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資料1 覚書 (MOU)

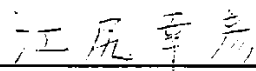
MEMORANDUM OF UNDERSTANDING  
BETWEEN  
JAPAN INTERNATIONAL COOPERATION AGENCY  
AND  
UZBEKISTAN TEMIR YOLLARI  
ON  
PROJECT FOR CAPACITY DEVELOPMENT ON UPGRADING TRACK MAINTENANCE AND TRAIN  
OPERATION SKILLS ON TASHGUZAR-KUMKURGAN RAILWAY LINE

DATE: 20 March 2012

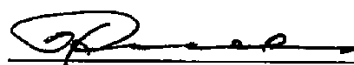
PLACE: Tashkent, Uzbekistan

For  
Japan International Cooperation Agency

For  
Uzbekistan Temir Yollari



Yukihiro EJIRI  
Chief Representative  
JICA Uzbekistan Office



A. J. RAMATOV  
Chairman of Board  
Uzbekistan Temir Yollari

Japan International Cooperation Agency (hereinafter referred to as "JICA") had a series of discussions with the representatives of relevant organizations through JICA Uzbekistan Office for the purpose of developing a detailed plan for the Project for Capacity Development on Upgrading Track Maintenance and Train Operation Skills on Tashguzar – Kumkurgan New Railway Line (hereinafter referred to as "the Project").

As a result, the JICA Uzbekistan Office and Uzbekistan Temir Yollari (hereinafter referred to as "UTY") confirmed that both parties would sincerely cooperate with each other with a view to contributing toward smooth implementation and enhancing development effect of Tashguzar-Kumkurgan New Railway Construction Project signed on October 15, 2004 by attaining the purposes of the Project.

Both parties also agreed the Project details and main points discussed during the survey as described in attached draft of Memorandum of Understanding (hereinafter referred to as "MOU"), which is subject to approval by the competent higher authorities on both sides.

In case both parties intend to modify any items described in the draft of MOU, they may hold a meeting to finalize the draft, if necessary.

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## I. INTRODUCTION

Japan International Cooperation Agency (hereinafter referred to as "JICA") had a series of discussions with the representatives of relevant organizations through JICA Uzbekistan Office for the purpose of developing a detailed plan for the Project for Capacity Development of Upgrading Track Maintenance and Train Operation Skills on Tashguzar-Kumkurgan Railway Line (hereinafter referred to as "the Project").

As a result, the JICA Mission and Uzbekistan Temir Yollari (hereinafter referred to as "UTY") confirmed that both parties would sincerely cooperate with each other with a view to contributing toward smooth implementation and enhancing development effect of Tashguzar-Kumkurgan New Railway Construction Project signed on October 14, 2004 by attaining the purposes of the Project.

Appendix 1: PROJECT DOCUMENT

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## PROJECT DOCUMENT

## I. BACKGROUND

In Uzbekistan the railway freight transportation covers more than 50% of the total land transportation. Furthermore, it is expected that the railway traffic volume will keep increasing exponentially due to recent rapid economic growth of the country and the growing reconstruction assistance to Afghanistan, therefore, the enhancement of railway transport capacity is a pressing issue to be tackled. In this situation, JICA and the Government of Uzbekistan have signed the ODA loan projects "Railway Transportation Modernization Project (UZB-P2)" and "Tashguzar-Kumkurgan New Railway Construction Project (UZB-P8)".

The railway lines of UTY are mostly located in flat area, but the new railway under UZB-P8 is located in mountain area - 1,180m above sea level, where there are many steep slopes with more than 10 per mil longitudinal gradient and the sharp curves with less than 600m curvature radius. Due to increase of volume of cargo and passenger transportation it is necessary to increase a potential in issues related to track maintenance and train operation skill on Tashguzar-Kumkurgan Railway Line.

Given this situation, JICA dispatched the experts for "Capacity Development Project of Tashguzar-Kumkurgan New Railway Construction in Uzbekistan" from April to August 2010. In the project, the experts pointed out that the following countermeasures shall be made: access to information on precise railway alignment through survey, development of valid operational plan, track maintenance plan and locomotive maintenance plan. Meanwhile, Japanese Government pledged to provide ODA loan for the implementation of "Karshi-Termez Railway Electrification Project" in February 2011, therefore the above pointed out issues shall be solved at an early date in order to expand the development effectiveness of the ongoing and future ODA loan projects.

Accordingly, JICA decided to conduct "Project for Capacity Development on Upgrading Track Maintenance and Train Operation Skills on Tashguzar-Kumkurgan Railway Lines" and dispatch the experts in this project. The experts will assist UTY in developing the train operational plan, track alignment plan, locomotive maintenance plan for the railways in mountain area, which will lead to the establishment of operating structure corresponding to the future traffic demand.

## II. OUTLINE OF THE PROJECT

## 1. Overall Goal

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More reliable and efficient railway transport network responding to the transit demands is achieved.

2. Project Purpose

Technical capability of UTY to develop valid train operation plan, track alignment plan and locomotive maintenance plan for the railway in mountain area is strengthened.

3. Output

- I. Proposal to raise effectiveness of train operation plan is prepared
- II. Proposal to raise effectiveness of track maintenance plan is prepared
- III. Proposal to raise effectiveness of locomotive maintenance plan is prepared

4. Activities

- I. Proposal to raise effectiveness of train operation plan is prepared
  - 1) Analysis of train operation
    - a) Review the traction force, cars formation, pattern of operation, operation record
    - b) Review the tracks and facilities (track alignment, wire connections of stations, signaling data, track norms etc.)
    - c) Review the problems in transit plan
    - d) Input the data of tracks and facilities into software
  - 2) Transit plan with electric locomotives
    - a) Review the traffic volume (passengers and cargos) from the demand forecast
    - b) Set the traction force based on the forecast transit
  - 3) Rolling stock plan
    - a) Analyze highest speed, acceleration-deceleration performance, curve passage quality, limiting speed for down slope, heat capacity, brake performance, input of data on rolling stocks, operational simulation
  - 4) Diagram and operational facility plan
    - a) Review and input the data (notch curve, characteristic curve etc.) of electric locomotives owned by UTY
    - b) Develop the characteristic curve (pulling force, load characteristic curve etc.) of electric locomotives
    - c) Review the traction force and equilibrium speed based on input data
    - d) Develop the run curve for each rolling stock with use of software
    - e) Develop the traction force and operational hours from operating curve
    - f) Develop the proposal to raise effectiveness of the diagram for trains based

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- on operational hours
- g) Develop the proposal to raise effectiveness of the diagram for rolling stocks based on the digram for trains, compute the necessary number of rolling stocks
- h) Recommendations on renewal (procurement) of operational facilities
- 5) Develop train operation plan with use of software
  - a) Simulation training on operational plan
  - b) Training on theory and practice of velocity and traction constant, theory of standard operating time, and operational planning

II. Proposal to raise effectiveness of track maintenance plan is prepared

- 1) Review of the survey conducted by UTY
  - a) Record the traction displacement randomly with track master, measure the curve line, slope, and the vertical curve of the changing point of gradient, review the survey record
  - b) Review the positions of railway norms (curve, cant, slope, mileposts)
  - c) Review the profile and traverse survey on particular sections if necessary
- 2) Determine the curve specifications by IP calculation and develop the revised track profile (plain and vertical)
- 3) Develop the run curve for electric locomotives and trains based on the revised track profile, curve and slope specifications, review the adequacy of revised alignment, cant, transition curve and slope. If necessary, revise the improvement plan.
- 4) Consider the necessity of improvement of curved sections, and develop the improvement plan if necessary.
- 5) Develop the alignment improvement plan for the section of Dekhanabad – Darband (or Boysun) through survey on traverse, centerline, horizontal and vertical sectional view of tracks. Develop the implementation plan for alignment improvement and reflect the revised alignment in the operational planning.  
Review the current situation of track and develop the track rectification plan
  - a) Analyze the tracks' current horizontal and vertical sectional view based on the survey conducted by UTY, analyze the record and develop the draft track alignment plan, and conduct the on-site training
- 6) Develop the improvement plan of horizontal and vertical curves
  - a) Review the result of track rectification and linear improvement works conducted by UTY, and develop improvement plan if necessary. Upon review, particular attention will be paid to the following points:
    - ✓ Curves with less than R300m

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- ✓ Unnecessary S-typed curves
  - ✓ Possibility of simplification of compound curves
  - ✓ Slopes with more than 35 per mil
  - ✓ Slope changes
- 7) Analyze the norms on tracks and make recommendations for its improvement
    - a) Install the degression sign at the starting point of relaxation curves
    - b) Contain a description of cant, slack, length of circular curves and relaxation curves in the curve signs
    - c) Make recommendation to the maintenance standards including the method of setting the signs
  - 8) Review the cant setting on the compound and s-type curve sections
    - a) Analyze the method of cant setting, calculate the average speed of each train based on run curve of passing trains and, set the cants at each curve radius
  - 9) Conduct seminar in order to improve the maintenance skill of UTY personnel on following issues a) the causal analysis on expanded gauge on the straight sections and removal, b) appropriate setup of slacks by introducing prestressed concrete sleeper on the steep curve sections, c) slope protection and maintenance plan on the high embankment and cut earth sections.
- III. Proposal to raise effectiveness of locomotive maintenance plan is prepared
- 1) Determine the functional and technical specifications of locomotive for the train operation plan of the locomotives for mountain areas
    - a) Review the traction force, required qualifications for slopes and curves, functions and specifications.
    - b) Review the vehicle weight, axle arrangement, axle load, carriage formation, types of driving motor, control system, auxiliary equipments (sand spreader, flange lubricator etc.), amperage rating, rated speed, traction force, climbing force, heatproof capacity of equipments including motors, RAMS, requirement of maintenance and upgrading
  - 2) Recommendations for maintenance and inspection based on the operational plan of the locomotives for the mountain area (inspection plan, locomotive plant in Tashkent, Darband and Termez, structure for inspection)
5. Input
- i. From Japanese side
    - 1) JICA will dispatch experts in the areas of operational planning, alignment planning, track maintenance, locomotives and survey.
    - 2) JICA will procure the necessary equipments for survey, equipment for

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maintenance and measurement of track parameters and technical condition of rails.

