Testing of Rails / welds by the vehicular USFD system as being done in JR West may also be introduced on trial basis	・ Indian Railway is going for procuring vehicular USFD system to adopt best global practices.
Long Term Plans		
L-1	**Flash Butt Welding plant upgrade** At least One Flash Butt welding plant on Indian Railway can be upgraded to the standard of Mukoumachi Railtech F.B.W plant. In this regard possibility of Japanese collaboration may be explored	・ Upgradation of various Flash Butt welding plant of Indian Railway is already been taken up.
L-2	**Introduction of Gas Pressure Welding** Introduction of Gas Pressure Welding for in-situ cess welding can be explored. In this regard possibility of Japanese collaboration may be explored	・ In India Mobile Flash Butt welding plants are used for in-situ welding of rails and around 115 mobile flash butt welding plants are available on IR network.

Source: JET

Output 2 Activities for Trackwork Maintenance

O2-1 Status check of trackwork maintenance in India

O2-2 Discussion of the contents for trackwork maintenance training.

As for O2-1 and O2-2, JET conducted site survey from 28th July until 10th August 2019. The findings and reflected training program contents as follows;

Table II-9 Issues Observed in India and the proposed training program according to issues (Track Maintenance Group)

Issues Observed in India	Training Program in Japan
1. Education and Training • Safety education to protect oneself	• Freshman Training intro. • Safety education

2. Examination on work quality
• Understanding/ Recognizing the quality of its examination method
• The frequency is high, but the quality is relatively low since the implementation comes first priority
• Examination quality shall be improved by advanced systems
• Input data into TMS shall be better if it includes more figures
• Proper management of CWR/LWR based on its site condition
• Unfixed track possession time
	• Lecture on Japanese history of track maintenance technology
	• Track maintenance work introduction in Japan
	• OCC visit
	• Rail defect management
	  • Rail center inspection
	  • Rail welding and rail exchange work
	  • Ultrasonic detection
	• Introducing PDCA cycle at site office

Source: JET

O2-3 Carry out trackwork maintenance Training in Japan and Support action plan preparation

The training for trackwork maintenance training in Japan has been carried out according to the schedule as follows. 7 trainees were dispatched out of 10 candidates from India as listed in Table II-11. The action plan has been drafted by Indian C/Ps during the training.

Table II-10 Commenced Training Program in Japan (Track Maintenance Group)

Date		AM	Place	PM	Place
06 Oct	Sun	Arrival Japan			
07 Oct	Mon	Assemble in the lobby of the hotel and move to JICA Tokyo by chartered bus Briefing	Seminar Room 306, JICA Tokyo	[Lecture] Japanese history of track maintenance technology	SR 306, JICA Tokyo
08 Oct	Tue	[Lecture] Flaw detection technology	TOKYO KEIKI Techno,Tokyo	[Lecture] Flaw detection technology	TOKYO KEIKI Techno,Tokyo
09 Oct	Wed	[Visit] JR-West headquarters	JR-West headquarters,Osaka Pref.	[Visit]14:00-17:00 Osaka Track Maintenance Office	Noda City, Osaka Prefecture
10 Oct	Thu	[Visit] Takatsuki Track Maintenance Office	Mukomachi City, Osaka Prefecture	[Visit] Rail Welding Management Room	Mukomachi City, Osaka Prefecture
11 Oct	Fri	~~[Visit]~~ ~~Training Center: Observation of skills competition~~ **(Cancelled due to typhoon approached)** [Lecture] Flew Detection Technology	Suita City, Osaka Pref.	[Visit] Shin-Osaka Operation Center	Osaka
12 Oct	Sat	Day off		Day off	
13 Oct	Sun				
14 Oct	Mon	Day off		Move from Kyoto to Osaka	
15 Oct	Tue	Night Work (Track Work)	Osaka	[Visit] Training Center :Training for new employees [Visit] Educational Institution of Railway accidents and Safety 'Think-and-Act	Suita City, Osaka Pref.
16 Oct	Wed	[Visit] Training Center: Safety training, Observation of practices	Suita City, Osaka Pref.	[Visit] Training Center	Suita City, Osaka Pref.
17 Oct	Thu	Move from Kyoto to Osaka		[Visit] Railway Technical Research Institute (RTRI)	Tokyo
18 Oct	Fri	Meeting (Investigation Result・Action Plan Support)	Seminar Room 306, JICA Tokyo	Meeting with JICA (Training in Japan・Action Plan Presentation) Closing Party	Seminar Room 306, SR 304,JICA Tokyo
19 Oct	Sat	Dept Japan			

Source: JET

Table II-11 Trained C/P Members (Track Maintenance Group)

Sr.	Institution		Name	Position
1	Railway board		Mr. R.K. Jain	(ED Civil Engg./ Planning)
2	Zonal Railway	NR	Mr. Ashish Bansal	(Chief Engineer/Track Machine)
3			Mr. Pankaj K. Gupta	(Additional Divisional Railway Manager)
7		ECoR	Mr. Manoj Kumar Ojha	(Safety Inspector/ Eng.)
8		NCR	Mr. Ajay Kumar	(Chief Workshop Manager/ Track Machine)
9	IRICEN		Mr. C S Sharma	(Sr. Professor/ Track-I)
10	DFCCIL		Mr. Harvinder Singh	(Additional GM/ Procurement)

Note: IRICEN= Indian Railway Institute of Civil Engineering, DFCCIL= Deliciated Freight Corridor Corp. of India
NR= Northern Railway, WR= Western Railway, ECoR= East Coast Railway, NCR=North Central Railway
Source: JET

The draft action plans are summarized in Table II-12 by Indian C/Ps during the training.

Table II-12 Draft Action Plan prepared by Indian C/Ps (Track Maintenance Group)

Term	No.	Item
Short (-1 yr)	1	Safety First – Always: -Introduction of "Pointing and Calling" System (Yoshi) -Pre and post work meeting
	2	Shift focus: "WHO caused it" to "WHY it happened"
	3	Assured track possession for planned track works: Corridor blocks to avoid wastage of time and energy
	4	Quality and safety certification by executing agency and inspecting agency
	5	Check by Infringement template after completion of repair works; before certification
	6	Reduction of Trolley inspections of JE/SSE
	7	Inspections by key-man with look-out person
Medium (1-3yrs)	1	USFD testing regime -Vehicular testing and confirmation by portable equipment -Improved efficacy of testing methodology by using transverse defect detection equipment etc.
	2	Rail Grinding regime for removal of RCF defects
	3	Elimination of holes in rails for signaling / electrical bonds (welding / clamping)
	4	Separating inspections unit from Maintenance / Renewals units
	5	Provision of mobile sets with camera to all SE/JE to record inspections photographs
	6	Use of portable TGMS with software interface (e.g. Trackmaster)
	7	Use of handy inspection / maintenance tools
	8	Functional Uniform (Trackman and Supervisors)
	9	Cables through ducts only
	10	Accidents cases display with photographs and models (Zonal Railway, Training Institutions)
Long (3-5yrs)	1	Proliferation of Fully mechanized maintenance units with -Handy and smart Tools for improving productivity -Mobility
	2	Recruitment of Technically qualified Trackman and exhaustive training
	3	Mandatory Training of Contractual personnel for Track Works
	4	Setting-up of state of art Training schools with training track having working equipment
	5	Development of specialized agencies for regular track works -With assured Long term commitment -Regular Training, tools, and equipment
	6	Improved design for slab tracks
	7	RDSO: Recruitment of only professionally qualified personnel for continuous research on long term basis (RTRI has 196 persons having doctoral qualification)
	8	Corridors for speed of 130 km/h and higher, restrict axle load to 17-20/22t for coaching/mixed traffic
	9	Increase in frequency of TRCs (e.g., Shinkansen – once in 10 days)

Note: Short, medium and long term are defined until one (1), one (1) to three (3) and three (3) to five (5) years, respectively.

O2-4 Support the execution of trackwork maintenance training in India

Indian side requested to explore the possibility to provide as much as five devices to Northern Railway and expedite the time it takes to measure. Indian side delivered a letter of interest by August 2020 on "No.219-W/1/Track Maintenance System/TP/2019-20" and it was approved in 4th JCC.

As requested, Japanese manufacture (Deicy Co., Ltd) has manufactured "LR-S100", which is portable geometric recording trolley adopted Indian gauge. Following figures show the device components and the appearance.

		
Device mounted on the rail	Devices to be carried including accessories	Carton Package

Source: JET and Deicy Co., Ltd.

Figure II-6 Geometric Recording Trolley (LR-S100)

In December 2021, JET carried LR-S100 into Indian field site (Ambala section) and conducted the handing over ceremony on 22nd December 2021.

Source: JET

Figure II-7 Handing Over Ceremony of Geometric Recording Trolley (LR-S100)

JET visited Ambara section where track irregularity measurement work using the track geometry measuring trolley "LR-S100" has been carried out as a pilot district for

implementing one of track maintenance action plans to identify the current status of the progressing the action plans for improving the process of achieving the purpose of each item of action plans. Totally the appropriate progress of some items of action plan, not only high efficiency and accuracy track irregularity measurement but other items was identified and very serious attitude for their implementation was realized in Indian side.

In addition, very valuable and helpful discussions through Q & A sessions and others were frankly carried out for the further development of this project.

The progress of the action Plan implementation and the achievement as of May 2022 is as follows;

Table II-13 Achievement of Action Plan (Approved by Railway Board) as of May 2022

(Trackwork Maintenance Group)

ID	Item	Achievement
Short Term		
S-1	**Safety First- Always: Guideline revision**	**Fully implemented.** This has been implemented fully as in order to ensure the safety first and always, guidelines of the Pr. CE circular no. 278 are being followed for measurement of yard parameters as follows: - ・ Yard track parameters like Gauge, Cross level, Twist & versine measured at every 5th sleeper on the main line, other than main line and Turn in curve at a frequency of 3 months over all the divisions. ・ Separate registers are being maintained for each station yard and track measurements and these registers are test checked by ADEN & scrutinized by Sr.DEN (Sectional). ・ Portable track geometry measurement trolley is also being used to measure the track parameters in Ambala division ・ Safety of work site is being ensured as per IR Permanent Way Manual 2020. ・ Winter safety jackets and luminous safety jackets have been distributed to staff to ensure the visibility in night and low visibility during fog/stormy weather.
S-2	**Introduction of "Pointing and Calling" system (Yoshi)**	**Fully implemented.** ・ All divisions of Northern Railway are using the “Pointing and Calling” method whereby the field staff momentarily stop, observe and call while pointing their fingers left and right and look out for the approaching train. After making sure that “No train” is coming, they enter the work site or cross the track. ・ A new software “SIMERROR” was introduced by JICA team for implementation of Pointing and Calling. All divisions of Northern Railway were demonstrated the working of the software by JICA team. The staff is being trained for implementing “pointing and calling” system as a part of their daily routine. ・ SIMERROR software is being actively used by all divisions. ・ Benefits : This system ensures the safety of work site as well as personal safety of working staff on the track. The system is properly implemented according to the instruction of training, which looks safety mind surely enhanced
S-3	**Pre and post block work meeting**	**Fully implemented.** Pre block meetings are being held to discuss in detail regarding: ・ Protection and safety at worksite. ・ Step by step working procedure and activities. ・ Distribution of task (Duty) to staff present at site. ・ Fixing of responsibility of staff regarding allotted work. ・ Timely completion of the work efficiently.

ID	Item	Achievement
		· It ensures failure free and safe traffic block working. · Benefits: Efficiency improved, Output of various works/activities increased and failures reduced. The content of meeting is basically all right and the consolidation of the working group is surely motivated.
S-4	**Shifting of focus from "WHO caused it" to "Why it happened"**	**Implemented.** · Instructions have been issued to sub-divisions to maintain the record along with photographs to find the actual cause of problem. · Field officials have been advised to work on “Why” i.e. finding root cause instead of “Who” responsible. · This has improved root cause analysis of the problem in the field and helped to rectify the issues related to material failure, manpower negligence or wrong working method for the future works.
S-5	**Use of Track Master for faster track parameter monitoring**	**Implemented.** Implemented in UMB division · JICA handed over one LR-S100 to India in Dec 2021 and conducted training for the field staff in New Delhi. The machine was handed over to the Consignee -SSE/Permanent way/STM/Ambala. · The Ambala team used the trolley for measurement of various track parameters like gauge, cross-level, twist etc. · Comparison was drawn between the readings taken by LR-S100 and manually using Gauge-cum-Cross level. · Action Plan: Standardization of specifications by RDSO in progress for full implementation and extensive use. The recording trolley is precisely operated under the perfect understanding the function of the trolley
S-6	**Check by Infringement Template after completion of repair work; before certification**	**Partially Implemented.** · Work order was placed with Bridge Workshop , Jalandhar (Punjab) for the supply of 40 Nos. Infringement Detection Device (IDD) for distribution in the field. · 16 no. Infringement detection device has been developed and being used. 35 more devices are under fabrication which nos is likely to be completed by August 2022. · Benefits: It is being used to check the infringement at work sites and ensure the safety of track from all obstructions
S-7	**Reduce manual/subjective inspections : More of Track Monitoring through automated gadgets**	**Partially implemented.** · Track monitoring through automated gadgets is being done using Track Recording Cars and GPS enabled Oscillation Monitoring Systems on all BG routes at prescribed frequency. The maintenance and attention to track is planned based on the results. · Vehicular USFD is also being done on selected routes of Northern Railway.
S-8	**Inspection by Key-man with look-out person**	**Under implementation** · This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
S-9	**Assured track possession Time**	**Partially implemented.** · Partially Implemented by Organizing Weekend Mega Traffic Blocks on Regular Basis. Setting the window time of track possession as much as possible is identified, which is one of very valuable effects obtained from this project.
Middle Term		
M-1	**Doing away with Trolley inspections of JE/SSE**	**Partially implemented.** · Has been implemented on TKD-PWL section (UP & DN line) having speed >130 kmph
M-2	**"Foot" and "On-board" inspections to capture all defects.**	**Partially implemented.** · Implemented as per para 103, 106 and 110 of IR Permanent Way Manual 2020 · Foot Inspection - Has been implemented on TKD-PWL section (UP & DN line - >130 kmph) · Trolley Inspection Items, which are required to be checked in on foot inspection, would also be checked in trolley inspection.

