The Socialist Republic of Vietnam
Directorate of Roads in Vietnam

The Pavement Data Collection Survey in the Socialist Republic of Vietnam

Survey Report

March 2013

Japan International Cooperation Agency

PASCO Corporation

EI
JR
13-085

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List of Acronyms

Acronym	Description
DRVN	Directorate of Roads in Vietnam
GIS	Geographic Information System
JICA	Japan International Cooperation Agency
RRMU 2	Regional Road Management Unit 2
RTC	Road Technical Center
VITRANSS 2	The Comprehensive Study on the Sustainable Development of Transport System in Vietnam 2

1. INTRODUCTION

The 9th Five-Year Socio-Economic Development Plan (2011-15), targeting sustainable development in an era of continuing high growth, the Socialist Republic of Vietnam (hereinafter referred to as "Vietnam") positions development of infrastructure management systems, including transportation infrastructure, as the highest issue to be tackled for further development. In line with the national development plan, rehabilitation and new construction of national road network are underway with the national budget and financial assistance from the Yen loans, the World Bank, the ADB and other international organizations. As a result, the national road network reached a total length of 17,385km in 2010, and the network is still expanding. Development of national roads is crucial in transport and traffic infrastructure and contributes to economic development.

While the road network has been steadily expanding, maintenance and management need to be strengthened including budget allocations and capacity development of relevant organizations and individuals nationwide. JICA has been committed to assist to enhancing quality of road maintenance and management through technical cooperation projects for national roads and expressways among other projects. Unfortunately, the results of the survey on pavement condition in 2004 and 2007 were not what would be required for future pavement management for their lack of survey items and inadequate data.

Under such circumstances, the pavement data collection survey aims to collect basic data for setting direction on road-related cooperation, and for the data to be used in other projects.

2. OVERVIEW OF THE SURVEY

(1) Objectives of Survey

Preparation of Survey Data File on Data Condition:

Based on the specifications, the data collection survey will be conducted to create pavement condition data file from the results.

Technical Support for the Usage of the Pavement Data:

The survey will be conducted with the Counterpart. Through the cooperative activities, the methods of survey and analysis will be transferred. The Survey Team will support the Counterpart on the usage of the data.

(2) Survey Routes (National Highways of RRMU2 in Region 2)

Survey routes cover Regions 2 in the north of the country with total length of 2,303 km and in both directions totaling 4,606 km, which is under the jurisdiction of the Regional Road Management Unit 2 (RRMU2). Locations of the survey routes are shown in Figure 1.

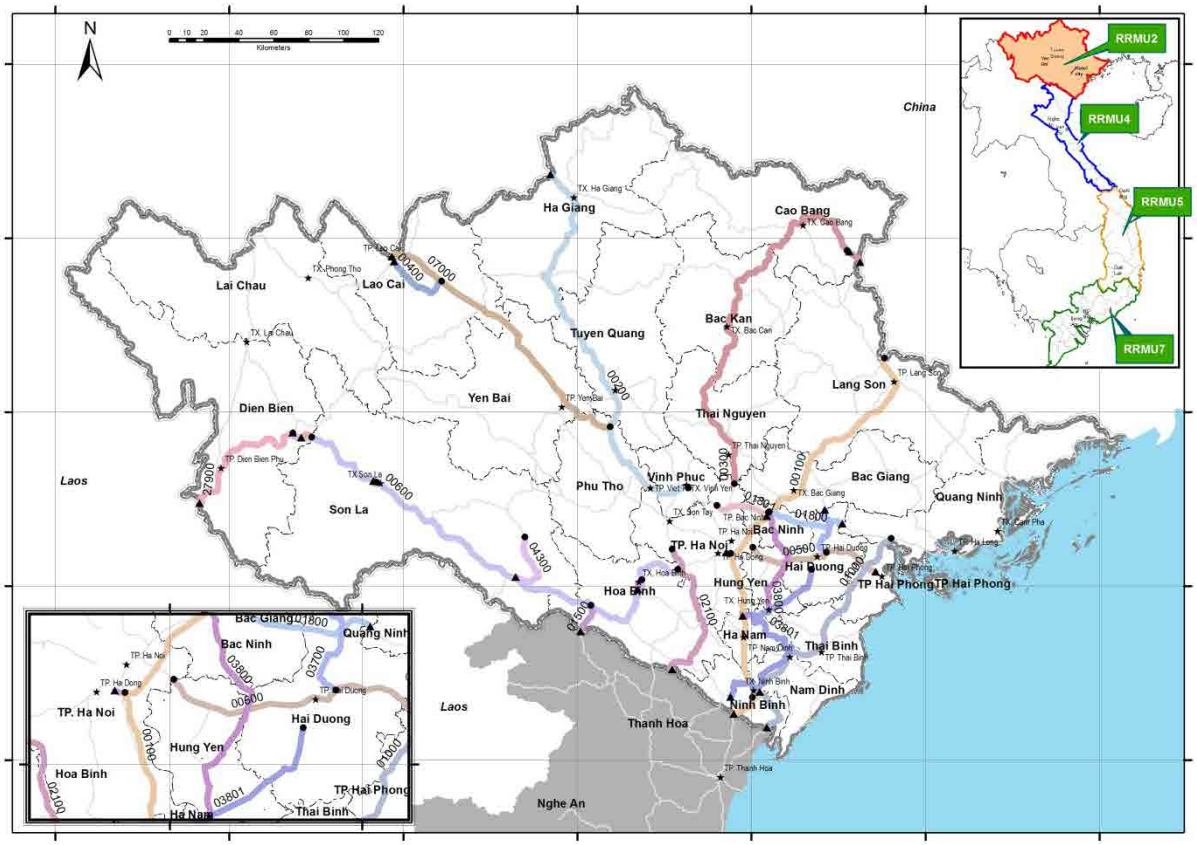


Figure 1 Location Maps of Survey Routes

(i) Target Organizations: Pavement Data Collection Survey and Data Utilization Support

DRVN is the target organization for: the pavement condition survey; and interpretation and analysis. DRVN, RRMU2 and RTC are the organizations for supporting pavement condition data utilization.

(3) Project Work Flow

The project work flow is summarized in Figure 2.

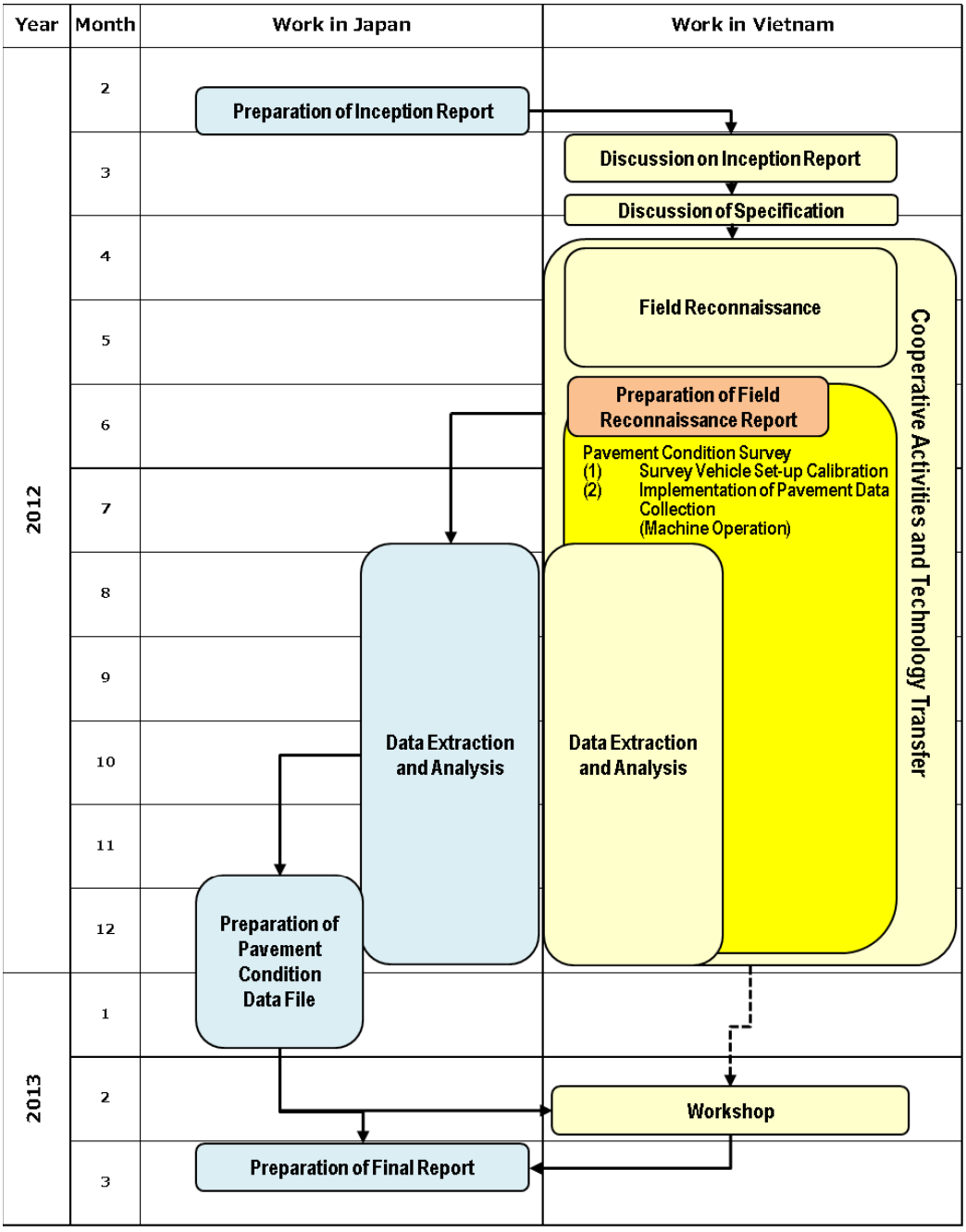


Figure 2 Project Work Flow

(4) Survey Implementation Structure

The survey was implemented by JICA, the DRVN, and the Survey Team. Figure 3 Survey Implementation Structure shows the structure of the survey implementation.

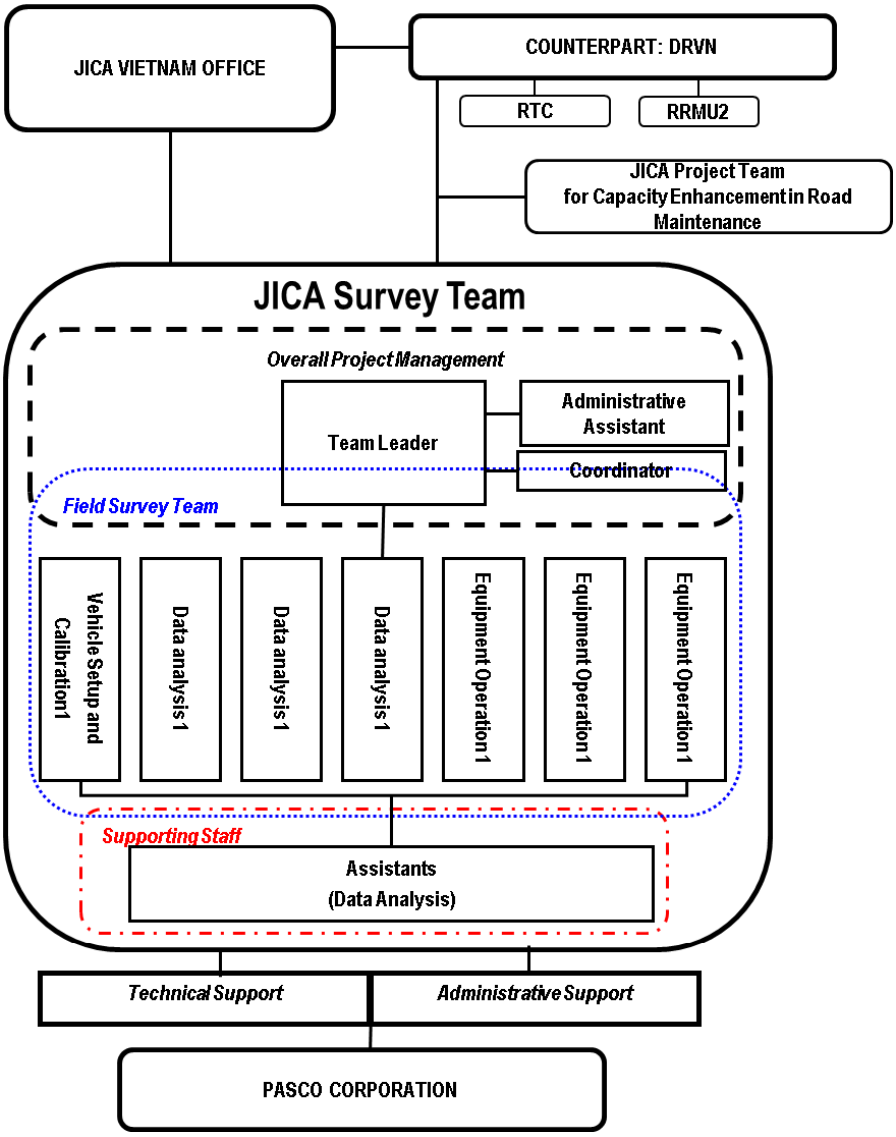


Figure 3 Survey Implementation Structure

(5) Major Project Activities of Survey Team

The Survey Team and the JICA Hanoi Office held the following activities with the counterparts, DRVN, RTC, RRMU2 and JICA Project Team for Capacity Enhancement in Road Maintenance from March 2012 to the present. The contents of the meeting were: explanation, discussion and agreement of the Inspection Report; discussion and agreement of the Specifications; discussion and confirmation of Survey Routes; discussion of draft specifications and technical briefing on field reconnaissance.

Figure 4 Discussion Activities (Photos)

The major activities of Survey Team are listed in Table 1.

Table 1 Major Activities

Meeting Record No	Date	Subject	Venue
1	March 9, 2012	Meeting on Explanation of Output in draft Specifications	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
2	March 15, 2012	Meeting on Explanation and Discussion of Inception Report	Meeting Room: DRVN
3	March 16, 2012	Meeting on Discussion of draft Specifications	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
4	March 22, 2012	Meeting on Discussion of Pavement Condition Survey	Meeting Room: the Pavement Data Collection Survey Team
5	March 27, 2012	Meeting on Discussion of Specifications	Meeting Room: DRVN
6	April 3, 2012	Meeting on Confirmation of Survey Routes	Meeting Room: RRMU2
7	April 5, 2012	Meeting on Issues of Road Database	Meeting Room: DRVN
8	April 23, 2012	Coordination Meeting on Field Reconnaissance	Meeting Room: RRMU2
9	June 15, 2012	Meeting on Explanation and Discussion of Field Reconnaissance Report	Meeting Room: DRVN
10	June 27, 2012	Meeting on Confirmation of Field Reconnaissance Results and Plan for the Pavement Condition Survey	Meeting Room: DRVN
11	July 24, 2012	Meeting on Discussion of the Survey Route Length	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
12	July 27, 2012	Meeting on Confirmation of Survey Route	Meeting Room: DRVN
13	August 29, 2012	Meeting on Clarification Meeting on Stations Used in Road Survey	Meeting Room: RRMU2
14	September 20, 2012	Meeting on Stations Used in Pavement Condition Survey	Meeting Room: DRVN
15	December 11, 2012	Meeting on Explanation about Data Output, Questionnaire and Workshop	Meeting Room: DRVN
16	January 31, 2013	Meeting on Discussion on Preparing for the Workshop held on February 28, 2013	PMU Director's Room
17	February 28, 2013	Discussion Record: Workshop on Pavement Data Collection Survey	Daewoo Hotel Meeting Room

(6) Safety Management

Based on the safety-management information of the Embassy of Japan and JICA Hanoi office, the Survey Team implemented safety management measures as it is supported by DRVN.

The Survey Team had a meeting with DRVN on April 23, 2012 at the commencement of field reconnaissance to assign one safety keeper to secure on-road work during field reconnaissance conducted in collaboration with RRMU2.

The Survey Team requested entry permits to ensure smooth operation of field reconnaissance at the discussion of Inception Report. DRVN issued the entry permits for field reconnaissance on April 12, 2012, and for pavement condition survey on July 4, 2012.

The Survey Team had a series of safety management meeting from April 9, 2012 to April 13, 2012, and informed the emergency communication and its structure among other safety management measures.

The safety -management organizational structure is shown in Figure 5.

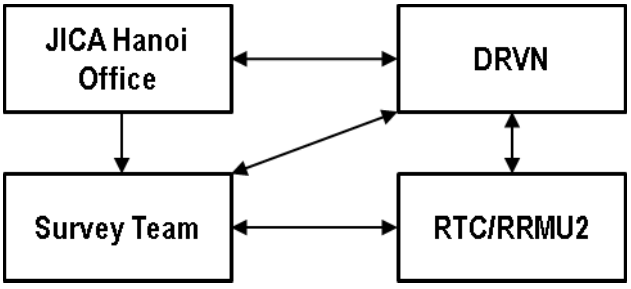


Figure 5 Safety Management Structure

(7) Participants to the Survey

The participants to the pavement condition survey are listed in Table 2.

Table 2 Participants to the Survey Project

Organization	Name	Position
Survey Team	Mr. Yutaka KOKUFU	Team Leader
	Mr. Koroku SOMA	Equipment Operation 1/ Operation Management
	Mr. Yoshiyasu TSUCHIYA	Equipment Operation 2
	Mr. Syoichi KITAGAWA	Equipment Operation 3
	Dr. Chikakuni MAEDA	Vehicle Set up & Calibration
	Mr. Hideaki KUROSU	Vehicle Set up & Calibration
	Mr. Joel F. CRUZ	Data Analysis 1
	Mr. Kohei SAKAI	Data Analysis 2
	Mr. Gaku SAITO	Data Analysis 3
	Dr. Kazuya AOKI	Coordinator/Survey Planning Assistant
	Mr. Kensuke KIMURA	Administrative Assistant
JICA Hanoi Office	Mr. Shigeki MIYAKE	Director, Transportation and ICT Division 2, Transportation and ICT Group, Economic Infrastructure Department
	Mr. Kohtaro NISHIGATA	Deputy Director, Transportation and ICT Division 2, Transportation and ICT Group, Economic Infrastructure Department (From February 2012 to December 2012)
	Mr. Toru TSUCHIHASHI	Planning and Coordination Division, Economic Infrastructure Department (From January 2013 to March 2013)
	Mr. Toshio NAGASE	JICA Hanoi Office, Senior Representative

Organization	Name	Position
JICA Hanoi Office	Dr. Phan Le BINH	JICA Hanoi Office, Senior Program Officer (From February 2012 to September 2012)
	Ms. Maki TOMURO	JICA Hanoi Office, Representative (From October 2012 to March 2013)
	Ms. Nguyen Dieu Linh	JICA Hanoi Office, Program Coordinator (From October 2012 to March 2013)
	Mr. Hideyuki KANOSHIMA	JICA Expert/Team Advisor Road Maintenance Strategy
	Mr. MURATA Shigeo	MOT, Expressway Management Institution Advisor
JICA Consulting Team	Mr. KATO Tsuneo	Team Leader
	Mr. AOKI Yasushi	Co-Team Leader
	Mr. MATSUDA Toshiya	Road Asset Management
	Mr. OKUDA Motoi	Road Inspection Technology
	Dr. KUSANO Seiichi	Road Maintenance Institution
	Mr. KANAZAWA Toshinori	Road Pavement Technology
	Dr. PANTHA Bhoj Raj	Road Database
	Ms. MIYAKAWA Akiko	Capacity Development
	Mr. MORI Hisashi	Computer System Technology
	Mr. TANAKA Takuya	Project Coordinator/ Road Maintenance Planning
DRVN	Mr. Nguyen Ngoc DONG	Former Director
	Mr. Le Dinh THO	Director
	Mr. Nguyen Xuan CUONG	Deputy Director
	Mr.Nguyen Duc CUONG	Former Director of PMU; Deputy Director of Road Maintenance & Management Department
	Mr. Nguyen Trong PHU	Director of PMU
	Mr. Hoang Viet HA	Staff of PMU
	Mr. Le Van THANH	Staff of PMU
	Mr. To Nam TOAN	Director - Science & Technology, International Cooperation Department
	Ms. Nguyen Thi Nguyet NGA	Deputy Director - Science & Technology, International Cooperation Department
	Mr. Dang Cong CHIEN	Deputy Director - Science & Technology, International Cooperation Department
	Mr. Thieu Duc LONG	Deputy Director - Science & Technology, International Cooperation Department
	Ms. Dinh Thi Thanh HUYEN	Expert - Science & Technology, International Cooperation Department
	Mr. Nguyen Viet TUAN	Expert - Science & Technology, International Cooperation Department
	Mr. Quach Van KHOA	Director of Road Infrastructure and Traffic Safety Department
	Mr. Nguyen Khanh TOAN	Expert, Road Infrastructure & Traffic Safety Department
	Mr. Tran Ba DAT	Expert, Road Infrastructure & Traffic Safety Department
	Mr. Tran Tuan ANH	Expert, Road Maintenance & Management Department
	Mr. Tran Quoc TOAN	Expert, Road Maintenance & Management Department
	Mr. Luong Van MINH	Expert, Road Maintenance & Management Department
	Ms. Nguyen Thi LOAN	Expert, Road Maintenance & Management Department
	Mr. Pham Thanh BINH	Director, Planning & Investment Department
	Mr. Nguyen Van KINH	Deputy Director, Planning & Investment Department
	Mr. Trinh Xuan SINH	Expert, Planning & Investment Department
	Ms. Ta Thi THUY	Expert, Planning & Investment Department
	Ms. Nguyen Thi Hai HA	Expert, Planning & Investment Department
RRMU2	Mr. Bui Xuan TRUONG	Deputy General Director
	Mr. Nguyen Xuan LAM	Deputy Director
	Mr. Chu Van LUONG	Deputy Director of Traffic Management Department
	Mr. Nguyen Anh TU	Director of Traffic Management Department
	Mr. Tu Minh PhUONG	Expert of Traffic Management Department
	Mr. Hoang Ngoc NHI	Expert, Technical & Construction Management Department
	Ms. Phuong Thi HONG	Director- Economic and Planning Department
	Mr. Tran Thanh TUNG	Expert
	Mr. Nguyen Dai NGHIA	Expert
	Mr. Nguyen Van TUYEN	Expert
	Mr. Nguyen Trung HIEU	Expert
	Mr. Tran Nam DUONG	Expert
RTC	Mr. Vu Anh TUAN	Former Director
	Mr. Le Khac ANH	Director
	Mr. Nguyen Vu TUAN	Deputy Director
	Mr. Nguyen Van DAN	Deputy Director
	Mr. Dinh Duy TIEN	Expert
	Mr. Hoang Anh TUAN	Expert
	Mr. Luu Quang TUAN	Expert
	Mr. Luong Xuan NGOC	Expert
	Mr. Ho Hai BAC	Expert

Organization	Name	Position
RTC	Mr. Trinh Ngoc VINH	Expert
	Mr. Le Tuan ANH	Expert
	Mr. Trinh Quoc VIET	Expert
	Mr. Nguyen Van LUC	Expert

(8) Outputs

The outputs and the reports are listed in Table 3. Among the outputs, the final outputs are (3) and (4).