- 3) JICA will organize the training on operational planning in Japan.
- 4) JICA will bear costs for local assistants and interpreters.

ii. From Uzbek side

- 1) UTY will provide counterpart personnel (partner's personnel) and suitable office space including furniture.
- 2) UTY will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of the Project, through full and active involvement in the Project by all related authorities, beneficiary groups and institutions.
- 3) UTY will ensure that the technologies and knowledge acquired by the Uzbek personnel as a result of the Project will contribute to the economic and social development of Uzbekistan.
- 4) UTY will ensure that the equipments procured by JICA will be utilized effectively for the implementation of the Project by recommendation of the Japanese experts.
- 5) UTY will take necessary measures to ensure that the knowledge and experience acquired by the Uzbek personnel from technical training in Japan will be utilized effectively in the implementation of the ongoing and future JICA projects.
- 6) UTY will provide security-related information as well as measures to ensure the safety of the experts.
- 7) UTY will provide information as well as support in obtaining medical service.
- 8) UTY will provide credentials or identification cards.
- 9) UTY will take necessary measures to permit the experts to enter, leave and sojourn in Uzbekistan for the duration of Project realization.

6. Project Site(s)

Targeted sections of "Tashguzar-Kumkurgan New Railway Construction Project"

7. Duration

March 2012 – July 2013

8. Reports

- 1) Inception report (Apr. 2012, English/Russian)
- 2) Progress report I (Oct. 2012, English/Russian)

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3) Progress report II (Mar. 2013, English/Russian)

4) Final report (Jul. 2013, English/Russian)

The reports in English shall prevail.

Details of the Project are described as the Project Design Matrix (Annex 1) and the tentative plan of operation. (Annex 2)

### III. IMPLEMENTING ARRANGEMENTS

#### 1. Administration of the Project

UTY will be the counterpart agency/partner for the Project implementation.

#### 2. Evaluation (/Monitoring)

##### 1) Ex-Ante Evaluation

Ex-Ante Evaluation was conducted jointly by JICA and the Uzbek authority concerned, prior to the commencement of the Project implementation. Summary of the Ex-Ante Evaluation is as per Annex 3.

##### 2) Terminal Evaluation and Ex-Post Evaluation

Evaluation of the Project will be conducted jointly by JICA and the Uzbek authority concerned, during the last six months of the Project (Terminal Evaluation) and after completion (Ex-Post Evaluation) in order to examine the level of achievement and impact of the Project. Ex-Post Evaluation will be conducted under the evaluation of the Project.

##### 3) Mutual Cooperation

JICA and UTY will consult each other whenever any major issues arising in the course of Project/ implementation.

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**Annex 1 Project Design Matrix**  
**Annex 2 Tentative Plan of Operation**  
**Annex 3 Summary of Ex-Ante Evaluation**

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Project Design Matrix (Draft)  
Project for Capacity Development on Upgrading Track Maintenance and Train Operation Skills on Tashguzar-Kumkurgan Railway Line

Project Implementation Period: From March 2012 (17 months)

Implementation Agency: Uzbekistan Temir Yollari (UTY)

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumption
<p><b>Overall Goal</b> More reliable and efficient railway transport network responding to the transit demands is achieved</p>	<p>1. Reliable and sustainable railway operation in the mountain area is achieved through the increasing of efficiency of operation plan, track alignment plan, locomotive maintenance plan</p>	<p>1. Annual Report of UTY</p>	<ul style="list-style-type: none"> <li>- ODA Loan Project "Karshi-Termez Electrification Project" is signed.</li> <li>- The electric locomotives are procured.</li> <li>- Power supply is stable.</li> </ul>
<p><b>Project Purpose</b> Technical capability of UTY to develop valid train operation plan, track alignment plan and locomotive maintenance plan for the railway in mountain area is strengthened.</p>	<p>1. Proposal to raise effectiveness of train operation plan is prepared 2. Proposal to raise effectiveness of track maintenance plan is prepared 3. Proposal to raise effectiveness of locomotive maintenance plan is prepared</p>	<p>1. Approved documents on train operation plan, track alignment plan, locomotive maintenance plan</p>	<ul style="list-style-type: none"> <li>- The plans are developed and the approval procedure of UTY is made smoothly.</li> </ul>
<p><b>Output</b></p> <p>1. Proposal to raise effectiveness of train operation plan is prepared</p> <p>2. Proposal to raise effectiveness of track maintenance plan is prepared</p>	<p>1-1 Analysis of train operation is conducted 1-2 Transit plan with electric locomotives is formulated 1-3 Rolling stock plan is formulated 1-4 More effective diagram and operational facility plan are formulated 1-5 Train operation plan is developed with use of software</p> <p>2-1 Survey conducted by UTY is reviewed 2-2 Curve specifications are determined by IP calculation and revised track profile (plain and vertical) is developed 2-3 Run curve for electric locomotives and trains is developed based on the revised track profile, curve and slope specifications, Adequacy of revised alignment, cant, transition curve and slope is reviewed. Improvement plan is revised. 2-4 Necessity of improvement of curved sections is considered, and the improvement plan is developed if necessary. 2-5 Alignment improvement plan is developed for the section of Dekhanabad – Darband (or Boysun) through survey on traverse, centerline, horizontal and vertical sectional view of tracks. Implementation plan for alignment improvement is improved and revised alignment is reflected in the operational planning. Current situation of track is reviewed and track rectification plan</p>	<p>1-1 Documents and data on the current situation of operation 1-2 Transit plan with electric locomotives 1-3 Rolling stock plan 1-4 Diagram and operational facility plan 1-5 Train operation plan</p> <p>2-1 Documents and data on the survey result 2-2 Data on the curve specifications 2-3 Run curve for electric locomotives 2-4 Documents and data on sections of slopes and curves 2-5 Alignment improvement plan 2-6 Analysis paper of tracks, draft track rectification plan, on-site training 2-7 Improvement plan of horizontal and vertical curves 2-8 Analysis and recommendation paper on the norms on tracks 2-9 Analysis paper on compound and s-type curve 2-10 Seminar</p>	<ul style="list-style-type: none"> <li>- Necessary cooperation is granted by the related authority concerning train operation plan, track maintenance plan (alignment and track) and, locomotive maintenance plan</li> <li>- Necessary cooperation is granted from UTY</li> </ul>

	<p>is developed</p> <p>2-6 Improvement plan of horizontal and vertical curves is developed</p> <p>2-7 Norms on tracks are analyzed and recommendations are made for its improvement</p> <p>2-8 Cant settings on the compound and s-type curve sections are reviewed</p> <p>2-9 Seminar is conducted</p>		
<p>3. Proposal to raise effectiveness of locomotive maintenance plan is prepared</p>	<p>3-1 Functional and technical specifications of locomotive are determined for the train operation plan of the locomotives for mountain areas</p> <p>3-2 Recommendations are made for maintenance and inspection based on the operational plan of the locomotives for the mountain area (Inspection plan, locomotive plant in Tashkent, Darband and Termez, structure for inspection)</p>	<p>3-1 Documents and data on specifications of locomotives</p> <p>3-2 Locomotive maintenance plan and recommendation paper</p>	

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Activities	Inputs (Japanese side)	(Uzbek side)	Preconditions
<b>0. Review and analyze</b>			
0-1 Review and analyze the present situation and surroundings			Related loan projects are proceeded smoothly.
0-2 Survey is conducted			
<b>1. Train operation plan preparation</b>			
1-1 Review of current operational situation			
a) Review the traction force, cars formation, pattern of operation, operation record			
b) Review the tracks and facilities (track alignment, wire connections of stations, signaling data, track norms etc.)			
c) Review the problems in transit plan			
d) Input the data of tracks and facilities into software			
1-2 Transit plan with electric locomotives			
a) Review the traffic volume (passengers and cargos) from the demand forecast			
b) Set the traction force based on the forecast transit			
1-3 Rolling stock plan			
a) Analyze highest speed, acceleration-deceleration performance, curve passage quality, limiting speed for down slope, heat capacity, brake performance, input of data on rolling stocks, operational simulation			
1-4 Diagram and operational facility plan			
a) Review and input the data (notch curve, characteristic curve etc.) of electric locomotives owned by UTY			
b) Develop the characteristic curve (pulling force, load characteristic curve etc.) of electric locomotives			
c) Review the traction force and equilibrium speed based on input data			
d) Develop the run curve for each rolling stock with use of software			
e) Develop the traction force and operational hours from operating curve			
f) Develop the proposal to raise effectiveness of the diagram for trains based on operational hours			
g) Develop the proposal to raise effectiveness of the diagram for rolling stocks based on the diagram for trains, compute the necessary number of rolling stocks			
h) Recommendations on renewal (procurement) of operational facilities			
1-5 Develop train operation plan with use of software			
a) Conduct simulation training on operational plan			

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<p>b) Conduct training on theory and practice of velocity and traction constant, theory of standard operating time, and operational planning</p>			
<p><b>2. Track maintenance plan preparation</b></p>			
<p>2-1 Review of the survey conducted by UTY</p>			
<p>a) Record the traction displacement randomly with track master, measure the curve line, slope, and the vertical curve of the changing point of gradient, review the survey record</p> <p>b) Review the positions of railway norms (curve, cant, slope, mileposts)</p> <p>c) Review the profile and traverse survey on particular sections if necessary</p>			
<p>2-2 Determine the curve specifications by IP calculation and develop the revised track profile (plain and vertical)</p>			
<p>2-3 Develop the run curve for electric locomotives and trains based on the revised track profile, curve and slope specifications; review the adequacy of revised alignment, cant, transition curve and slope; revise the implementation plan, if necessary.</p>			
<p>2-4 Consider the necessity of improvement of curved sections, and develop the improvement plan if necessary</p>			
<p>2-5 Develop the alignment improvement plan for the section of Dekhanabad – Darband (or Boysun) through survey on traverse, centerline, horizontal and vertical sectional view of tracks; develop the implementation plan for alignment improvement; reflect the revised alignment in the operational planning.</p>			
<p>Review the current situation of track and develop the track rectification plan</p>			
<p>a) Analyze the tracks' current horizontal and vertical sectional view based on the survey conducted by UTY, analyze the record obtained by track master and develop the draft track rectification plan, and conduct the on-site training</p>			
<p>2-6 Develop the improvement plan of horizontal and vertical curves</p>			
<p>a) Review the result of track rectification and linear improvement works conducted by UTY, and develop improvement plan if necessary. Upon review, particular attention will be paid to the following points:</p> <ul style="list-style-type: none"> <li>✓ Curves with less than R300m</li> <li>✓ Unnecessary S-typed curves</li> <li>✓ Possibility of simplification of compound curves</li> <li>✓ Slopes with more than 35 per mil</li> <li>✓ Slope changes</li> </ul>			