ID	Item	Achievement
M-3	**Improvement in USFD testing regime**	**Partially implemented.** · Vehicular USFD has been implemented on selected Group A routes. Tender for procurement and operation of 7 nos VUSFD has been called by Railway Board. · Benefits: Vehicular testing and confirmation by portable equipment and Improved efficacy of testing methodology by using transverse defect detection equipment etc.
M-4	**Implementation of Rail Grinding regime for removal of RCF defects**	**Partially implemented.** · RGI-6 RGM machine runs on NDLS-PNP-UMB-SIR-LDH route of Northern Railway. · 10 new RGMs (96 stones) and 6 new SRGMs are being procured · Routes have been identified for working of RGM and SRGM. · Sample deployment plan has been prepared.
M-5	**Elimination of holes in rails for signaling / electrical bonds (Use of clamps/welding)**	**Under implementation.** · RB had issued instructions vide letter dated 20.08.2020 for field trials of clamp type fixing arrangement for all new works and sanctioned works on all GO/GD and HDN routes. · On experimental basis, welding of bond wires is being adopted in some new construction works. However for large scale adoption, formal instructions from RDSO/Railway Board are awaited. · Letter sent to RB on 27.09.21 seeking approval for extensive use on IR.
M-6	**Separating Inspection units from Maintenance/ Renewals units**	**Under implementation.** · On Pilot Project Basis in One SSE/P.Way Section on Ambala Division of NR · Processed for creation of separate Id in TMS
M-7	**Provision of mobile sets with camera to all SSE/JE**	**Under implementation.** · CE TMS and CRIS have been approached to make suitable provision in TMS software to upload photographs of inspections. · Software for the same is under development.
M-8	**Use of GPS based portable OMS with software interface.**	**Implemented.** · GPS based portable OMS are being used in Northern Railway for monitoring the riding quality and health of the track.
M-9	**Use of handy maintenance tools** - Power wrenches, Over raised rail shifter (for handling rails), etc.	**Under implementation.** **Power wrenches** · Introduction as a part of 'Small Track Machines' by publishing its specifications and approved vendors. **Over raised rail shifter (for handling rails) etc.** · The specifications for the over raised rail shifter as sent by JICA have been shared with RDSO. · An online meeting was also conducted with the manufacturer YAMAGOSHIKI of Over raised Rail Shifter in Japan by Northern Railway and RDSO. The doubts regarding working of this machine in Indian conditions were discussed. · Further action is being taken by RDSO.
M-10	**Introduction of functional Uniform to trackman and supervisors**	**Under implementation.** A sample uniform will be obtained from CMRL vendor and its usage trial is planned to be done in Delhi division field unit. Its performance will be reviewed and suitable recommendation will be submitted to Rly. Bd. for issuing necessary guidelines. The almost same uniform as Japanese one is procured to enhance the safety and the quality of work.
M-11	**Accident cases to be displayed with photographs, models & lesson learnt.**	**Under implementation.** · Rly. Bd has been approached to issue necessary directions to IRICEN, the centralized Training Institute of Civil Engineers for displaying accident cases. · However, it has been partially implemented by Accident Investigation group
Long Term		
L-1	**Proliferation of Fully Mechanized maintenance units**	**Under implementation.**

ID	Item	Achievement
		・ To achieve full mechanisation of track renewal and maintenance activities, procurement of additional track machines is being done with the planning to complete it by 2024.
L-2	**Recruitment of Technically qualified (ITI trained) trackmen and artisans** able to do mechanized maintenance	**Under implementation.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-3	**Mandatory Trg. Of contractual personnel for track works**	**Under implementation.** ・ The training module for training of contractual personnel has been developed by IRICEN, Pune. However, the issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-4	**Cable through ducts only**	**Under implementation.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-5	**Setting-up of state of art Training schools with training track having working equipment**	**Under implementation.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-6	**Development of specialized agencies for track works with assured long term commitment and daily track possession**	**Under implementation.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-7	**Improved design for slab tracks for higher speeds**	**Under consideration.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guideline will be issued by Railway Board.
L-8	**RDSO Recruitment**	**Under consideration.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guidelines will be issued by Railway Board.
L-9	**Restrict Axle load** to 20/22t for coaching/mixed traffic for 130 Kmph and high speed corridors.	**Under consideration.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guidelines will be issued by Railway Board.
L-10	**Increase in frequency of TRCs** (Shinkansen once in 10 days)	**Under consideration.** ・ This issue is under consideration of Railway Board and after due deliberation, necessary guidelines will be issued by Railway Board.

Note: Underlined contents were confirmed by JET at site in April 2022
Source: JET

Output 3 Activities for Rolling stock Maintenance

O3-1 Status check of rolling stock maintenance in India

O3-2 Discussion of the contents for rolling stock maintenance training.

As for O3-1 and O3-2, JET conducted site survey from 21st July until 2nd August 2019 for EMU and PC, 18th August until 31st August 2019 for EL, DL, FC & DEMU. The findings and reflected training contents as follows;

Table II-14 Issues Observed in India and the proposed training program according to issues

(Rolling Stock Maintenance Group)

Issues Observed in India	Training Program in Japan
1. Reported Rolling Stock Issues in India • Wheel shelling and coil spring rupture issues were reported by Indian C/Ps. • Magnetic flaw detection for coil spring is recommended.	• Discussion at RTRI (Railway Technical Research Institute) • Workshop observation (TX, JRF-Kawasaki, Hiroshima)
2. Workplace environment • Storage: Many parts outside the building have been observed. Some are rusted. • Lack of 5S: Small parts (screws, washers, pins and etc.) and oil on the floor, Tools and parts remained after the work has been completed.	• Workshop observation (TX, JRF-Kawasaki, Hiroshima, & Hitachi) • Lectures from Railway Operator (TX, JRF)
3. Facilities, tools and jigs • Preferable facilities are not prepared. Clean room for bearing, grease amount measurement tool & etc. • Improper use of tools. Torque wrenches, Wires	• Workshop observation (TX, JRF-Kawasaki, Hiroshima, & Hitachi) • Lectures from Railway Operator (TX, JRF)
4. Training • List up each worker's skills and their levels and proceed necessary trainings are recommended.	

Source: JET

O3-3 Carry out rolling stock maintenance Training in Japan and Support action plan preparation

The training for rolling stock maintenance training in Japan has been carried out according to the schedule as follows. 8 trainees were dispatched out of 10 candidates from India. The action plan has been drafted by Indian C/Ps during the training.

Table II-15 Commenced Training Program in Japan (Rolling Stock Maintenance Group)

Date		AM	Place	PM	Place
04 Nov	Mon	Japan Arrival			
05 Nov	Tue	Orientetion	Jica-Tokyo		TBD
06 Nov	Wed	Presentation about the Metropolitan Intercity Railway Company and its plant where we will visit	Metropolitan Intercity Rilway Company	Visit the Rolling Stock Inspection Plant & Railcar Rejuventation Center and Repair Sheds for the maintenance and overhaul of their EMUs including some marchines for detection of abonormaliteies with guidance and Q&A session	Metropolitan Intercity Rilway Company
07 Nov	Thu	Presentation about the Japan Freight Railway Company and this training center	Central Training Center of Japam Freighter Railway Company	Visit some special facilities and tools for the training with explanation and discussions	Central Training Center of Japam Freighter Railway Company
08 Nov	Fri	Presentation about the Kawasaki depot & workshop for Freight cars and wagons. Following the explanation about the work flow of this work shop, visit each shops and process.	Kawasaki depot & workshop of Railway Company	Presentation about the Kawasaki depot & workshop for Freight cars and wagons. Following the explanation about the work flow of this work shop, visit each shops and process.	Kawasaki depot & workshop of Railway Company
09 Nov	Sat	off		off	
10 Nov	Sun	off		off	
11 Nov	Mon	Presentation about Hitachi Railway Business Unit and Kasado works	Hitachi,Railway Business Unit, Kasado works	Presentation about Hitachi Railway Business Unit and Kasado works	Hitachi,Railway Business Unit, Kasado works
12 Nov	Tue	Presentation about Hiroshima workshop	Hiroshima depot &Workshop of Japan Freight Railway Company	Presentation about Hiroshima workshop	Hiroshima depot &Workshop of Japan Freight Railway Company
13 Nov	Wed	Following the presentation	Railway Technical Reserch Institute	Negotiating with RTRI to hold the following lectures from the specialist	Railway Technical Reserch Institute
14 Nov	Thu	Discussion and building-up the action plan	Jica-Tokyo	Discussion and building-up the action plan	Jica-Tokyo
15 Nov	Fri	Discussion and building-up the action plan	Jica-Tokyo	Discussion and building-up the action plan	Jica-Tokyo
16 Nov	Sat	Depature from Japan			

Source: JET

Table II-16 Trained C/P Members (Rolling Stock Maintenance Group)

Sr.	Institution		Name	Position
1	Railway board		Mr. Kishore Kumar	EDEE (Executive Director Electrical Engineering) RS (Rolling Stock)
2	Zonal Railway	NR	Mr. Mohit Chandra	Chief Electrical Locomotive Engineer
3			Mr. Shailendra Singh	Chief Rolling Stock Engineer/ Coaching
4			Mr. Aishvarya Sachan	SME
7			Mr. Sourav Karmakar	SSE/C&W
8			Mr. Pushpak Ranjan	Chief Instructor
9		SECR	Mr. Srikanth Malladi	CRSE
10	DFCCIL		Mr. Ravi Bhushan	GM/Elect

Note: DFCCIL= Deliciated Freight Corridor Corp. of India
NR= Northern Railway, SECR= South East Central Railway
Source: JET

The draft action plan is summarized in Table II-17 by Indian C/Ps during the training.

Table II-17 Draft Action Plan prepared by Indian C/Ps (Rolling Stock Maintenance Group)

Term	No.	Item
Short (-0.5 yr)	1	Safety Measures: Trainees/employees in various training institutes as well as at respective workplaces over IR may be counseled and encouraged to adopt all safety measures like safety shoes, helmets, hand gloves, goggles etc.
	2	Safety Audits: Safety audits/patrols may be conducted at regular intervals.
	3	Exchange of Ideas: To improve working and working environment, ideas/suggestion from categories of staff should be called for as a part of system (Kaizen).
	4	Automation: For efficient, accurate and higher productivity, digital gauges and automated tools/ jigs may be adopted.
	5	Acrylic Sheets: On the lines of Shinkansen, high quality acrylic sheets may be tried in lieu of window glasses.
	6	Overhead Portable Inspection Trolley: Overhead portable trolley may be developed for inspection of overhead equipment on various location in workshop area.
Medium (0.5~ 1.5yrs)	1	Horizontal Rolling Shutter: To prevent any occurrence due to falling of workman during empty pit.
	2	Underframe Cleaning Room: To attend cleaning work of bogies as well during various major/shop schedules.
	3	Dust Collection Booth: Before offering a coach for schedule to evacuate dust from inside of coach.
	4	Tread Brake Unit: On the lines of Tsukuba Express tread brake unit may be tried on few coaches in addition to existing disc brakes in LHB coaches.
	5	Wheel Profile Device: Wheel profile measurement sensors should be installed in yard which automatically relays the profile to control center.
	6	Wheel Shelling and Spring Breakage: To address the issue of wheel shelling of LHB coaches in Indian Railways, RTRI may be approached by Indian Railways for detailed study and action plan.
Long (1.5~ 3yrs)	1	Automatic Train Control: Automatic train control (ATC) may be adopted in Locomotives over IR to control collision and derailment to support safe train operation.
	2	Automatic Train Operation: To provide automatic acceleration and de-acceleration up to a predefined speed, the same may be adopted over IR.
	3	Multi-level Stacking for Storage: To overcome space constraint, Multilevel automatic stacking of wheels and other spares may be done by RFID tagging.
	4	Effective and Rapid Braking System: Braking System may be designed in such a manner that braking distance must be within prescribed limit irrespective of weather.
	5	Electro Pneumatic Braking in Freight Operation: Electro-pneumatic braking system may be adopted in container freight operation for faster train operation.
	6	Guardless Freight Operation: With the help of online monitoring freight operation may be inducted without guard which comprises only train driver.
	7	Automated Bearing Mounting Device: Fully automated machine may be adopted for efficient and effective bearing mounting.
	8	Aluminum Body Structure: For catering high speed operation, coaches with aluminum body structure may be adopted.
	9	Friction Stir Welding: For high strength and weldability of coach body structure friction Stir Welding may be introduced over IR.
	10	Underslung Mounted AC Unit: To keep the center of gravity low, provision of underslung AC unit in Indian Railway may be studied by RDSO.
	11	Silicon Bump: Silicon bump may be provided with center pivot top for guided movement of traction center of LHB coaches.
	12	Crashworthy Test: This kind of test may be conducted in all kind of Rolling Stock to determine crashworthiness.

Note: Short, medium and long term are defined until half year (0.5yr), half year (0.5yr) to one and half year (1.5 yr) and ne and half year (1.5 yr) to three (3) years, respectively.
Source: JET

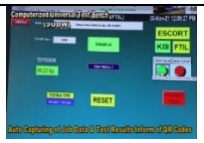
O3-4 Support the execution of rolling stock maintenance training in India

The acknowledgement and understanding for the action plans were confirmed in each site and of course although differences in many aspects were seen in each sites, the progress of the Action Plans' implementations and the achievements as of April 2022 were satisfactory enough as follows;

Table II-18 Achievement of Action Plan (Approved by Railway Board) as of May 2022

(Rolling Stock Maintenance Group)

SHORT TERM PLAN			
ID	**ITEM IDENTIFIED**	**LOCATION IDENTIFIED**	**ACHIEVEMENT**
S-1	Safety Measures	Anand Vihar Coaching Depot	**ACHIEVED** Requisite Safety Gadgets/devices are made available at all field units. Counselling by Officials and Senior Supervisors is being done to encourage staff for adoption of safety measures/device and not to bypass any safety gadget/device. Focus on Fire Safety is also been done. Various Summer Drives and Summer Preparedness activities been done in all field units.
S-2	Safety Audits	Jagadhari Workshop	**ACHIEVED** • Monthly Shop council meeting is being done. • Safety audits being carried out both internally, inter railways and through third party.
S-3	Exchange of Ideas	1. EMU Car Shed, Ghaziabad 2. Freight Depot, Tuglakabad	**ACHIEVED** Knowledge sharing and exchange of ideas being done in field units. Staff coming out with innovation/innovative idea is being encouraged, recently Ludhiana C&W depot has developed inhouse LHB air trouble repair kit with flexible air hoses. Officers and Staff also directed to Zonal Railways to learn better maintenance practices.
S-4	Acrylic Sheets	Sick Line, New Delhi	**PARTIALLY ACHIEVED** Window glasses of sub-urban trains of EMU Car shed/GZB have been fitted with acrylic sheet and found satisfactory. Same will be tried upon on Mainline Coaches after exploring wind velocity and aerodynamic behaviour of the train under a cross wind environment at high speed.  
S-5	Overhead Portable Inspection Trolley	Electric Loco Shed, Ghaziabad	**ACHIEVED** Portable ladders has been provided in Electric Loco Shed/GZB. However, two battery operated portable Ladders are operational at DEMU Car Shed, Budgam for overhead inspection of Carriages
S-6	Automation of tools	Jagadhari Workshop	**ACHIEVED** • To enhance accuracy, system reliability and Zero Human error, Jagadhari Workshop adopted automation in various sections/field units such as: FIAT bogie Dismantling & Assembly with IOT based Torquing tools with Advanced Data acquisition system and Storage.  • Automatic testing of air brake child part testing bench with simultaneous testing of all components based on QR code activation and algorithm based digital pressure check and result generation. • Automatic Disc Brake Cylinder Test Bench are being used at JUDW.