Table 3 Outputs

Outputs, etc.	Notes	No. of copies	Submission
(1) Work plan (Inception Report)	Basic policy, methods and work schedule, personnel plan and other implementation plans	10 Copies (Japanese) 10 copies to be submitted to the Vietnam government out of 15 copies (English)	At the time of commencement of the survey
(2) Field Reconnaissance Report (Summary)	Results study and review; results of discussion on the survey and analysis with the Vietnam side until the end of the field reconnaissance	10 Copies (Japanese)	During the last ten days of June
(3) Survey report	Overall outputs of the survey, and achievements of technical transfer	10 Copies (Japanese) 15 Copies (English)	During the middle ten days of March, 2013
(4) Pavement Condition Data Files	A set of data from the survey	One (1) CD-R submitted to the Vietnam government out of three CD-R: discs.	Mid-March, 2013

3. SURVEY METHOD AND IMPLEMENTATION OF THE SURVEY WORKS

The Survey Team commenced the Pavement Condition Survey in February 2012. Each work items are described in this section.

(1) Preparation of Inception Report and Discussion

The Inception Report consisting of the basic policies for implementation, survey method, operation plan, manning schedule and technology transfer (support), other necessary items of the survey implementation and request to the Vietnam side was prepared by Survey Team in February 2012.

1) Explanation and Discussion on the Inception Report (Work in Vietnam)

The Survey Team explained and discussed with DRVN the contents of the Inception Report on March 15, 2012. The operation plan for the cooperative activities was also discussed. In the meeting, the DRVN requested that the Survey Team to prepare the “Detailed Work Plan” for collaboration works and Technology Transfer, and be submitted to DRVN.

On April 5, 2012, the DRVN and the Survey Team agreed a Meeting Record on Inception Report .

2) Procurement of the Road Condition Survey Vehicle (Survey Implementation Policy)

The Survey Team conducted an investigation with a local shipping agent in consultation with DRVN

and JICA Hanoi Office for a survey vehicle import permit.

After a thorough study, the Survey Team confirmed that to import a right-hand driving vehicle: 1) An escort car is required in traffic regulation of Vietnam; 2) The import period of vehicle (duty-free period of the treatment car) is 120 days; 3) the tax amount of imported vehicle: 100% of import car price; 4) the import customs clearance period is over one month.

It was judged that a road condition survey vehicle is difficult to import to Vietnam. The Survey Team decided that the road condition survey vehicle would be assembled using a locally leased vehicle and mounted to the road condition survey vehicle in Vietnam.

(2) Discussion of the Specifications for Data Acquisition Items

Since the Survey results will be used for the Project for Capacity Enhancement in Road Maintenance (CERM) of another JICA project, the Survey Team and the project team for CERM had discussions over specifications on the pavement condition data file three times: on March 9 (c.f. Meeting Record 3), 16 (c.f. Meeting Record 3) and 22 (c.f. Meeting Record 4), 2012.

The contents of pavement data items are summarized in Table 4.

Table 4 List of Acquisition Data Items

Data File Items	
・Road Inventory Data	**・Pavement Condition Data**
- Administrative Organization: RRMU2 and RRMC	- Paved Type : Asphalt Concrete, Cement Concrete and Un-Paved
- Administration Boundary: Province	- Cracking Ratio(%), Cracking Index(cm/㎡) including Pothole
- Route No.	- Patching Ratio(%, ,Patching Index(cm/㎡), Patching Rate (%)
- Route Blanch No.	- Rutting Depth, MAX, and Average (mm)
- UP:Bound & DOWN:Bound	- IRI (mm/m)
- Kilo meter post	- Image data for each road route will relate with GPS data.
- Longitude, Latitude	
- Distance in section	
- No. of Lane（Visual judgment）	
- inspected Lane(inner most)	
- Road Facilities : Bridge、Tunnel、Intersection with signal、Roundabout、Railway Crossing and Viaduct	
- inspected Lane(inner most)	

The contents of pavement condition data files are summarized in Table 5.

Table 5 Contents of Pavement Condition Data Files

RRMU	Province	Class	Route Number	Branch Number	Route Name	Kirometer Post		Section Length (m)	Analysis Width (m)	Structure
						From (km,m)	To (km,m)			
RRMU2	Province1	1	1	0	1	0 0	0 100	100		
	Province1	1	1	0	1	0 100	0 120	20		
	Province1	1	1	0	1	0 120	0 160	40		
	Province1	1	1	0	1	0 160	0 200	40		
	Province1	1	1	0	1	0 200	0 300	100		
	Province1	1	1	0	1	0 300	0 400	100		
	Province1	1	1	0	1	0 400	0 500	100		
	Province1	1	1	0	1	0 500	0 600	100		
	Province1	1	1	0	1	0 600	0 700	100		
	Province1	1	1	0	1	0 700	0 800	100		
	Province1	1	1	0	1	0 800	0 900	100		
	Province1	1	1	0	1	0 900	0 960	60		
	Province1	1	1	0	1	0 960	0 970	10		B
	Province1	1	1	0	1	0 970	1 0	30		
	Province1	1	1	1	1	0 0	0 100	100		

(3) Explanation and Discussion of the Specifications

The Survey Team explained the contents and items of pavement data collection, and discussed matters over the specifications of the pavement condition data file on March 27, 2012 at a meeting room of DRVN in Hanoi. The DRVN side approved the items for the pavement condition data file. The discussion extended to the routes of field reconnaissance; the routes for field reconnaissance were approved also.

In order to facilitate the discussions regarding the specification of survey and analysis of pavement condition, the Survey Team prepared reference material (in Vietnamese) based on the "Pavement Study and Testing Guideline" prepared by the Japan Road Association.

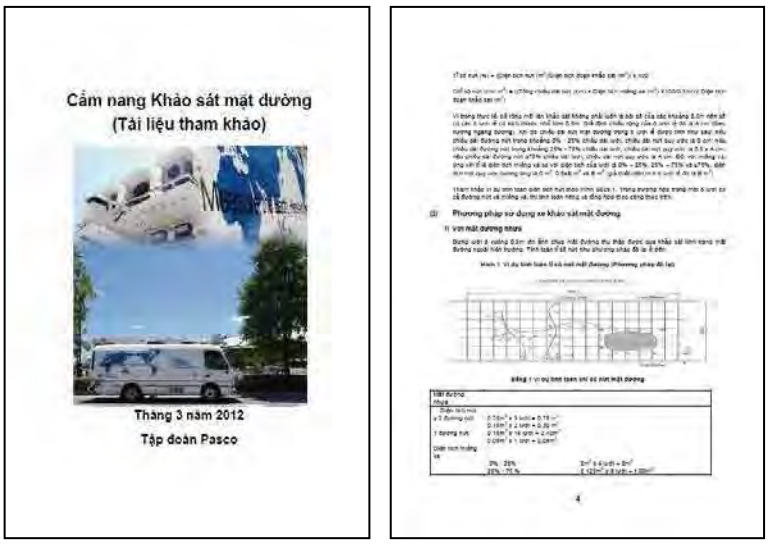


Figure 6 Reference Material for the Survey Specifications (in Vietnamese)

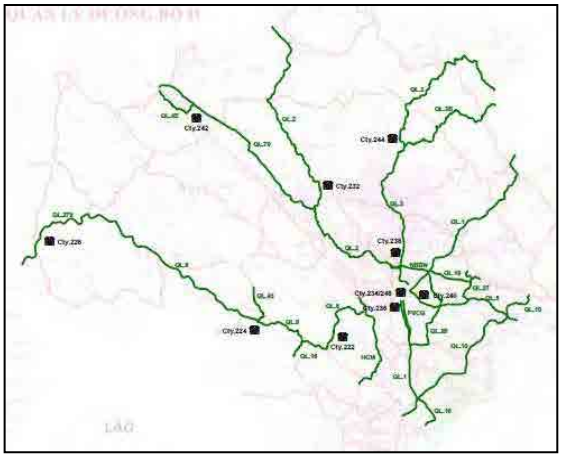
(4) Discussion and Confirmation of Survey Route

The Survey Team discussed the Survey Routes of the National Highways under jurisdiction of the Regional Road Management Unit 2 (RRMU2) in Region 2 with DRVN, RTC and RRMU2 in the explanation meeting of the specifications on March 27,2012. In the meeting, the DRVN requested the Survey Team to continue the discussion to determine the survey routes with RRMU2.

In compliance with the DRVN request, the Study Team met and confirmed the survey routes with

RRMU2 as shows in the attached “Survey Route Descriptions dated April 3, 2012” (c. f. Meeting Record 6).

Based on the confirmed "Survey Routes,” a ledger table and route map were prepared on the field reconnaissance planning routes including ID, route names (National Highway 1 to 38B routes--a total of 19 maps), the total lengths (about 2,332.6 km). The field survey routes, total lengths and the route map are shown as follows:



(Source: DRVN)

Figure 7: National Highway (Survey Routes) Network

Table 6 Field Reconnaissance Routes and Lengths

ID	Route Name	From (km)	To (km)	R_Length (km)
1	NH.1	0	285.4	285.4
2	NH.2	30.6	312.5	281.9
3	NH.3	33.3	344.4	311.1
3-1	Southern ringroad No.3 to Cau Dau	0	2.7	2.7
4	NH.4E	0	44.2	44.2
5	NH.5	11.1	92.5	81.4
6	NH.6	38	383.3	345.3
10	NH.10	0	173.3	173.3
10-1	Connecting National Highway 1 with Ninh Phuc port	0	6.414	6.414
15	NH.15	0	20.0	20.0
18	NH.18	0	46.3	46.3
37	NH.37	61	98.2	37.2
38	NH.38	0	84.5	84.5
43	NH.43	26	79.7	53.7
70	NH.70	0	198.1	198.1
279	NH.279	0	116.0	116.0
-	NB-BN	0	31.1	31.1
-	HCM	409	503.0	94.0
38-1	NH.38B	0	120.0	120.0
	Total	-	-	2332.614

National Highway 1 ～ National Highway 38B

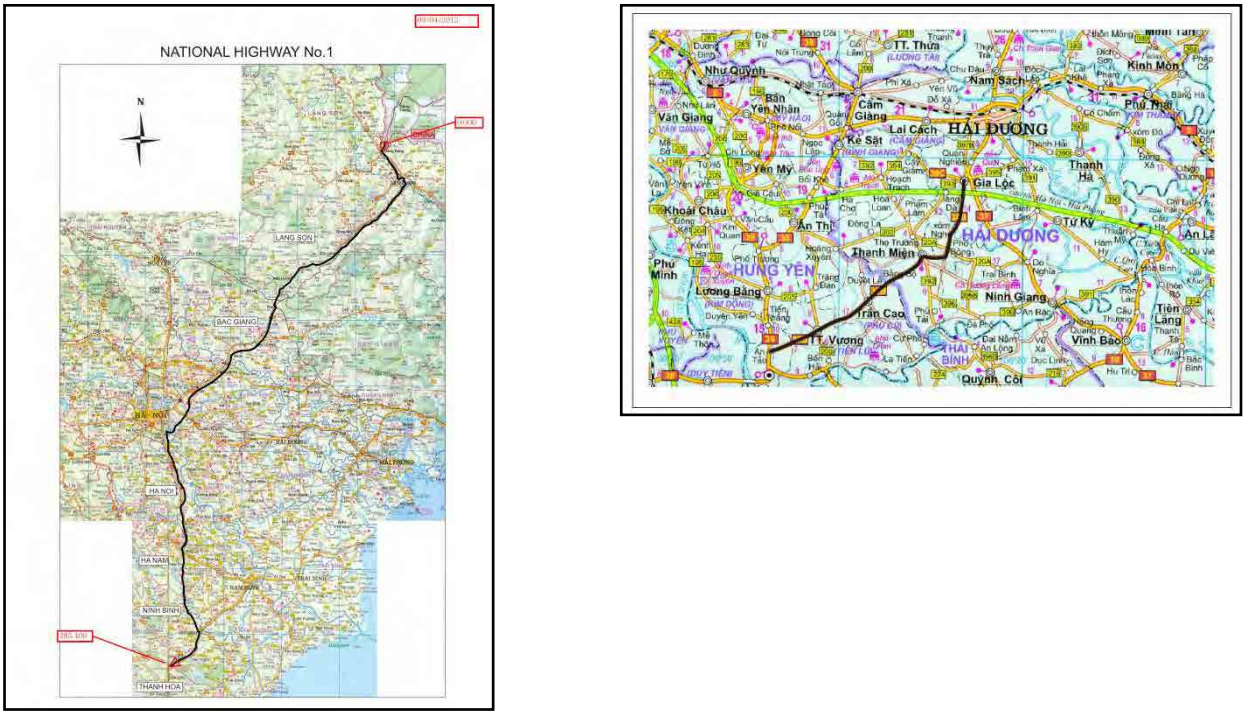


Figure 8 Survey Route Maps

(5) Field Reconnaissance

The Survey Team, RRMU2 and RTC conducted field reconnaissance from April 9, 2012 to June 8, 2012 based on the field reconnaissance planning route maps. The field reconnaissance work recorded the checking points required for the pavement condition survey and pavement damage interpretation/analysis and pavement condition data file preparation. The major checking items (c.f. Table 4) were locations and conditions of: starting and ending points; distances between kilometer posts; major road structures; and locations of administration changes.

1) Equipment

Trip Meter is the main equipment used during field reconnaissance.

Figure 9 Trip Meter

2) Method

Following chart shows the work flow of field reconnaissance.

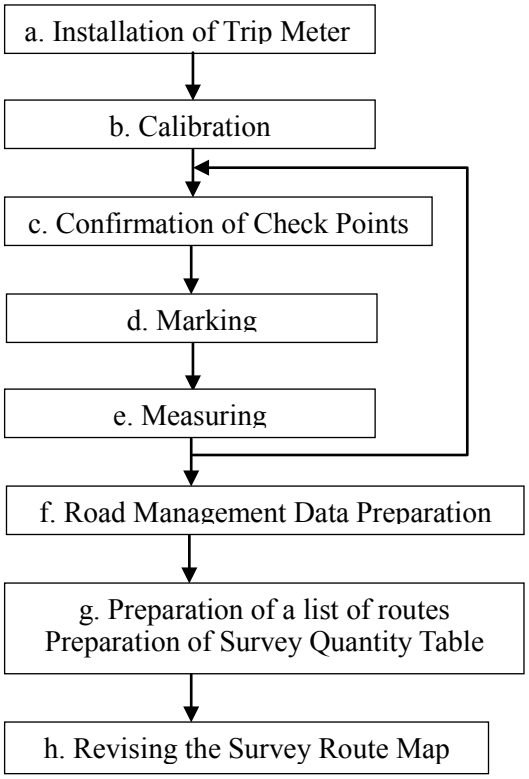


Figure 10 Work Flow of Field Reconnaissance

a. Installation of Trip Meter:

Install Trip Meter and check if it functions.

b. Calibration:

Calibrate the Trip Meter on a 1,000 meter road segment directly measured.

c. Confirmation of Check Points:

Confirm check points: starting and ending points; kilometer posts; structures; administrative boundaries.

d. Marking:

Mark starting/ending points, kilometer posts, structures and administrative boundaries with white paint so that the pavement condition survey vehicle can record the locations.

e. Distance Measurement:

Use the Trip Meter to measure distances between kilometer posts or identify locations of structure and administrative boundaries from kilometer posts.

f. Preparation of Road Management Data:

Use the distances measured, prepare the road management data including the distances between kilometer posts, starting/ending points of field reconnaissance among other data that are necessary to prepare the pavement condition data file.

g. Preparation of Survey Route List and Survey Quantity Table

Organize the results of field reconnaissance by routes with quantity in one table.

h. Updating the Survey Route Maps

Update the Survey Route maps as reflecting the results of field reconnaissance.

The survey route map prepared before field reconnaissance was updated as the results of field reconnaissance was reflected. The survey quantity table is prepared and the final survey route is updated.

3) Implementation of Technology Transfer

Technology transfer on field reconnaissance, OJT, was conducted from April 9, 2012 to June 2, 2012 to the experts of RTC and RRM2 based on the collaborative work and its schedule agreed with DRVN (c.f. Meeting Record 5).

Table 7 Results of Technology Transfer (Field Reconnaissance)

Field Reconnaissance	Period	The number of participants (persons * day)	
		RTC	RRMU2
Work Planning	April 9 - April 10	2 (4)	5 (7)
Basic Operation Training	April 11 - April 13	2 (6)	5 (4)
Collaborative Work through OJT			
・Group 1	April 16 to June 2	3 (32)	3 (32)
・Group 2	April 16 to May 28	4 (25)	4 (22)
Sub-total		11 (67)	17 (65)
Total			28 (132)

A weekly-work report, which was requested by DRVN in a technical meeting on April 5, was prepared to record and report the collaborative work on field reconnassance. The weekly reports were submitted to DRVN. The items in the reports are: 1) Group number; 2) Name of the group leader; 3) vehicle number; 4) name of the driver; 5) name of the translator; 6) name of collaborative work; 7) Route name and quantity of work; 8) contents of training; and 9) list of trainees.

Table 8 Weekly Report (Example)

WEEKLY PROGRESS REPORT FOR FIELD RECONNAISSANCE AND TECHNOLOGY TRANSFER			
Group 2			
Group Leader:	Mr. TSUCHIYA		
Car No.:	29YP7849		
Driver:	Mr.Tuang , Mr.Phuong		
Iinterpreter:	Mr.Phong		
Data	Descriptions		Remarks
16 April, 2012 (Mon)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1 L=38km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: Binh Miule
17 April, 2012 (Tus)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1 L=65km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: Xuan Hoa
18 April, 2012 (Wed)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1 L=30km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: SOMERSET
19 April, 2012 (Ths)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1(ring road No.3) L=19.520km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: SOMERSET
20 April, 2012 (Fri)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1 L=83km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: Phuong Anh
21 April, 2012 (Sat)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH.1,Connecting route between NH.1 and Ninh Phuc Port,NH,10 L=63km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: Phuong Anh
22 April, 2012 (Sun)	Work Item:	Field Reconessance	
	Surveyed Route and Length (km):	NH38B L=13km	
	Training programm:	Marking and measure the distance	
	Instructor:	Yoshiyasu Tsuchiya	
	Participant:	Refer to attendance list	
			Hotel: SOMERSET

(6) Preparation of Field Reconnaissance Report

Field Reconnaissance Report, after the field reconnaissance, was prepared including the contents: finalized survey quantity; survey quantity table; updated survey routes; implementation policies, method of the pavement condition survey; condition of the survey routes; and points of concern during the pavement condition survey. "Lessons Learned and Points of Concern" is included in the Section 7 of this report.

1) Finalization of the Survey Routes and Lengths

The Survey Team presented and explained the results of field reconnaissance on June 15th at the meeting of field reconnaissance (c.f. Meeting Record 9). On June 27th, a technical meeting was held (c.f. Meeting Record 10). During the technical meeting, the Survey Team and DRVN has discussed and confirmed matters on: points of concern and measures to be taken during the implementation; and the survey routes and lengths (a total of 4,720.090 km). DRVN proposed to hold a meeting among member of the Survey Team and RRMU2 on finalization of the survey routes and lengths. The Survey Team and RRMU2 had a discussion over the matter (c. f. Meeting Record 11), and reached an agreement on July 27, 2012 (c.f. Meeting Record 12).

The planned survey routes lengths, field reconnaissance routes and length, and finalized survey lengths after discussion between RRMU2 and the Survey Team are shown in Table 9.