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<p>2-7 Analyze the norms on tracks and make recommendations for its improvement</p> <ul style="list-style-type: none"> <li>a) Install the depression sign at the starting point of relaxation curves</li> <li>b) Contain a description of cant, slack, length of circular curves and relaxation curves in the curve signs</li> <li>c) Make recommendation to the maintenance standards including the method of setting the signs</li> </ul> <p>2-8 Review the cant setting on the compound and s-type curve sections</p> <ul style="list-style-type: none"> <li>a) Analyze the method of cant setting, calculate the average speed of each train based on run curve of passing trains and, set the cants at each curve radius</li> </ul> <p>2-9 Conduct seminar in order to improve the maintenance skill of UTY personnel on following issues a) the causal analysis on expanded gauge on the straight sections and removal, b) appropriate setup of slacks by introducing prestressed concrete sleeper on the steep curve sections, c) slope protection and maintenance plan on the high embankment and cut earth sections.</p>			
<p><b>3. Preparation of maintenance plan of locomotives</b></p> <p>3-1 Determine the functional and technical specifications of locomotive for the train operation plan of the locomotives for mountain areas</p> <ul style="list-style-type: none"> <li>a) Review the traction force, required qualifications for slopes and curves, functions and specifications.</li> <li>b) Review the vehicle weight, axle arrangement, axle load, carriage formation, types of driving motor, control system, auxiliary equipments (sand spreader, flange lubricator etc.), amperage rating, rated speed, traction force, climbing force, heatproof capacity of equipments including motors, RAMS, requirement of maintenance and upgrading</li> </ul> <p>3-2 Recommendations for maintenance and inspection based on the operational plan of the locomotives for the mountain area (Inspection plan, locomotive plant in Tashkent, Darband and Termez, structure for inspection)</p>			

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## Plan of Operation (PO) &lt;DRAFT&gt;

## Project for Capacity Development on Upgrading Track Maintenance and Train Operational Skills on Tashguzar-Kumkurgan Railway Line

Time Schedule	YEAR 1												YEAR 2					
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
<b>0. Review, Analysis, Survey</b>																		
0-1 Review and analyze the present situation and surroundings	←→																	
0-2 Conduct survey		←→	←→															
<b>1. Train operational planning</b>																		
1-1 Review the current operational situation	←→																	
1-2 Formulate the transit plan with electric locomotives										←→								
1-3 Formulate the rolling stock plan											←→							
1-4 Formulate the proposals on increase of the efficiency of diagram and operational facility plan												←→						
1-5 Develop train operation plan with use of software													←→					
<b>2. Track maintenance plan</b>																		
2-1 Review the survey conducted by UTY	←→																	
2-2 Determine the curve specifications and develop the revised track profile							←→											
2-3 Develop the run curve for electric locomotives and trains							←→											
2-4 Consider the necessity of improvement of curved sections								←→										
2-5 Develop the alignment improvement and track rectification plans									←→									
2-6 Develop the improvement plan of horizontal and vertical curves								←→										
2-7 Analyze the norms on tracks and make recommendations for its improvement									←→									
2-8 Review the cant setting on the compound and s-type curve sections										←→								
2-9 Conduct seminar										←→								
<b>3. Maintenance plan of locomotives</b>																		
3-1 Determine the functional and technical specifications of locomotive											←→							
3-2 Make recommendations for maintenance and inspection												←→						

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1. Relevance

- 1) According to the Japanese cooperation plan to Uzbekistan, one of the priority areas is to develop the transport infrastructure, therefore the Overall Goal and Project Purpose are coherent with the Japanese cooperation plan to Uzbekistan.
- 2) According to the Welfare Improvement Strategy and the different Presidential Decrees, it is strongly needed to develop transport infrastructure to maintain sustainable high economic growth; therefore the Overall Goal and Project Purpose are coherent with the national strategy of Uzbekistan.

2. Effectiveness

- 1) The Project Purpose is very clear because the technical assistance transferred by the Japanese experts will be utilized for the first railway constructed in the mountain area by Japanese ODA loan.
- 2) The achievement of the Project Purpose, such as the development of more effective train operation plan, results from all the Outputs from the Project since the Outputs are to secure that partner has all necessary capabilities to operate the railways system in mountain area.

3. Efficiency

- 1) The timing of the Project is appropriate because "Tashguzar-Kumkurgan New Railway Construction Project" is completing and the implementation of "Karshi-Termez Electrification Project" is starting at an early date.
- 2) The staffs are already nominated from UTY and the expensive and large-scale equipments are not necessary, therefore the present Project structural plan fulfills the necessary conditions for its implementation.

4. Impact

- 1) The safe and reliable operation will be realized because of transfer of the highly evaluated Japanese railway operation and maintenance technology in the world.

5. Sustainability

- 1) The partner personnel will work full-time for the Project. Human resources development plan will be established within the Project for the future; therefore the personal sustainability will be secured.

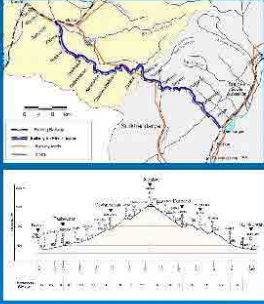
## 資料2 第1回合同調整委員会（JCC）資料

Project for Capacity Development  
on Upgrading Track Maintenance  
and Train Operation Skills  
on Tashguzar-Kumkurgan Railway Lines

**Background and Outline**  
June 26, 2012

1

Profile of Target Railway Line



Line Tashguzar - Kumkurgan  
has to pass through and  
overcome the mountain range  
between Kashkandarya and  
Surkhandarya with continuous  
steep grade and sharp curves

Akrabat Station is at the  
summit and almost all  
sections before and after there  
were one-sided grade

2

Background of this Project

- "Tashguzar-Kumkurgan New Railway Construction Project"  
JBIC Loan (UZB-P8) L/A October 14, 2004
- JICA Experts (April to August, 2010)  
Assessment of situation, conducting seminars  
Recommendation: access to information on precise railway alignment  
through survey, development of valid operational plan, track  
maintenance plan and locomotive maintenance plan
- "Karshi-Termez Railway Electrification Project"  
JICA Loan (UZB-P10) L/A February \*\*, 2012

Purpose of this Project (According to MOU)  
Technical capability of UTY to develop valid train operation plan, track  
alignment plan and locomotive maintenance plan for the railway in  
mountain area is strengthened

3

Capacity of Current Line and Operation



- # Train Operation Plan may not be  
ideal for current locomotives and  
track profile
- # Alignment of route may have rooms  
to be rectified to improve Transport  
Capacity
- # Track alignment within the roadbed  
may not be ideal for Train Operation  
and Track Maintenance

4

Three(3) Approaches of this Project

- 1. Train Operation Planning**  
Transportation Plan > Rolling Stock Plan > Train Running Curve >  
Time, Speed & Load > Train Diagram > Mobilization Plan >  
Maintenance Plan > Facility Plan
- 2. Track Rectification Planning**  
# Review existing Track Profile > Survey > Rectification Plan  
# Review Track Maintenance Work > Plan to mitigate critical points >  
Recommendation for better maintenance
- 3. Locomotive Maintenance Planning**  
Advice for Electric Loco maintenance and required specification

5

Basic Policy of this Project

1. Maximize effects of Japanese ODA Loan  
→ Full utilization of line capacity
2. Capacity Development of UTY  
→ Sustainable management after the Project period
3. Appropriate advice considering technical culture  
→ Adoption of Japanese Technology to Uzbekistan
4. Efficient approach considering limited input and period  
→ Important role of core Counterpart personnel
5. Implementation under JICA's regulation

6

Schedule of this Project	
<b>2012</b>	
June – July	1st on-site Work (confirming current situation)
July – Nov.	Survey and prepare existing Track Profile
Nov. – Dec.	1st draft of Track Rectification Plan and Wrap-up of 1st on-site Work
<b>2013</b>	
Jan. – April	2nd on-site Work “Train Operation Planning”, “Track Rectification Planning”, “Locomotive Maintenance Planning”
April	Wrap-up on Track Rectification & Locomotive
May	Training in Japan for Operation / Rolling Stock Planning
June	Follow-up of Training in Japan for Sustainable Management
July	Project Completion

7

Experts assigned for this Project	
<b>Leader</b>	<b>S. Okamoto</b> <i>May 29 – Jun 26, Nov 20 – Dec 3, Jan 15 – 26, Mar 23 – Apr 12, Jun 24 – Jul 8</i>
<b>Train Operation Planning</b>	<b>Y. Miura</b> <i>Jun 1 – Jul 15, Jan 15 – Apr 26, Jun 3 – Jul 8</i>
<b>Track Rectification Planning (Alignment)</b>	<b>T. Odan</b> <i>Jun 1 – Jul 15, Nov 3 – Dec 3, Jan 15 – Apr 12</i>
<b>Track Rectification Planning (Track)</b>	<b>Y. Takino</b> <i>Jun 1 – Jul 15, Nov 20 – Dec 3, Jan 13 – Apr 12</i>
<b>Locomotive</b>	<b>K. Funaki</b> <i>Nov 20 – Dec 3, Feb 26 – Apr 12</i>
<b>Survey</b>	<b>C. Horiuchi</b> <i>Jun 1 – 20, Jun 11 – Aug 23, Oct 9 – Nov 21</i>
<b>Coordinator</b>	<b>H. Tobita</b>

8

**END**

9

Project for Capacity Development  
on Upgrading Track Maintenance  
and Train Operation Skills  
on Tashguzar-Kumkurgan Railway Lines

Joint Coordination Committee  
Progress of Work in June  
June 26, 2012

Progress in the 1<sup>st</sup> on-site work

Kick-off meeting was held on June 5, 2012

Field survey of the target section was done on June 12-14, 2012

Schedule of 1<sup>st</sup> On-site Works

Task #	Contents of Works	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
210	Confirmation of Current Condition of Target Railway Section	■						
220	Preparation and Establishment of Track Re-alignment Plan		■					
230	Survey for Obtaining Accurate Alignment	■	■	■	■	■	■	
240	Improvement of Track Maintenance Work, Equipment Provision		■					
250	Wrap-up of First on-site Works							■

Progress in the 1<sup>st</sup> on-site work

Task 210: Confirmation of current condition of target railway section

For train operation planning

- > Track profile and curve list were obtained and being examined
- > Dispatcher of major stations were observed and found that train operation record is available at UTY HQ
- > Software "Ter Vsm" is not utilized
- > Depot at Karshi and Darband were observed, Tachograph was confirmed
- > Passenger train's speed running on up grade was confirmed

Progress in the 1<sup>st</sup> on-site work

Task 210: Confirmation of current condition of target railway section

For train operation planning

Darband depot

Tachograph



Progress in the 1<sup>st</sup> on-site work

Task 210: Confirmation of current condition of target railway section

For track realignment planning

- > Track profile and curve list were obtained and being examined
- > Small curves, compound curves, steep grade are found from the Track profile
- > Visual inspection of current track condition from the front window as well as video shooting were planned, but are not yet achieved
- > Track plan drawing is being examined
- > Kilometer-post were confirmed along the line with 100m post