			    • Further automation is being proliferated is inducted in newly commissioned Rail Coach Navinikaran Karkhana, Sonipat such as Coach Shower Plant: To detect leakage/seepage from Ceiling or Coach Body, Digital Shock Absorber Testing Machine, Automated Coach Paint Booth: Painting is done by Reciprocators and Paint Gun etc.
MEDIUM TERM PLAN			
M-1	Horizontal Rolling Shutter	Anand Vihar Coaching Depot	M/s Sharda Enterprises has carried out site inspection of ANVT coaching depot and submitted budgetary and specification. However, specification submitted by the firm is not considered due to less load bearing capacity. Site inspection has been conducted by M/s Motothrottle, revised budgetary and specification with enhanced capacity will be submitted soon by the firm.
M-2	Dust Collection Booth	1. SSB Coaching Depot 2. EMU Car shed GZB	Analysis of feasibility, drawing, location and other requirements with Engineering and Electrical department is under process. However, dust collection booth is operational for traction motors at EMU Car Shed/GZB.   Proliferation for coach interior and passenger interface area to be done for Mainline and EMU coaches also for driver's Cab of Locomotives
M-3	Tread Brake Unit	MCF/RCF	MCF/RBL is working on feasibility and requisite analysis and consideration of various technical aspects for conducting trial. In the meanwhile RDSO has suggested modification in piping arrangement and wiring of LHB coaches, these improvements have led to reduction of wheel shelling by 50%.
M-4	Wheel Profile Device	1. Anand Vihar Coaching Depot 2. EMU Car shed GZB 3. Freight Depot TKD 4. Loco trip shed, Delhi	Wheel Profile Device is sanctioned for freight depot/TKD under Smart yard Project, Anand Vihar coaching depot and EMU Car Shed/GZB. Technical specification has been drafted with consultation of RDSO draft guideline and IRCA conference rules. Budgetary offer has been submitted by the firm and tendering is under process. COFMOW is also preparing technical specification for Wheel Data Acquisition system for proliferation of Monitoring of wheel profile over Indian Railways.
M-5	Electro Pneumatic Braking in Coaching Operation	1. MCF/RCF 2. RDSO	**ACHIEVED** 5 trains (Tejas Coaches) and 2 Vande Bharat (T-18 coaches) are operated with Electro- Pneumatic braking system. EP braking system is also operational in sub-urban train rakes of DEMU and EMU/MEMU.
M-6	Wheel Shelling and Spring Breakage	RDSO	IR has taken preventive measures which have resulted in substantial reduction in wheel shelling and Spring breakage as per RDSO maintenance guidelines. Yashvantpur and Bangalore coaching depots of SWR is carrying out ECA testing method to deduct surface and sub surface cracks which are not visible in the DPT method and proper fault code analysis noted down from the WSP display unit which may involve problems like signal error in speed sensor, short circuit of dump valve (Error: 72/73), interruption of dump valve (Error: 72/73) etc. which are major contributors to wheel shelling
M-7	Under frame Cleaning Room	1. SSB Coaching Depot 2. EMU Car shed GZB	Analysis of feasibility, drawing, location and other aspects with Engineering and Electrical department is under process. However on trial, underframe cleaning is being done at SSB coaching depot through Pressurized Water jet giving favorable results, same is under proliferation.
LONG TERM PLAN			

L-1	Silicon Bump	MCF	**DROPPED** Item is dropped since IR is already using Rubber Bumps in all Rolling Stocks and this feature will not add any additional safety reliability.
L-2	EP Braking in freight Operation	1. Railway Board 2. RDSO	Electro Pneumatic Braking is been tried upon 7 Coaching Trains. Due to integrity issue in freight stock Electro Pneumatic Braking in freight stock is under consideration with Railway Board and RDSO.
L-3	Guard less Freight Operation	1. Railway Board 2. RDSO	**PARTIALLY ACHIEVED** End of Train Telemetry (EoTT) is under trial stage at various Zones over Indian Railway, however ECoR has conducted successful field trial with a freight train between Talcher and Paradip section. Currently 11(eleven) locomotives have been fitted with EoTT devices and are operational. In addition purchase orders have been issued for 250 numbers, which are expected to be received from Aug'22 onwards.
L-4	Automatic bearing mounting device	Jagadhari Workshop	Double ended CTRB mounting/dismounting machine is under procurement for Jagadhari Workshop. Purchase Order has been issued and installation will be done by June 2022, further proliferation will be done after commissioning and successful trails at Jagadhari Workshop.
L-5	Multi-level stacking for storage	1. Jagadhari Workshop 2. DSL Shed LDH 3. Elect. Loco shed LDH	Jagadhari workshop has adopted the Multi Level Stacking for Store, RMPU and wheel section. Proliferation being studied for heavy materials.  Automated Store and Retrieval System (ASRS) has been inducted in newly commissioned Rail Coach Navinikaran Karkhana (RCNK), Sonipat. 
L-6	Automation	Jagadhari Workshop	**Same as S-6**
OTHERS			
O-1	Automatic Train Control/Operation	RDSO	Automatic Train Protection System (Kavach) has been installed in locomotives in Indian Railways to prevent accidents on rail tracks like collision of trains. The Kavach protection system is designed in such a way that if one loco comes in front of the engine, the Kavach immediately stops the engine from a distance of 380 meters.
O-2	Aluminium Body Structure	RDSO	LoA for manufacturing of Mainline and MEMU Coaches with Aluminium Body Structure has been issued. Manufacturing of Coaches with Aluminium Body Structure on trial basis will start soon at MCF/RBL.
O-3	Friction Stir Welding	RDSO	Friction Stir Welding is being studied by RDSO.
O-4	Under slung Mounted AC Unit	RDSO	Indian Railways has phased out coaches fitted with Underslung Mounted AC units and adopted Roof Mounted AC Unit (RMPU) , since irregular and less cooling quality of Underslung Mounted AC units in Extreme Summer Condition in India especially Northern and Western part of India
O-5	Crashworthiness Test	RDSO	Crashworthiness of coaches has been done to enhance passenger safety and coaches reliability: **ICF Coaches:** All ICF coaches have been provided with 'Z' stiffeners at the end panels, Destruction Tube in buffers and **LHB Coaches:** All LHB coaches are fitted with 'H' type Centre Buffer Coupler

Note: Underlined contents were confirmed by JET at site in April 2022
Source: MoR

JET also recognized that it varies the well-organized or not, depending on the location. It is desirable that all the workplaces shall keep organized at the same level.

Output 4 Activities for Investigation of railway accidents

O4-1 Status check for investigation of railway accidents in India

O4-2 Discussion of the contents for training in investigation of railway accidents

As for O4-1 and O4-2, JET supported JTSB site visit and preparation of the training program.

O4-3 Carry out Training in Japan for accident investigation and Support action plan preparation

The training for accident investigation group training in Japan has been carried out according to the schedule as follows. 10 trainees were dispatched from India. The action plan has been drafted by Indian C/Ps during the training.

Table II-19 Commenced Training Program in Japan (Accident Investigation Group)

Date			Contents
Jun	29	SAT	Leave India
	30	SUN	Japan Arrival
Jul	1	MON	General Orientation
			Meeting with Board member of JTSB/ Purpose of accident investigation, responsibility of the agency of accident investigation, history of JSTB, etc.
	2	TUE	Fundamentals of investigation/ ・Accidents and incidents to be investigated in Japan (concerned laws included) ・Procedure of the investigation, relationship with other agencies (Railway Bureau, Police, etc.) ・Fact-finding investigation (site preservation, site investigation, interview with concerned person, etc.) ・Contents of investigation report ・Case studies (No. 1~3)
	3	WED	Visit to JR East/ Training center, Activities by railway operator for safety (explanation by JR East), Museum concerned safety
Jul	4	THU	Workshop/ Brief review of training
			Track, structure/ Investigation method, Case studies (No. 4~8)
			Rolling stock/ Investigation method, Case studies (No. 9~13)
	5	FRI	Visit to RTRI/ Railway Technical Research Institute (RTRI)
	6	SAT	Day off
	7	SUN	Day off
	8	MON	Visit to JR East/ Tokyo Operation Control Centre
			Signaling safety, electrical facilities/ Investigation method, Case studies (No. 14~16)
			Train operation/ Investigation method, Case studies (No. 17~19)
Jul	9	TUE	Case studies (No. 20~26)
			Visit to JR East/ Technology and Training Center
	10	WED	Workshop/ Brief review of training, Action plan preparation by C/Ps
			Visit to JR Freight/ Activities by railway operator for safety (explanation by JR Freight), Omiya Rolling Stock Center
	11	THU	Visit to JR East /Tokyo General Rolling Stock Center, Research and Development Center
	12	FRI	Workshop/ Action plan preparation by C/Ps
			Discussion/ Presentation of the prepared action plan by C/Ps, Discussion with railway accident investigator of JTSB
			Wrap up/ Question and answer session
	13	SAT	Leave Japan

Source: JET

Table II-20 Trained C/P Members (Accident Investigation Group)

	Institution	Name	Potision
1	Ministry of Railways (Railway Board)	Mr. Naresh Goyal Chand	Principal Executive Director/ Safety
2	Ministry of Railways (Railway Board)	Mr. Tej Prakash Agrawal	Executive Director /Safety
3	Ministry of Railways (Railway Board)	Mr. Vinay Kumar Nama	Director/ Safety
4	Northern Railway	Ms. Promila Gupta	Senior Divisional Safety Officer/ Ambala Division
5	Northern Railway	Ms. Madhusmita Patra	Senior Divisional Operations Manager (General)/ Delhi
6	CRS	Mr. Manoharan Arthanari Kumalankuttai	Commissioner of Rail Safety (CRS) /Southern Circle
7	CRS	Mr. Janak Kumar Garg	CRS /Commissioner of Metro Railway Safety.
8	CRS	Mr. Abhai Kumar Rai	CRS/South Eastern Circle
9	DFCCIL	Mr. Vijay Kumar	Deputy General Manager
10	DFCCIL	Mr. Alok Kumar	Joint General Manager/Civil

Source: JET

The draft action plan is summarized in Table II-21 by Indian C/Ps during the training.

Table II-21 Draft Action Plan prepared by Indian C/Ps (Accidents Investigation Group)

Term	No.	Item
Short (-1 yr)	1	To investigate accident cases based on 'why' concept instead of 'who' concept. ・Systems & Procedures to be checked in perspective irrespective of the human intervention. ・Fixing of responsibilities vs. fine tuning of existing system.
	2	Railway Board to review and refine the parameters in detail to be recorded after the accidents.
	3	Timeline for accident enquiry to be revised from D+10 days to D+30 days ・To ensure detailed and broad based investigations. ・Necessary instructions will be issued in this regard by Railway Board.
	4	General Managers and the Commission for Railway Safety to be empowered to hire specialists, retired officials and/or agencies during accident investigation in order to use ・Specific domain knowledge. ・Detailed investigation to ascertain the root cause of the accident. ・Necessary instructions will be issued by Railway Board.
	5	Voice communication between various units including train crew at the station to recreate the circumstances preceding the accident. ・Will aid in accident investigation in better manner.
	6	Detailed and systematic photography of the accident site to be done. ・The details to be provided by the commission for Railway Safety and final instructions to be issued by Railway Board.
	7	Indian Railway Institute of Disaster Management, Bangaluru to impart safety training to working officers.
	8	Each officer must undergo training before he/she is granted Selection Grade.
	9	Consequential accidents in each Railway to be enquired into by Safety officers of the Headquarter or as decided by the General Manager.
	10	After every consequential accident enquiry, the concerned Railway to conduct a workshop and concerned officials from other zonal Rly./Rly Board to attend the same. ・Brainstorming sessions to be held.
Long (3-5yrs)	1	Training of investigators by leading institutes of the World (Cranfield University, UK etc.) ・Enhancement of knowledge. ・To learn and imbibe best practices followed across the Globe.
	2	Model room for re-creation of important accident site in each Zonal Railway Training Institute.
	3	Videography and photography to be widely displayed. All necessary details of the accidents to be shown.
	4	Measurements of accident parameters by advance instruments (Track Master, Laser Equipment etc.).
	5	Voice and Cam recorder (Like Cockpit Voice Recorder) to be provided in all locos to ascertain the circumstances at the time of accident to help in accident investigation.
	6	GPS based alarm system between train crew and maintenance staff. (Trackmen, signalling and OHE staff working at site.)
	7	Installation of Load Measuring Device for right and left wheel in order to ascertain uneven loading.
	8	After accident enquiry, to refer a few important cases for detailed appreciation by University/Management body expert in the field.

Note: Short, medium and long term are defined until one (1), one (1) to three (3) and three (3) to five (5) years, respectively.
Source: JET

O4-4 Support the execution of training in India for railway accident investigation

According to the request in the training in Japan, JTSB/ JET had shared three cases of the accident investigation report and presentation materials in English by the letter "L-JET-MOR-2004-01" dated 13th April 2020.

In September 2021, JET was requested from Indian side to review and comment on the report, which was issued after training in Japan in 2019. According to the request, JTSB have reviewed the Accident Investigation Report prepared by CRS and IR, and JTSB made a comment during the online meeting, held in 8th December 2021.

The progress of the action Plan implementation and the achievement as of May 2022 is as follows;

Table II-22 Achievement of Action Plan (Approved by Railway Board) as of May 2022 (Accident Investigation Group)

ID	Item	Achievement
Short Term Plans		
S-1	•To investigate accident cases based on 'why' concept instead of 'who' concept.	**Implemented.** Zonal Railways have been advised on 31.12.2019. Recent Accident Investigation Report into Consequential Accidents covers detailed discussion and reason of as to why accident has happened and also covers recommendations for system improvement to prevent recurrence of similar accidents. 300 Officers across Indian Railways have been imparted training in Root Cause Analysis using Ishikawa Fishbone Diagram and "Why Why Why" Analysis. All accident Inquiry reports from 01.02.2022 do include Ishikawa Fishbone Diagram.
S-2	•Timeline for accident enquiry to be revised from D+10 days to D+30 days	**Implemented.** Zonal Railways have been advised on 31.12.2019. This extended time was given to ensure detailed investigation in to accidents to find and deliberate upon the actual reason for accident.
S-3	General Managers and the Commission for Railway Safety to be empowered to hire specialists, retired officials and/or agencies during accident investigation: -To use Specific domain knowledge. -Detailed investigation to ascertain the root cause of the accident.	Accident Investigation Teams at Zonal Railways are already taking assistance of Forensic Laboratories and RDSO during accident investigations
S-4	Recording of voice communication between various units including train crew at the station to recreate the circumstances preceding the accident. -Will aid in accident investigation in better manner.	**Under Implementation.** Concerned Directorate has advised Zonal Railways for implementation on 13.09.2021. Under Implementation. This facility is already available at 44 Stations across North Central Railway, North Western Railway, East Central Railway and Northeast Frontier Railway.
S-5	Detailed and systematic photography of the accident site to be done. -The details to be provided by the Commission for Railway Safety and final instructions to be issued by Railway Board.	**Implemented.** Zonal Railways have been advised on 11.12.2019. Recent Accident Investigation Reports include photographs of accident sites. However, being linked with photography skills, it will take time to develop this skills with photographers of various zones and divisions of Indian Railway.