Table 9 Quantity of Planned, Estimated and Surveyed Lengths

	Survey Route Lengths Planned by the Survey Team (km)	Road Lengths Reported by RRMU2 (km)	Actual Survey Lengths (km)
Outbound	2,303	2,332.60	2,360.640
Inbound	-	-	2,359.450
Total	4,606	4,665.20	4,720.090

Table 10 Quantity Confirmed Survey Routes and Road Lengths

Route Name	Confirmed Road_Length (km)	Surveyed Road_Length		
		Down-bound Length(km)	Up-bound Length(km)	Down+Up (km)
National Highway 1	570.8	275.825	276.915	552.740
Southern Ring Road No.3to Cau Dau	5.4	13.980	13.990	27.970
National Highway 2	563.8	275.015	274.145	549.160
National Highway 3	622.2	298.445	298.385	596.830
National Highway 4E	88.4	43.510	43.500	87.010
National Highway 5	162.8	81.705	81.715	163.420
National Highway 6	690.6	345.715	345.375	691.090
National Highway No.6-1 (The old bypass road)	0.0	7.940	7.925	15.865
National Highway No.6-2 (The old bypass road)	0.0	4.110	4.105	8.215
National Highway No.6-3 (The old bypass road)	0.0	13.740	13.845	27.585
National Highway 10	346.6	171.155	171.195	342.350
Connecting National Highway 1 with Ninh Phuc port	12.828	6.415	6.410	12.825
National Highway 15	40.0	20.045	19.985	40.030
National Highway 18	92.6	46.000	45.945	91.945
National Highway 37	74.4	34.795	34.780	69.575
National Highway 38	169	86.845	86.800	173.645
National Highway 43	107.4	53.340	53.400	106.740
National Highway 70	396.2	198.840	198.185	397.025
National Highway 279	232.0	110.925	110.740	221.665
Route Noi Bai - Bac Ninh	62.2	32.845	32.785	65.630
Ho Chi Minh Route	188.0	94.545	94.485	189.030
National Highway 38B	240.0	144.905	144.840	289.745
Total	4665.228	2360.640	2359.450	4720.090

2) Updating the Survey Routes

Before the field reconnaissance, "Survey Routes" was prepared. The route maps were updated as reflecting the results of the field reconnaissance. Each route in the survey route map is shown in

attached document (c.f. the Meeting Record 12).

The Field Reconnaissance Report was submitted to JICA on August 10, 2012. The report included: results of field reconnaissance; the pavement condition survey implementation policy and method, conditions of target routes, and points of concerns regarding the survey. On November 20, 2012, a meeting was held to explain the contents of the field reconnaissance report to JICA. The report was accepted by JICA.

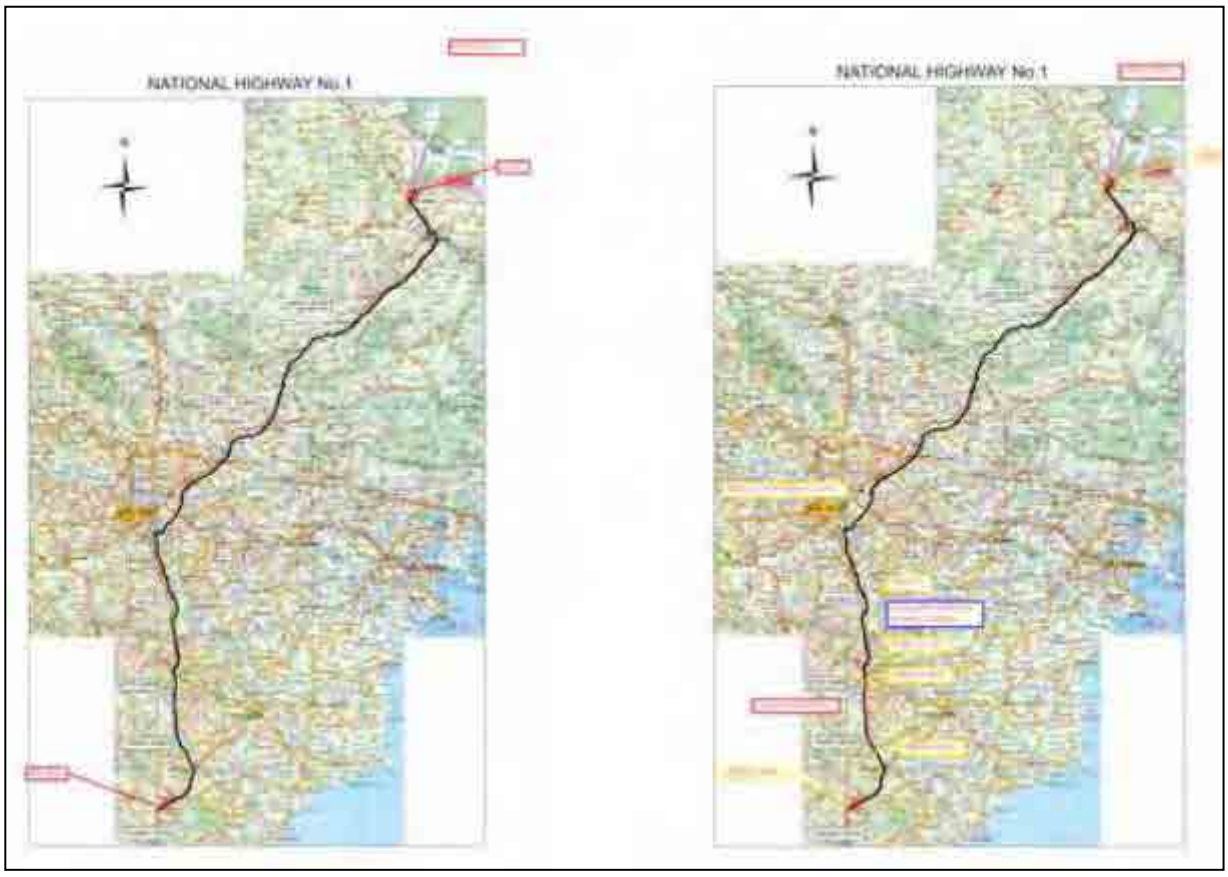


Table 11 Location Maps of Survey Routes (Left: Before Field Reconnaissance, Right: After Field Reconnaissance)

(7) Implementation of Pavement condition survey

The pavement condition survey was conducted in the period from July 16, 2012 to November 10, 2012 in collaboration with three parties: the Survey Team, RRMU2 and RTC. The equipment for the pavement condition survey was transported from Japan to Vietnam. A vehicle had been acquired in Vietnam, and the equipment was installed to the vehicle. The pavement condition survey was conducted using the vehicle which had been set up in Vietnam to the routes extending to 4,720 km in the jurisdiction of RRM2 on pavement conditions (crack ratio, rut-depth volume and IRI).

1) Equipment

(i) Setting up the pavement condition survey vehicle

The survey equipment was installed to a vehicle in Vietnam to conduct the pavement condition survey.

Vehicle: TOYOTA HIACE
Location of Setting Up: Capital Ford (Hanoi)
Period: May 22, 2012 to July 3, 2012
Member: The Survey Team members

Figure 11 Setting Up Equipment to the Road condition survey vehicle

(ii) Equipment

The pieces of equipment attached to the vehicle are as shown in Figure 12 Road Condition Survey Vehicle and Figure 13 Control Devices.

Figure 12 Road Condition Survey Vehicle

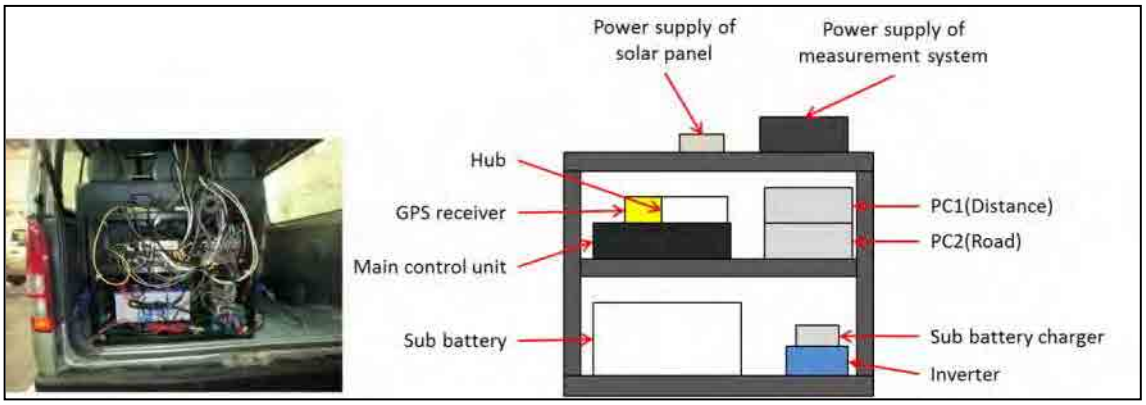


Figure 13 Control Devices

2) Pavement Condition Survey Specifications and Methodology

(i) Specifications of the Road Condition Survey Vehicle

The specifications of the equipment on the road condition survey vehicle are as in Table 12.

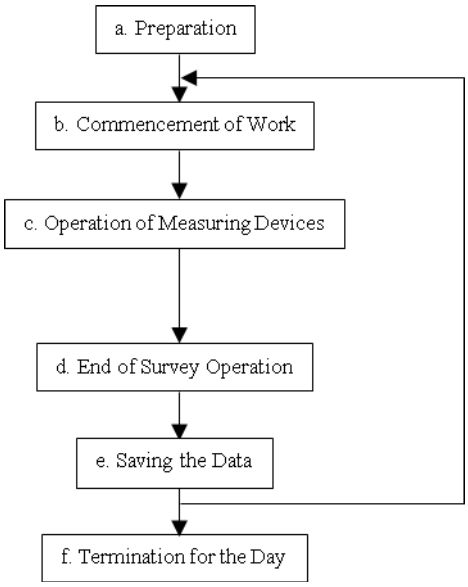
Table 12 Specifications of Measurement Devices

Item	Survey Precision
Length	Within ±0.5% of the actual value of tape measurement
Crack	A crack with of two millimeters wider can be identifiable.
Rut-depth	±6 ㎜ of the measured values of the section profile graphs
IRI	Class 2 (Pavement Study and Testing Guideline)
Forward View Images	Full High Vision CCD Camera (1,920 (W) ×1,080 (H))

The road condition survey vehicle is registered in NETIS (New Technology Information System, the Ministry of Land, Infrastructure and Transport: No.KT-110060-A).

(ii) Method of Pavement Condition Survey

The pavement condition survey was conducted as in the workflow in Figure 14.



a. Before the work, all the covers of the measuring devices are uncovered, and power shall be turned on.

b. Start the operation before the survey starting point.

c. Adjust brightness of cameras (front camera and rear cameras). Operate the control buttons at major checking points: start; end; kilometer posts.

d. The operation shall be switched off after confirming the vehicle has passed the end point of the survey.

e. The data acquired are copied to an external hard disk.

f. After confirming the acquired data, the leader ends the survey of the day. All the casings of the equipment shall be securely covered.

Figure 14 Pavement Condition Survey - Work Flow

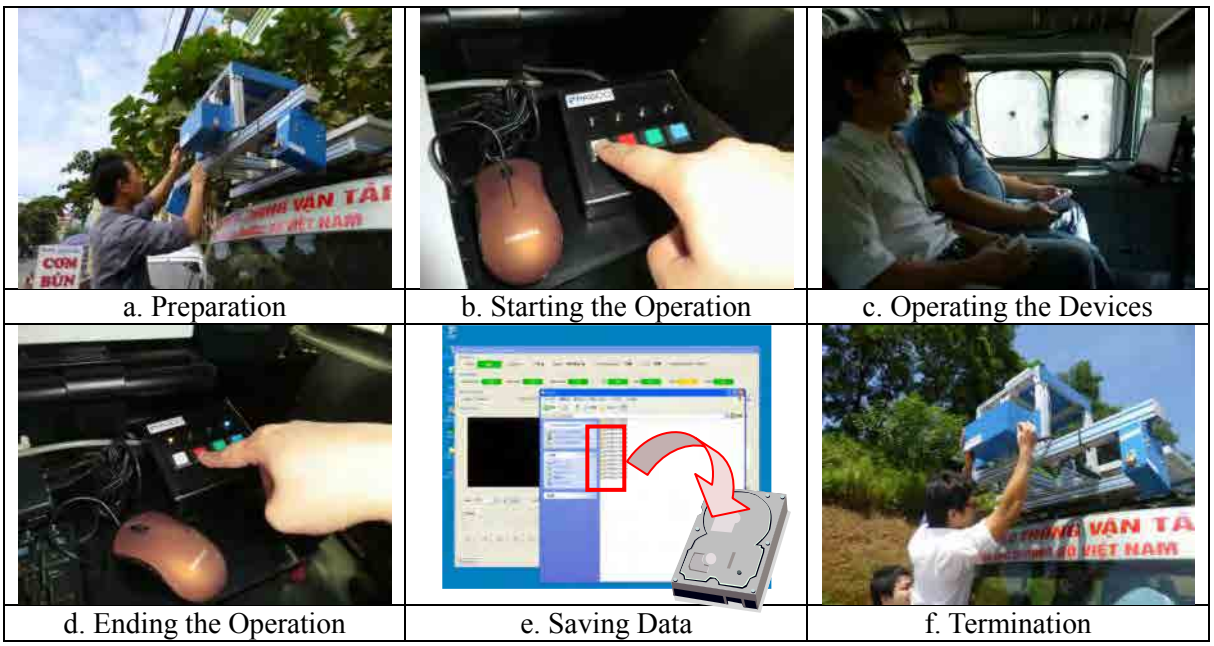


Figure 15 Images of Work Flow

Figure 16 Pavement Condition Survey Vechile in Operation

3) Survey Routes and Quantity of Survey

The pavement condition survey was conducted at the following routes shown in Table 13.

Table 13 Survey Routes and Lengths

Route Name	Surveyed Road Length		
	Down-bound	Up-bound	Down+Up (km)
	Length(km)	Length(km)	
National Highway 1	276.170	277.045	553.215
Southern Ring Road No.3 to Cau Dau	14.950	14.955	29.905
National Highway 2	275.055	275.060	550.115
National Highway 3	299.125	299.010	598.135
National Highway No.3-2 (The old bypass road)	1.355	1.355	2.710
National Highway 4E	43.560	43.495	87.055
National Highway 5	81.675	81.685	163.360
National Highway 6	345.725	345.720	691.445
National Highway No.6-1 (The old bypass road)	7.940	7.940	15.880
National Highway No.6-2 (The old bypass road)	4.110	4.110	8.220
National Highway No.6-3 (The old bypass road)	13.745	13.775	27.520
National Highway 10	171.305	171.390	342.695
Connecting National Highway 1 with Ninh Phuc port	6.420	6.410	12.830
National Highway 15	20.045	20.045	40.090
National Highway 18	46.000	45.960	91.960
National Highway 37	34.795	34.815	69.610
National Highway 38	84.625	84.685	169.310
National Highway 43	53.345	53.340	106.685
National Highway 70	198.840	198.885	397.725
National Highway 279	110.885	110.885	221.770
Route Noi Bai - Bac Ninh	32.845	32.790	65.635
Ho Chi Minh Route	94.540	94.490	189.030
National Highway 38B	155.110	155.105	310.215
Total	2,372.165	2,372.950	4,745.115

4) Implementation of Technology Transfer

The Survey Team conducted the pavement condition survey in collaboration with DRVN, RRMU2 and RTC. The contents of technology transfer is in Table 14 and the list of participants to the technology transfer sessions is listed in Table 15.

Table 14 Contents of Technology Transfer

Organization	Contents
DRVN	Implementation of the Survey
RRMU2	
RTC	Preparatory work, operation of equipment, data storage

Table 15 List Participants to the Collaborative Work

No.	Name		
	DRVN	RRMU2	RTC
1	Ta Thi Thuy	Tu Minh Phuong	Ho Hai Bac
2	Ngyuen Thi Loan	Nguyen Van Tuyen	Luu Quang Tuan
3		Tran Duc Sa	Dinh Duy Tien
4		Ngyuen Dai Nghia	Luong Xuan Ngoc
5		Tran Thanh Tuong	Nguyen Do Duy
6		Dao Ngoc Tuong	Nguyen Van Luc
7		Pham Van Tuan	Le Tuan Hai
8		Ngyuen Phuong Hoan	Ngyuen Tuan Hai
9		Ngyuen Duc Tho	Le Son Tung
10		Hoang Viet Ha	Pham Cong Oanh

Figure 17 Technology Transfer (Collaborative Work)

(8) Pavement Damage Interpretation/Analysis and Pavement Data File Preparation

The Survey Team has conducted the pavement damage interpretation/analysis was conducted from July 23, 2012 to December 21 in collaboration with RRMU2 and RTC. The data to be acquired is based on the "Pavement Study and Testing Guideline" by Japan Road Association.

1) Equipment

The devices is shown in Figure 18 Pavement Damage Interpretation/Analysis Program.

<Program for Pavement Damage Interpretation/Analysis>

The program for pavement damage interpretation/analysis was developed by Pasco Corporation.

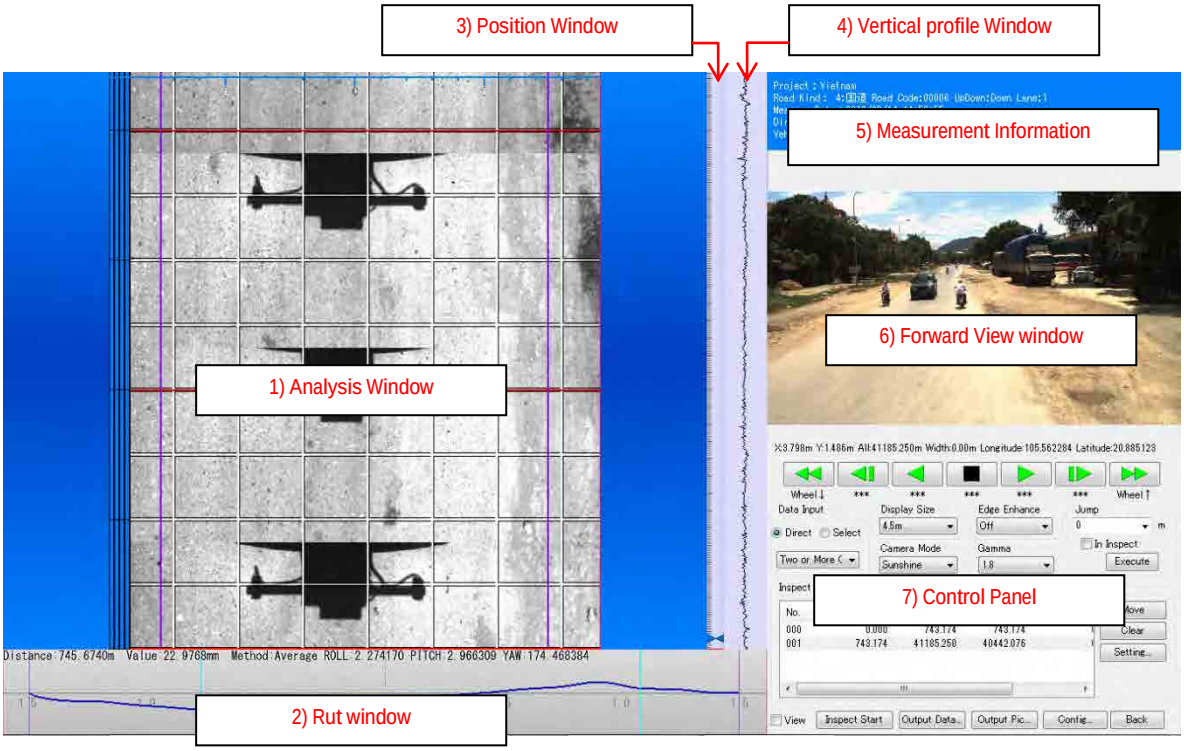


Figure 18 Pavement Damage Interpretation/Analysis Program

2) Specifications of Pavement Damage Interpretation/Analysis

The specifications of pavement damage interpretation/analysis were prepared based on the "Pavement Study and Testing Guideline" by the Japan Road Association. The Survey Team discussed the contents of the specifications with DRVN on March 27, 2012, and based on the specifications agreed by both parties, the work has been conducted.

3) Method of Pavement Damage Interpretation/Analysis

(i) Implementation of Pavement Damage Interpretation/Analysis

The pavement condition data stored in PC on the road condition survey vehicle are copied to another HDD and then imported to a PC for pavement damage interpretation/analysis. The interpretation and analysis was conducted using the program developed by Pasco Corporation. The work flow of the work is in Figure 19. Since the data to be interpreted were large, the work was conducted both in Japan and Vietnam.

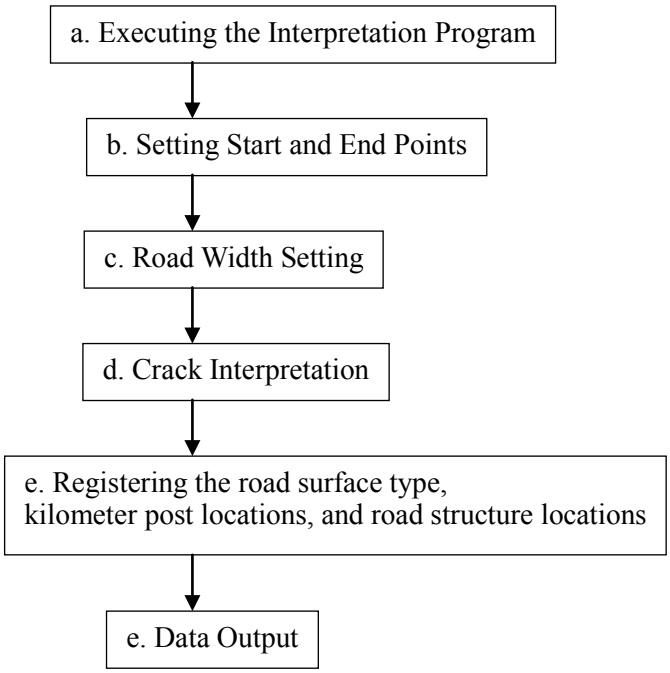


Figure 19 Work Flow (Pavement Damage Interpretation/Analysis)

Executing the Pavement Damage Interpretation/Analysis Program

The interpretation and analysis program was executed and the pavement condition data are imported.