Progress in the 1<sup>st</sup> on-site work

Task 210: Confirmation of current condition of target railway section

For track realignment planning

Special coach for Experts was coupled to a passenger train, however only side view through windows were available



**Task 210: Confirmation of current condition of target railway section**

For track Maintenance planning

- > Track profile and curve list were obtained and being examined
- > Visual inspection of current track condition from the front window as well as video shooting were planned, but are not yet achieved
- > Recent record (chart) of Track inspection car is in the computer on the car and is not yet obtained nor examined
- > Track maintenance Gang were found often working on-site
- > Foreman of each Gang had the chart of Inspection car and used for track maintenance work
- > Worn out rail head were observed at some curve section

7

**Task 210: Confirmation of current condition of target railway section**

For track Maintenance planning

- > Track maintenance Gang were found often working on-site
- > Worn out rail head were observed at some curve section
- > Track maintenance machines were mobilized at Akrobat station, window time for maintenance work was less than 1.5hr



8

**Task 220: Preparation and Establishment of Track Rectification Plan**

- > Only from the information of Track profile and Track plan drawings, expert is identifying locations which need alignment improvement
- > So far, the above work is done by only Expert, because relevant Counterpart staff of UTY is not identified
- > This work will be effectively done after accurate alignment of existing track is confirmed by survey, during the 2<sup>nd</sup> on-site work in 2013

9

**Task 220: Preparation and Establishment of Track Rectification Plan**

View from the road over line



Electrification pole were constructed



10

**Task 230: Survey for Obtaining Accurate Alignment**

- > Survey will be executed by Design Institute contracted by JTC under the supervision of Expert
- > Survey will cover the section between Dekhanabad and Boysun (110km)
- > Control survey will be done first by GPS traverse method
- > TOR was prepared and quotation for reference are being collected
- > Contract package and ceiling price will be fixed, then proceed to selection / contract procedure

11

**Task 240: Examination of Improvement of Track Maintenance Work, Supporting in Procedure of Equipment Provision**

- > Track maintenance Gang were found to replace rails on a bridge using simple tools
- > Necessary equipment for provision by JICA shall be identified



12

## End of Progress of work in June

13

## Work Plan from now

14

Work Plan from now

### Train Operation Planning

- Using current Track profile, Expert will make Train Running Curve of diesel locomotive by Japanese way
- Compare with actual train operation record



15

Work Plan from now

### Track Realignment Planning

- Using current Track profile, Expert will prepare realignment plan only for critical section
- Complicated compound curve, curve with less than R300 (according to curve list, minimum one is R146)



16

Work Plan from now

### Survey

Expert will come again on July 11 to supervise survey work  
Survey is supposed to begin from July 2012 and complete work in November 2012



17

Work Plan from now

### Important issues to be done until July 15; period of Experts' assignment of this time

1. Another opportunity to inspect track condition by front view from driver's cabin or motor car
2. Identify needs of equipment necessary for effective track maintenance work to decide the list of equipment to be procured and donated by JICA
3. Specify sections which are necessary to realign the track in order to avoid construction work of electrification pole is executed for such section
4. Specify sections which are necessary to realign the track in order to designate executing cross-section survey in the survey contract

18



**Important issues to be done until 2<sup>nd</sup>  
on-site work from January 2013**

1. Identify counterpart staff of UTY in each field of Expert
2. Assign the counterparts to work together with Experts in order to develop their capacity
3. Proceed the procurement procedure to receive equipment to be provided by JICA for effective utilization of them under the guidance of Experts

Thank you very much  
for your kind attention !

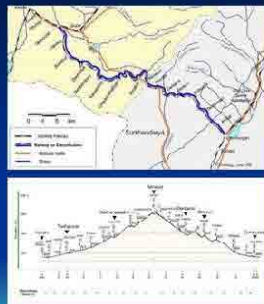
**END**

資料3 第2回合同調整委員会（JCC）資料

Project for Capacity Development on Upgrading Track Maintenance and Train Operation Skills on Tashguzar-Kumkurgan Railway Lines

**Joint Coordination Committee  
Progress of Work in Phase I  
May 24, 2013**

Profile of Target Railway Line



Line Tashguzar - Kumkurgan has to pass through and overcome the mountain range between Kashkandarya and Surkhandarya with continuous steep grade and sharp curves

Akrabat Station is at the summit and almost all sections before and after there were one-sided grade

Background of this Project

- Tashguzar-Kumkurgan New Railway Construction Project" JBIC Loan (UZB-P8) L/A October 14, 2004
- JICA Experts (April to August, 2010) Recommendation: Confirm precise track alignment through survey, Development of valid plan in the field of Operation, Track Maintenance and Locomotive Maintenance
- "Karshi-Temez Railway Electrification Project" JICA Loan (UZB-P10) L/A February 27, 2012

Purpose of this Project

Technical capability of UTY to develop valid Train Operation Plan, Track Alignment Plan and Locomotive Maintenance Plan for the railway in mountain area is strengthened

Three(3) Approaches of this Project

- 1. Train Operation Planning**
  - Transportation Plan
  - Rolling Stock Plan
  - Train Running Curve
  - Time, Speed & Load
  - Train Diagram
  - Mobilization Plan
  - Maintenance Plan
  - Facility Plan
- 2. Track Rectification Planning**
  - Improve Track Alignment
  - Survey
  - Rectification Plan
  - Improve Track Maintenance Work
  - Plan to mitigate critical points
  - Recommendation for better maintenance
- 3. Locomotive Maintenance Planning**
  - Advice for Electric Loco maintenance

Experts assigned to this Project

Leader	S. Okamoto
Train Operation Planning	Y. Miura
Track Rectification Planning (Alignment)	S. Yamashina
Track Rectification Planning (Track)	Y. Takino
Locomotive	K. Funaki
Survey	C. Horiuchi
Coordinator	K. Ishiuchi

Schedule of this Project

2012	June - July	1st on-site Work (confirming current situation)
	July - Mar.	Track Survey and prepare revised Track Profile
	Nov. - Dec.	1st on-site Work of Locomotive, Supervising Track Survey
2013	Jan. - May	2nd on-site Work Training on "Train Operation Planning", "Track Rectification Planning", "Locomotive Maintenance Planning" <b>Ph 1</b>
	May	Wrap-up on Track Rectification & Locomotive
	June	Training in Japan for Operation / Track Rectification Planning <b>Ph 2</b>
	July	Follow-up of Training in Japan for Sustainable Management
	August	Project Completion

Progress in the Phase 1

**Train Operation Planning by the Expert MIURA**

2012					2013				
6	7	8	9	10	1	2	3	4	5

Confirmation of Current Condition of Train Operation and its Plan

- Tractive Load : 2,200 t with 3TE10M type locomotive
- Train set formation: 30 ~ 35 freight cars
- Pattern of Operation: 14 trains/day, whole train schedule model pattern is almost used up >> In order to accommodate future demand increase, the line capacity of the mountain section needs to be improved




Progress in the Phase 1

**Train Operation Planning by the Expert MIURA**

2012					2013				
6	7	8	9	10	1	2	3	4	5

Confirmation of Current Condition of Train Operation and its Plan

- Operation records: Tachograph records showed low speed operation of around 20km/h over a long period, which might have caused heat generation of the main traction motor or generator.

Darband depot



Tachograph



Progress in the Phase 1

**Train Operation Planning by the Expert MIURA**

2012					2013				
6	7	8	9	10	1	2	3	4	5

Training program in Uzbekistan (at Tashkent, Karshi, Termez)

**Purpose**

- To master how to make "Train Operation Plan" on mountainous section, making the most of capacity of Electric Locomotives after the traction power is replaced from Diesel
- To enhance the capacity of UTY regarding "Train Operation Planning" in order to deal with increasing rail transport demand through the section Tashguzar - Kumkurgan

**Schedule**  
February 4 to April 24 including training in Karshi and Termez

Progress in the Phase 1

**Train Operation Planning by the Expert MIURA**

2012					2013				
6	7	8	9	10	1	2	3	4	5

**Contents**

- Introduction to Transport Plan
- Determine tractive load depending on demand forecast
- Analyze locomotive performance specifications and prepare locomotive performance curve (Traction force curve, Tractive load curves, etc.)
- Prepare Train Running Curves for each train type
- Prepare tables for Time, Speed & Load, and Minimum Train Running Time
- Prepare Train Diagrams
- Prepare Allocation Plan of Locomotives and Drivers

Progress in the Phase 1

**Train Operation Planning by the Expert MIURA**

2012					2013				
6	7	8	9	10	1	2	3	4	5

**Participants of the training in Uzbekistan**

Tashkent	max.11p	Operation Control Center, Locomotive department, UTY HQ, Tashkent RRB, PIU-E
Karshi	max.11p	Train Operation Department/RRB, Karshi Depot, stations of Buzar, Chashmaifiza, Karadahna, Dehkanabad
Termez	max.15p	Transport section/RRB, stations of Darband, Tangimush

**Nomination of participants for the training in Japan**  
Among the participants of training in Uzbekistan above, 7 candidates are nominated for the training in Japan in June, 2013

Progress in the Phase 1

**Track Rectification Planning by the Expert TAKINO**

2012					2013				
6	7	8	9	10	1	2	3	4	5

Confirmation of current condition of target railway section

- Track profile and curve list were obtained and being examined
- Small curves, compound curves, steep grade are found from the Track profile
- Recorded Chart of the Track Inspection Car was obtained and examined
- Some discrepancy between Track Profile and Chart was found in chainage, combination of curves, etc.
- It was decided to measure the actual track alignment on site by hand, in order to compare with the Track Profile data

Progress in the Phase 1

**Track Rectification Planning by the Expert TAKINO**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

Manual survey of track alignment by Mr. Takino

- It was done on July 6, 2012
- Confirm the accurate curve radius by measuring with a 10m string
- 94km570 - 95km500 and 95km795 - 96km175 section
- Manually measured data was different from Track Profile data, but similar to the Chart of Track Inspection Car
- It was found necessary to carry out Track Survey



13

Progress in the Phase 1

**Survey for obtaining accurate alignment supervised by Expert**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

Executed by Boshtransloyiha supervised by Expert Horiuchi

- Survey covered the section **Dehkanabad - Boysun (100km)**
- **Control survey** was done first by GPS traverse method
- **Track center line survey** for main railway ( 100m interval on straight section / 20m interval on curve section )
- **Profile leveling** ( 100m interval / 20m on some specified section )
- **Cross-section survey** ( at 31 selected locations, where realignment civil work are supposed necessary )

14


Progress in the Phase 1

**Survey for obtaining accurate alignment supervised by Expert**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

- The track alignment was defined using **computer AutoCAD trial work** by inserting surveyed track center coordinates
- All the outputs were submitted in March, 2013
- They have been utilized for the activities of Experts, Mr. Takino and Mr. Yamashina

Before the survey work, Expert Mr. Horiuchi had walked throughout the section (100km). These photos were taken at that time.