ID	Item	Achievement
S-6	• Indian Railway Institute of Disaster Management, Bengaluru to impart safety training to working officers. • Each officer must undergo training before he/she is granted Selection Grade.	**Under examination for implementation.** Concerned Directorate has been advised.
S-7	Consequential accidents in each Railway to be enquired into by Safety officers of the Headquarter or as decided by the General Manager.	**Implemented.** Zonal Railways have been advised on 20.08.2019. Now all consequential accidents are being investigated by Headquarter Officers, both for SAG as well JAG Committee. This has helped in preventing possibility of conflict of interest as well as in improving quality of accident investigation.
S-8	After every consequential accident enquiry, the concerned Railway to conduct a workshop and concerned officials from other zonal Rly./Rly Board to attend the same. -Brainstorming sessions to be held.	**Implemented.** Zonal Railways have been advised. First such brainstorming session was held at NCR on 25.07.2019. Since then, Zonal Railways are conducting such workshops, regularly.
Long Term		
L-1	Training of investigators by leading institutes of the World (Cranfield University, UK etc.) -Enhancement of knowledge. -To learn and imbibe best practices followed across the Globe.	**Under examination for implementation. .** Concerned Directorate has been advised. Covid-19 Pandemic have affected progress.
L-2	• Model room for re‑creation of important accident site in each Zonal Railway Training Institute. • Videography and photography to be widely displayed. All necessary details of the accidents to be shown.	**Under implementation.** Zonal Railways have been advised on 10.01.2020. Progress have been affected due to Covid-19 Pandemic.
L-3	Measurements of accident parameters by advance instruments (Track Master, Laser Equipment etc.).	**Under Implementation** Railway Board have advised Zonal Railways on 07.02.2020 to take necessary action toward its implementation. Concerned Directorate at Railway Board has advised RDSO on 24.06.2021 to workout details of upgradation of measuring instruments to be used at accident site.
L-4	Voice and Cam recorder (Like Cockpit Voice Recorder) to be provided in all locos to ascertain the circumstances at the time of accident to help in accident investigation.	**Under implementation.** Crew Voice & Video Recording System(CVVRS) has been sanctioned for 5,000 Locomotives. 245 Locomotives have already been provided with CVVRS.
L-5	GPS based alarm system between train crew and maintenance staff. (Trackmen, signalling and OHE staff working at site.)	**Under Implementation** Concerned Directorate was advised. It has been informed that a similar system based upon Advance Starter System and VHF, with RDSO specifications & known as RAKSHAK, was under trial at 22 Stations an 19 Block Sections across NR, NER, SCR & SECR was under trial. Based upon trial feedback, RDSO specification have been revised. The equipment is under development based upon revised specification for further proliferation over Indian Railways.
L-6	Installation of Load Measuring Device for right and left wheel in order to ascertain uneven loading.	**Under Implementation** Railway Board have advised Zonal Railways on 14.01.2020 to take necessary action toward its implementation. Further, RDSO has been advised on 24.06.2021 to study and determine the feasibility of installing Load Measuring Device for right and left wheel in existing weighbridges.
L-7	After accident enquiry, to refer a few important cases for detailed appreciation by University/ Management body expert in the field.	**Implemented.** Two accident cases sent for detailed appreciation.

Source: JET

Output 5 Activities for Safety Management

O5-1 Status check of safety management initiatives in India

O5-2 Settlement of the contents for the training in Japan and Seminar in India

As for O5-1 and O5-2, JET conducted site survey from 29th July until 6th August 2019. The findings and reflected training contents are listed as follows. However the training in Japan has been cancelled by Indian side;

Table II-23 Issues Observed in India and the proposed training program according to issues (Safety Management Group)

Issues Observed in India	Training Program in Japan
1. Driver's Cab • Safety of train operation was dependent on the driver's discretion	• OCC & Train Crew office • Driver's Cab • History of Transport Safety Management in Japan • Railway museum

2. Station
• Communication errors between workers are concerned
• Improvement of markers to support the handling of workers (e.g., vehicle contact limit markers)
• Unnecessary rules (e.g., waving green flag from the driver's cab)
	• Case Study & Discussion:
	  • Prevention of labor accident
	  • Human Factor, etc.
	• Station works observation
	• Rolling Stock Depot

3. Railway facility Maintenance work • No safety gear such as helmets or safety shoes were equipped • Inattention to train approaching is concerned (e.g., How to walk on track)	• Facility Maintenance workplace observation • Educational Institution of Railway accidents & Safety

Source: JET

The second arrangement for training in Japan was cancelled again. On the view of pandemic circumstances on July 15th, 2020; JET officially proposed to conduct a web seminar with filtering the previous agreed contents, by selecting the most adequate for the platform.

Although in principle, the proposal was rejected by the Safety Management Team Leader, in view of limited possibility of the team visiting Japan in near future, it was decided during the 4th JCC to exclude this portion from the scope of Technical Cooperation.

Despite activities for this Team were cancelled, in view that Dedicated Freight Corridor (DFC) Corporation has started partial operation of the West Corridor, JET approached DFC and suggested to hold a web seminar on safety management only for DFC employees.

2. Achievement of the Project

2-1 Project Purpose/ Outputs and the indicators

For four teams, 34 persons from railway sector of Indian have conducted their training in Japan. Four out of five teams have started to implement concrete actions inside Northern Railways to improve capability and promotional activities related to safety. As agreed in 4th JCC, the activities after training of Safety Management group shall excluded in the project.

Action plan of four group prepared in the training in Japan in 2019 has been approved by MoR in 2019-2020. After the approval of the action plan, JET have conducted monitoring activity at site on four groups (Rail Welding, Trackwork maintenance, Rolling Stock Maintenance) and confirmed progress of items which is based on the action plan.

Additional activities are also proposed for trackwork maintenance group and rail welding group. As for trackwork maintenance group, LR-S100, track geometry recording trolley has been handed over in December 2022 and JET trained Indian officials in Ambara section for the utilization. As for rail welding group, SM-20R, rail flaw detector has been handed over to Indian side and instructed “double probe technology” to Indian officials in Lucknow.

3. History of PDM Modification

(1) 1st amendment: 2nd JCC (June 2019)

The position of JET has been reflected in the Inputs from the Japanese side. The target Zonal Railway, i.e., Northern Railway and the equipment to be procured (a digital ultrasonic rail flaw detector) were specified in the PDM.

(2) 2nd amendment: 4th JCC (October 2020)

Project period has been extended from December 2020 to December 2021 due to COVID-19. Although training in Japan for four (4) group i.e., rail welding, track maintenance, rolling stock and accident investigation, have been carried out, the number of the attendance specified in the PDM has been changed from forty (40) attendees to thirty-four (34) according to the actual record of the training. The training in Japan of the safety management group could not be conducted and the activity is decided to be excluded in the project. The portable track irregularity measurement device, specified in the action plan of track maintenance group, is added as the scope of the project.

(3) 3rd amendment: 5th JCC (September 2021)

Project period has been extended from December 2021 to February 2022 due to COVID-19. (It has been agreed between JICA and MoR to extend the project period until May 2022

in February 2022.)

(4) 4th amendment: Final (6th) JCC (May 2022)

Project period has been extended from February 2022 to May 2022 due to COVID-19.

4. Others

4-1 Results of Environmental and Social Considerations (if applicable)

Not applicable

4-2 Results of Considerations on Gender/Peace Building/Poverty Reduction, Disability, Disease infection, Social System, Human Wellbeing, Human Right, and Gender Equality (if applicable)

Not applicable

III. Results of Joint Review

1. Results of Review based on DAC Evaluation Criteria

1-1 Relevance

The relevance can be addressed high.

(1) Necessity of the Project

IR is the world's largest railway operator, with a network of 66,000 km of track and more than 1.4 million employees. According to Indian Railways Yearbook 2016-2017, the number of derailment accidents has been on the rise in the last five years in IR while collisions, level crossing accidents and train fires have all declined. Moreover, major derailments have also occurred. In November 2016, the derailment in Kanpur, Uttar Pradesh, was a catastrophe that killed over 120 people. The reduction of the derailment accident is the highest priority of MoR.

(2) Consistency with the MoR policies

The deputy railway minister mentioned the possibility of damage to the tracks as the cause of the accident. Reduction of derailment accidents is the most urgent issue in improving the safety of railways in India. In this occasion, the Project is formed based on the Memorandum of Cooperation between Ministry of Land, Infrastructure, Transport and Tourism of Japan and MoR on Railway safety, signed in February 2017. Minutes of meetings on the Detailed Planning Survey for the Project signed on 21st December, 2017 between the Counterpart and JICA.

Remarkably high ✓ **High** Moderate Low

1-2 Effectiveness

The effectiveness can be addressed moderate.

(1) Achievement of the project purpose and contribution of outputs

The project purpose is on track and expected to be achieved. However, the activity originally planned five (5) groups but the Safety Management is excluded from the scope as described in Output-5.

(2) Effects generated by the Project and factors that promoted the effectiveness of the Project

・ Establishment of Action Plans supported by JET

MoR drafted Action Plan by four (4) sectors i.e., rail welding, track maintenance, rolling stock maintenance and accident investigation supported by JET and approved properly.

・ Implementation organization

A team-based implementation structure was established in MoR during the project period.

The project leaders on duty the implementation of the Action Plans were appointed and proceed the Action Plans continuously.

Remarkably high | High | ✓ **Moderate** | Low

1-3 Efficiency

The efficiency can be assessed moderate. The project has begun in December 2018 and the period has been extended from December 2020 to May 2022 due to COVID-19 pandemic. Due to the pandemic, the input of the project from the Japan side has limited against the plan, though JET has monitored the project by online and achieved the project objective.

Remarkably high | High | ✓ **Moderate** | Low

1-4 Impact

Prospect of achievement of the overall goal is high. The number of derailment accidents in IR has been decreased from 46 (2018) to 27 (2021). Assuming that the activity will be continued for the implementation of the Action Plan, it is likely to decrease the railway accident.

Remarkably high | ✓ **High** | Moderate | Low

1-5 Sustainability

MoR is strongly determined to diffuse nation-wide in NR and, as presented above, its emphasis on railway safety should be highly appreciated. However, COVID-19 makes socio-economic environment in coming years unpredictable although quite an encouraging policy framework is in presence. Assuming that negative influence of the pandemic in coming years is minimal, sustainability can be high.

(1) Policy Aspect

Sustainability from the policy aspect is high. The direction which leads activity related to safety is established in the Action Plans and the plan has approved officially. It covers long-term and the activity, including and it expects produce safety activities after completion the Project.

(2) Technical Aspect

Sustainability from the technical aspect is high. Technical knowledge has been transferred in the training in Japan and the action plan was prepared taken into the experience in the training. In the Project, some specific items added for follow-up e.g., Ultrasonic Rail Flaw Detection “Double Probe Method”.

Remarkably high ✓ **High** Moderate Low

2. Key Factors Affecting Implementation and Outcomes

The occurrence of global pandemic poses a huge change in the approach and communication between the teams and JET. Also, some actions have been delayed due the pandemic as well, since remote activities are strongly encouraged. Nevertheless, in teams with enough initiative this condition has strengthened the relationship since the use of tools for remote communication have become the new norm. This allows to Indian teams to expedite their queries to JET and explain directly, without a need of constant site staff as communication window.

As for the project operation after training in Japan, It takes time for assignment of new C/Ps in India for replacement in change. Also, it needed time for approval of action plan.

3. Evaluation on the results of the Project Risk Management

No experts have been deployed during COVID-19 pandemic, from February 2020 until November 2021, however; Experts have been engaged and approached on a need basis, and meetings via video conferences have been made possible the exchange of ideas between both counterparts.

To accelerate the assignment of new C/Ps and/or action plan approval, JET issued letters and informed by coordinator in India.

4. Lessons Learnt

It has not been motivated after the training in Japan to progress the action plan of Indian C/Ps. Though the project planned one time per group, several times of the training could keep the motivation longer.

IV. For the Achievement of Overall Goals after the Project Completion

1. Prospects to achieve Overall Goal

The overarching goals of this project are as follows

Overall Goal	Safety of railway network in Concerned Northern Railway and DFCCIL is improved.
Indicator 1	Number of annual accidents on railway network in Concerned Northern Railway are reduced from the last year.
Indicator 2	Number of activities related safety improvement in Northern Railway and DFCCIL is increased.

Source: JET

As for Indicator 1, the number of accidents in NR could be monitored by Indian side. As for Indicator 2, the table below shows the number of action plan items in each area and their implementation status as of May 2022. The implementation of these items will continue after the completion of the project, and the Indian side itself needs to work to increase the number of items implemented at the mid-term evaluation stage.

Table IV-1 Number of action plan items and number of implementation (monitoring for Overall Goal)

Field / Item	Welding	Track maintenance	Rolling stock maintenance	Accident Investigation
Number of Action Plan Item	15	30	19	15
Number of items implemented (May 2022)*	4	6	7	6

Source: JET
Note: *Number of items which status indicated “(Fully) Implemented” or “Achieved”, as of May 2022

The number of items implemented well progressed at the timing of the project completion. Furthermore, since high-level officials of MoR attended the training in Japan, and it is expected to progress for further implementation of the action plan continuously.

2. Plan of Operation and Implementation Structure of the Indian side to achieve Overall Goal

The action plans are approved officially by MoR. With the high level of commitment of MoR together with the expected output of the proposed project by four group i.e., rail welding, track maintenance, rolling stock maintenance and accident investigation, it is highly likely to achieve the overall goal.