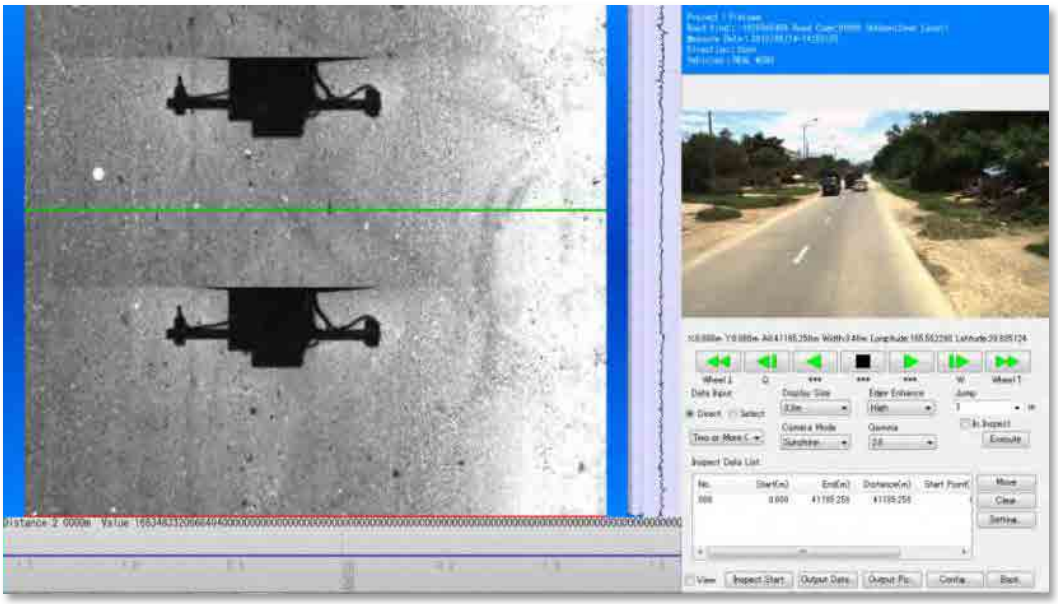


Figure 20 Pavement Damage Interpretation/Analysis

Setting Start and End Points

Starting and ending points are set on the screen.

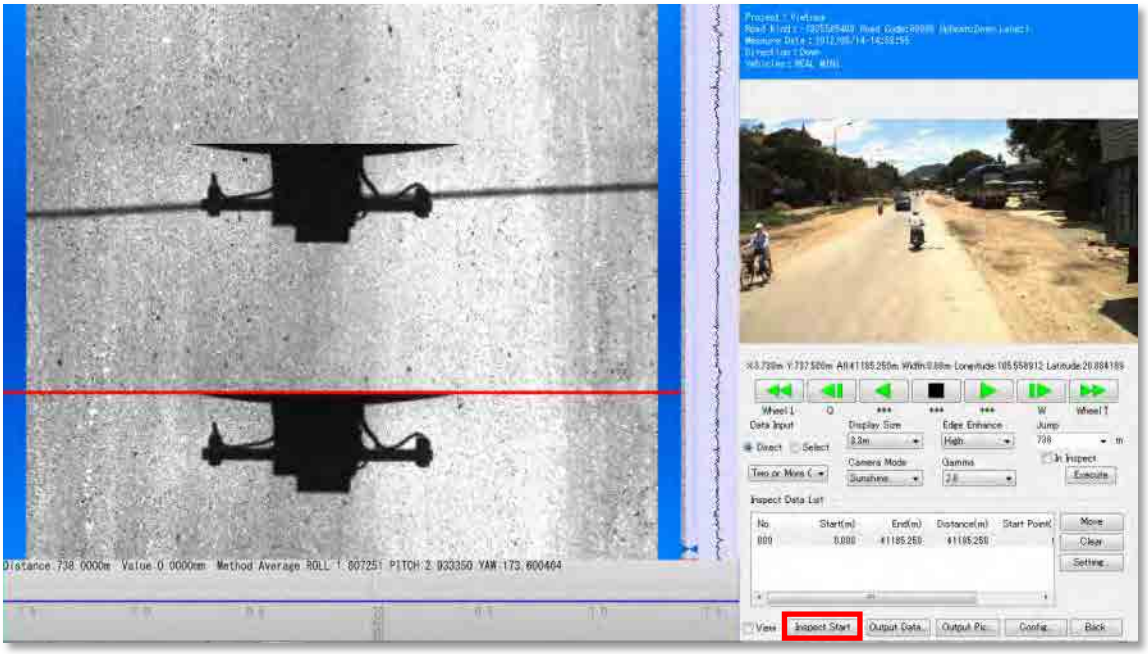


Figure 21 Setting the Start Point

Width Setting

Widths of the road can be set on the screen of crack interpretation.

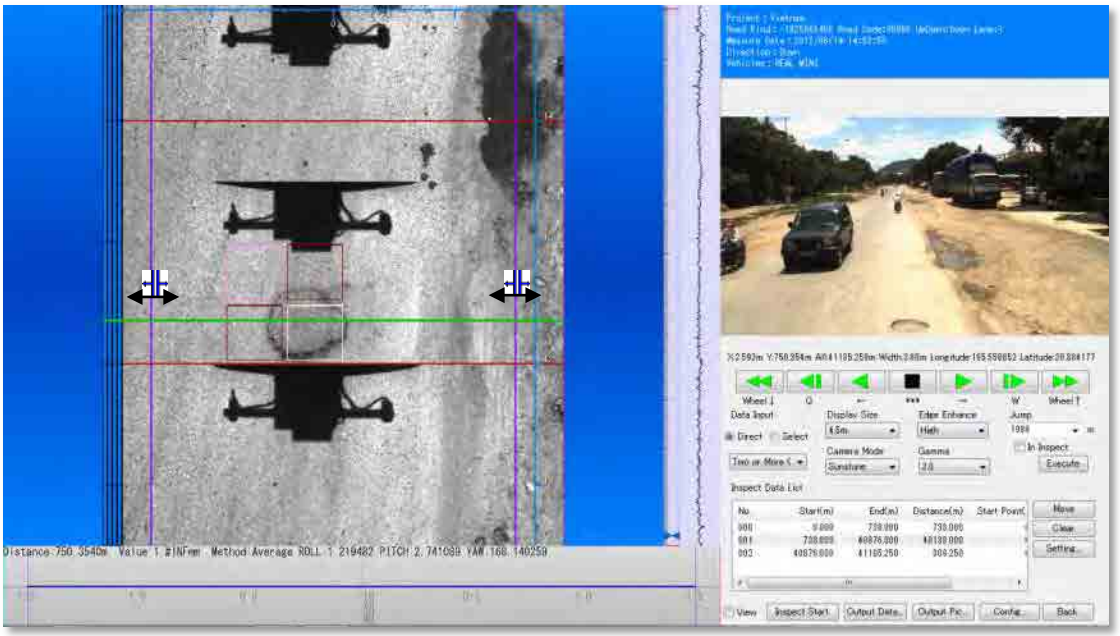


Figure 22 Setting Road Widths

Crack Interpretation

Road surface is divided into 50 cm grid. An interpreter of crack interprets the crack condition grid by grid. The criteria for assessing the crack conditions are listed in Table 17.

Table 16 Crack Interpretation Criteria

Classification	Explanations	Road Surface Type[1/]
Two or More Crack	There are two or more cracks in the mesh	AC
One Crack	There is one crack in the mesh	AC
Patching 75%	Patching occupies an area more than 75% of the mesh	AC, CC
Patching 25%	Patching occupies an area more than 25% to less than 75% of the mesh	AC, CC
Pothole 75%	Pothole occupies an area more than 75% of the mesh	AC, CC
Pothole 25%	Pothole occupies an area more than 25% to less than 75% of the mesh	AC, CC
Pothole	Pothole occupies an area greater than 0% to less than 25% of the mesh	AC, CC
Concrete Crack 25cm	Total length of crack in the mesh are more than 25cm to less than 50cm	CC
Concrete Crack 50cm	Total length of crack in the mesh are more than 50cm to less than 75cm	CC
Concrete Crack 75cm	Total length of crack in the mesh are more than 75cm to less than 100cm	CC
Concrete Crack 100cm	Total length of crack in the mesh are more than 100cm to less than 125cm	CC
Concrete Crack 125cm	Total length of crack in the mesh are more than 125cm to less than 150cm	CC
Concrete Crack 150cm	Total length of crack in the mesh are more than 150cm	CC

[1/]AC: Asphalt Cement; CC: Concrete Cement

The cracks on asphalt cement are classified into one crack or two or more cracks.

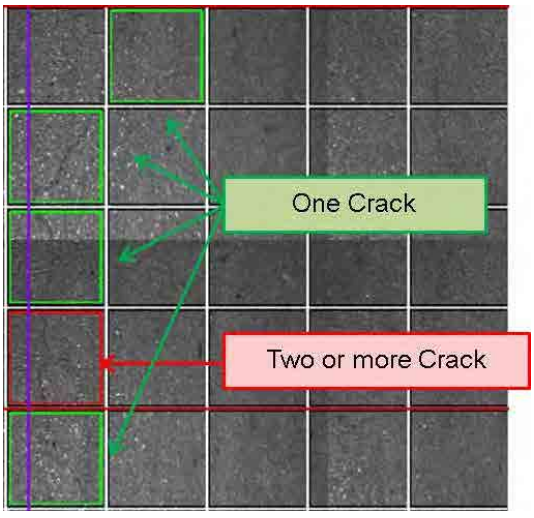


Figure 23 Example of Cracks on Asphalt Cement

Patching is classified into “Patching 75%” and “Patching 25%” for both asphalt concrete and cement concrete. An interpretation example is shown in Figure 24.

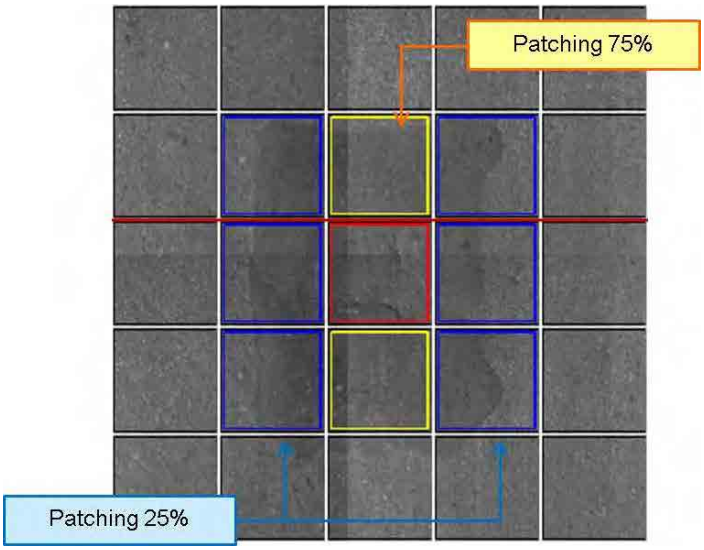


Figure 24 Patching Interpretation (Example)

Examples of pothole classification are shown in Figure 25. The classification categories for potholes are the same for asphalt concrete and cement concrete.

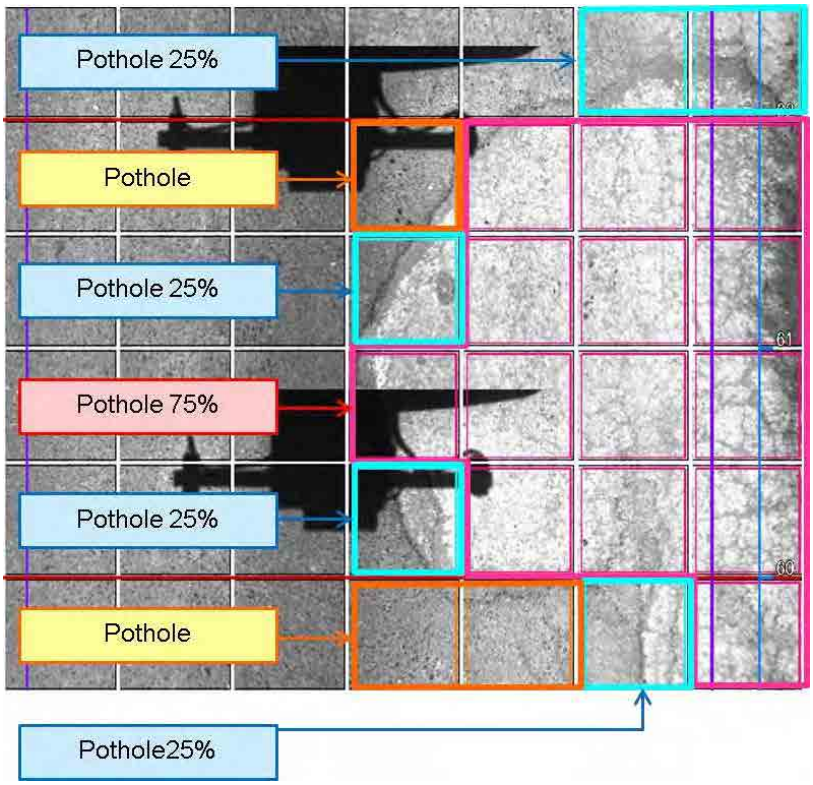


Figure 25 Example of Pothole Interpretation

Interpretation examples and schematic presentation of concrete cracks are shown in Figure 26.

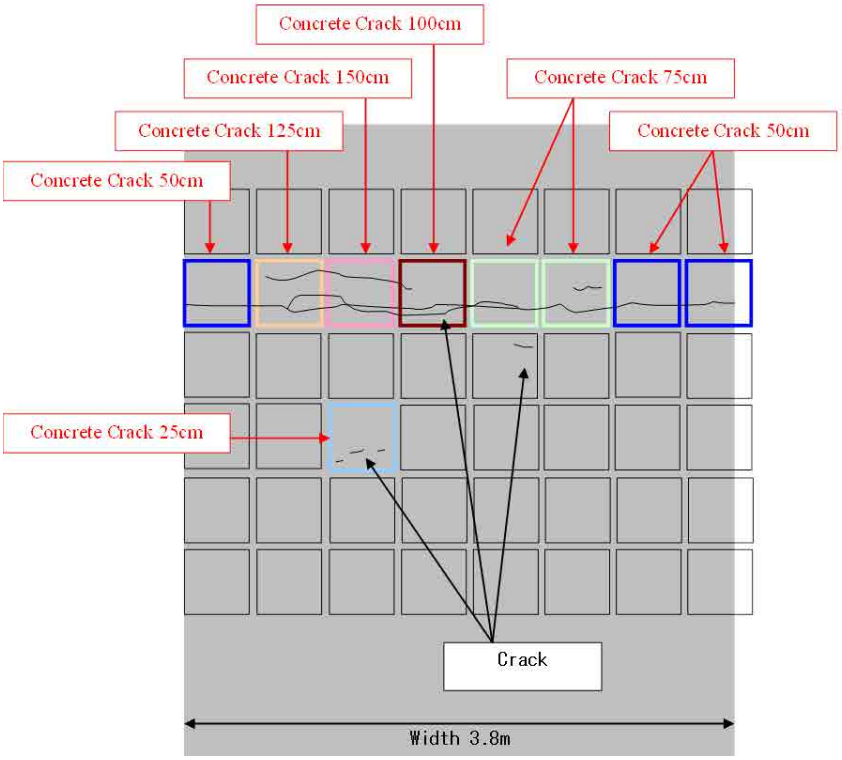


Figure 26 Crack Interpretation on Concrete Cement

Registering: Road surface type; kilometer posts; road structures

The road surface type, locations of kilometer post and road structures were registered using the pavement damage interpretation/analysis program.

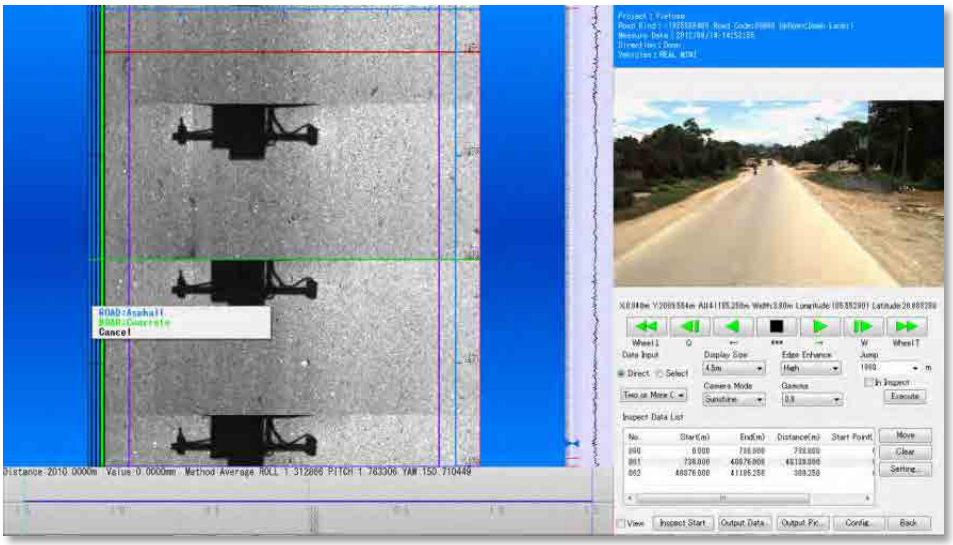


Figure 27 Setting Road Surface Type

Data Outputs

Crack, rut depth and IRI (profile data and IMU data) can be retrieved using the program. The following image shows the parameter setting for data output.

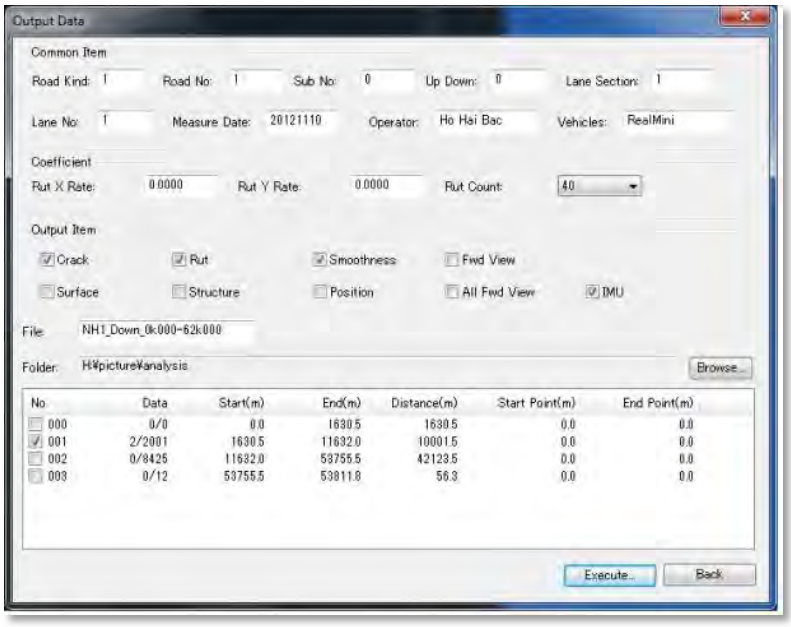


Figure 28 Parameter Setting for Pavement Condition Data Outputs

The program outputs interpretation and analysis data by route.

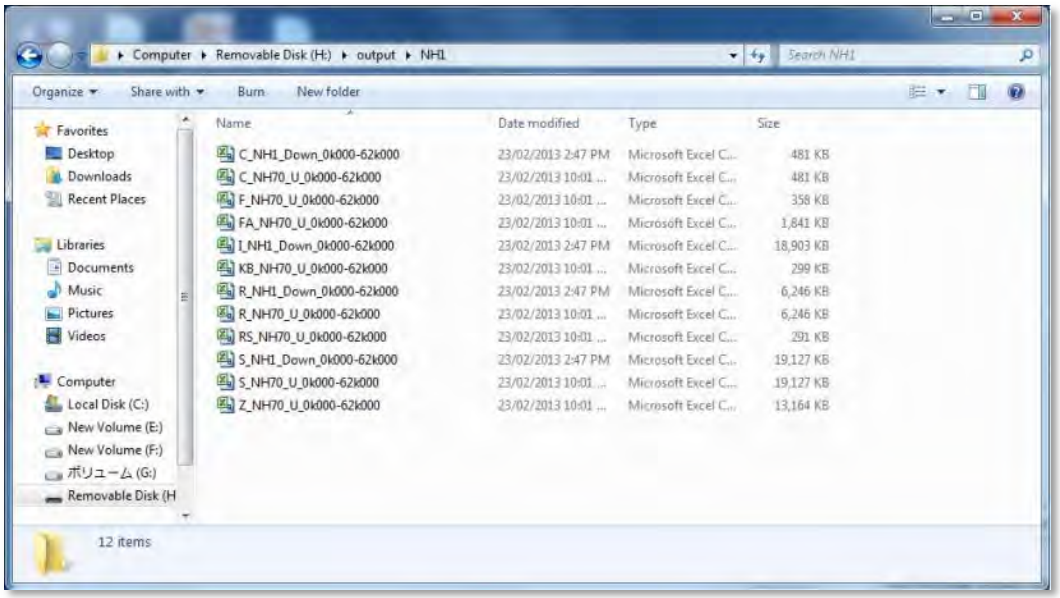


Figure 29 Example of Data Outputs

(ii) Organizing Forward View Images

The forward view images at an interval of every 5 meters, captured during the pavement condition data collection survey were edited and linked to the GPS data and organized by route.