15

Progress in the Phase 1

**Track Rectification Planning (Alignment) by the Expert YAMASHINA**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

Training program in Uzbekistan (at Tashkent)

**Purpose**

- To master basics of Track Alignment Planning
- To specify the critical points where the improvement of track alignment is required, based on the recent Track Profile made by the Survey conducted in this Project

**Schedule**  
March 14 to May 23 including site survey at the target section

16


Progress in the Phase 1

**Track Rectification Planning (Alignment) by the Expert YAMASHINA**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

**Contents**

- Introduction to Track Alignment Planning
- Basics of curve, profile and drawing method
- Design factor for alignment plan
- Selection of critical points to be improved, based on the recent Track Profile made by the survey
- Site observation of the selected location
- Drawing out rectification plan



17

Progress in the Phase 1

**Track Rectification Planning (Alignment) by the Expert YAMASHINA**

2012												2013							
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8					

**Participants of the training in Uzbekistan**

Head of Track Department	Boshtransloyiha
1st category Engineer, Railway Track Design Team	Toshtemirjolloyiha
Deputy Head, Track Inspection Station	Track Facility Department, UTY HQ
Chief Work Planner Engineer, Construction Operations	Capital Construction Directorate, UTY HQ

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Progress in the Phase 1

**Track Maintenance Work by the Expert TAKINO**

Training program in Uzbekistan (at Tashkent, Karshi and Termez)

**Purpose**

- To master proper track maintenance works for preventing derailment due to the condition of track
- To organize an efficient track maintenance system

**Schedule**

March 28 to May 17 including training in Karshi and Termez

Progress in the Phase 1

**Track Rectification Plan (Track) by the Expert TAKINO**

**Contents**

- Introduction to utilize "Track Master" improve track alignment
- Outsourcing of track maintenance work in Japan
- Introduction of PC sleepers which can set slack
- Introduction of DHH rail
- Installation of L-shape guard for prevention of derailment

Progress in the Phase 1

**Track Rectification Plan (Track) by the Expert TAKINO**

**Participants of the training in Uzbekistan**

Tashkent	Max.18p	Track Facility Department, UTY HQ,
Karshi	4p	Track Facility Department, Karshi RRB, Track Maintenance Division #12, Track Maintenance Division #14
Termez	4p	Darband Track Maintenance Division Track Maintenance Division #13, Track Maintenance Division #15

Progress in the Phase 1

**Locomotive Maintenance Plan by the Expert FUNAKI**

Training program in Uzbekistan (at Tashkent, Karshi and Termez)

**Purpose**

- Introduction of basic knowledge to adapt maintenance work of newly introduced Electric Locomotives by the Electrification Project
- Basic items include both of practical maintenance work and related works to make the maintenance work more effective

**Schedule**

April 29 to May 17 including training in Karshi and Termez

Progress in the Phase 1

**Locomotive Maintenance Plan by the Expert FUNAKI**

**Contents**

- Basics of Locomotive Maintenance
- Maintenance management system
- Comparison of technical specification of locomotives between UTY and Japan Railways
- Trend of troubles of Electric Locomotives
- Adaptation of new Electric Locomotive

Progress in the Phase 1

**Locomotive Maintenance Plan by the Expert FUNAKI**

**Participants of the training in Uzbekistan**

Tashkent Workshop	9p	Chief Engineer of Structural, Mechanical, Process, Power. Quality Control Department
Uzbekistan Depot	10p	Foreman, Safety Engineer, Process Control Engineer
Karshi Depot	9p	Health & Safety Manager, Chief Foreman, Foreman, Loco driver-Instructor, Head of Darband Intermediate Depot
Termez Depot	9p	Head of Technical Department Training Instructor, Safety Manager Serviceman



## End of Progress of work in Phase I as of May, 2013

## Work Plan from now in Phase 2



### Work Plan from now

#### Work schedule of Phase 2

Task	Contents of Works	June	July	August
510	Training Program in Japan (Track Maintenance and Rectification Planning) June 16 - 26	█		
510	Training Program in Japan (Operation Planning) June 11 - 21	█		
610	Follow-up of Training in Japan (Operation Planning) and Assistance for Sustainable Management		█	
620	Project Completion Meeting			█

- ### Work Plan from now
- #### Training Program in Japan for “Track Maintenance and Rectification Planning”
- Objectives**
    - Introduce the track structure and maintenance system of mountain railway lines in Japan
    - Deepen the understanding of the significance and effectiveness of track rectification planning and improvement of track maintenance activities recommended by this Project
  - Schedule**

10 days from June 17 (Mon) to June 26 (Wed) in Japan
-

Work Plan from now

### Training Program in Japan

#### 3. Participants (3)

1)	Track Maintenance Facilities Department, UTY HQ
2)	Track Maintenance Facilities Division, Karshi RRB
3)	Darband Track Maintenance Division # 15, Termez RRB

#### 4. Program

Lecture	Track structure and maintenance system, Work system of maintenance company, Work flow of track maintenance
Observation	Ride on a Track Inspection Car, Maintenance work at night, Instruction Center, Railway Technical Research Institute, Manufacturer of Track Master

31

Work Plan from now

### Training Program in Japan for "Operation Planning"

#### 1. Objectives

- Introduce general idea and procedure of Train Operation Planning and Allocation Planning
- Including regulations in operation theory, rolling stock allocation, crew allocation, and the general concept of preparing Train Running Curve

#### 2. Schedule

10 days from June 12 (Wed) to June 21 (Fri) in Japan

32

Work Plan from now

### Training Program in Japan

#### 3. Participants (7)

1)	Head of Operation Control Center
2)	Train Dispatcher in Operation Control Center
3)	Engineer in Locomotive Repair Division, Locomotive Operation Department
4)	Train Planning Engineer in Operation Control Center
5)	Locomotive expert, PIJ-Electrification
6)	Deputy Head of Freight Division, Karshi RRB
7)	Deputy Head of Transportation Division, Termez RRB

#### 4. Program

Lecture	Management System of Freight Railways, Operation Planning of Freight Railways in Japan
Observation	Freight Terminal, Locomotive Depot, Workshop, Operation Control Center

33

Work Plan from now

### Follow-up of Training in Japan (Operation Planning) and Assistance for Sustainable Management By Expert Mr. Miura (July 2 to Aug.5)

2012												2013				
6	7	8	9	10	11	12	1	2	3	4	5	6	7	8		
													7			

↓

- Follow-up activities for participated trainees in Japan (Operation Planning) after returning back to Uzbekistan
- If necessary, some guidance will be prepared, and arrangement of implementation structure will be advised for sustainable management.

34

Work Plan from now

### Project Completion Meeting

Experts Mr. Okamoto, Mr. Miura, Mr. Ishiuchi  
( at the beginning of August, 2013 )

- Completion meeting with relevant department of UTY and JICA Uzbekistan Office
- Views and opinions on the outcome, lessons learned, will be exchanged, including management policy of UTY after this Project.

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Thank you very much for your kind attention !

END

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# 資料4 ラップアップ・セミナー（2013年5月）資料

## (1) 軌道整正計画（線形）



### 研修の内容と実績

線形計画の研修は、全19回（総時間数58.5時間）行われた。

研修内容	日程	時間数
1. 線形計画の基本事項、曲線の作図方法	3/14,19,26,29,4/2	15
2. 線形改良計画の作成		
➢ 整備水準、現況把握、改良箇所の抽出	4/4,9,11,16	10
➢ 平面線形改良計画【概略検討】	4/19,23	6.5
➢ 線形改良箇所の現地確認	4/25,26	12
➢ 平面線形改良計画【詳細検討】	4/30,5/3,7,17,21,23	15
	合計	58.5

### 線形計画の基本事項、曲線の作図方法

線形計画に関係する以下の項目について、ウズベクと日本の基準を比較しながら確認した。

- 1) 線路等級
- 2) 平面曲線の種類
- 3) 緩和曲線
- 4) カント
- 5) 勾配と縦曲線
- 6) 車両限界、建築限界
- 7) 軌道中心間隔
- 8) 施工基面幅
- 9) 分岐器
- 10) 線形計画上の制約条件
- 11) 緩和曲線の作図法
- 12) 中間緩和曲線の意義とその作図法

### 線形計画の基本事項、曲線の作図方法

#### ◆ カントとは？

遠心力と重力の合力が軌道の中央にくるように、外側レールを内側レールより高くするのがカントである。

カントは原則として、曲線の内側レールを基準にして外側レールを上げる。

カントのていどは緩和曲線の全長において行う。

カントは、緩和曲線の長さを算出するための基礎となる重要な値である。

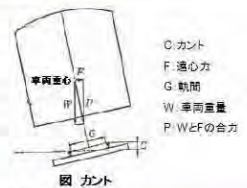


図 カント

表 カントの算出式

ウズベキスタン (軌間1520mm)	日本 (軌間1067mm、1435mm)
$h = K \times 12.5 \times V^2 / R$	$C = \alpha \times V^2 / R$
h: カント (mm)	C: カント (mm)
K: カントの増加係数=1.2	$\alpha$ : 軌間が1067mmの場合は8.4
V: 速度 (km/h)	1435mmの場合は11.8
R: 曲線半径 (m)	V: 速度 (km/h)
カントの最大値 150mm	R: 曲線半径 (m)
	カントの最大値 軌間1067mmの場合105mm
	1435mmの場合180mm

※ 列車速度Vは、運転計画担当部署と打合せの上、決めることになる。

### 整備水準、現況把握、改良箇所の抽出

研修で作成する線形改良計画に適用する設計基準は以下のようにした。

項目	内容	備考
設計勾配	1%	
設計最高速度	120km/h	
最小曲線半径	500m (250m)	コンクリート枕木が原則的な基本とする。R=250mとした場合は既設枕木をそのまま使用する。
電圧勾配	許容幅内: 1.5% (2.5%) 許容幅外: 0% (1.8.5%)	18.5%は後継車運送の確保。 曲線側は曲線半径による勾配修正を行う。(100%)
線路半径	10700m (5000m)	
施工基面幅	設計材料幅: 7.8m 既設材料幅: 6.6m	
レール種別	RN50	
道床厚	砂利: +25mm 砂: +200mm	
道床層	3層	
曲線側の枕木長	軌道方向の長さ: 500mm 垂直方向の長さ: 100mm	
計画線形	1:100以上	※ 変形係

注1) CNR 2.05.01.96: [Construction Norms and Rules Railways of 1520mm Track Gauge Designing Standards (CN 02.05.01) 90 The State Committee of the Republic of Uzbekistan for Architecture and Construction Tashkent 1998]