3. Recommendations for the Indian side

Indian and Japanese sides discussed and agreed Action Plans, which were approved by the board of IR successfully. Further implementation of the Action Plans and future dissemination throughout IR are expected under the rules/ manuals of IR including handed over equipment if necessary. The number of accidents is reported every year, and the number is set as the indicator of an overall goal of the project. In addition to that, the status of the action plan by group also shall be reported internally in MoR, in this regard, it is recommended the frequent communication between JICA and MoR shall be kept for monitoring the action plan

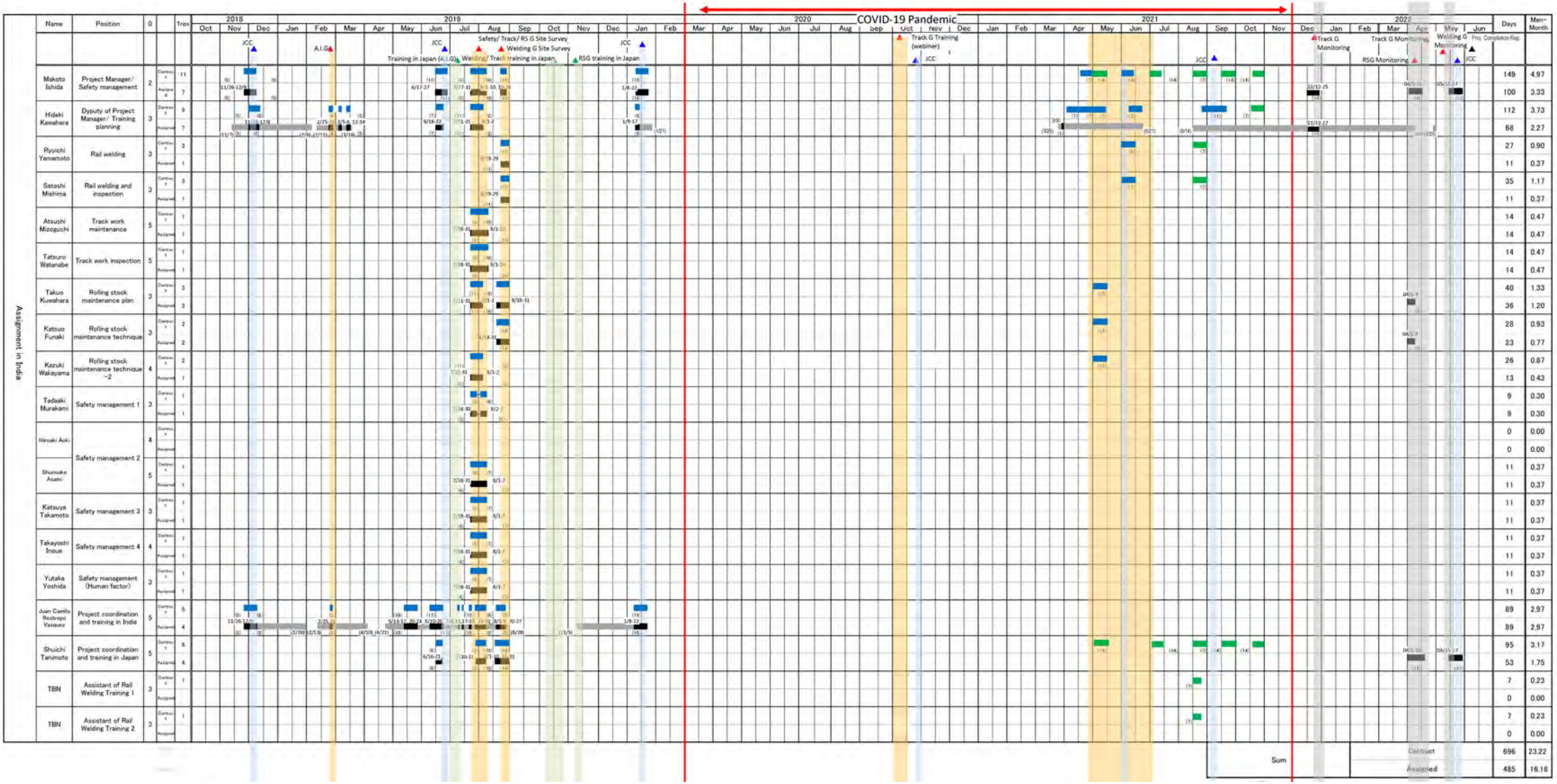
4. Monitoring Plan from the end of the Project to Ex-post Evaluation

The joint monitoring framework is currently under consideration.

ANNEXURES

Annex 1: Results of the Project

List of Dispatched Experts



Name	Position	D	Trips	Days	Man-Month
Makoto Ishida	Project Manager/ Safety management	2	Contract 11	149	4.97
			Assigned 7	100	3.33
Hideki Kawahara	Dypuity of Project Manager/ Training planning	3	Contract 9	112	3.73
			Assigned 7	68	2.27
Ryuichi Yamamoto	Rail welding	3	Contract 3	27	0.90
			Assigned 1	11	0.37
Satoshi Mishima	Rail welding and inspection	3	Contract 3	35	1.17
			Assigned 1	11	0.37
Atsushi Mizoguchi	Track work maintenance	5	Contract 1	14	0.47
			Assigned 1	14	0.47
Tatsuro Watanabe	Track work inspection	5	Contract 1	14	0.47
			Assigned 1	14	0.47
Takuo Kuwahara	Rolling stock maintenance plan	3	Contract 3	40	1.33
			Assigned 3	36	1.20
Katsuo Funaki	Rolling stock maintenance technique	3	Contract 2	28	0.93
			Assigned 2	23	0.77
Kazuki Wakayama	Rolling stock maintenance technique -2	4	Contract 2	26	0.87
			Assigned 1	13	0.43
Tadaaki Murakami	Safety management 1	3	Contract 1	9	0.30
			Assigned 1	9	0.30
Hiroaki Aoki	Safety management 2	4	Contract	0	0.00
			Assigned	0	0.00
Shunsuke Asami		5	Contract 1	11	0.37
			Assigned 1	11	0.37
Katsuya Takamoto	Safety management 3	3	Contract 1	11	0.37
			Assigned 1	11	0.37
Takayoshi Inoue	Safety management 4	4	Contract 1	11	0.37
			Assigned 1	11	0.37
Yutaka Yoshida	Safety management (Human factor)	3	Contract 1	11	0.37
			Assigned 1	11	0.37
Juan Camilo Restrepo Vasquez	Project coordination and training in India	5	Contract 6	89	2.97
			Assigned 4	89	2.97
Shuichi Tanimoto	Project coordination and training in Japan	5	Contract 8	95	3.17
			Assigned 4	53	1.75
TBN	Assistant of Rail Welding Training 1	3	Contract 1	7	0.23
			Assigned	0	0.00
TBN	Assistant of Rail Welding Training 2	3	Contract 1	7	0.23
			Assigned	0	0.00
			Sum Contract	696	23.22
			Sum Assigned	485	16.18

List of Counterparts (Team Leaders)

Group	Name	Position	Institution
-	R.K.Singh	ED/ Safety-II	Ministry of Railway
Rail Welding	A.B.Khare	PED/ CEP, MoR	Ministry of Railway
Track Maintenance	P.K.Sharma	CTE, NR	Northern Railway
Rolling Stock Maintenance	Kishore Kumar	PED/ EE, MoR	Ministry of Railway
Accident Investigation	T.P.Agrawal	ED/Safety-I, MoR	Ministry of Railway

Note: As of May 2022
Source: JET

List of Training in Japan and the Counterparts

Group/ Sector	Rail Welding	Track Maintenance	Rolling Stock Maintenance	Accident Investigation
Date	12 October – 26 October, 2019	6 October – 19 October, 2019	3 November – 16 November, 2019	29 June – 13 July, 2019
Participants	9 trainees	7 trainees	8 trainees	10 trainees

Source: JET

Training Program in Japan (Rail Welding Group) (2019)

Date		AM	Place	PM	Place
15 Oct	Tue	**Arrival in Japan**			
16 Oct	Wed	**Visit** West Japan Railway Company	West Japan Railway Company Head Office	**Visit** Raiiltech Head Office **Lecture** Rail Flaw Detection & Education for Shinkansen New Visitors **Observation** Rail Ultrasonic Detection Insepection car	Railtech Head Office
17 Oct	Thu	Move from Tokuyama to Shin Osaka		off	
18 Oct	Fri	**Observation** Flashu Butte Welding Line	Railtech (Mukomachi)	**Visit** Rail Welding Technical Management Room	Railtech Takatuki Track Maintenance Office (Mukomachi City)
19 Oct	Sat	off		off	
20 Oct	Sun	off		off	
21 Oct	Mon	**Lecture** Current Rail Welding in Japan: Certification of Welding Operator	Railtech (Mukomachi)	**Plactical Skill Training** Aluminothermic Welding	Railtech (Mukomachi)
22 Oct	Tue	**Plactical Skill Training** Aluminothermic Welding / Demonstration of Gas Pressure Welding	Railtech (Mukomachi)	**Plactical Skill Training** Ultrasonic Detection **Observation** Rail Replacement Work	Railtech (Mukomachi)
23 Oct	Wed	Return to the Hotel at 5:30		off	
24 Oct	Thu	Move from Shin Osaka to Tokyo		**Visit** Tokyo Keiki Techno	Tokyo Keiki Techno (Tokyo)
25 Oct	Fri	Action Plan Preparation	JAICA Tokyo	Presentation and Discussion on Action Plan Closing Party	JAICA Tokyo
26 Oct	Sat	Depature from Japan			

Source: JET

Participants of Rail Welding Group

Sr.	Institution		Name	Position
2	Zonal Railway	NR	Mr. Rakesh Kumar	Chief Engineer/TMS
3			Mr. Sandeep Bajpayee	Sr. Section Engineer/ TPP
4			Shailendra Shukla	Sr. Section Engineer/ TWTC
5			Mr. Dharmvir Singh	Executive Engineer
6		ECR	Mr. Aditya Prakash	Sr. Divisional Engineer-I
7		SCR	V.V.J. Nagendra	Principal and Assistant Engineer
8	RDSO		Mr. Ranjit Kumar	Jt. Director Track-V
9			Mr. Roop Singh Jatav	Assistant Research Official (M&C)
10	DFCCIL		Mr. Ajay Kumar	Manager/ Procurement works contract

Note: RDSO= Research Design and Standards Organization, DFCCIL= Deliciated Freight Corridor Corp. of India
NR= Northern Railway, ECR= East Central Railway, SCR= South Central Railway

Training Program in Japan (Track Maintenance Group) (2019)

Date		AM	Place	PM	Place
06 Oct	Sun	Arrival Japan			
07 Oct	Mon	Assemble in the lobby of the hotel and move to JICA Tokyo by chartered bus Briefing	Seminar Room 306, JICA Tokyo	[Lecture] Japanese history of track maintenance technology	SR 306, JICA Tokyo
08 Oct	Tue	[Lecture] Flaw detection technology	TOKYO KEIKI Techno,Tokyo	[Lecture] Flaw detection technology	TOKYO KEIKI Techno,Tokyo
09 Oct	Wed	[Visit] JR-West headquarters	JR-West headquarters,Osaka Pref.	[Visit]14:00-17:00 Osaka Track Maintenance Office	Noda City, Osaka Prefecture
10 Oct	Thu	[Visit] Takatsuki Track Maintenance Office	Mukomachi City, Osaka Prefecture	[Visit] Rail Welding Management Room	Mukomachi City, Osaka Prefecture
11 Oct	Fri	~~[Visit]~~ ~~Training Center: Observation of skills competition~~ **(Cancelled due to typhoon approached)** [Lecture] Flew Detection Technology	Suita City, Osaka Pref.	[Visit] Shin-Osaka Operation Center	Osaka
12 Oct	Sat	Day off		Day off	
13 Oct	Sun				
14 Oct	Mon	Day off		Move from Kyoto to Osaka	
15 Oct	Tue	Night Work (Track Work)	Osaka	[Visit] Training Center :Training for new employees [Visit] Educational Institution of Railway accidents and Safety 'Think-and-Act	Suita City, Osaka Pref.
16 Oct	Wed	[Visit] Training Center: Safety training, Observation of practices	Suita City, Osaka Pref.	[Visit] Training Center	Suita City, Osaka Pref.
17 Oct	Thu	Move from Kyoto to Osaka		[Visit] Railway Technical Research Institute (RTRI)	Tokyo
18 Oct	Fri	Meeting (Investigation Result・Action Plan Support)	Seminar Room 306, JICA Tokyo	Meeting with JICA (Training in Japan・Action Plan Presentation) Closing Party	Seminar Room 306, SR 304,JICA Tokyo
19 Oct	Sat	Dept Japan			

Source: JET

Participants of Track Maintenance Group

Sr.	Institution		Name	Position
1	Railway board		Mr. R.K. Jain	(ED Civil Engg./ Planning)
2	Zonal Railway	NR	Mr. Ashish Bansal	(Chief Engineer/Track Machine)
3			Mr. Pankaj K. Gupta	(Additional Divisional Railway Manager)
7		ECoR	Mr. Manoj Kumar Ojha	(Safety Inspector/ Eng.)
8		NCR	Mr. Ajay Kumar	(Chief Workshop Manager/ Track Machine)
9	IRICEN		Mr. C S Sharma	(Sr. Professor/ Track-I)
10	DFCCIL		Mr. Harvinder Singh	(Additional GM/ Procurement)

Note: IRICEN= Indian Railway Institute of Civil Engineering, DFCCIL= Deliciated Freight Corridor Corp. of India, NR= Northern Railway, WR= Western Railway, ECoR= East Coast Railway, NCR=North Central Railway

Source: JET

Training Program in Japan (Rolling Stock Maintenance Group) (2019)

Date		AM	Place	PM	Place
04 Nov	Mon	Japan Arrival			
05 Nov	Tue	Orientetion	Jica-Tokyo		TBD
06 Nov	Wed	Presentation about the Metropolitan Intercity Railway Company and its plant where we will visit	Metropolitan Intercity Rilway Company	Visit the Rolling Stock Inspection Plant & Railcar Rejuventation Center and Repair Sheds for the maintenance and overhaul of their EMUs including some marchines for detection of abonormaliteies with guidance and Q&A session	Metropolitan Intercity Rilway Company
07 Nov	Thu	Presentation about the Japan Freight Railway Company and this training center	Central Training Center of Japam Freighter Railway Company	Visit some special facilities and tools for the training with explanation and discussions	Central Training Center of Japam Freighter Railway Company
08 Nov	Fri	Presentation about the Kawasaki depot & workshop for Freight cars and wagons. Following the explanation about the work flow of this work shop, visit each shops and process.	Kawasaki depot & workshop of Railway Company	Presentation about the Kawasaki depot & workshop for Freight cars and wagons. Following the explanation about the work flow of this work shop, visit each shops and process.	Kawasaki depot & workshop of Railway Company
09 Nov	Sat	off		off	
10 Nov	Sun	off		off	
11 Nov	Mon	Presentation about Hitachi Railway Business Unit and Kasado works	Hitachi,Railway Business Unit, Kasado works	Presentation about Hitachi Railway Business Unit and Kasado works	Hitachi,Railway Business Unit, Kasado works
12 Nov	Tue	Presentation about Hiroshima workshop	Hiroshima depot &Workshop of Japan Freight Railway Company	Presentation about Hiroshima workshop	Hiroshima depot &Workshop of Japan Freight Railway Company
13 Nov	Wed	Following the presentation	Railway Technical Reserch Institute	Negotiating with RTRI to hold the following lectures from the specialist	Railway Technical Reserch Institute
14 Nov	Thu	Discussion and building-up the action plan	Jica-Tokyo	Discussion and building-up the action plan	Jica-Tokyo
15 Nov	Fri	Discussion and building-up the action plan	Jica-Tokyo	Discussion and building-up the action plan	Jica-Tokyo
16 Nov	Sat	Depature from Japan			