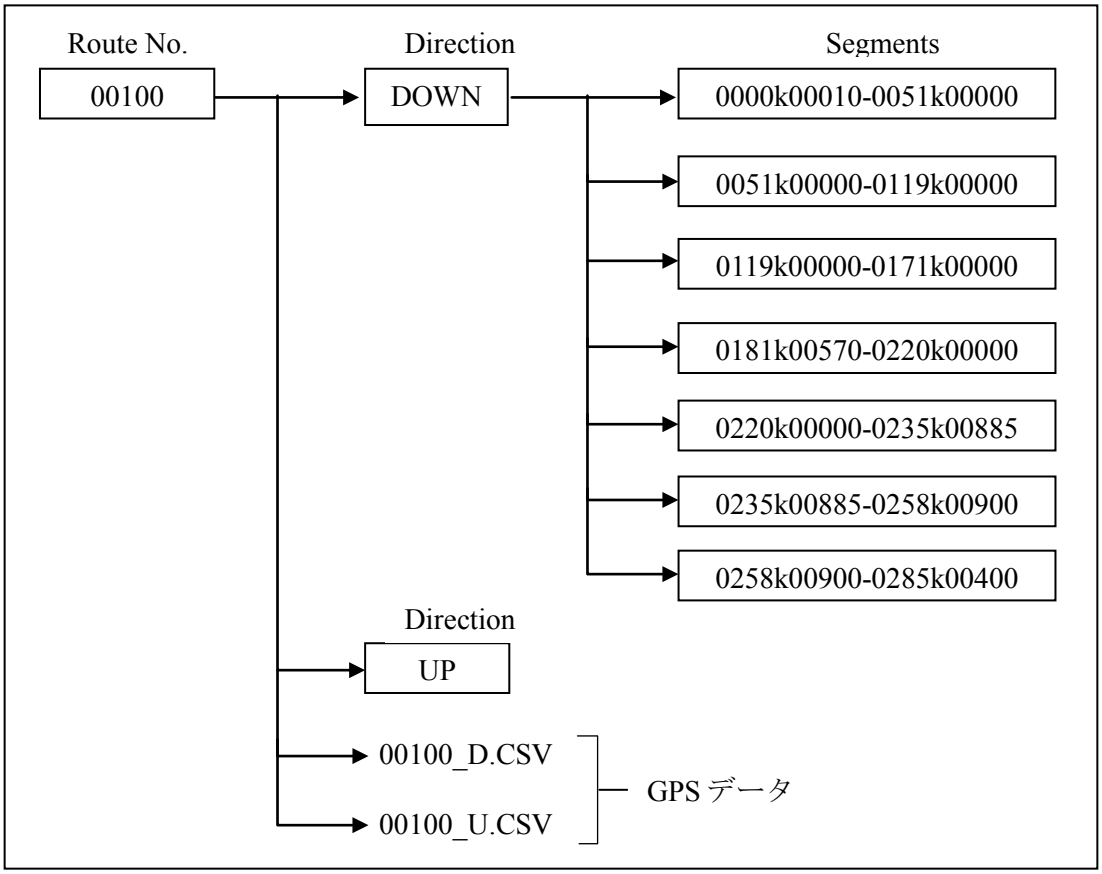


Figure 30 Organizing the Forward View Images and Associated GPS Data

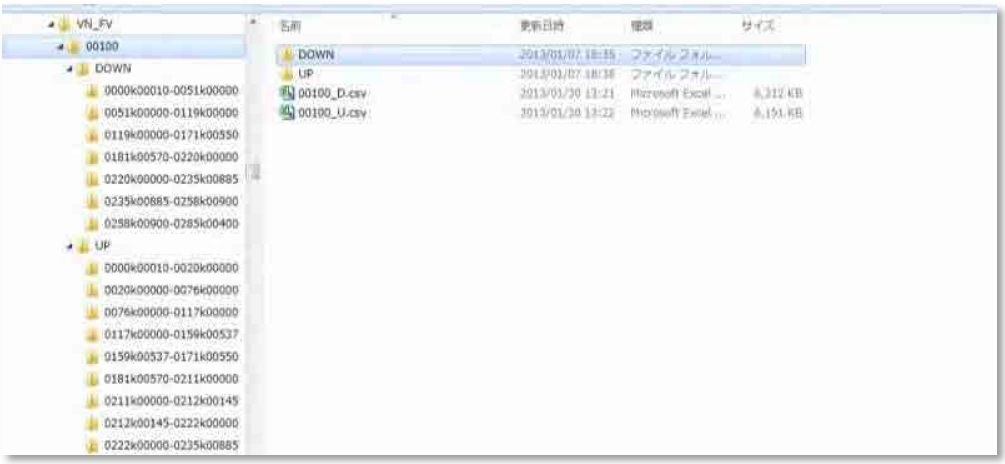


Figure 31 Actual Image of Forward View Image Organization

The forward view images can be previewed in the folder.

Figure 32 Organization of Forward View Images

Figure 33 Forward View Image (Example)

A. Technology Transfer

Technology transfer of interpretation and analysis was conducted from July 23, 2012 to December 21, 2012 to the experts from DRVN, RRMU and RTC. The names of experts participated are listed in Figure 34.

Table 17 Experts Participated to Technology Transfer (Pavement Damage Interpretation/Analysis)

No.	Names		
	DRVN	RRMU2	RTC
1	Trinh Xuan Sinh	Nguyen Trung Hieu	Luu Quang Tuan
2		Tran Duc Sa	Hoang Anh Tuan
3		Chu Manh Thang	Dinh Duy Tien
4		Tu Minh Phuong	Luong Xuan Ngoc

5		Nguyen Van Tuyen	Nguyen Do Duy
6		Pham Trung Kien	Nguye Van Thom
7		Luong Hai Trung	Trinh Quoc Viet
8		Ngyuen Dai Nghia	Nguyen Van Luc
9		Chu Van Hoai	Le Tuan Anh
10		Hoang Viet Ha	
11		Tran Thanh Tuong	
12		Tran Nam Duong	

A Survey Team member showed operation methods and the experts worked for interpreting pavement damages.

Figure 34 Technology Transfer (Pavement Damage Interpretation/Analysis)

(9) Pavement Condition Data File Preparation

The Survey Team has conducted the pavement condition data file preparation in the period from October 15, 2012 to January 31, 2013. The road management data from field reconnaissance and pavement damage interpretation/analysis data were used as inputs to the data processing system.

1) Equipment (Program)

The pavement condition data files are were prepared using software developed by Pasco Corporation. The screen image of Excel is shown in Figure 35.

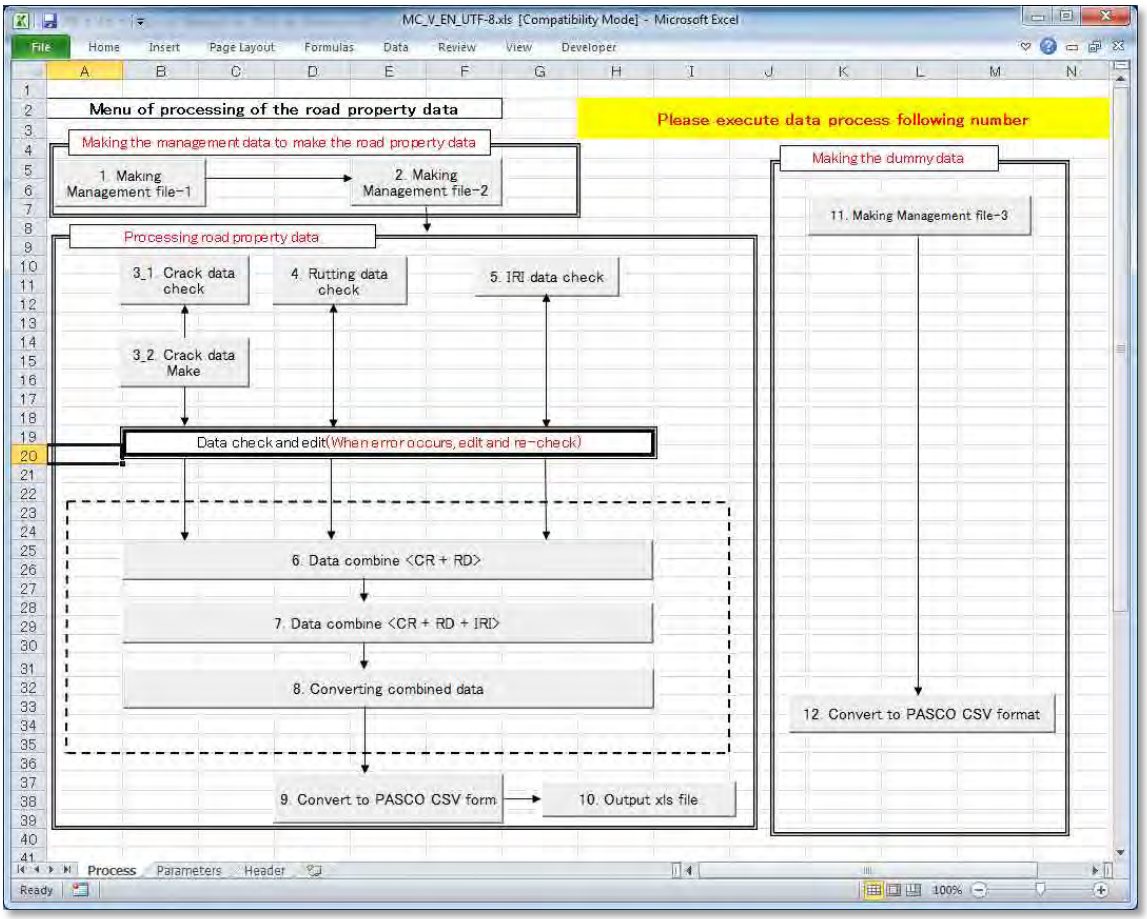


Figure 35 Data Processing Program Main Screen

2) Specifications of Pavement Data File Preparation

The specifications of road surface data files were prepared based on the "Pavement Study and Testing Guideline" by the Japan Road Association. The Survey Team discussed the specifications with DRVN on March 27, 2012 and finalized. The data file format is text (csv); formatted Excel files are also prepared.

3) Method of Preparation of Pavement Condition Data File

The pavement data file was prepared as in the flow chart shown in Figure 36.

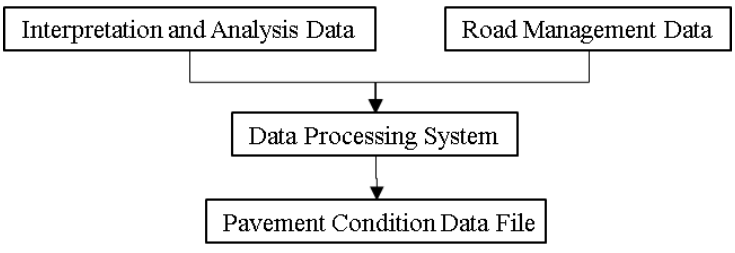


Figure 36 Pavement condition data file Preparation Flow

Pavement Damage Interpretation/Analysis Data:	The data output from the pavement damage interpretation/analysis program (crack ratio, rut depths, IRI)
Road Management Data:	Data acquired during field reconnaissance on the specified check points
Data Processing System:	It is system shown in Figure 35.
Pavement Condition Data File:	A data file having data on road management data items, crack ratio, rut depths, IRI by 100 meter road segment

4) Pavement condition data file

The pavement condition data file was prepared in file formats of CSV and Excel.

Geographical Area	Jurisdiction	Maintenance Company	Route Number	Branch Number	Route Name	Kilometer Post		Section Length (m)	Analysis Area (m2)	Structure	Intersection	Overlapping	Number of Lane			Survey Lane	Surface Type	Condition (Distress)								Note
						From (km,m)	To (km,m)						U	D	UD	Pass Lane		Date (yyyy/mm)	Cracking Ratio				Rutting Depth(mm)		IRI (mm/m)	
																			Cracking	Patching	Pothole	Total	Max	Ave		
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	0	0	30	10	*****			2	2D		AC	*****	*****	*****	*****	*****	***	***	*****	Impassable (International Border Area)
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	10	0	100	90	340.2			2	2D		AC	2012	0	0	0	0	31	9	10.25	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	100	0	200	100	344			2	2D		AC	2012	0	0	0	0	13	6	5.5	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	200	0	300	100	325			2	2D		AC	2012	0	0	0	0	10	6	2.95	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	300	0	400	100	324			2	2D		AC	2012	0	0	2.9	2.9	15	7	2.95	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	400	0	500	100	328			2	2D		AC	2012	0	0	0	0	11	8	2.3	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	500	0	600	100	327			2	2D		AC	2012	0	0	0	0	10	7	2.91	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	600	0	700	100	331			2	2D		AC	2012	0	0	0	0	16	7	3.14	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	700	0	800	100	354			2	2D		AC	2012	0	0	0	0	20	11	2.66	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	800	0	900	100	362			2	2D		AC	2012	0	0	0	0	28	10	2.39	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	900	0	0	100	377			2	2D		AC	2012	0	0	0	0	12	7	2.41	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	0	0	100	100	376			2	2D		AC	2012	0	0	0	0	13	6	2.35	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	100	0	200	100	348			2	2D		AC	2012	0	0	0	0	13	7	4.08	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	200	0	300	100	350			2	2D		AC	2012	0	0	0	0	17	6	3.28	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	300	0	400	100	351			2	2D		AC	2012	0	0	0	0	12	7	2.57	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	400	0	500	100	360			2	2D		AC	2012	0	0	0	0	13	7	2.23	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	500	0	600	100	339			2	2D		AC	2012	0	0	0	0	15	9	2.36	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	600	0	700	100	344			2	2D		AC	2012	0	0	0	0	15	7	2.01	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	700	0	800	100	358			2	2D		AC	2012	0	0	0	0	18	7	1.96	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	800	0	900	100	372			2	2D		AC	2012	0	0	0	0	28	13	2.28	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	900	0	1000	100	347			2	2D		AC	2012	0	0	0	0	18	10	2.41	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	1000	0	0	10	33.5			2	2D		AC	2012	0	0	0	0	11	7	2.09	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	0	0	100	100	337			2	2D		AC	2012	0	0	0	0	17	9	2.31	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	100	0	200	100	348			2	2D		AC	2012	0	0	0	0	21	13	2.28	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	200	0	300	100	343			2	2D		AC	2012	0	0	0	0	10	10	1.79	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	300	0	400	100	339			2	2D		AC	2012	0	0	0	0	13	6	1.99	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	400	0	500	100	340			2	2D		AC	2012	0	0	0	0	12	7	2.66	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	500	0	600	100	346			2	2D		AC	2012	0	0	0	0	18	10	2.21	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	600	0	700	100	353			2	2D		AC	2012	0	0	0	0	17	10	2.02	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	700	0	755	55	184.2			2	2D		AC	2012	0	0	0	0	20	6	2.51	
NORTHERN AREA	RRMU2	RRMC256	1	0	NATIONAL HIGHWAY 1	0	755	0	800	45	149.4			2	2D		AC	2012	0	0	0	0	17	8	2.22	DONGDANG Brg

Figure 37 Pavement Condition Data File

4. WORKSHOP

The workshop was conducted on February 28, 2013 for the purposes of: explaining general condition of roads in the region; contents of the pavement condition data files; and showing a generalized method of the pavement condition survey from survey planning to interpretation and analysis.

Proposed data utilization methods and points of concern on the Survey were explained and discussed. The Survey Team members presented, and experts who had participated to the collaborative work during the Survey reported the results of technology transfer. The participants of the workshop included: MOT, DRVN, RRMU2, RTC-Central; and universities (UTC and UTT).

(1) Participants

The number of participants to the workshop by organization is summarized in Table 18. The list of participants and comments attached in the appendices.

Table 18 Workshop Participants by Organization

Organization	Number
MOT	3
DRVN	40
RRMU2	3
RTC-CENTRL	4
Universities	19
Others	28
Total	**97**

(2) Date and Venue

Date: February 28, 2013
Hours: 8:00 a.m. − 13: 00 p.m.
Venue: The Daewoo Hotel (Hanoi)

(3) Program of the Workshop

The workshop program is shown in Table 19.

Table 19 Workshop Program

Time Table	Presentation	Presenter	Duration (min.)
8:00–8:30	Registration		30
8:30–8:45	Welcome and Opening Remarks from DRVN	DRVN Leader	15
8:45–8:55	Message from JICA representative	Representative, JICA Vietnam Office	10
8:55–9:30	Overview the pavement condition survey	Mr. Yutaka KOKUFU	35
9:30–9:50	Introduction to the pavement condition survey	Mr. Yoshiyasu TSUCHIYA	20
9:50–10:10	Tea Break		20
10:10–10:30	Introduction of pavement inspection vehicle		20
10:30–10:50	Explanation of survey results and progress report	Mr. Ho Hai Bac Mr. Luu Quang Tuan	20
10:50–11:10	Data utilization	Dr. Kazuya AOKI	20
11:10–11:50	Open Discussion		40
11:50–12:00	Conclusion	DRVN Leader	10
12:00–13:00	Lunch		60
13:00	End of Workshop		

5. RESULTS OF PAVEMENT CONDITION SURVEY (OVERVIEW OF THE TARGET ROUTE CONDITIONS)

(1) Pavement condition - Overall Assessment of the Target Routes

Three indices are used assess the pavement condition; they are: 1) Crack ratio; 2) Rut depth (the maximum and average); 3) IRI (International roughness index). General condition of roads in the target areas were summarized using the pavement condition data files prepared in this Survey. The results are shown in the following figures. The targeted roads in the analysis has a total length of 4,385 km of out the total length of 4,745 km excluding road segments of: overlapping areas, under construction; managed by other road maintenance companies. Definitions and specifications of crack ratio, rut-depth volume, and IRI were agreed between the Survey Team and DRVN on March 27, 2012 during the discussion on specifications.

*Rut depth (max): the maximum value of rut- depth volume in the assessment segment (mm)
*Rut depth (average): the average value of rut- depth volume in the assessment segment (mm)

1) Crack Ratio

- Overall Average: 8.8%
- 60 % of the total lengths, about 2,615 km has a crack ratio of 0%.
- The crack ratio with the value of 10% or less occupies 80% of the total length.

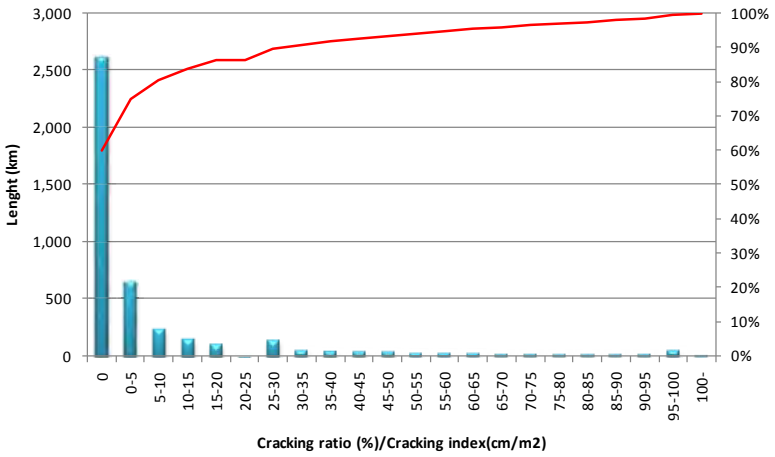


Figure 38 Crack Ratio Distribution (Vertical axis: Length, Horizontal axis: Cumulative Ratio)

2) Rut Depth Volume (Maximum)

- Overall Average: 27.5mm
- Road segments with the values between 15 mm or larger and less than 20 mm are the largest covering about 24% of the total which is about 1,025 km.
- The value less than 30mm covers 74% of the total length.

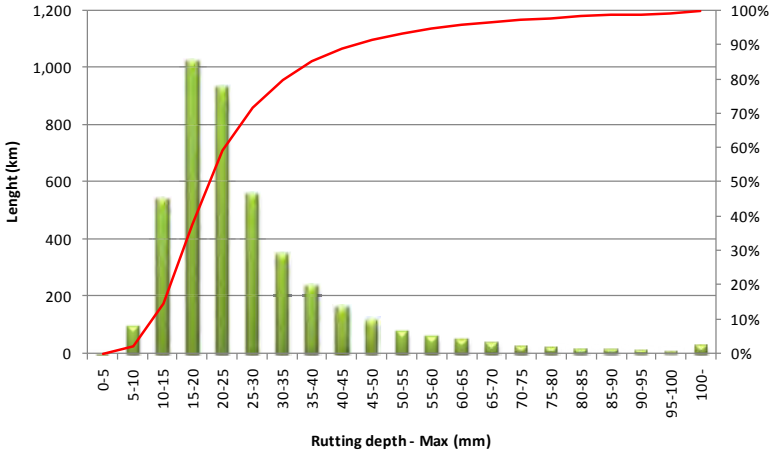


Figure 39 Rut-depth Volume (Maximum) (Vertical axis: Length, Horizontal axis: Cumulative Ratio)

3) Rut-Depth Volume (Average)

- Overall Average: 11.6mm
- The values between 10 mm or larger and less than 15 mm share about 40% of the total lengths equivalent to 1,733 km with the large number of segments.
- The segments with the value of 15 mm or smaller share 83% of the total.