設計指導書「イスタンブール・ムスタファ・カシムパシャ鉄道線改良設計計画書」

注2) 「1」は必ずやむを得ない場合を指す。

### 整備水準、現況把握、改良箇所の抽出

昨年実施した現地測量図より、曲線半径、勾配等、現在線の状況を把握した。

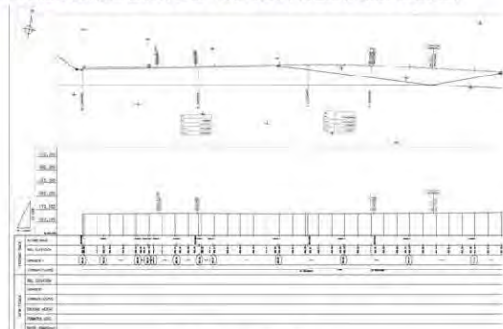


図 現在線測量図 (抜粋)



**整備水準、現況把握、改良箇所の抽出**

半径300m未満の曲線位置



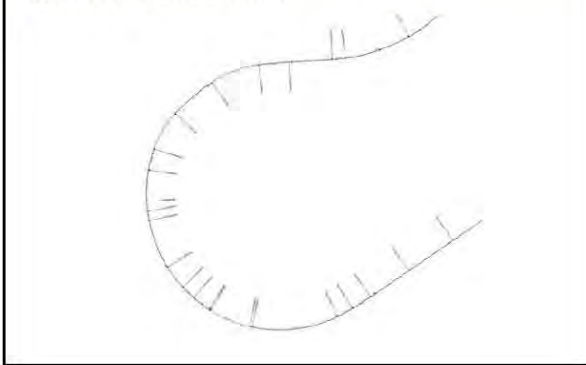
**整備水準、現況把握、改良箇所の抽出**

半径300m未満の曲線位置 ⇒ 89箇所

区間	区間番号	区間名称	区間長さ	区間平均	区間標準	区間最大	区間最小	区間平均	区間標準	区間最大	区間最小
1	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000	111817000000

**整備水準、現況把握、改良箇所の抽出**

複心曲線の状況 (73k800m~75k000m)



**平面線形改良計画【概略検討】**

平面線形改良の方針

- ✓ 半径300m未満の曲線を300m以上に改良する。(地形上等の理由によりやむを得ない場合は250m以上)
- ✓ 曲線半径改良と併せて、現地に出来てしまった複心曲線を単曲線に改良する。もしくは複心曲線の数を可能な限り減らす。



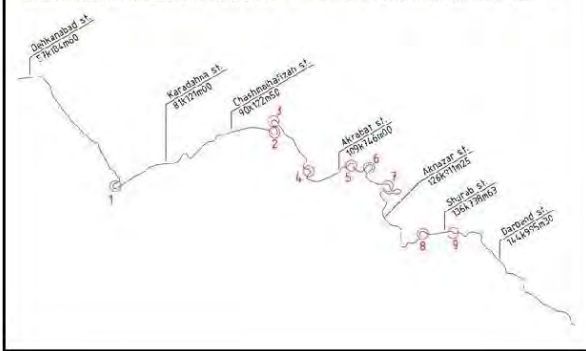
平面線形改良計画【概略検討】では、単曲線で半径を300mに改良する『理想案』と改良による線路移動量が少ない『現実案』を作成。



現地踏査、横断測量図、現地写真等により『最適案』を選定する。

**線形改良箇所の現地確認**

線形改良計画【概略検討】で検討した改良箇所の中から、線路移動量が多い箇所、橋梁等の構造物がある箇所をピックアップして、下図に示す9箇所の線路状況を確認した。



**平面線形改良計画【詳細検討】**

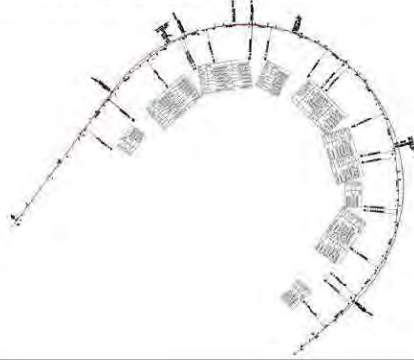
現地踏査等の結果を踏まえ、線形改良計画案を精査した。

89箇所のうち、83箇所について曲線改良案を作成し、リストにまとめた。

No.	改良区間	改良長さ	改良内容
1	111817000000	111817000000	改良区間: 改良区間の長さ
2	111817000000	111817000000	改良区間: 改良区間の長さ

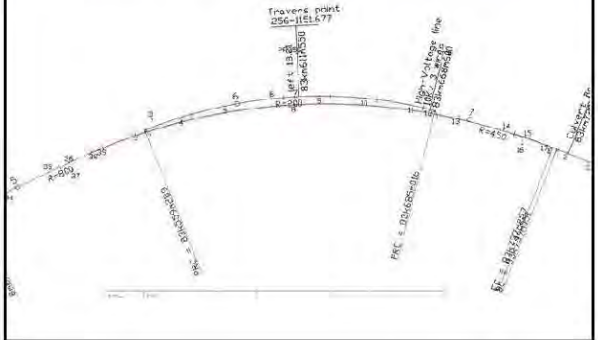
平面線形改良計画【詳細検討】

平面線形改良計画案（複心曲線を単曲線に改良）



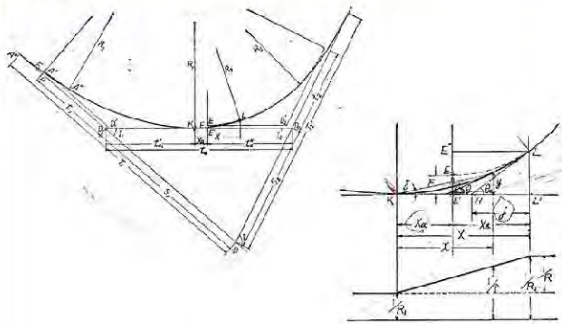
平面線形改良計画【詳細検討】

平面線形改良計画案（半径300mへの改良）



平面線形改良計画【詳細検討】

◆複心曲線



中間緩和曲線

(2) 軌道整備計画

Japan Transportation consultants Inc.  
日本交通技術株式会社

JICA 独立行政法人 国際協力機構

### Capacity Development Project for Tashguzar – Kumkurgan New Railway Line Construction in Uzbekistan

UTY (Uzbekistan Temir Yullari)

## Track Maintenance Training

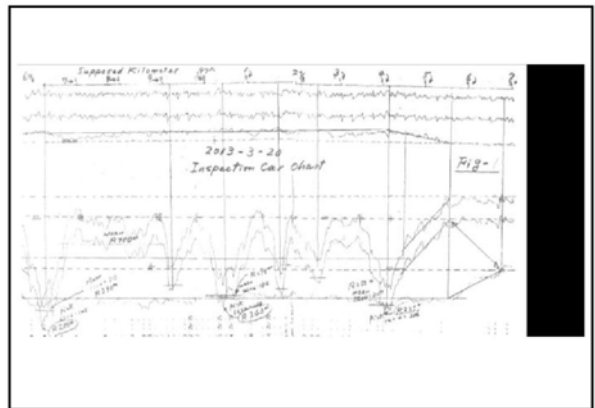
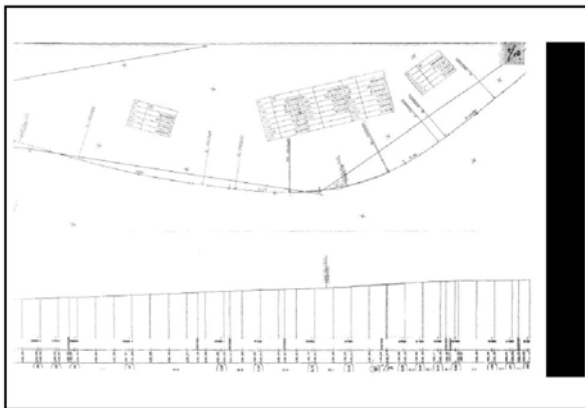
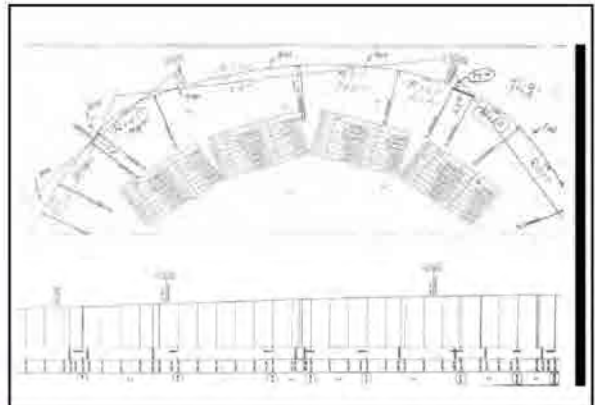


Table-1 Place of Less than curve R250m due to survey result

Section: 054893m-156881m, Survey date: Nov. 2012

Kilometer	Curve		Curve radius of before or after	
	Length (m)	Radius (m)	Before curve	After curve
66.303	285.11	128	246	
71.071	119.63	113	240	300
73.074	214.77	113	240	300
82.995	303.66	128	240	300
84.179	230	95	240	300
92.262	388	81	240	300
95	451	81	240	300
97	514	81	240	300
98.525	217	82	240	300
98.525	322	74	160	300
97.611	32	41	160	300
97.298	420	78	160	300
100.342	418	78	210	400
101.019	134.88	104	240	300
104.021	209	81	240	300
106.341	421	81	200	300
106.703	60	81	200	300
106.022	114	81	170	300
113.924	414	81	240	300
119.881	686	108	200	240
114.424	674	81	240	300
111.762	69	81	240	300
114.975	116.09	111	210	300
118.885	663	91	200	300
119.081	124	81	240	300
120.714	734	81	200	300
120.263	181	81	240	300
126.468	577	110	240	300
124.915	126.78	81	240	300
126.965	126.66	106	240	300
126.762	60	111	240	300
130.84	421	81	200	300
131.094	130.02	111	240	300
130.214	309	81	240	300

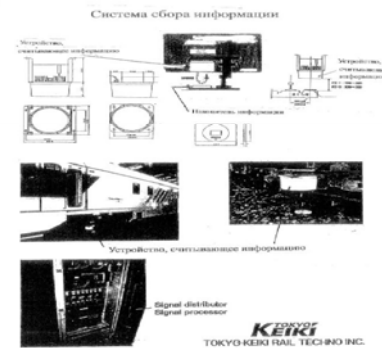
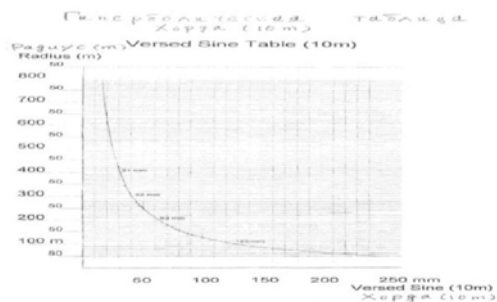
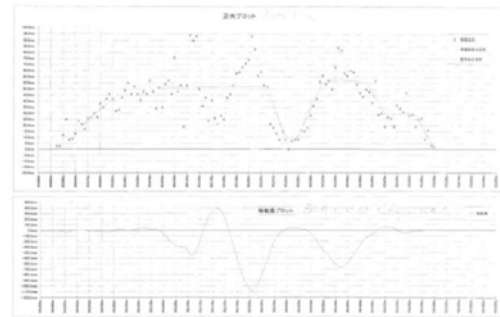
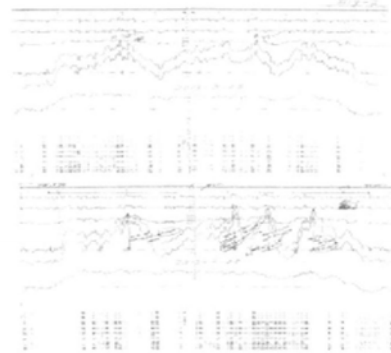
Hand-drawn table with multiple columns and rows, likely a detailed survey or inspection report. It includes various numerical data points and possibly some text annotations. The table is oriented horizontally but appears to be a scan of a document page.