Source: JET

Participants of Rolling Stock Maintenance Group

Sr.	Institution		Name	Position
1	Railway board		Mr. Kishore Kumar	EDEE (Executive Director Electrical Engineering) RS (Rolling Stock)
2	Zonal Railway	NR	Mr. Mohit Chandra	Chief Electrical Locomotive Engineer
3			Mr. Shailendra Singh	Chief Rolling Stock Engineer/ Coaching
4			Mr. Aishvarya Sachan	SME
7			Mr. Sourav Karmakar	SSE/C&W
8			Mr. Pushpak Ranjan	Chief Instructor
9		SECR	Mr. Srikanth Malladi	CRSE
10	DFCCIL		Mr. Ravi Bhushan	GM/Elect

Note: DFCCIL= Deliciated Freight Corridor Corp. of India
NR= Northern Railway, SECR= South East Central Railway
Source: JET

Training Program in Japan (Accident Investigation Group) (2019)

Date			Contents
Jun	29	SAT	Leave India
	30	SUN	Japan Arrival
Jul	1	MON	General Orientation
			Meeting with Board member of JTSB/ Purpose of accident investigation, responsibility of the agency of accident investigation, history of JSTB, etc.
	2	TUE	Fundamentals of investigation/ ・Accidents and incidents to be investigated in Japan (concerned laws included) ・Procedure of the investigation, relationship with other agencies (Railway Bureau, Police, etc.) ・Fact-finding investigation (site preservation, site investigation, interview with concerned person, etc.) ・Contents of investigation report ・Case studies (No. 1~3)
	3	WED	Visit to JR East/ Training center, Activities by railway operator for safety (explanation by JR East), Museum concerned safety
Jul	4	THU	Workshop/ Brief review of training
			Track, structure/ Investigation method, Case studies (No. 4~8)
			Rolling stock/ Investigation method, Case studies (No. 9~13)
	5	FRI	Visit to RTRI/ Railway Technical Research Institute (RTRI)
	6	SAT	Day off
	7	SUN	Day off
	8	MON	Visit to JR East/ Tokyo Operation Control Centre
			Signaling safety, electrical facilities/ Investigation method, Case studies (No. 14~16)
			Train operation/ Investigation method, Case studies (No. 17~19)
Jul	9	TUE	Case studies (No. 20~26)
			Visit to JR East/ Technology and Training Center
	10	WED	Workshop/ Brief review of training, Action plan preparation by C/Ps
			Visit to JR Freight/ Activities by railway operator for safety (explanation by JR Freight), Omiya Rolling Stock Center
	11	THU	Visit to JR East /Tokyo General Rolling Stock Center, Research and Development Center
	12	FRI	Workshop/ Action plan preparation by C/Ps
			Discussion/ Presentation of the prepared action plan by C/Ps, Discussion with railway accident investigator of JTSB
			Wrap up/ Question and answer session
	13	SAT	Leave Japan

Source: JET

Participants of Accident Investigation Group

	Institution	Name		Potision
1	Ministry of Railways (Railway Board)	Mr.	Naresh Goyal Chand	Principal Executive Director/ Safety
2	Ministry of Railways (Railway Board)	Mr.	Tej Prakash Agrawal	Executive Director /Safety
3	Ministry of Railways (Railway Board)	Mr.	Vinay Kumar Nama	Director/ Safety
4	Northern Railway	Ms.	Promila Gupta	Senior Divisional Safety Officer/ Ambala Division
5	Northern Railway	Ms.	Madhusmita Patra	Senior Divisional Operations Manager (General)/ Delhi
6	CRS	Mr.	Manoharan Arthanari Kumalankuttai	Commissioner of Rail Safety (CRS) /Southern Circle
7	CRS	Mr.	Janak Kumar Garg	CRS /Commissioner of Metro Railway Safety.
8	CRS	Mr.	Abhai Kumar Rai	CRS/South Eastern Circle
9	DFCCIL	Mr.	Vijay Kumar	Deputy General Manager
10	DFCCIL	Mr.	Alok Kumar	Joint General Manager/Civil

Source: JET

Annex 2: List of Products

No.	Name of product	Product ID	The dates of handover of the products
1	Track Geometry Measuring Trolley (1Nos.)	LR-S100	21 December 2021
2	Digital Ultrasonic Flaw Detector (1 Nos.)	SM-20R	19 May 2022

Source: JET

CERTIFICATE OF HANDOVER

To: JICA India Office

Re: Project for Capacity Development on Railway safety

This certificate of handover is to certify that the equipment shown in the list below, which shall be utilized for the Project for Capacity Development on Railway safety, have been handed over properly to Ministry of Railways, as of 21st December2021.

List of Equipment

Track Geometry Measuring Trolley (LR-S100): 1 No.

27 January, 2022

(Signature) Pragya 27/01/2022

(Pragya)

Dy.Chief Engineer/TM

Northern Railway

For witness

(Signature) 27/1/2022

(V.K.Sharma)

Asstt.Executive Engineer/TR

Northern Railway

CC: Makoto Ishida, Team Leader, Technical Cooperation Project on Rail Safety

CERTIFICATE OF HANDOVER

To: JICA India Office

Re: Project for Capacity Development on Railway safety

This certificate of handover is to certify that the equipment shown in the list below, which shall be utilized for the Project for Capacity Development on Railway safety, have been handed over properly to Ministry of Railways, as of 19th May 2022.

List of Equipment

Digital Ultrasonic Flaw Detector (SM-20 R): 1 Nos.

From,
Northern Railways
Handed over to RDSO

Sr DEN/S/LKO

19th May, 2022

(Signature) 19.05.2022

<Name> Prashant Kr Tewari

<Position> ARO(M&C), RDSO

Ministry of Railways

ARO (M&C)
M&C Dte., RDSO
Min. of Rly. Manak Nagar
Lucknow-226011

For witness

(Signature) 19.5.2022

<Name> Rajeev Pachauri

<Position> ADE/Track, RDSO

Ministry of Railways

CC: Makoto Ishida, Team Leader, Technical Cooperation Project on Rail Safety

Note: Approval accorded by ED/M&C on Computer No: 16309 vide Note No.#120 of File No: RDSO-MC0NDT(TEST)/1/2020-O/o Director/MC/RDSO with condition that no financial claim or implication will be involved after handover to NDT Section/M&C Dte./RDSO.

Annex 3: PDM (All versions of PDM)

Version	Date of Approval
v0	Signed in 14th August 2018 (Date of R/D) and reconfirmed in 4th December 2018 (1st JCC)
v1	20th June 2029 (2nd JCC)
v2	19 October 2020 (4th JCC)
v3	16th September 2021 (5th JCC)
v4	25th May 2022 (Final (6th) JCC)

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Capacity Development on Railway safety

Version 0

Dated December 4, 2018

Implementing Agency: Ministry of Railways

Target Group: Indian Railways (IR), Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Commission of Railway Safety (CRS), Research Design and Standards Organization (RDSO)

Period of Project: 2 years

Project Site: A Zonal Railway of India Railways

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal -Safety of railway network in Concerned Zonal Railway and DFCCIL is improved.	-Number of annual accidents on railway network in Concerned Zonal Railway are reduced XX%. -Number of activities related safety improvement in IR and DFCCIL is increased.	-Annual report of IR, CRS and DFCCIL. -Safety information management system (SIMS) in India.	-IR will invest more on safety. -IR will continue various activity related to safety improvement.		
Project Purpose (to be achieved within this project) -Technical capability and promotional activity related to safety are improved in the zonal railway and DFCCIL.	-Number of activities related to railway safety are increased in the zonal railway and DFCCIL. -XX(Number) of staffs get trained in this project and get to have the mindset of safety first.	-Annual report of IR and CRS. -Questionnaire survey and training report of training programs. -the proposed improvement plan of safety department in DFCCIL.	-C/P will increase/prepare their budget to conduct safety activities implemented based on prepared action plans in the project. -Staff members for safety are not relocated drastically. -Technical staff members are not relocated drastically.		
Outputs			-All members joining trainings in Japan are to be C/P to the end of the project. -MOR takes the responsibility for the necessary procedures for the official approval regarding those outputs from this project. -Necessary cooperation is granted by MOR, IR, DFCCIL, CRS and RDSO and other concerned agencies. -The system in which railway operators need to respond to recommendations to improve their operation made by CRS and to be formulated and transparency of which system is secured in India.		
1. Technique, knowledge and experience of rail welding are shared by Japanese experts to Indian C/Ps.	1-1: 10 core trainers of rail welding are trained in Japan. 1-2: Training on rail welding is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.	2-1: 10core trainers of track maintenance are trained in Japan. 2-2: Training on track maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.	3-1: 10 core trainers of rolling stock maintenance are trained in Japan. 3-2: Training on rolling stock maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
4. Technique, knowledge and experience of railway accident investigation are shared by Japanese experts to Indian C/Ps.	4-1: 10 core trainers of railway accident investigation are trained in Japan. 4-2: Training on railway accident investigation is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
5. Management system for safety improvement is improved.	5-1: Evaluation of safety improvement activities. 5-2: Seminar on safety management is held by Japanese expert in India. 5-3: 10 core staffs of safety management are trained. 5-4: Number of safety promotion activities are increased.	-Report for safety management evaluation made by Japanese experts. -Record of training in Japan -Record of training in India -Safety promotion activity report			

Activities	Inputs		Important Assumption
	The Japanese Side	The Indian Side	
1-1: To conduct current situation survey and accident analysis regarding rail welding by both Indian and Japanese sides. 1-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 1-3: To conduct a training of trainers for rail welding and make action plans by Indian trainers in Japan. 1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India. 2-1: To conduct current situation survey and accident analysis regarding track maintenance by both Indian and Japanese sides. 2-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 2-3: To conduct a training of trainers for track maintenance and make action plans by Indian trainers in Japan. 2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India. 3-1: To conduct current situation survey and accident analysis regarding rolling stock maintenance by both Indian and Japanese sides. 3-2: To discuss and fix content of training in Japan by both Indian and Japanese sides. 3-3: To conduct a training of trainers for rolling stock maintenance and make a action plan by Indian trainers in Japan. 3-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rolling stock maintenance in India. 4-1: To conduct current situation survey and accident analysis regarding railway accident investigation by both Indian and Japanese sides. 4-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 4-3: To conduct a training of trainers and make action plans by Indian trainers in Japan. 4-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for railway accident investigation in India. 5-1: To conduct current situation survey regarding safety management activities by both Indian and Japanese sides. 5-2: To discuss and fix contents of training in Japan and a seminar in India for safety management by both Indian and Japanese sides. 5-3: To share the knowledge and activity of Japan related to safety management activities in a training in Japan. 5-4: To conduct feedback seminars for safety management by Indian C/Ps supported by Japanese experts in India. 5-5: To make 1st draft action plans for improvement of safety by Indian C/Ps. 5-6: To make comments on the action plans by Japanese experts. 5-7: To implement the action plans and review them by Indian C/Ps. 5-8: To make 2nd draft action plans by Indian C/Ps based on review of the 1st draft. 5-9: To make comments on the 2nd draft action plans by Japanese experts and review by Indian C/Ps. 5-10: To implement the action plan and disseminate safety management activity of Indian C/Ps and training conducted in the project to public.	1.Dispatch of Japanese experts Field of experts (several person) 1) Project manager 2) Deputy Project Manager 3) Adviser for safety policy 4) Rail Welding 5) Rail Welding Inspection 6) Track Maintenance 7) Track Inspection 8) Rail Defect Analysis 9) Rolling Stock Maintenance Planning 10) Rolling Stock Maintenance Technique 11) Railway Accident Investigation (Track) 12) Railway Accident Investigation (Rolling Stock) 13) Safety Improvement Activity 14) Organization Structure for Railway Safety 15) Human Error 16) Project Coordinator 17) Project Coordinator for Training in Japan 2. Counterpart Training in Japan 1) Rail welding/Inspection (10 people (Including 1 people from DFCCIL)) 2) Track maintenance (10 people (Including 1 people from DFCCIL)) 3) Rolling stock (10 people (Including 1 people from DFCCIL)) 4) Accident investigation (5 people from IR, 3 from CRS and 2 from DFCCIL) 5) Safety Management (10 people from MOR, 8 from IR zonal railways and 2from DFCCIL) 3.Necessary equipment for expert's activities proposed by experts. ex,; handy rail flaw detector 4.Expense -For research, traveling, training, the other activities for Japanese experts.	1. Assignment of Counterpart 1) PED/Infra/Railway Board 2) PED/Safety/Railway Board 3) ED/Infra (System)/Railway Board 4) ED/Track (P)/Railway Board 5) ED/ME (Coaching)/Railway Board 6) ED/EE(RS)/Railway Board 7) ED/Safety-II/Railway Board 8) ED/Chief Commissioner of Railway Safety 9) Commissioner of Railway Safety Northern Circle 10) General Manager/Northern Railway 11) Chief Track Engineer/Northern Railway 12) Chief Electrical Local Engineer/Northern Railway 13) Chief Safety Officer/Northern Railway 14) MD/DFCCIL 15) GGM(CE)/DFCCIL 16) GGM(Mechanical-II)/DFCCIL 17) GGM(Operation & Safety)/DFCCIL 18) Others as appropriate 2. Provision of facilities for the project implementation. -Project office (in MOR / Zonal Railways). -Working tools and furniture for the project office. -National Academy of Indian Railways (Vadodara) -Internet connection in the project office. 3. Joint Coordination Committee (JCC) -Establishment of JCC 4. Expense -Local cost for personnel and expense for the project at site. -Other expense: For research, traveling, training, the other activities for counterpart personnel. 5. Others -Status guarantees of Japanese experts, ID card for access into the MOR properties. -Access to the necessary statistical data and related information. -Other necessary local cost.	Pre-Conditions <Issues and countermeasures>

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Capacity Development on Railway safety
Implementing Agency: Ministry of Railways
Target Group: Indian Railways (IR), Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Commission of Railway Safety (CRS), Research Design and Standards Organization (RDSO)
Period of Project: 2 years
Project Site: ~~A Zonal Railway of India Railways~~Northern Railway