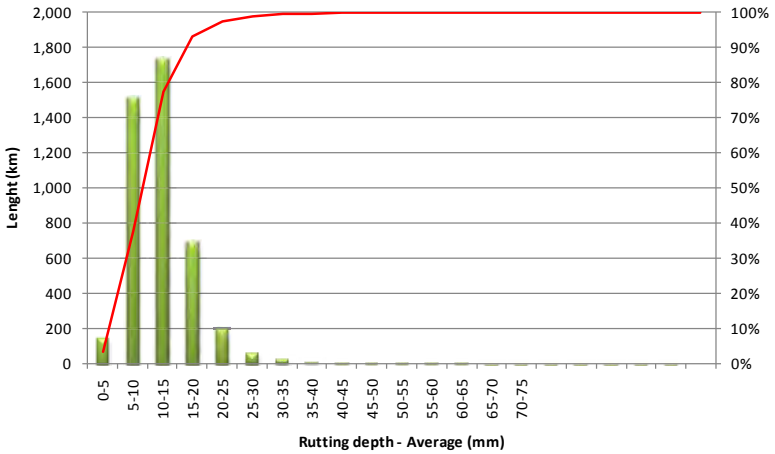


Figure 40 Distribution of Rut-Depth Volume (Average) (Vertical axis: Length, Horizontal axis: Cumulative Ratio)

4) IRI

- The overall average is 4.2mm/m.
- The road sections with values between 2.0mm/m or larger and less than 3.0mm/m are dominant sharing about 40% equivalent to 1,768 km.
- 86% of the total are sections with 6.0mm/m or less value.

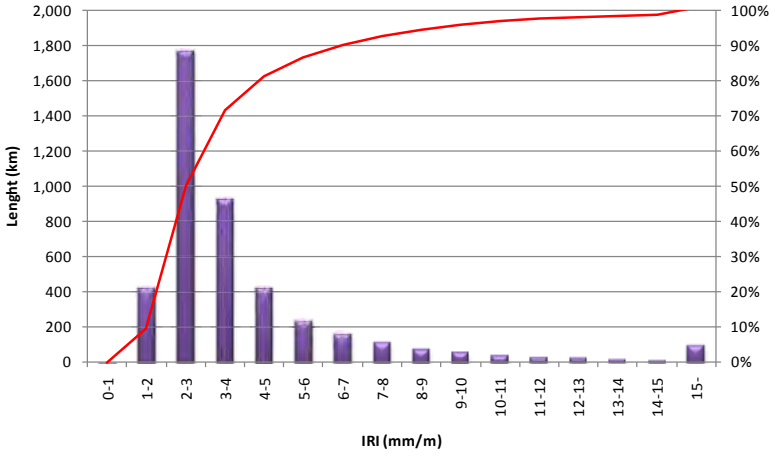


Figure 41 IRI Distribution (Vertical axis: Length, Horizontal axis: Cumulative Ratio)

(2) Pavement Condition by Route

Pavement condition is summarized by route. The result is shown in Table 20. Definitions of indices of crack ratio, rut depth and IRI are based on the discussion on the sepcifications held on March 27, 2012 with DRVN.

Table 20 Pavement Condition by Route (Averages of Pavement Condition Data)

Route	Crack Ratio (%)	Rut-Depth Volume (mm)		IRI (m/mm)
		Max.	Ave.	
NATIONAL HIGHWAY 1	2.81	24.86	12.37	3.06
SOUTHERN RING ROAD 3 TO CAU DAU	0.06	23.79	10.98	3.24
NATIONAL HIGHWAY 2	11.60	28.88	12.92	3.65
NATIONAL HIGHWAY 3	2.14	22.55	9.04	3.56
NATIONAL HIGHWAY 3 (THE OLD ROAD BRANCH)	1.28	41.92	13.94	7.79
NATIONAL HIGHWAY 4E	55.11	58.59	18.15	11.58
NATIONAL HIGHWAY 5	6.44	27.01	13.98	2.75
NATIONAL HIGHWAY 6	9.15	27.74	11.67	3.9
NATIONAL HIGHWAY 6-1 (THE OLD BYPASS ROAD)	0.19	19.39	8.69	4.59
NATIONAL HIGHWAY 6-2 (THE OLD BYPASS ROAD)	14.02	34.69	12.55	8.35
NATIONAL HIGHWAY 6-3 (THE OLD BYPASS ROAD)	50.56	40.25	12.66	9.63
NATIONAL HIGHWAY 10	0.26	21.73	10.6	3.21
CONNECTING NATIONAL HIGHWAY 1 WITH NINH PHUC PORT	0.04	29.68	18.46	3.27
NATIONAL HIGHWAY 15	9.42	32.93	11.28	6.36
NATIONAL HIGHWAY 18	3.45	19.06	9.66	3.33
NATIONAL HIGHWAY 37	12.13	18.96	7.56	3.84
NATIONAL HIGHWAY 38	24.37	31.85	10.46	7.16
NATIONAL HIGHWAY 43	22.76	41.2	15.63	6.93
NATIONAL HIGHWAY 70	3.19	27.19	11.17	3.3
NATIONAL HIGHWAY 279	18.82	37.71	13.98	6.11
ROUTE NOI BAI - BAC NINH	0.48	17.92	10.68	2.91
HO CHI MINH ROUTE	4.16	22.6	11.63	3.05
NATIONAL HIGHWAY 38B	18.81	29.13	8.98	7.84
Overall Average	**8.8**	**27.5**	**11.6**	**4.2**

Following pictures are examples of cracks representing the crack ratios:

Figure 42 Crack Ratio 10% (Outbound NH.38, 15k100-15k200)

Figure 43 Crack Ratio 30% (Inbound NH.18, 17k200-17k300)

Figure 44 Crack Ratio 70% (Inbound NH.5, 84k000-84k100)

6. QUESTIONNAIRE SURVEY -- EVALUATION OF TECHNOLOGY TRANSFER

A questionnaire survey was conducted to assess levels of achievement and understanding of Vietnamese experts on the collaborative work items. The items of technology transfer were:

- Field Reconnaissance;
- Pavement condition survey; and
- Pavement Damage Interpretation.

The results of the questionnaire survey would be used to become basic information to judge feasibility of conducting the pavement condition survey using the road condition survey vehicle in Vietnam. This questionnaire was requested by JICA at the beginning of the Survey.

(1) Targets of Questionnaire Survey

The questionnaire survey was conducted to the all the experts from DRVN, PPMU2 and RTC who participated the collaborative work. A total of 37 was requested; out of 37 experts, 33 experts responded. The respondents are listed in Table 21.

Table 21 Respondents the Questionnaire Survey

No.	Name	Collaboration work
	RTC	
1	Luu Quang Tuan	Field Reconnaissance;Data Analysis;Pavement Condition Survey Training
2	Hoang Anh Tuan	Field Reconnaissance;Data Analysis
3	Trinh Ngoc Vinh	Field Reconnaissance
4	Dinh Duy Tien	Field Reconnaissance; Data Analysis Training; Pavement Condition Survey Training
5	Luong Xuan Ngoc	Field Reconnaissance;Data Analysis;Pavement Condition Survey
6	Nguyen Do Duy	Field Reconnaissance;Data Analysis Training;Pavement Condition Survey Training
7	Nguyen Van Thom	Field Reconnaissance;Data Analysis Training
8	Trinh Quoc Viet	Field Reconnaissance;Data Analysis
9	Nguyen Van Luc	Field Reconnaissance;Data Analysis;Pavement Condition Survey
10	Le Tuan Anh	Field Reconnaissance;Data Analysis;Pavement Condition Survey
11	Nguyen Tuan Hai	Pavement Condition Survey Training
12	Le Son Tung	Pavement Condition Survey Training
13	Pham Cong Oanh	Pavement Condition Survey Training
	RRMU2	
14	Nguyen Trung Hieu	Field Reconnaissance;Data Analysis
15	Tran Duc Sa	Field Reconnaissance;Pavement Condition Survey
16	Chu Manh Thang	Field Reconnaissance
17	Tu Minh Phuong	Field Reconnaissance;Pavement Condition Survey; Data Analysis Training
18	Nguyen Van Tuyen	Field Reconnaissance;Pavement Condition Survey
19	Pham Trung Kien	Field Reconnaissance
20	Lương Hai Trung	Field Reconnaissance
21	Nguyen Dai Nghia	Field Reconnaissance;Pavement Condition Survey
22	Chu Van Hoai	Field Reconnaissance
23	Hoang Viet Ha	Field Reconnaissance
24	Tran Thanh Tung	Field Reconnaissance;Pavement Condition Survey
25	Tran Nam Duong	Field Reconnaissance
26	Dao Ngoc Tuong	Pavement Condition Survey
27	Pham Van Tuan	Pavement Condition Survey
28	Nguyen Phuong Hoan	Pavement Condition Survey
29	Nguyen Duc Tho	Pavement Condition Survey
30	Hoang Viet Ha	Pavement Condition Survey
	DRVN	
31	Ta Thi Thuy	Pavement Condition Survey
32	Nguyen Thi Loan	Pavement Condition Survey
33	Trinh Xuan Sinh	Data Analysis Training

(2) Period of Questionnaire Survey

The questionnaire survey was conducted in the period from December 24 to January 16.

(3) Contents of Questionnaire

The form has the multiple choice section and free writing section. Q1 covers self-assessment of understanding in a scale from one to five. Five is the highest level of understanding. Questions from Q2 to Q5 are to evaluate technology transfer activities and collect comments on improvement.

Q1. Please rate the items below about the training you have received. ***(check only one)***

1. Field reconnaissance *(if you worked on the Field reconnaissance)*						
			Low		***Medium***	***High***
Overall knowledge of pavement condition survey	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
Level of understanding in this training	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
2. Pavement condition survey *(if you worked on the Pavement condition survey)*						
Overall knowledge of pavement condition survey	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
Level of understanding in this training	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
3. Data extract and analysis *(if you worked on the Data extract and analysis)*						
Overall knowledge of pavement condition survey	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
Level of understanding in this training	**Before the training**	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**
	After the training	□ **1**	□ **2**	□ **3**	□ **4**	□ **5**

Q2. Was there anything you did not understand during the training? Please provide specific examples.

Q.3 What is the most valuable thing you learned (knowledge or skills)?

Q.4 What additional training-development do you require?

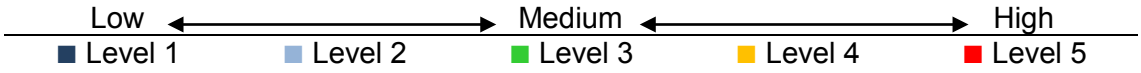
Q.5 Do you have other comments (positive or negative) and/or suggestions (for improving) on PASCO's pavement condition survey system?

Results

The results of the questionnaire survey are summarized as follows:

Q1. Level of understanding on the pavement condition survey and collaborative works (1 - 5)

〈Scale of Understanding 〉



1 Self-Evaluation by Participants on Field Reconnaissance

Overall level of understanding on the pavement condition survey was raised as they have received the training. Before the training, about 60% of the participants marked Level 2, but after the training, about 80% marked Level 4.

On field reconnaissance, the level of understanding went higher. About 60% marked Level 2, before the training; about 90% marked Level 4 or higher; further, about 50% marked Level 5. Many local experts deepened their knowledge and skills.

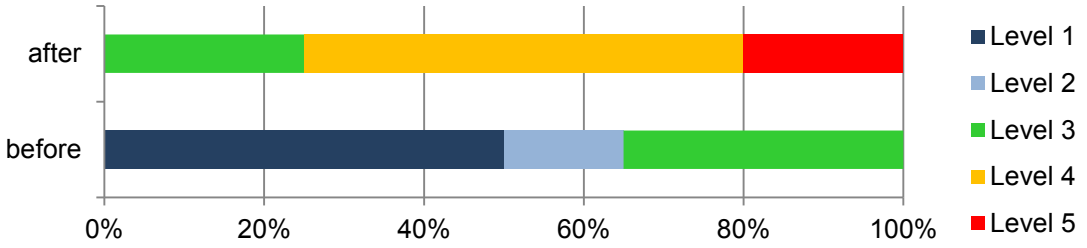


Figure 45 Overall Level of Understanding on the Pavement Condition Survey Expressed by the Participants to Field Reconnaissance

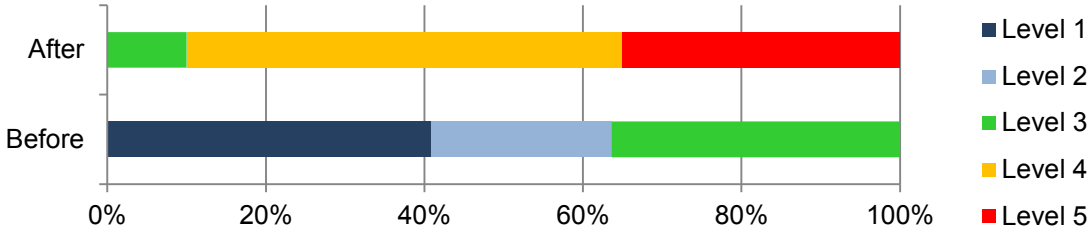


Figure 46 Level of Understanding on the Training (Field Reconnaissance Survey) Expressed by the Participants to Field Reconnaissance

2 Self-Evaluation on the Pavement Condition Survey

The level of understanding on the overall pavement condition survey became higher. Before the training, about 60% of the participants marked two or lower before the training, but after the training, about 80% marked Level 4 or higher. The percentage of participants marked Level 5 was limited to only about 5% showing that most of the rating remained in Level 4.

The level of understanding on the collaborative work on the pavement condition survey (automated data collection) was raised from Level 2 (about 60%) to Level 4 or higher (about 80%). As seen in the overall evaluation on the Survey, Level 5 rating is low.

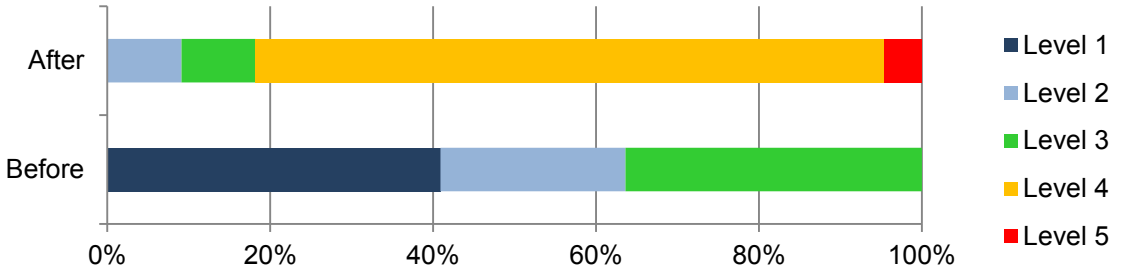


Figure 47 Overall Level of Understanding on the Pavement Condition Survey Expressed by the Pavement Condition Survey Participants

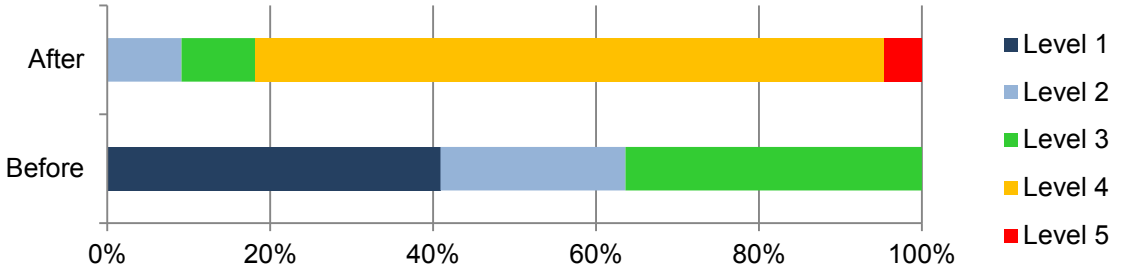


Figure 48 Level of Understanding of the Training (Pavement Condition Survey) Expressed by the Pavement Condition Survey Participants

3 Self-Evaluation of the Participants to the Pavement Damage Interpretation/Analysis

The overall understanding on the Survey became higher. Before the training, about 40% marked Level 2 or lower; after the training about 90% marked Level 4 or higher.

On the collaborative work on the pavement damage interpretation/analysis, about 50% marked Level 2 or lower, but after the training, all marked Level 4 or higher. The fact that about 40% marked Level 5 is remarkable.

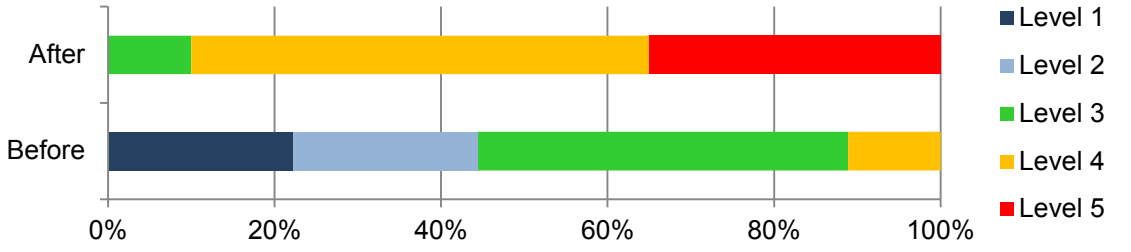


Figure 49 Overall Level of Understanding on the Pavement Condition Survey Expressed by the Participants to Pavement Damage Interpretation/Analysis

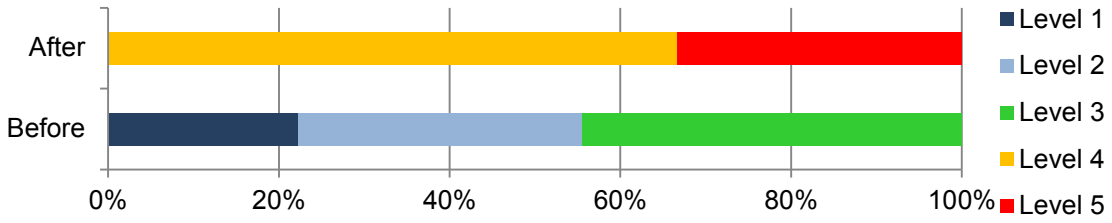


Figure 50 Level of Understanding of the Training (Pavement Damage Interpretation/Analysis) Expressed by the Participants to the Pavement Condition Survey

The participants answered the questions from Q2 to Q5 descriptively. Responses and the numbers of respondents are as follows:

Q2 On training items hard to understand

- Level of pavement damage (destruction to the pavement, large or small cracks, rut depths) varies from segment to segment; therefore, methods of maintenance would be different. Could the road condition survey vehicle evaluates the level of damage quantitatively? [One DRVN expert responded.]
- Would it be possible to differentiate heavily damaged sections and unpaved sections? I would like to identify and calculate heavily damaged sections. [One RTC expert responded.]
- The RTC members have not received training on data utilization. I (we) expect that such training would be provided by the Survey Team. [Six RTC experts responded.]
- Each individual has received training on each work process only. Overall understanding on the pavement condition survey may not be sufficient. [Twe RTC experts responded.]

Q3 A type of training valued highest

- Pavement damage interpretation/analysis and technology on the pavement condition survey equipment [Five RRMU2 experts and three RTC experts responded.]
- Experience in the latest technology [One DRVN expert, two RRMU2 experts and four RTC experts responded.]
- Experience of professionalism in working [Three RTC experts responded.]

Q4 Further Training Required

- More staff needs to receive the training. [One DRVN expert responded.]
- Management methods on road facilities and traffic safety facilities. [One RRMU2 expert responded.]
- A training on all the processes of the pavement condition survey in a limited scale shall be conducted. About a 50 km section shall be selected. To the section, local experts shall conduct all the processes (field reconnaissance, data conversion, pavement damage interpretation, data preparation). After one cycle of implementation, the experts monitor the results. [Four RTC experts responded.]

Q5 Comments and suggestions on the Pavement Condition Survey

- After the damage interpretation and analysis, the level of damage shall be ranked and expressed on a map in different color depending on the level of damage. [One DRVN expert responded.]
- The national highways require a survey on two or more lanes. [Two RRMU2 experts responded.]
- An analysis system would be necessary on the forward view images. The source of the system shall be open, and the analysis system shall be customizable so that functionalities would be added when necessary. [One RTC expert responded.]
- The Survey used the latest technology with the road condition survey vehicle, but it required hours on pavement damage interpretation/analysis. To ease the work load on the pavement damage interpretation, an automatic interpretation system on pavement damages (crack ratio, crack depth, rut depth and others) could be developed. If it becomes possible, the manual damage interpretation would not become necessary; only data editing would be required for efficient operation. [One DRVN expert responded.]
- Many other local experts shall take part in the training to acquire the technology. [One expert responded.]

Insights on Results of the Questionnaire Survey

The result of questionnaire shows that technology transfer through OJT during the Survey has been sufficient and valued. In all the process of collaborative works--field reconnaissance, the pavement condition survey, and pavement damage interpretation/analysis—the participants answered the experiences positively and the "after" was scored higher than the "before." Especially on the pavement damage interpretation/analysis, all the experts expressed higher. Mentoring by the experts and discussion resulted positive responses whenever the local experts had questions on damage interpretation.

On the other hand, there were many responses for further training. During the Survey, time allocated for training was short, and the number of participants was limited. It is hard to conclude that sufficient training had been conducted. More training to larger number of local experts will be required. For mid-to-long term sustainability of technology, it is important to conduct trainers' training.

7. LESSONS LEARNED AND POINTS OF CONCERN

Lessons learned and points of concern through the Survey are discussed by work process:

(1) Survey Planning

1) Determining the Target Survey Routes

Before executing field reconnaissance, it is important to understand local conditions: locations of target routes; starting and ending points; actual lengths; and others-- as studying the existing reference materials for efficient reconnaissance survey.

In this Survey, such pre-study to ensure efficiency of work has been done as planned survey routes were studied using existing road maps as the Survey Team discussed local conditions with members of

DRVN, RTC and RRMU2 on March 27, 2012.