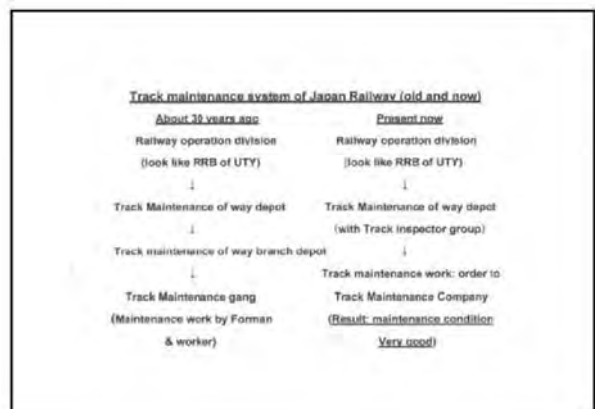
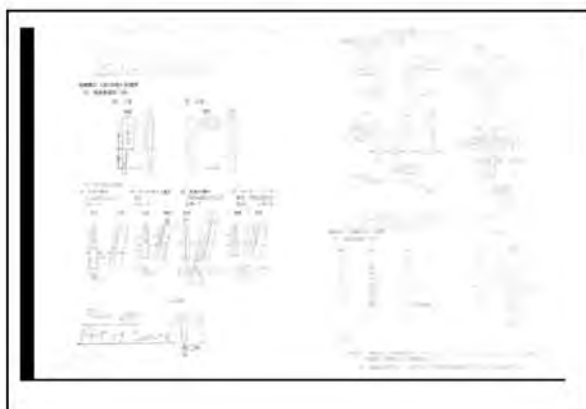
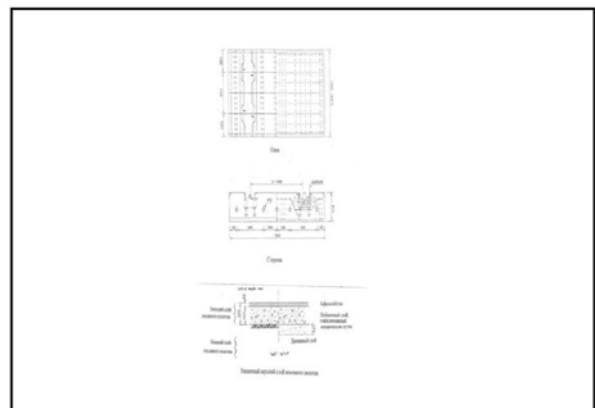
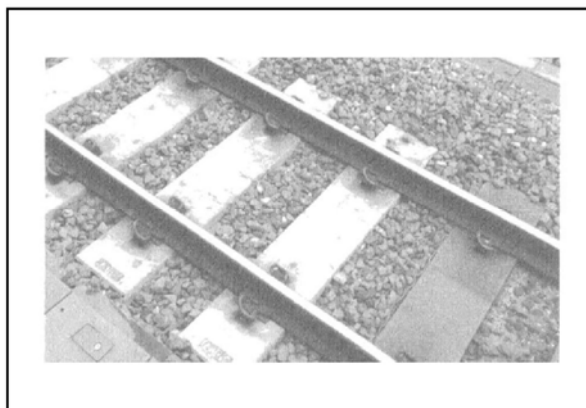
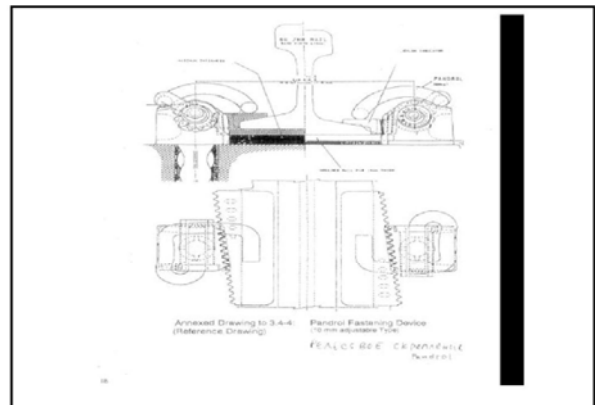
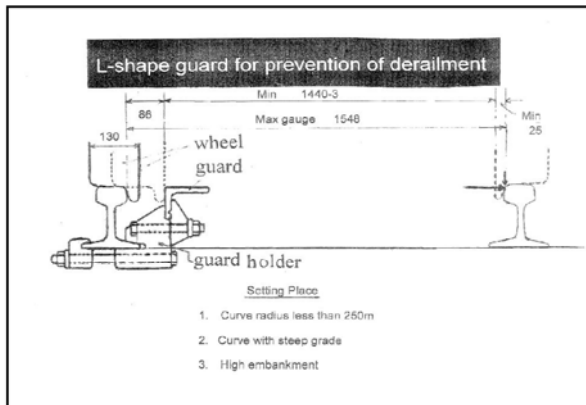
№ п/п	№ ПК+м	№	№	№	№	№
76.	101 км ПК0+10	614	263	480	39	
77.	102 км ПК5+30	355	503	660	75	
78.	102 км ПК5+50	1625	103	115	22	
79.	103 км ПК5+20	15.11.2012	316	720	953	90
80.	104 км ПК4+20	19.11.2012	328	961	1091	83
81.	105 км ПК0+00	22.11.2012	329	784	976	85
82.	106 км ПК0+70	26.11.2012	723	127	177	19
83.	106 км ПК5+60	12.02.2013	1003	171	240	20
84.	106 км ПК0+27	07.02.2013	600	284	315	26
85.	107 км ПК0+06	13.11.2012	1919	86	68	25
86.	108 км ПК1+22	13.11.2012	1365	77	70	27
87.	110 км ПК0+20		313	406	410	51

Всего по участку Тошгузар-Аребад имеется 87 крышек, из них до 06.03.2013 года произведено снятие 37 крышек участков пути.

ПКГ-12-

Шодмонов Б.Б.





(3) 電気機関車整備計画

電気機関車整備計画

Japan Transportation Consultants

### 51.EH500発電ブレーキ

電空ブレンディング方式

- 「発電停止ブレーキ」  
停車を目的としている
- 「発電抑速ブレーキ」  
下り勾配を一定の速度で運転する

### 52.EH500発電停止ブレーキ

< 例 >  
90km/h→0km/h  
1kg/cm<sup>2</sup>減圧

- ① 発電ブレーキが立ち上がるまでは空気ブレーキが作用
- ② 発電ブレーキが立ち上がった後もブレーキシリンダ内に0.24 1kg/cm<sup>2</sup>残る
- ③ 発電ブレーキ力が不足した場合は空気ブレーキが付加される
- ④ 速度が15km/h以下になると発電ブレーキが付加されるは作用せず自動的に空気ブレーキとなる。

### 53.EH500発電抑速ブレーキ

「定速運転」のことを言い下り勾配で使用する

- ① 自動ブレーキ弁によりブレーキ管を減圧
  - ブレーキを掛け速度を落とす  
電気機関車：発電ブレーキ  
貨車：空気ブレーキ
- ② 目的の速度になったら
  - 自弁を払い
  - 空気ブレーキは「ユルメ込め位置」
  - 逆転ハンドル「抑速」位置
  - 「抑速ブレーキ」で一定の速度

### 62.フランジ塗油器

○曲線の多い区間に効果  
○熱処理された硬めのレールに効果

潤滑

潤滑

内軌 外軌

### 64.フランジ塗油器の例(1)

### 65. フランジ塗油器の例(2)



### 74. 自然環境

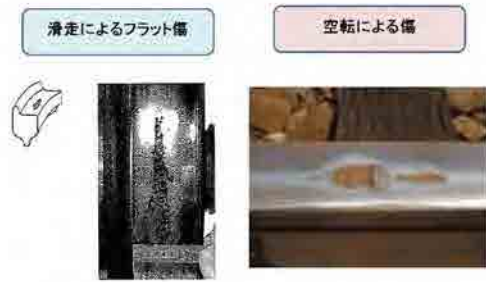
山岳鉄道線の自然環境

- 標高 : 最大1,500m以上
  - 勾配 : 最大18.5%以上
  - 気温 : +50°C~-35°C
- 低温による機器への影響

### 75. 結氷と対策



### 76. レール面の凍結



### 77. 砂管への影響



### 78. 耐雪ブレーキの必要性



### 79.酸素濃度の影響

標高1,500m ➡ 酸素濃度80%

○空気圧縮機への影響  
蓄積される空気量が少なくなる可能性がある。  
➡ブレーキ用空気タンクの空気容量の不足が懸念される

○砂まき装置  
空気タンクの空気容量が少ないため、散砂作用への影響が懸念される

### 86.GTOとIGBTの故障傾向(1)

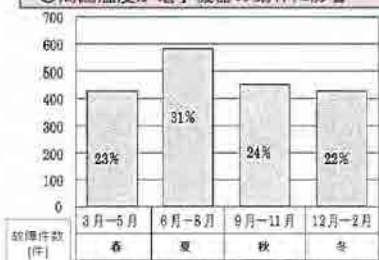
**故障率**  
GTO: 故障率が新製から1年経過すると低くなり、新製から8年目で高くなり、再度12年目から高くなる傾向にある。  
IGBT: 新製から1年未満ではGTOより低い値、新製から8年目で高くなり、更に12年目から高くなる傾向が見られ、15年目が最も高い