Version ~~1~~0
Dated ~~August~~ May 21~~14~~, ~~2018~~2019

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal -Safety of railway network in Concerned ~~Zonal~~ Northern Railway and DFCCIL is improved.	-Number of annual accidents on railway network in Concerned Northern ~~Zonal~~ Railway are reduced ~~XX%~~from the last year. -Number of activities related safety improvement in Northern Railway~~IR~~ and DFCCIL is increased.	-Annual report of Northern Railway~~IR~~, CRS and DFCCIL. -Safety information management system (SIMS) in India.	-IR will invest more on safety. -IR will continue current various activity conducted by IR and agreed activities in the project related to safety improvement.		
Project Purpose (to be achieved within this project) -Technical capability and promotional activity related to safety are improved in the ~~zonal~~ Northern railway and DFCCIL.	-Number of activities related to railway safety are increased in the Northern~~zonal~~ Rrailway and DFCCIL. -~~XX(Number)~~60 of staffs get trained in this project and get to have the mindset of safety first.	-Annual report of IR and CRS. -Questionnaire survey and training report of training programs. -the proposed improvement plan of safety department in DFCCIL.	-C/P will increase/prepare their budget to conduct safety activities implemented based on prepared action plans in the project. -Staff members for safety are not relocated drastically. -Technical staff members are not relocated drastically.		
Outputs					
1. Technique, knowledge and experience of rail welding are shared by Japanese experts to Indian C/Ps.	1-1: 10 core trainers of rail welding are trained in Japan. 1-2: Training on rail welding is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	-All members joining trainings in Japan are to be C/P to the end of the project. -MOR takes the responsibility for the necessary procedures for the official approval regarding those outputs from this project. -Necessary cooperation is granted by MOR, IR, DFCCIL, CRS and RDSO and other concerned agencies. -The system in which railway operators need to respond to recommendations to improve their operation made by CRS and to be formulated and transparency of which system is secured in India.		
2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.	2-1: 10core trainers of track maintenance are trained in Japan. 2-2: Training on track maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.	3-1: 10 core trainers of rolling stock maintenance are trained in Japan. 3-2: Training on rolling stock maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
4. Technique, knowledge and experience of railway accident investigation are shared by Japanese experts to Indian C/Ps.	4-1: 10 core trainers of railway accident investigation are trained in Japan. 4-2: Training on railway accident investigation is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India			
5. Management system for safety improvement is improved.	5-1: Evaluation of safety management improvement activities. 5-2: Seminar on safety management is held by Indian trainers supported by Japanese expert in India. 5-3: 20~~10~~ core staffs of safety management are trained in Japan. 5-4: Number of safety ~~promotion~~ management improvement activities are increased.	-Report for safety management evaluation made by Japanese experts. -Record of training in Japan -Record of training in India -Safety ~~promotion~~ management activity report			

Activities	Inputs		Important Assumption
	The Japanese Side	The Indian Side	
1-1: To conduct current situation survey and accident report analysis ~~and accident analysis~~ regarding rail welding by both Indian and Japanese sides. 1-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 1-3: To conduct a training of trainers for rail welding and make action plans by Indian trainers in Japan. 1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India. 2-1: To conduct current situation survey and accident report analysis ~~and accident analysis~~ regarding track maintenance by both Indian and Japanese sides. 2-2: To discuss ~~and fix~~ contents of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. ~~.~~ 2-3: To conduct a training of trainers for track maintenance and make action plans by Indian trainers in Japan. 2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India. 3-1: To conduct current situation survey and accident report analysis ~~and accident analysis~~ regarding rolling stock maintenance by both Indian and Japanese sides. 3-2: To discuss ~~and fix~~ content of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. 3-3: To conduct a training of trainers for rolling stock maintenance and make a action plan by Indian trainers in Japan. 3-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rolling stock maintenance in India. 4-1: To conduct current situation survey and accident report analysis ~~and accident analysis~~ regarding railway accident investigation by both Indian and Japanese sides. 4-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 4-3: To conduct a training of trainers and make action plans by Indian trainers in Japan. 4-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for railway accident investigation in India. 5-1: To conduct current situation survey regarding safety management activities by both Indian and Japanese sides. 5-2: To ~~discuss and fix~~propose contents of training in Japan by Japanese side and discuss the contents by both Indian and Japanese sides. Then fix the contents of training in Japan by Japanese side. In parallel with this, fix a seminar contents in India ~~_~~ for safety management by ~~both~~ Indian ~~and Japanese~~ side~~s~~. 5-3: To share the knowledge and activity of Japan related to safety management activities in a training in Japan. 5-4: To conduct feedback seminars for safety management by Indian C/Ps supported by Japanese experts in India. 5-5: To make 1st draft action plans for improvement of safety by Indian C/Ps. 5-6: To make comments on the action plans by Japanese experts. 5-7: To implement the action plans and review them by Indian C/Ps. 5-8: To make 2nd draft action plans by Indian C/Ps based on review of the 1st draft. 5-9: To make comments on the 2nd draft action plans by Japanese experts and review by Indian C/Ps. 5-10: To implement the action plan and disseminate safety management activity of Indian C/Ps and training conducted in the project to public.	1.Dispatch of Japanese experts Field of experts (several person) 1) Team Leader/ Safety management~~Project manager~~ 2) Training program planning ~~Deputy Project Manager~~ ~~3) Adviser for safety policy~~ 3~~4~~) Rail Welding 4~~5~~) Rail Welding Inspection 5~~6~~) Track Maintenance 6~~7~~) Track Inspection ~~8) Rail Defect Analysis~~ 7~~9~~) Rolling Stock Maintenance Planning 8~~10~~) Rolling Stock Maintenance Technique-1 9) Rolling Stock Maintenance Technique-2 ~~11) Railway Accident Investigation (Track)~~ ~~12) Railway Accident Investigation (Rolling Stock)~~ ~~13~~10) Safety ~~Improvement Activity~~ Management-1 11) Safety Management-2 12) Safety Management-3 13) Safety Management-4 ~~14) Organization Structure for Railway Safety~~ 1~~4~~5) Safety Management (Human ~~Error~~Factor) 1~~5~~6) Project Coordination and Training in India~~or~~ 1~~6~~7) Project Coordination and ~~or for~~ Training in Japan 17) Railway Accident Investigation-1 18) Railway Accident Investigation-2 2. Counterpart Training in Japan 1) Rail welding/Inspection (10 people (Including 1 people from DFCCIL)) 2) Track maintenance (10 people (Including 1 people from DFCCIL)) 3) Rolling stock (10 people (Including 1 people from DFCCIL)) 4) Accident investigation (5 people from IR/ zonal railways, 3 from CRS and 2 from DFCCIL) 5) Safety Management (10 people from ~~MOR~~IR/ zonal railways, 8 from ~~IR~~ zonal railways and 2 from DFCCIL) 3.Necessary equipment for expert's activities proposed by experts. ~~ex.; handy rail flaw detector~~ Portable ultrasonic flaw detectors 4.Expense -For research, traveling, training, the other activities for Japanese experts.	1. Assignment of Counterpart 1) PED/Infra/Railway Board 2) PED/Safety/Railway Board 3) ED/Infra (System)/Railway Board 4) ED/Track (P)/Railway Board 5) ED/ME (Coaching)/Railway Board 6) ED/EE(RS)/Railway Board 7) ED/Safety-II/Railway Board 8) ED/Chief Commissioner of Railway Safety 9) Commissioner of Railway Safety Northern Circle 10) General Manager/Northern Railway 11) Chief Track Engineer/Northern Railway 12) Chief Electrical Loco Engineer/Northern Railway 13) Chief Safety Officer/Northern Railway 14) MD/DFCCIL 15) GGM(CE)/DFCCIL 16) GGM(Mechanical-II)/DFCCIL 17) GGM(Operation & Safety)/DFCCIL 18) Others as appropriate 2. Provision of facilities for the project implementation. -Project office (in ~~MOR / Zonal Railways~~Northern Railway). -Working tools and furniture for the project office. -National Academy of Indian Railways (Vadodara) -Internet connection in the project office. 3. Joint Coordination Committee (JCC) -Establishment of JCC 4. Expense -Local cost for personnel and expense for the project at site. -Other expense: For research, traveling, training, the other activities for counterpart personnel. 5. Others -Status guarantees of Japanese experts, ID card for access into the MOR properties. -Access to the necessary statistical data and related information. -Other necessary local cost.	Pre-Conditions <Issues and countermeasures>

Project Monitoring Sheet I (Revision of Project Design Matrix)

Item	Before (Agreed on 2nd JCC)	After
Period of Project	2 years	3 years and 2 months
Project Purpose (to be achieved within this project) [Objectively Verifiable Indicators]	-Number of activities related to railway safety are increased in the Northern Railway and DFCCIL. -60 of staffs get trained in this project and get to have the mindset of safety first.	-Number of activities related to railway safety are increased in the Northern Railway and DFCCIL. -34 of staffs get trained in this project and get to have the mindset of safety first.
Outputs 1. Technique, knowledge and experience of rail welding and Weld UT Inspection are shared by Japanese experts to Indian C/Ps.		
[Objectively Verifiable Indicators]	1-1: 10 core trainers of rail welding are trained in Japan.	1-1: 9 core trainers of rail welding are trained in Japan.
[Activities]	1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India.	1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India, focusing on ultrasonic detection method (double-prob method) and to support the regularization the method from MoR.
Outputs 2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.		
[Objectively Verifiable Indicators]	2-1: 10 core trainers of track maintenance are trained in Japan.	2-1: 7 core trainers of track maintenance are trained in Japan.
[Activities]	2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India.	2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India. Japan side shares experience of data management in Japan using “Portable Track Irregularity Measurement Device” and Indian side conducts pilot project by using the device.
Outputs 3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.		
[Objectively Verifiable Indicators]	3-1: 10 core trainers of rolling stock maintenance are trained in Japan.	3-1: 8 core trainers of rolling stock maintenance are trained in Japan.
Outputs 5. Management system for safety improvement is improved.		
[Objectively Verifiable Indicators]	5-3: 20 core staffs of safety management are trained in Japan. 5-4: Number of safety management improvement activities are increased.	5-3: Core staffs of safety management are trained by materials prepared by Japanese experts. ~~5-4: Number of safety management improvement activities are increased.~~
[Mans of Verification]	-Record of training in Japan -Record of training in India -Safety management activity report	~~-Record of~~ training in Japan -Presentation Materials shared to India ~~-Record of online training in India~~ ~~-Safety management activity report~~
[Activities]	5-3: To share the knowledge and activity of Japan related to safety management activities in a training in Japan. 5-4: To conduct feedback seminars for safety management by Indian C/Ps supported by Japanese experts. 5-5: To make 1st draft action plans for improvement of safety by Indian C/Ps. 5-6: To make comments on the action plans by Japanese experts. 5-7: To implement the action plans and review them by Indian C/Ps. 5-8: To make 2nd draft action plans by Indian C/Ps based on review of the 1st draft. 5-9: To make comments on the 2nd draft action plans by Japanese experts and review by Indian C/Ps. 5-10: To implement the action plan and disseminate safety management activity of Indian C/Ps and training conducted in the project to public.	5-3: To share the knowledge and activity of Japan related to safety management activities ~~in a training in Japan~~ ~~5-4: To conduct feedback seminars for safety management by Indian C/Ps supported by Japanese experts.~~ ~~5-5: To make 1st draft action plans for improvement of safety by Indian C/Ps.~~ ~~5-6: To make comments on the action plans by Japanese experts.~~ ~~5-7: To implement the action plans and review them by Indian C/Ps.~~ ~~5-8: To make 2nd draft action plans by Indian C/Ps based on review of the 1st draft.~~ ~~5-9: To make comments on the 2nd draft action plans by Japanese experts and review by Indian C/Ps.~~ ~~5-10: To implement the action plan and disseminate safety management activity of Indian C/Ps and training conducted in the project to public.~~
Inputs: The Japanese Side		
3.Necessary equipment for expert's activities proposed by experts.	Portable ultrasonic flaw detectors	Portable ultrasonic flaw detectors Portable track irregularity measurement device

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Capacity Development on Railway safety　　Version 2　　October, 2020

Implementing Agency: Ministry of Railways

Target Group: Indian Railways (IR), Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Commission of Railway Safety (CRS), Research Design and Standards Organization (RDSO)

Period of Project: 3 years

Project Site:　Northern Railway

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption	Achievement	Remarks
Overall Goal -Safety of railway network in Concerned Northern Railway and DFCCIL is improved.	-Number of annual accidents on railway network in Concerned Northern Railway are reduced from the last year. -Number of activities related safety improvement in Northern Railway and DFCCIL is increased.	-Annual report of Northern Railway, CRS and DFCCIL. -Safety information management system (SIMS) in India.	-IR will invest more on safety. -IR will continue current various activity conducted by IR and agreed activities in the project related to safety improvement		
Project Purpose (to be achieved within this project) -Technical capability and promotional activity related to safety are improved in the Northern railway and DFCCIL.	-Number of activities related to railway safety are increased in the Northern Railway and DFCCIL. -34 of staffs get trained in this project and get to have the mindset of safety first.	-Annual report of IR and CRS. -Questionnaire survey and training report of training programs. -the proposed improvement plan of safety department in DFCCIL.	-C/P will increase/prepare their budget to conduct safety activities implemented based on prepared action plans in the project. -Staff members for safety are not relocated drastically. -Technical staff members are not relocated drastically.	Regarding output from 1 to 4, the training has been conducted and 34 of staffs got trained in this project and got to have the mindset of safety first.	
Outputs					
1. Technique, knowledge and experience of rail welding and Weld UT Inspection are shared by Japanese experts to Indian C/Ps.	1-1: 9 core trainers of rail welding are trained in Japan. 1-2: Training on rail welding is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	-All members joining trainings in Japan are to be C/P to the end of the project. -MOR takes the responsibility for the necessary procedures for the official approval regarding those outputs from this project. -Necessary cooperation is granted by MOR, IR, DFCCIL, CRS and RDSO and other concerned agencies. -The system in which railway operators need to respond to recommendations to improve their operation made by CRS and to be formulated and transparency of which system is secured in India.	9 trainees have been trained in Japan	Action plan yet approved
2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.	2-1: 7core trainers of track maintenance are trained in Japan. 2-2: Training on track maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India		7 trainees have been trained in Japan	Approved action plan
3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.	3-1: 8 core trainers of rolling stock maintenance are trained in Japan. 3-2: Training on rolling stock maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India		8 trainees have been trained in Japan	Approved action plan
4. Technique, knowledge and experience of railway accident investigation are shared by Japanese experts to Indian C/Ps.	4-1: 10 core trainers of railway accident investigation are trained in Japan. 4-2: Training on railway accident investigation is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India		10 trainees have been trained in Japan	Approved Action plan
5. Management system for safety improvement is improved.	5-1: Evaluation of safety management improvement activities. 5-3: Core staffs of safety management are trained by materials prepared by Japanese experts.	-Report for safety management evaluation made by Japanese experts. -Presentation Materials shared to India		N/A	To be shared materials to India