2) Impassable Areas

All the survey routes needed to be surveyed using the road condition survey vehicle, but along the international border, there are areas where the road condition survey vehicle could not enter. In such international border areas, an application was needed to be submitted to acquire permits.

When this was the case, the Survey Team applied the entry permits to DRVN, and the Survey Team carried the permits while the Survey Team conducted the field reconnaissance and pavement condition survey using the survey vehicle.

3) Selection of Survey Lane

On March 27, 2012, the Survey Team and DRVN agreed that the survey lane to be the center most lane where heavy vehicles travel.

Where there are multiple lanes, one lane was selected as the survey lane. In general, the lane to be surveyed is the most vulnerable lane from heavy-load traffic or the lane with apparent damages.

(2) Field Reconnaissance

1) Safety Management at Heavy Traffic Routes during Field Reconnaissance

Field reconnaissance requires on-site work in lanes with traffic during marking, photographing or other activities. In such occasions, it is important to secure safety of workers to prevent possible traffic accident. Safety keepers were placed secured safety of workers during marking and other works during field reconnaissance, since on-site work required activities in traffic.

Figure 51 Safety Keepers Working During Marking (Field Reconnaissance)

2) Health Management

Workers' health management was significant especially when effective temperature becomes as high as 50 degree centigrade on the road. From April to June, such high temperature was experienced continuously during the day. The manager limited the on-site work from early morning till the hours when the temperature became high. Because of the limitation, the daily work was carefully planned and implemented. The overall schedule management was sound with well health management of workers, and the work was completed.

(3) Pavement Condition Survey

1) Security of Equipment

The road condition survey vehicle is equipped with cameras, sensors and other precise equipment. The pieces of equipment cannot be replaced easily in case of damage or theft. Security of the road condition survey vehicle itself and associated equipment became important.

Each piece of equipment on the road condition survey vehicle has metal casing with a lock to prevent from damage or theft. A parking space, with a roof and gate, was selected for safety and security of the vehicle.

Figure 52 Security: Equipment on the Road condition survey vehicle

2) Prevention of Contacting Other Vehicles

The road condition survey vehicle traveled without restricting traffic during the day; therefore, it was necessary to pay attention to other vehicular traffic to avoid contacts. In urbanized areas in Vietnam, traffic is heavy. When the roads were congested, there was a chance of the road condition survey vehicle hits vehicles.

To avoid possible collision, another car follow the pavement condition survey vehicle so that no

vehicles were able to come close to the pavement condition survey vehicle. The sensors and cameras at the back of the survey vehicle were attached to higher positions of the vehicle to avoid possible contact with automobiles.

(4) Pavement Damage Interpretation/Analysis

1) Confirmation on the Contents of the Pavement Condition Data File and Agreement

The pavement condition data file was prepared form the pavement condition survey data. The data format had to be in accordance with future requirement on data utilization.

The Survey Team discussed the specifications on the pavement condition data file with DRVN, and the specifications were agreed by both sides during the specification discussion held on March 27, 2012. Further, in the middle of the pavement damage interpretation/analysis, on December 11, 2012, the Survey Team explained the interim results of the pavement condition data file to DRVN, and both sides confirmed the contents of the data file.

2) Data Inspection during Pavement Damage Interpretation/Analysis

More than one local experts conducted the pavement damage interpretation/analysis work. When more than one persons are involved, the process is more prone to errors; therefore, data inspection becomes significant.

During the pavement damage interpretation/analysis, a data inspection person-in-charge was allocated to conduct data inspection to avoid errors in encoding the interpretation results.

(5) Preparation of Pavement Condition Data File

When the pavement data file is prepared, items of consideration found during field reconnaissance need to be organized and methods of notation to the pavement data file need to be confirmed with the counterpart.

The Survey Team identified the following consideration points for the pavement damage interpretation/analysis and pavement condition data preparation from the results of field reconnaissance from April 9, 2012 to June 8, 2012 which was conducted in collaboration with RRMU2 and RTC. The Survey Team had explanation and discussion sessions with DRVN on conditions of road segments to consider on June 15, 2012 (Explanation Meeting on Field Reconnaissance) and on June 27, 2012 during a technical meeting. DRVN confirmed and agreed to the countermeasures to the issues identified by the Survey Team.

1) Discontinuity of Road Sections

Discontinuity of road sections was found because of road construction or differences in road management administration.

Possibility of changes over time in the data of discontinuous sections are high as construction would be completed; therefore, the data need to include information as the data secure continuity of routes. The pavement condition data –final output—will be used for pavement management; the detailed data on discontinuity need to be recorded to the master file so that when the data are used, one could

understand the data on discontinuities.

Because of the necessity described and to clarify each road segment, the name of road management entity and the segments of road under construction were recorded to the pavement condition data file.

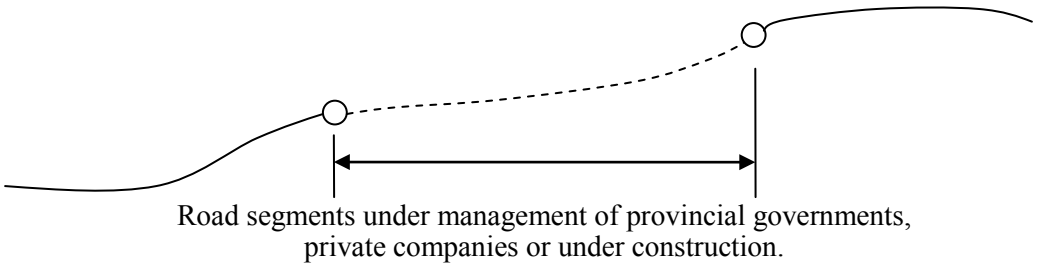


Figure 53 Discontinuity in the Survey Routes

2) Overlapping Administration Sections

Overlapping administration sections have been identified. The overlapping sections need to be recognized as one route when a pavement management plan is prepared; therefore, the overlapping administration segments were recorded as "overlapping" in the pavement condition data file.

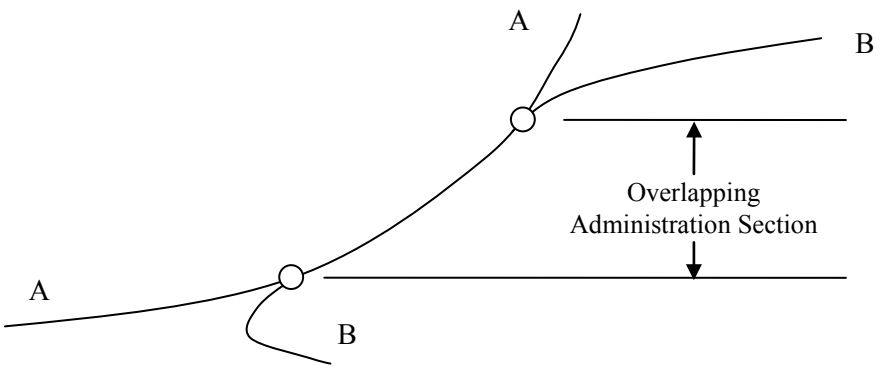


Figure 54 Overlapping Administration Sections

3) Narrow Road Section

At the narrow section or roads that are used for in and outbound traffic, "Narrow Section" has been noted on the inbound direction in the pavement condition data file.

A narrow section exists as schematically shown in Figure 55. In this Survey, the pavement condition data are classified by inbound and outbound routes; the data need to be continuous for both in and outbound directions. The narrow section of the roads would possibly be widened as to improve pavement conditions. The data need to be prepared as anticipating future uses.

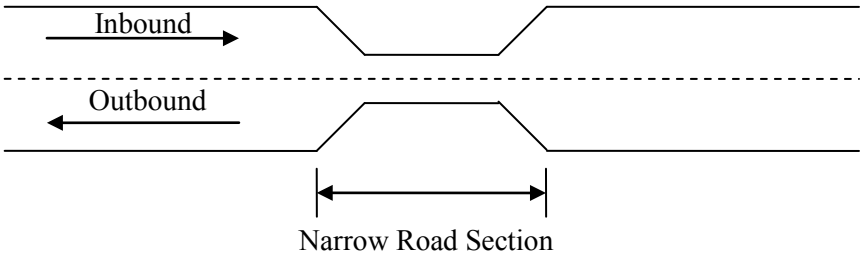


Figure 55 Narrow Road Section

8. PROPOSAL ON DATA FILES UTILIZATION

The Survey, through the process of the pavement condition survey, prepared 1) pavement condition data file and 2) forward view images. The results can be utilized for road maintenance administration in Vietnam.

The usage of the pavement condition data files and forward view images were proposed and presented to and discussed with the participants during the workshop held on February 28, 2013.

(1) Utilization as Inventory Data

The Survey included the following items to be checked and measured. The items were the ones discussed and agreed with the Vietnam side to be recorded in the data files.

- Road lengths
- Boundaries of administrative jurisdictions and road management company
- Locations of kilometer posts
- Distance between kilometer posts
- Locations of road structures (bridges) and names of bridges

The data are road inventory data to be the basis of road maintenance. The pavement condition data files prepared during the Survey can be used to update the road inventory data.

(2) Pavement Maintenance Plan Preparation

The Survey assessed pavement damages every 100 meters using three indices: 1) Crack ratio; 2) Rut depth; 3) IRI. The pavement condition is also assessed by dividing road segments by locations of bridges and pavement surface types (asphalt cement or concrete cement).

Using the results of the assessment, a pavement maintenance plan can be prepared. Following items of pavement maintenance planning would be possible: Identification of pavement maintenance locations; Cost estimation for pavement maintenance; and Prioritization of pavement maintenance.

(3) Future Plans for Road Maintenance Plan

With the pavement condition data files prepared during the Survey and continuous pavement condition surveys based on the Survey, road management planning becomes possible.

By conducting the pavement condition survey on the same routes and by combining the pavement condition survey data, changes of pavement damage can be identified by road segment. Further, by combining the maintenance data with locational data, road maintenance archive data can be prepared. With the road maintenance archive data, following analyses can become possible:

- Pavement deterioration time-series simulation (Pavement deterioration projection modeling)
- Projection of road maintenance costs
- Mid-to-long term road maintenance planning

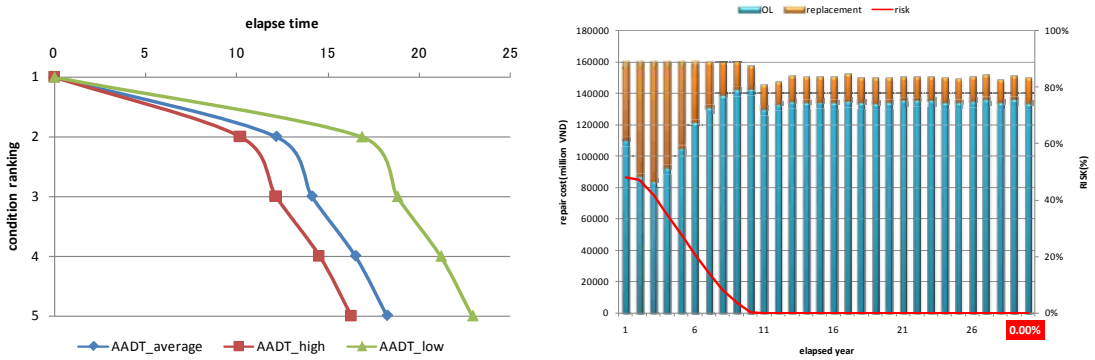


Figure 56 Pavement Deterioration Time Series Simulation and Maintenance Cost Projection (Example)

(4) Daily Use of Forward View Road Image Data

During the Survey, the forward view images for all the survey routes were acquired. The forward view images are link to the GPS data by route. The forward view images include not only the pavement conditions, but also surrounding area conditions such as shoulders, drainage and road signs. The images can be used for daily road maintenance work as reference for on-site works. More specifically, the images can be used for:

- Confirming road and surrounding conditions daily in offices; and
- Confirming locations of road facilities other than pavement conditions.

Figure 57 A System with Forward Road View Imanges and GIS (Example)

(5) Inventory Study Using the Forward View Road Image Data

The forward view camera captured images every five meters both inbound and outbound directions of the survey routes.

When the forward view images and pavement condition survey data are combined, road facility locations can be identified at a precision of five meters by viewing the forward view images. It would become possible to acquire inventory data without conducting on-site surveys such as:

- Acquisition of road facility locations using the forward view images; and
- Confirmation of basic information of road facilities using the forward view images.

Figure 58 Road Inventory Survey using the Forward View Images

9. RECOMMENDATIONS: CONTINUOUS PAVEMENT CONDITION SURVEY IMPLEMENTATION

Following matters are recommended for continuous implementation of the pavement condition survey.

Continuous Training using the Basic Operation Manual

During the Survey, the Basic Operation Manual has been prepared to conduct the collaboration work items. In order to stabilize the technology as the pavement condition surveys will be implemented continuously in Vietnam, the Basic Operation Manual shall be used to train required personnel.

Management and Revision of the Basic Operation Manual

The Basic Operation Manual has been prepared based on the work items conducted during the Survey. It is expected that various revision would be required as the pavement condition surveys would be implemented over years. It is recommended that DRVN manage and update the Basic Operation Manual.

Regular Maintenance of the Road Condition Survey Vehicle and On-Board Devices

The road condition survey vehicle shall be maintained regularly as the pavement condition survey would be implemented regularly. It is recommended that regular maintenance contract shall be signed with the provider of the road condition survey vehicle for timely responses to possible malfunctions of equipment or inquires on operation of the equipment.

Regular cleaning and minor inspection shall be conducted to monitor the condition of the vehicle and equipment.

Precision Calibration of the Road condition survey vehicle

The road condition survey vehicle may have less precision due to wear and tear of equipment naturally occur due to repeated uses. Regular inspection on precision shall be carried out and calibrate equipment if necessary to secure required precision. On precision inspection, it is recommended that maintenance contract shall be signed with the provider of the vehicle and equipment.

Appendices

Meeting Records

No	Date	Subject	Venue
1	March 9, 2012	Meeting on Explanation of Output in draft Specifications	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
2	March 15, 2012	Meeting on Explanation and Discussion of Inception Report	Meeting Room: DRVN
3	March 16, 2012	Meeting on Discussion of draft Specifications	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
4	March 22, 2012	Meeting on Discussion of Pavement Condition Survey	Meeting Room: the Pavement Data Collection Survey Team
5	March 27, 2012	Meeting on Discussion of Specifications	Meeting Room: DRVN
6	April 3, 2012	Meeting on Confirmation of Survey Routes	Meeting Room: RRMU2
7	April 5, 2012	Meeting on Issues of Road Database	Meeting Room: DRVN
8	April 23, 2012	Coordination Meeting on Field Reconnaissance	Meeting Room: RRMU2
9	June 15, 2012	Meeting on Explanation and Discussion of Field Reconnaissance Report	Meeting Room: DRVN
10	June 27, 2012	Meeting on Confirmation of Field Reconnaissance Results and Plan for the Pavement Condition Survey	Meeting Room: DRVN
11	July 24, 2012	Meeting on Discussion of the Survey Route Length	Meeting Room: the Project for Capacity Enhancement in Road Maintenance
12	July 27, 2012	Meeting on Confirmation of Survey Route	Meeting Room: DRVN
13	August 29, 2012	Meeting on Clarification Meeting on Stations Used in Road Survey	Meeting Room: RRMU2
14	September 20, 2012	Meeting on Stations Used in Pavement Condition Survey	Meeting Room: DRVN
15	December 11, 2012	Meeting on Explanation about Data Output, Questionnaire and Workshop	Meeting Room: DRVN
16	January 31, 2013	Meeting on Discussion on Preparing for the Workshop held on February 28, 2013	PMU Director's Room
17	February 28, 2013	Discussion Record: Workshop on Pavement Data Collection Survey	Conference Room: the Daewoo Hotel

Meeting Record No. 1

March 9, 2012

Meeting on Explanation of Output in draft Specifications

Meeting Room: the Project for Capacity Enhancement in Road Maintenance

MINUTES OF MEETING

Activity	Activity 2-1
Target:	Pavement Condition Survey
Time:	09th March 2012, Time: 13:30 – 16:20
Location	JICA Study Team Office
Participant	- Pavement Condition Survey (PCS) Team 1. Mr. Kokufu, Team Leader 2. Mr. Soma, Equipment Operation 1 3. Mr. Tsuchiya, Equipment Operation 2 4. Mr. K.Aoki, Coordinator
	- JICA study (CERM) team: Mr. Mori, Mr. Matsuda,
Handover material:	From PCS Team: Output Specification (Japanese) From CERM Team: Data item to be collected during Site Survey (Draft, Japanese) (Refer to Attached files)

Major contents of meeting

CERM and PCS teams had a meeting on Friday 9th March, 2012 regarding Specification of PCS and Data items to be collected during the PCS. The major contents are as follows:

1. PCS team explained output of the site survey to be conducted during April and December 2012 based on the handover material. The summary is shown as follows:
   a) Necessary Data as per the contract;
      1) Quantity sheet (List of target surveyed roads) includes province, class, route No., branch No. route name, kilometer post, section length, total length and comments
      2) Location map for surveyed roads
      3) List of Pavement condition each 100m interval such as same as 1), and analysis width, structure, lane No., survey lane, pavement structure, conditions (cracking ratio, index, rutting depth and IRI)
   b) Recommended Data
      1) Cumulative Frequency Matrix (crack, rutting and IRI) by each province, route, route in province.
      2) Evaluation map (color marked each road in accordance with damaged grade)
      3) Visual view (linked map and video in the same screen)
2. CERM team explained necessary data to be utilized Pavement Management System (PMS) and Pavement Monitoring System (PMOS) as per the material. The items are as follows:
   a) Road Inventory Data

1) Administrative organization (i.e. RRMU2, RRMC and others)
2) Administration Boundary (i.e. province)
3) Route No.
4) Route Branch No.
5) Right or Left lane
6) Kilometer post
7) Longitude and Latitude
8) Distance in section
9) Carriageway width
10) Pavement width
11) Number of lane
12) Number of lane surveyed
13) Road facilities (i.e. bridge, tunnel, intersection, roundabout, railway crossing, viaduct and so on)
14) Vertical curve

b) Pavement condition data

1) Date to be surveyed
2) Pavement type (i.e. Cement concrete, Asphalt Concrete: AC, Bituminous Penetration Macadam: BPM, Gravel and Earth)
3) Crack rate (unit: %, each 100m and over 2mm opening crack)
4) Patching rate (unit: %)
5) Potholes (unit: number)
6) Rutting depth (unit: mm, Max and Average, each 100m and accuracy ±6mm)
7) IRI (unit: mm, each 100m section)
8) Road Image (each route, the image associated with GPS)

3. PCS team requested to prepare definition of each item explained by CERM team such as 5) Right or Left lane, 11) No. of lane in case if without marking, 12) No. of lane surveyed and measurement points of 13) Road facilities as shown in a) of the above. CERM team will prepare the definition of each item.
4. Regarding 5) Potholes (unit: number) CERM mentioned, CERM team is required to confirm that PCS team should analyze pothole area or pothole number in accordance with PCS team's suggestion.
5. PCS team also pointed out that it is difficult to measure 9) Carriageway and 10) Pavement widths since there are so many different road cross section points and they can't measure during limited site survey period. Instead of the direct survey at the sites, they recommended that using by topographic maps with scale of 1: 50,000 for all area and 1:10,000 for major urban area. The major roads in the maps are shown by different lines as per the number of lanes. They also added that measurement of Intersection under Item 13) of a) is also difficult due to the same reason.

CERM team will internally talk and inform to PCS team about above matters.

6. Regarding 8) Road image of b), PCS team suggested saving image file by each province since some roads are very long as the result one volume of the file is become large and heavy. It will be discussed with WG-3 because the image will be used under PMOS.
7. PCS team said about IRI value that the measurement results will be different if measured by ROMDAS (used HDM-4, Level 3 machine) and equipment using PCS in this time (Level 2 machine). Therefore, it is necessary calibration test of ROMDAS if use previous HDM-4 data.
   CERM team will internally talk and inform to PCS team about above matters.
8. In accordance with the schedule of the initial field survey to be conducted from the beginning of April, 2012, PCS team requested to finalize the above matters before starting the field survey. CERM team has understood the proposed schedule.

The meeting was adjourned at 16:20.

Meeting Record No. 2

March 15, 2012

Meeting on Explanation and Discussion of Inception Report

Meeting Room: DRVN

MINUTES OF MEETING

ON

INCEPTION REPORT

FOR

PAVEMENT DATA COLLECTION SURVEY
IN
THE SOCIALIST REPUBLIC OF VIET NAM

Hanoi, March 15 2012

NGUYEN DUC CUONG
Director of TA PMU
Directorate for Roads of Vietnam
Ministry of Transport
The Socialist Republic of Vietnam

YUTAKA KOKUFU
Team Leader
Survey Team
Japan International Cooperation Agency
Japan

I. INTRODUCTION

The JICA Survey Team (hereinafter referred to as "the Survey Team") for the "Pavement Data Collection Survey", in The Socialist Republic of Vietnam (hereinafter referred to as "the Survey") dispatched by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Yutaka KOKUFU commenced the Survey in The Socialist Republic of Vietnam on March 5. 2012 for the data to be used in the project for Capacity Enhancement in Road Maintenance (hereinafter referred to as "the JICA Project").

The Survey Team presented and explained the contents of the Inception Report to the officials of Directorate for Roads of Vietnam (hereinafter referred to as "DRVN") as the counterpart agency on March 15, 2012.

The DRVN accepted the Inception Report and agreed the contents of the work plan, the work schedule, the survey methods and the outputs of the Survey.