### 87. GTOとIGBTの故障傾向(2)

季節別の故障発生件数

○夏期(6月～8月)に発生が全体の31%  
○周囲温度が電子機器の動作に影響



### 90.日本の全般検査周期

○日本では1997年にVVVFインバータ方式の電気機関車を導入した(新形式機関車約110両)  
○日本における全般検査の周期は8年  
○第1回目の全般検査はプリント基板等の清掃作業を中心に実施



### 92. プリント基板の検査該当枚数

EH500形式電気機関車が全般検査の際に検査するプリント基板の枚数

NO	装置名	該当枚数
1	電子制御装置	76
2	運転台制御部	10
3	主幹制御器	4
4	ブレーキ指令器	15
5	主変換装置	56
6	補助電源装置	12
7	ATC受信部	32
8	ATS車上装置	8
合 計		213

### 94.プリント基板の清掃作業(2)

○塵埃を除去するため「刷毛」により作業を行う  
「刷毛」: 静電気の影響をなくすため「静電気除去ブラシ」を使用





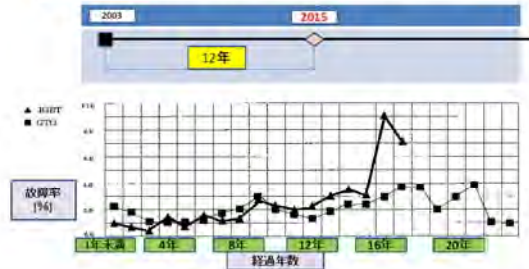
### 97.第2回目の全般検査における問題点(1)

- 基板の修理は不可能
- 数十年前の同一部品の入手は不可能
- 基板単位で互換性のあるものを新たに開発する必要がある

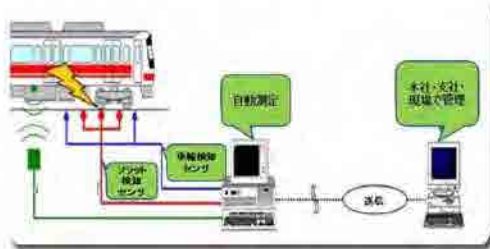
- 具体的には
- 主回路素子自体も製造中止の可能性があるため装置全体の見直しも必要
  - 機関車の記録データの読み出し装置も老朽化している可能性があり、パソコン自体も古くなっている可能性がある

### 102.ウズベキスタン号(2)

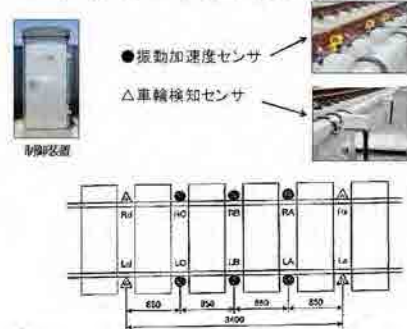
「KR-1における検査周期」  
 $2,000,000\text{km} \rightarrow 2,000,000\text{km}/460\text{km}(\text{day}) = 12\text{年}$



### 104.タイヤフラット検出装置(1)

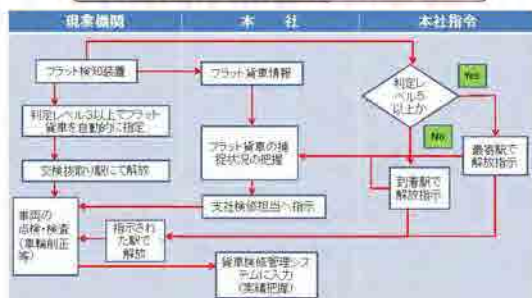


### 105.タイヤフラット検出装置(2)

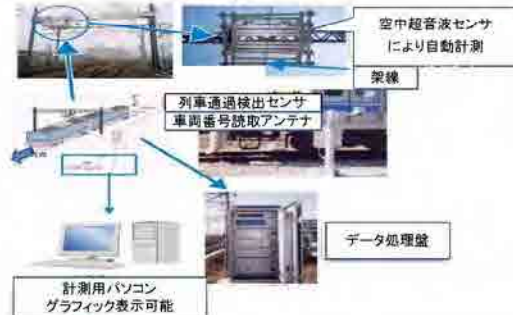


### 106.タイヤフラット検知装置(3)

フラット検知装置による車輪踏面の監視フロー



### 107.パンタグラフ摺り板測定装置(1)



### 108.パンタグラフ摺り板 測定装置(2)

- 空中センサ



### 109.パンタグラフ摺り板 測定装置(3)

- 摩耗状態のグラフィック表示が可能



## 資料5 ラップアップ・セミナー（運転計画）資料

運転計画の研修を終えて

運転計画専門家  
 日本交通技術㈱  
 調査役 三浦良宣

### 1. はじめに

### 山岳線: 急勾配と急曲線が多い

### 単線非電化の山岳線

### 2. 研修の準備調査とその結果

- 輸送計画策定の研修実施のための準備
- (1) 現在の列車運転状況の把握  
けん引定数=2200ton 編成30~35両、14本/日、遅れ少ない
- (2) 運転曲線作成ソフトウェアへの入力  
ロシア製ソフトウェア使わず日本製の簡易ソフトウェアを使用
- (3) 輸送状況の問題点の把握と整理  
上り勾配でハンドルポジション制限有り、速度20km/hまで低下している場合有り。
- (4) 線路の状態の確認  
100mピッチの勾配の差が大きい箇所あり、改善必要。正確な線路情報必要

### 3. 現地における研修実施

研修の実績 タシケント、カルシ、テルメズの3会場: 平均20名参加

研修内容	研修	研修数
タシケント(単物10名)		60
輸送計画概論	2/4/6/8	12
速度定数、車両運用、乗務員運用、運転設備	2/11/8, 20, 22, 27, 31	20
運転曲線、列車ダイヤ、運用計画	9/25, 27, 29, 4/1, 5, 6	21
カルシ(単物5名)		60
輸送計画概論	2/11, 12	12
速度定数、車両運用、乗務員運用、運転設備	3/4~7	16
運転曲線、列車ダイヤ、運用計画	8/8~10	16
テルメズ(単物4名)		60
輸送計画概論	2/11, 15	12
速度定数、車両運用、乗務員運用、運転設備	2/11~20	15
運転曲線、列車ダイヤ、運用計画	4/22~24	15

## 4. 運転計画シミュレーション研修

### 演習用輸送需要モデル

項目	2015年(計画)					2020年(計画)						
	乗客数	乗客量	乗客量	乗客量	乗客量	乗客数	乗客量	乗客量	乗客量	乗客量		
総乗客数	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	1000000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
平均乗客数	1000000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
平均乗客数	1000000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客数	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417
乗客量	300000	8844.64	714	818	1027	417	1000000	8844.64	714	818	1027	417

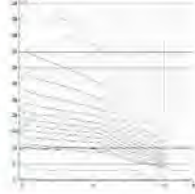
## 車両計画

18%上り勾配: 機関車2両で3200トンけん引速度63km/hクリア確認

研修員作成の荷重曲線



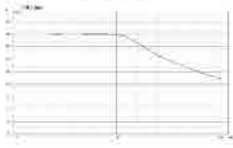
コンピュータソフトによる荷重曲線



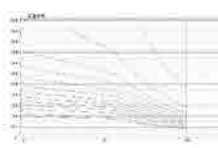
## 列車計画

- 運転曲線作成ソフトウェアで引張力曲線、荷重曲線、線運動曲線図作成

引張力曲線

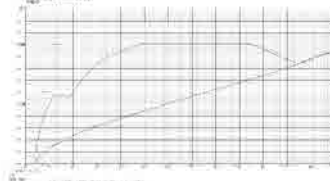


荷重曲線



## 運転曲線図と基準運転時分表

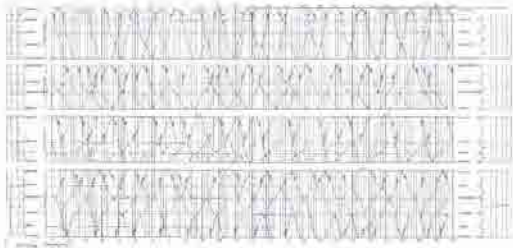
運転曲線図



基準運転時分表

区間	種別	距離	標準時間	備考
1	普通	1.0	10.0	
2	普通	1.0	10.0	
3	普通	1.0	10.0	
4	普通	1.0	10.0	
5	普通	1.0	10.0	
6	普通	1.0	10.0	
7	普通	1.0	10.0	
8	普通	1.0	10.0	
9	普通	1.0	10.0	
10	普通	1.0	10.0	

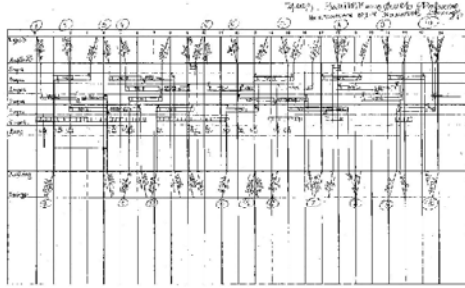
## 列車ダイヤ(タシケントグループ)



## 機関車運用ダイヤ(カルシグループ)



## 駅構内作業計画(テルメズグループ)



## 5. 日本での研修

- 日本における運転計画、運転理論、運用計画、機関車検修などの実務を紹介
- 日本の鉄道運営と国の規制の関係
- 貨物鉄道の操車場、機関区、機関車工場見学
- 日本貨物鉄道の機関車運転シミュレータ見学

## 6. 総括

- 研修参加者:最終20名(タシケント10、カルシ6、テルメズ4)
- 研修前半は講義形式、後半は作業を通じて学習
- 各担当者の専門を活かした実習が出来た。

## 実施した作業

- タシケント:タシグザール〜クムクルガン間の線路データ作成、電気機関車の引張り計算
- 作成したデータを運転曲線ソフトに入力
- 荷重曲線、引張り曲線、運転曲線図作成
- 基準運転時分表作成と列車ダイヤ作成
- 列車ダイヤを基に機関車運用ダイヤ作成
- ダルバンド駅構内作業計画表作成

## 結論と今後の課題

- 電化によって列車速度と牽引力は向上する
- 輸送力増強のための新線電化は妥当
- 電化後の山岳鉄道運営に必要な基本的知見は潜在的にもっている。

### 課題

1. 山岳鉄道の電気鉄道運営技術の更なる向上
2. 安全輸送(事故防止)・安定輸送(保守技術)のための教育訓練の充実
3. シミュレータ導入など教育訓練の近代化