Activities	Inputs		Important Assumption
	The Japanese Side	The Indian Side	
1-1: To conduct current situation survey and accident report analysis regarding rail welding by both Indian and Japanese sides. 1-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 1-3: To conduct a training of trainers for rail welding and make action plans by Indian trainers in Japan. 1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India, focusing on ultrasonic detection method (double-prob method) and to support the regularization the method from MoR. 2-1: To conduct current situation survey and accident report analysis regarding track maintenance by both Indian and Japanese sides. 2-2: To discuss contents of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. 2-3: To conduct a training of trainers for track maintenance and make action plans by Indian trainers in Japan. 2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India. Japan side shares experience of data management in Japan using “Portable Track Irregularity Measurement Device” and Indian side conducts pilot project by using the device. 3-1: To conduct current situation survey and accident report analysis regarding rolling stock maintenance by both Indian and Japanese sides. 3-2: To discuss content of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. 3-3: To conduct a training of trainers for rolling stock maintenance and make a action plan by Indian trainers in Japan. 3-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rolling stock maintenance in India. 4-1: To conduct current situation survey and accident report analysis regarding railway accident investigation by both Indian and Japanese sides. 4-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 4-3: To conduct a training of trainers and make action plans by Indian trainers in Japan. 4-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for railway accident investigation in India. 5-1: To conduct current situation survey regarding safety management activities by both Indian and Japanese sides. 5-2: To propose contents of training in Japan by Japanese side and discuss the contents by both Indian and Japanese sides. Then fix the contents of training in Japan by Japanese side. In parallel with this, fix a seminar contents in India for safety management by Indian side.5-3: To share the knowledge and activity of Japan related to safety management activities	1.Dispatch of Japanese experts Field of experts (several person) 1) Team Leader/ Safety management 2) Training program planning 3) Rail Welding 4) Rail Welding Inspection 5) Track Maintenance 6) Track Inspection 7) Rolling Stock Maintenance Planning 8) Rolling Stock Maintenance Technique-1 9) Rolling Stock Maintenance Technique-2 10) Safety Management-1 11) Safety Management-2 12) Safety Management-3 13) Safety Management-4 14) Safety Management (Human Factor) 15) Project Coordination and Training in India 16) Project Coordination and Training in Japan 17) Railway Accident Investigation-1 18) Railway Accident Investigation-2 2. Counterpart Training in Japan 1) Rail welding/Inspection (10 people (Including 1 people from DFCCIL)) 2) Track maintenance (10 people (Including 1 people from DFCCIL)) 3) Rolling stock (10 people (Including 1 people from DFCCIL)) 4) Accident investigation (5 people from IR/ zonal railways, 3 from CRS and 2 from DFCCIL) 5) Safety Management (10 people from IR/ zonal railways, 8 from zonal railways and 2 from DFCCIL) 3.Necessary equipment for expert's activities proposed by experts. Portable ultrasonic flaw detectors Portable track irregularity measurement device 4.Expense -For research, traveling, training, the other activities for Japanese experts.	1. Assignment of Counterpart 1) PED/Infra/Railway Board 2) PED/Safety/Railway Board 3) ED/Infra (System)/Railway Board 4) ED/Track (P)/Railway Board 5) ED/ME (Coaching)/Railway Board 6) ED/EE(RS)/Railway Board 7) ED/Safety-II/Railway Board 8) ED/Chief Commissioner of Railway Safety 9) Commissioner of Railway Safety Northern Circle 10) General Manager/Northern Railway 11) Chief Track Engineer/Northern Railway 12) Chief Electrical Loco Engineer/Northern Railway 13) Chief Safety Officer/Northern Railway 14) MD/DFCCIL 15) GGM(CE)/DFCCIL 16) GGM(Mechanical-II)/DFCCIL 17) GGM(Operation & Safety)/DFCCIL 18) Others as appropriate 2. Provision of facilities for the project implementation. -Project office (in Northern Railway). -Working tools and furniture for the project office. -National Academy of Indian Railways (Vadodara) -Internet connection in the project office. 3. Joint Coordination Committee (JCC) -Establishment of JCC 4. Expense -Local cost for personnel and expense for the project at site. -Other expense: For research, traveling, training, the other activities for counterpart personnel. 5. Others -Status guarantees of Japanese experts, ID card for access into the MOR properties. -Access to the necessary statistical data and related information. -Other necessary local cost.	N/A Pre-conditions <Issues and Countermeasures>

Project Monitoring Sheet I (Revision of Project Design Matrix)

Item	Before (Agreed on 3rd JCC)	After
Period of Project	3 years	3 years and 2 months

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Capacity Development on Railway safety Version 32 ~~October~~September, 202~~0~~1

Implementing Agency: Ministry of Railways

Target Group: Indian Railways (IR), Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Commission of Railway Safety (CRS), Research Design and Standards Organization (RDSO)

Period of Project: 3 years and 2 months

Project Site: Northern Railway

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal -Safety of railway network in Concerned Northern Railway and DFCCIL is improved.	-Number of annual accidents on railway network in Concerned Northern Railway are reduced from the last year. -Number of activities related safety improvement in Northern Railway and DFCCIL is increased.	-Annual report of Northern Railway, CRS and DFCCIL. -Safety information management system (SIMS) in India.	-IR will invest more on safety. -IR will continue current various activity conducted by IR and agreed activities in the project related to safety improvement
Project Purpose (to be achieved within this project) -Technical capability and promotional activity related to safety are improved in the Northern railway and DFCCIL.	-Number of activities related to railway safety are increased in the Northern Railway and DFCCIL. -34 of staffs get trained in this project and get to have the mindset of safety first.	-Annual report of IR and CRS. -Questionnaire survey and training report of training programs. -the proposed improvement plan of safety department in DFCCIL.	-C/P will increase/prepare their budget to conduct safety activities implemented based on prepared action plans in the project. -Staff members for safety are not relocated drastically. -Technical staff members are not relocated drastically.
Outputs			
1. Technique, knowledge and experience of rail welding and Weld UT Inspection are shared by Japanese experts to Indian C/Ps.	1-1: 9 core trainers of rail welding are trained in Japan. 1-2: Training on rail welding is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	-All members joining trainings in Japan are to be C/P to the end of the project. -MOR takes the responsibility for the necessary procedures for the official approval regarding those outputs from this project. -Necessary cooperation is granted by MOR, IR, DFCCIL, CRS and RDSO and other concerned agencies. -The system in which railway operators need to respond to recommendations to improve their operation made by CRS and to be formulated and transparency of which system is secured in India.
2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.	2-1: 7core trainers of track maintenance are trained in Japan. 2-2: Training on track maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.	3-1: 8 core trainers of rolling stock maintenance are trained in Japan. 3-2: Training on rolling stock maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
4. Technique, knowledge and experience of railway accident investigation are shared by Japanese experts to Indian C/Ps.	4-1: 10 core trainers of railway accident investigation are trained in Japan. 4-2: Training on railway accident investigation is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
5. Management system for safety improvement is improved.	5-1: Evaluation of safety management improvement activities. 5-2: Core staffs of safety management are trained by materials prepared by Japanese experts.	-Report for safety management evaluation made by Japanese experts. -Presentation Materials shared to India	

Activities	Inputs	
	The Japanese Side	The Indian Side
1-1: To conduct current situation survey and accident report analysis regarding rail welding by both Indian and Japanese sides. 1-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 1-3: To conduct a training of trainers for rail welding and make action plans by Indian trainers in Japan. 1-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rail welding in India, focusing on ultrasonic detection method (double-prob method) and to support the regularization the method from MoR. 2-1: To conduct current situation survey and accident report analysis regarding track maintenance by both Indian and Japanese sides. 2-2: To discuss contents of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. 2-3: To conduct a training of trainers for track maintenance and make action plans by Indian trainers in Japan. 2-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for track maintenance in India. Japan side shares experience of data management in Japan using “Portable Track Irregularity Measurement Device” and Indian side conducts pilot project by using the device. 3-1: To conduct current situation survey and accident report analysis regarding rolling stock maintenance by both Indian and Japanese sides. 3-2: To discuss content of training in Japan by both Indian and Japanese sides and fix the contents by Japanese side. 3-3: To conduct a training of trainers for rolling stock maintenance and make a action plan by Indian trainers in Japan. 3-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for rolling stock maintenance in India. 4-1: To conduct current situation survey and accident report analysis regarding railway accident investigation by both Indian and Japanese sides. 4-2: To discuss and fix contents of training in Japan by both Indian and Japanese sides. 4-3: To conduct a training of trainers and make action plans by Indian trainers in Japan. 4-4: To conduct a training based on the action plans by Indian trainers supported by Japanese experts for railway accident investigation in India. 5-1: To conduct current situation survey regarding safety management activities by both Indian and Japanese sides. 5-2: To propose contents of training in Japan by Japanese side and discuss the contents by both Indian and Japanese sides. Then fix the contents of training in Japan by Japanese side. In parallel with this, fix a seminar contents in India for safety management by Indian side. 5-3: To share the knowledge and activity of Japan related to safety management activities	1.Dispatch of Japanese experts Field of experts (several person) 1) Team Leader/ Safety management 2) Training program planning 3) Rail Welding 4) Rail Welding Inspection 5) Track Maintenance 6) Track Inspection 7) Rolling Stock Maintenance Planning 8) Rolling Stock Maintenance Technique-1 9) Rolling Stock Maintenance Technique-2 10) Safety Management-1 11) Safety Management-2 12) Safety Management-3 13) Safety Management-4 14) Safety Management (Human Factor) 15) Project Coordination and Training in India 16) Project Coordination and Training in Japan 17) Railway Accident Investigation-1 18) Railway Accident Investigation-2 2. Counterpart Training in Japan 1) Rail welding/Inspection (10 people (Including 1 people from DFCCIL)) 2) Track maintenance (10 people (Including 1 people from DFCCIL)) 3) Rolling stock (10 people (Including 1 people from DFCCIL)) 4) Accident investigation (5 people from IR/ zonal railways, 3 from CRS and 2 from DFCCIL) 5) Safety Management (10 people from IR/ zonal railways, 8 from zonal railways and 2 from DFCCIL) 3.Necessary equipment for expert's activities proposed by experts. Portable ultrasonic flaw detectors Portable track irregularity measurement device 4.Expense -For research, traveling, training, the other activities for Japanese experts.	1. Assignment of Counterpart 1) PED/Infra/Railway Board 2) PED/Safety/Railway Board 3) ED/Infra (System)/Railway Board 4) ED/Track (P)/Railway Board 5) ED/ME (Coaching)/Railway Board 6) ED/EE(RS)/Railway Board 7) ED/Safety-II/Railway Board 8) ED/Chief Commissioner of Railway Safety 9) Commissioner of Railway Safety Northern Circle 10) General Manager/Northern Railway 11) Chief Track Engineer/Northern Railway 12) Chief Electrical Loco Engineer/Northern Railway 13) Chief Safety Officer/Northern Railway 14) MD/DFCCIL 15) GGM(CE)/DFCCIL 16) GGM(Mechanical-II)/DFCCIL 17) GGM(Operation & Safety)/DFCCIL 18) Others as appropriate 2. Provision of facilities for the project implementation. -Project office (in Northern Railway). -Working tools and furniture for the project office. -National Academy of Indian Railways (Vadodara) -Internet connection in the project office. 3. Joint Coordination Committee (JCC) -Establishment of JCC 4. Expense -Local cost for personnel and expense for the project at site. -Other expense: For research, traveling, training, the other activities for counterpart personnel. 5. Others -Status guarantees of Japanese experts, ID card for access into the MOR properties. -Access to the necessary statistical data and related information. -Other necessary local cost.

Project Monitoring Sheet I (Revision of Project Design Matrix)

Item	Before (Agreed on 5th JCC)	After
Period of Project	3 years and 2 months	3 years and 5 months

Project Monitoring Sheet I (Revision of Project Design Matrix)

Project Title: Project for Capacity Development on Railway safety Version ~~3~~4 ~~September~~May, 202~~2~~1

Implementing Agency: Ministry of Railways

Target Group: Indian Railways (IR), Dedicated Freight Corridor Corporation of India Limited (DFCCIL), Commission of Railway Safety (CRS), Research Design and Standards Organization (RDSO)

Period of Project: 3 years and ~~2~~5 months

Project Site: Northern Railway

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
Overall Goal -Safety of railway network in Concerned Northern Railway and DFCCIL is improved.	-Number of annual accidents on railway network in Concerned Northern Railway are reduced from the last year. -Number of activities related safety improvement in Northern Railway and DFCCIL is increased.	-Annual report of Northern Railway, CRS and DFCCIL. -Safety information management system (SIMS) in India.	-IR will invest more on safety. -IR will continue current various activity conducted by IR and agreed activities in the project related to safety improvement
Project Purpose (to be achieved within this project) -Technical capability and promotional activity related to safety are improved in the Northern railway and DFCCIL.	-Number of activities related to railway safety are increased in the Northern Railway and DFCCIL. -34 of staffs get trained in this project and get to have the mindset of safety first.	-Annual report of IR and CRS. -Questionnaire survey and training report of training programs. -the proposed improvement plan of safety department in DFCCIL.	-C/P will increase/prepare their budget to conduct safety activities implemented based on prepared action plans in the project. -Staff members for safety are not relocated drastically. -Technical staff members are not relocated drastically.
Outputs			
1. Technique, knowledge and experience of rail welding and Weld UT Inspection are shared by Japanese experts to Indian C/Ps.	1-1: 9 core trainers of rail welding are trained in Japan. 1-2: Training on rail welding is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	-All members joining trainings in Japan are to be C/P to the end of the project. -MOR takes the responsibility for the necessary procedures for the official approval regarding those outputs from this project. -Necessary cooperation is granted by MOR, IR, DFCCIL, CRS and RDSO and other concerned agencies. -The system in which railway operators need to respond to recommendations to improve their operation made by CRS and to be formulated and transparency of which system is secured in India.
2. Technique, knowledge and experience of track maintenance are shared by Japanese experts to Indian C/Ps.	2-1: 7core trainers of track maintenance are trained in Japan. 2-2: Training on track maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
3. Technique, knowledge and experience of rolling stock maintenance are shared by Japanese experts to Indian C/Ps.	3-1: 8 core trainers of rolling stock maintenance are trained in Japan. 3-2: Training on rolling stock maintenance is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
4. Technique, knowledge and experience of railway accident investigation are shared by Japanese experts to Indian C/Ps.	4-1: 10 core trainers of railway accident investigation are trained in Japan. 4-2: Training on railway accident investigation is held by Indian trainers supported by Japanese experts in India.	-Record of training in Japan -Record of training in India	
5. Management system for safety improvement is improved.	5-1: Evaluation of safety management improvement activities. 5-2: Core staffs of safety management are trained by materials prepared by Japanese experts.	-Report for safety management evaluation made by Japanese experts. -Presentation Materials shared to India	

Activities	Inputs	
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