II. COMMENTS AND REQUESTS

DRVN officials reviewed the Inception Report and raised comments and requests on the contents of the Survey:

A. On the Methodology

1. The Survey Team shall be confirmed the data items presented are sufficient for utilization in the JICA Project.
2. The Survey Team shall be confirmed that the indicators presented can be covered with the surveying car (Real Mini configuration).
3. The Survey Team shall be confirmed the format of pavement condition data file having proper utilization.
4. DRVN requested that the pavement condition data shall be made compatibility data with the databases of Project on Transportation Information System for the Road Sector of DRVN.
5. DRVN requested that pavement loading capacity data and pavement structure data should include on the items of pavement condition data for big repairs. (But They understood that it is out of scope of work or TOR of the survey team.)
6. DRVN requested that the pavement condition data includes the bearing capacity of national road structure items using FWD.

B. On Equipment

1. DRVN requested that the Survey Team shall be provided a equipment for pavement condition survey and a software for the Pavement condition analysis after the completion of the survey.

2. A car for the pavemnt condition survey shall be procured by the Survey Team as soon as possible, since available cars of the counterpart are not suitable for usage.

C. On Technology Transfer

1. DRVN made proposal that the number of participants to the training shall be increased.
2. DRVN requested on-the-job training shall be conducted since the beginning and during time of implementing the survey for ensuring efficient and sufficient technology transfer to the counterpart after the completion of the JICA project.
3. The Survey Team should prepare detailed manuals and guidelines to sustain the operation after the end of the survey .

D. Administration

1. DRVN requested financial support for the staff who work full time with the Survey Team. DRVN will also send a official request letter to JICA on financial support for staff working full time with the survey team.

The Survey Team acknowledged the comments and requests, and agreed to convey them to the JICA headquarters.

III. AGREEMENTS

Other than the comments and requests from the DRVN, both parties agreed on the following matters:

A. Both sides agreed that the pavement condition Survey and data analysis shall be conducted in collaboration with DRVN and the Survey Team.

B. DRVN shall be assigned staff from RRMU2 and DRVN for the collaboration work and workshop.

C. DRVN shall be provided available maps and road management materials and ID cards/introduction letter necessary for the Survey Team. As for the digital maps, DRVN will be prepared a request letter to MONRE.

D. DRVN shall be supported to hold the Workshop.

IV. Attachments:

A. Inception Report

B. Table of Collaboration Work Schedule and Members

C. List of Attendants

Attachment A. Inception Report

THE PAVEMENT DATA COLLECTION SURVEY

IN

THE SOCIALIST REPUBLIC OF VIET NAM

INCEPTION REPORT

February, 2012

PASCO Corporation

Table of Contents

Tables

Figures

1. Background

The 9th Five-Year Socio-Economic Development Plan (2011-15), targeting sustainable development in an era of continuing high growth, the Socialist Republic of Vietnam (hereinafter referred to as "Vietnam") positions development of infrastructure management systems, including transportation infrastructure, as the highest issue to be tackled for further development. In line with the national development plan, rehabilitation and new construction of national road network are underway with the national budget and financial assistance from the Yen loans, the World Bank, the ADB and other international organizations. As a result, the national road network reached a total length of 17,385km in 2010, and the network is still expanding. Development of national roads is crucial in transport and traffic infrastructure and contributes to economic development.

While the road network has been steadily expanding, maintenance and management need to be strengthened including budget allocations and capacity development of relevant organizations and individuals nationwide. JICA has been committed to assist to enhancing quality of road maintenance and management through technical cooperation projects for national roads and expressways among other projects. Unfortunately, the results of the survey on pavement condition in 2004 and 2007 were not what would be required for future pavement management for their lack of survey items and inadequate data.

Under such circumstances, the pavement data collection survey aims to collect basic data for setting direction on road-related cooperation, and for the data to be used in the Project for Capacity Enhancement in Road Maintenance.

2. Outline of the Project

2.1 Objectives

Preparation of Survey Data File on Data Condition:

Based on the specifications, the data collection survey will be conducted to create pavement condition data file from the results.

Technical Support for the Usage of the Pavement Data:

The survey will be conducted with the Counterpart. Through the cooperative activities, the methods of survey and analysis will be transferred. The Survey Team will support the Counterpart on the usage of the data.

2.2 Targets

(1) The Target Route

The inspection will target national roads of 2,303km in both directions (4,606 km) in the north of the country under the jurisdiction of the Regional Road Management Unit 2 (RRMU2).

The area is in REGION 2. Within Region 2, three are the national roads with a total length of about 2,500 km, and other roads 4,500 km.

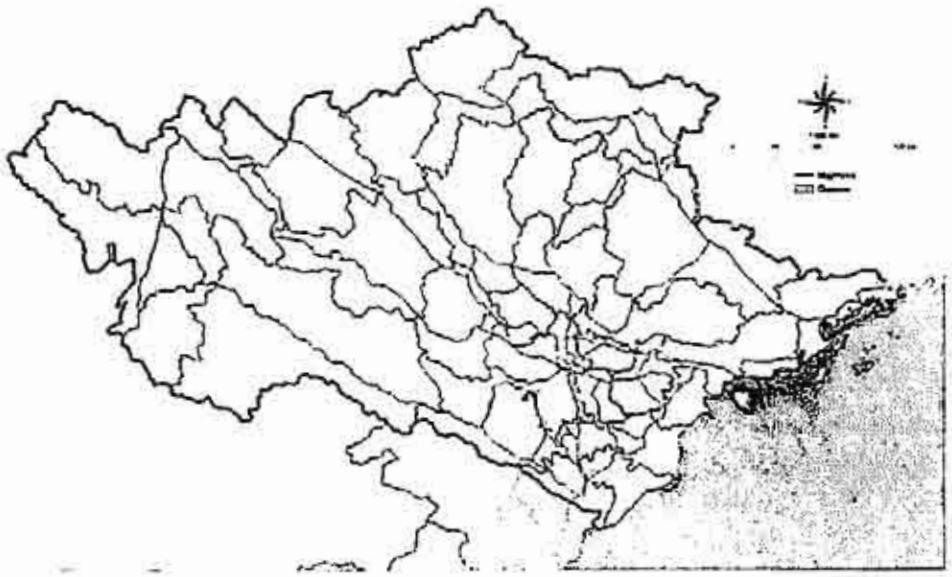


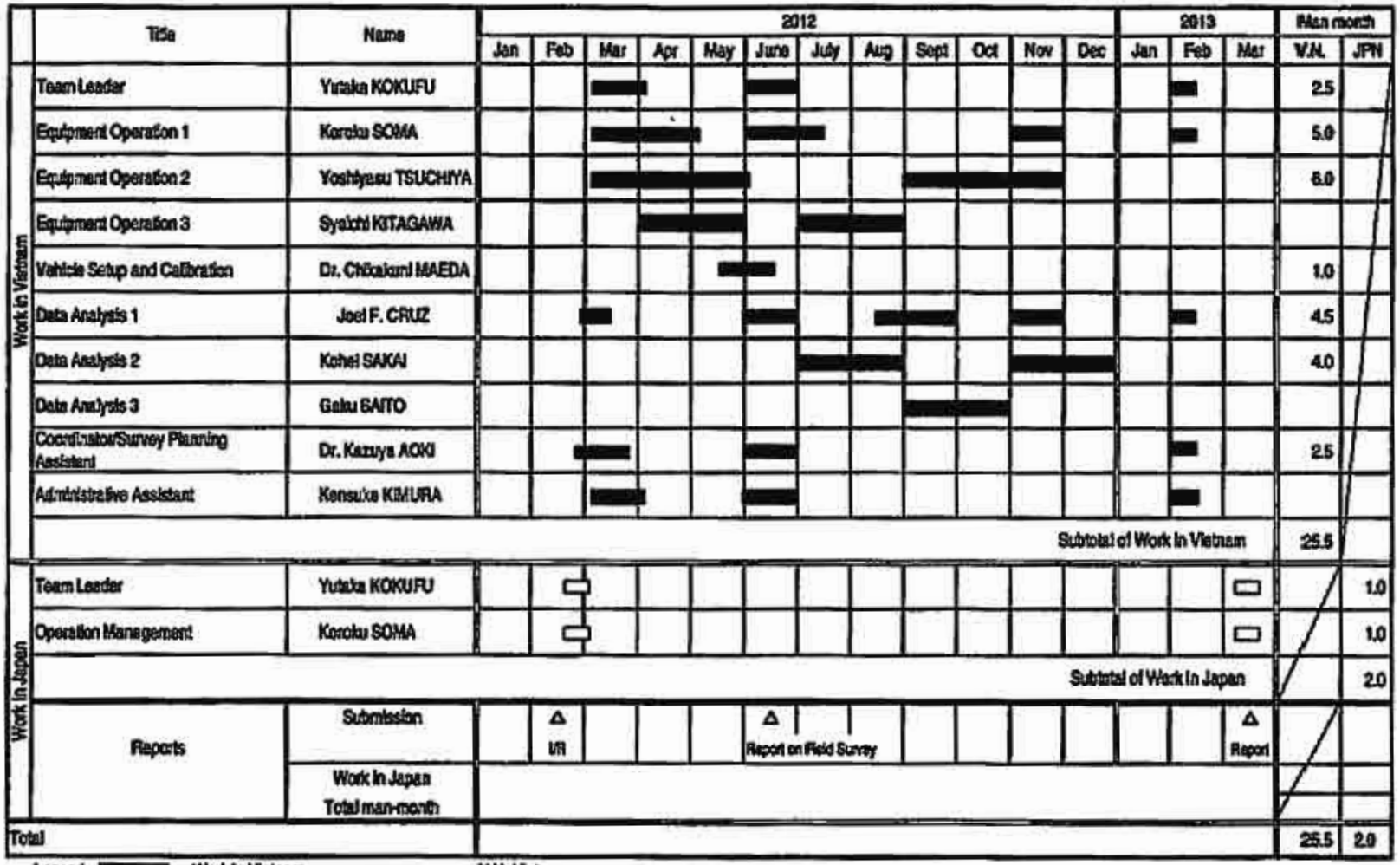
Figure 1 Survey Area

(2) Technology Transfer

The Directorate for Roads of Vietnam (DRVN) of the Ministry of Transport is the target organization of technology transfer on the survey methods and data analysis. DRVN, the Planning and Investment Department, PRMU2, RTC-CENTRAL are the organizations target to support data utilization.

2.3 Assignment

The assignment schedule of the members is shown in the chart:



	Title	Name	2012 Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec	2013 Jan	Feb	Mar	Man month V.N.	JPN
Work in Vietnam	Team Leader	Yutaka KOKUFU			■			■								■		2.5	
	Equipment Operation 1	Koroku SOMA			■	■		■	■				■			■		5.0	
	Equipment Operation 2	Yoshiyasu TSUCHIYA			■	■	■				■	■	■					6.0	
	Equipment Operation 3	Syuichi KITAGAWA				■	■		■	■									
	Vehicle Setup and Calibration	Dr. Chikaomi MAEDA					■	■										1.0	
	Data Analysis 1	Joel F. CRUZ			■			■		■	■		■			■		4.5	
	Data Analysis 2	Kohei SAKAI							■	■			■	■				4.0	
	Data Analysis 3	Gaku SAITO									■	■							
	Coordinator/Survey Planning Assistant	Dr. Kazuya AOKI			■			■								■		2.5	
	Administrative Assistant	Kensuke KIMURA			■			■								■			
																		Subtotal of Work in Vietnam	25.5	
Work in Japan	Team Leader	Yutaka KOKUFU		□													□		1.0
	Operation Management	Koroku SOMA		□													□		1.0
																		Subtotal of Work in Japan	2.0
	Reports	Submission		△ I/R				△ Report on Field Survey									△ Report		
		Work in Japan Total man-month																	
Total																		25.5	2.0

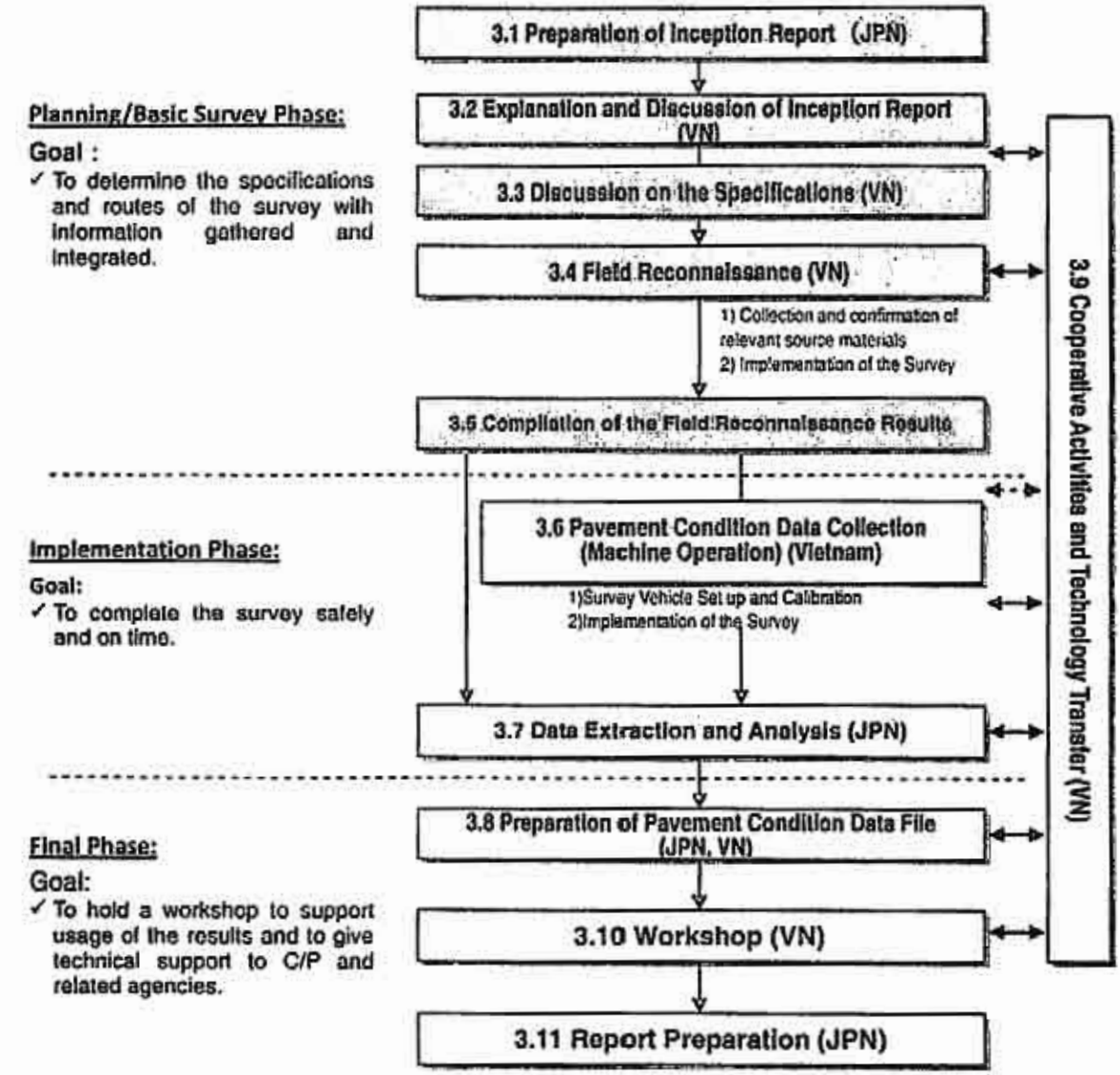
Legend ■ Work in Vietnam
□ Work in Japan

V.N. Vietnam
JPN: Japan

Figure 2 Assignment Schedule

2.4 Work Flow

The general work flow of the survey implementation and basic goals in three phases are shown in the following chart:



Note) JPN: Japan VN: Vietnam

Figure 3 Survey Flowchart

The operation schedule is shown in the following chart:

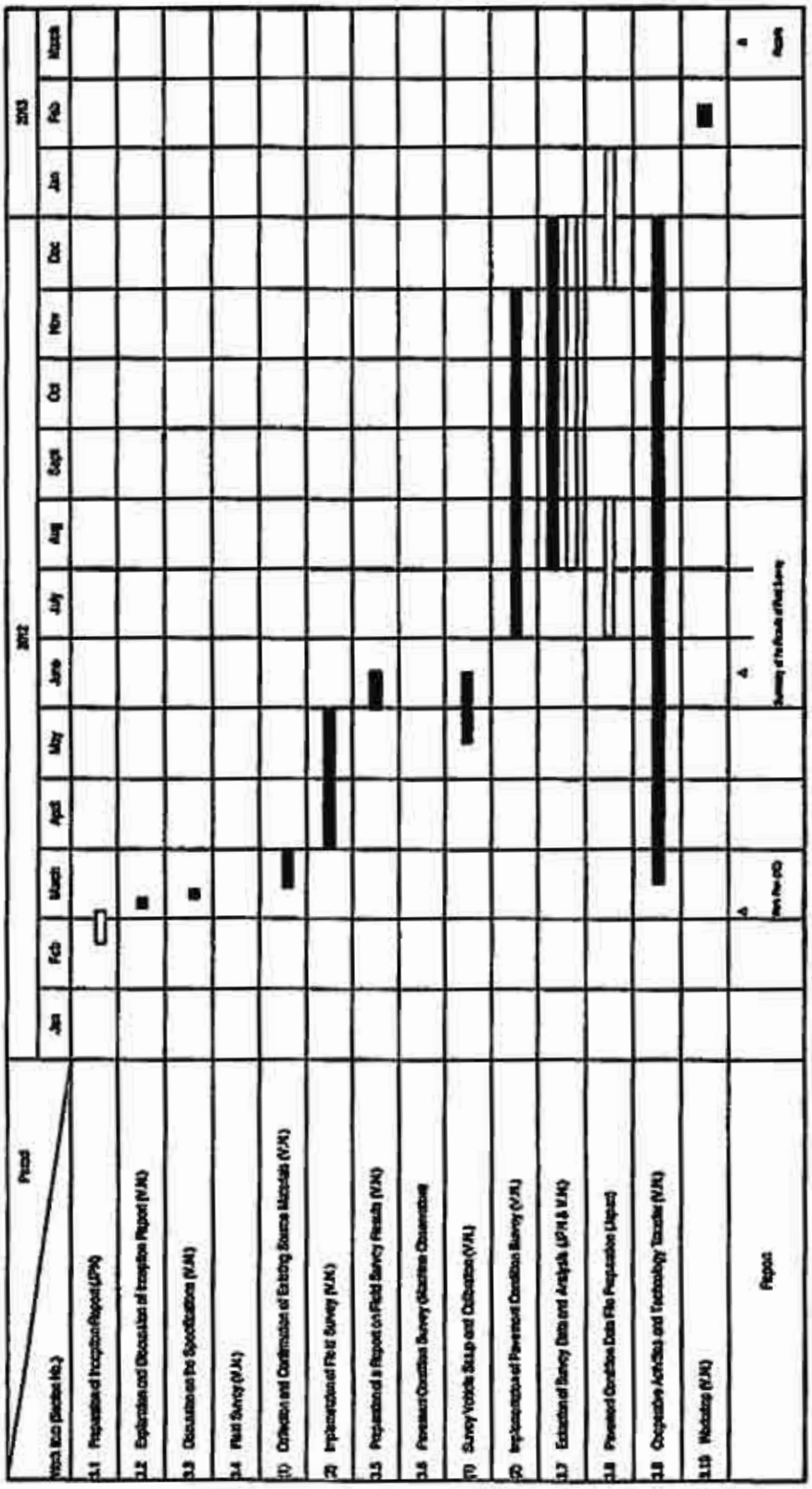


Figure 4 Operation Schedule

2.5 Basic Policies

The basic policies for the survey implementation are listed as follows:

(1) Cooperation with officers of relevant organizations in field surveys, measurement and analytical work

The work on the field survey, measurements and survey of pavement conditions and data extraction and analysis shall be conducted with the technical staff of the counterpart. During the work technology transfer will be conducted on: the method of survey; operation consideration during the survey; data usage after the survey; and implementation on the survey on pavement conditions.

(2) Clarification of the role of officers of the relevant organizations in the cooperative work

The survey on pavement data collection has three major items: 1) Field survey (Field survey and measurement); 2) Operation and management of the survey vehicle; 3) Data analysis and application. The roles and responsibilities of the staff shall be clarified during the discussion on the Inception Report for the method to be used sustainably after the termination of the survey. The implementation plan for the cooperative work shall be prepared.

(3) Coordination and consultation among road-related organizations

Data obtained in the survey will be used for the Project for Capacity Enhancement in Road Maintenance which is underway in Vietnam or for other projects; therefore, those that will use the data will be called and matters shall be discussed to define the data collection items and data application before implementation of the survey.

(4) Procurement of the Pavement Survey Vehicle

The vehicle which will be used for the survey is registered at NETIS (New Technology Information System, Registration Number of the Ministry of Land, Infrastructure, Transport and Tourism: KT-110060-A), and has been technically highly evaluated.

The survey vehicle and equipment will be exported from Japan to Vietnam. The Survey Team will request administrative support in securing the import permit to JICA Vietnam Office and the counterpart.

(5) Maintenance and management of the survey vehicle

The vehicle planned to be used during the survey is designed and prepared in Japan. The use of the vehicle increases the efficiency in data collection; however, when it malfunctions, the overall schedule may be delayed. To avoid unexpected problem, an expert is assigned to setup and calibrate the equipment and to maintain the vehicle regularly.

(6) Security arrangements for pavement survey vehicle

Since the survey covers roads in a wide area in RRMU2, we intend to secure storage sites for the vehicle and survey devices to minimize the overall travel distance as well as to secure safe operation. At the same time, to prevent any substantial delay in schedule due to loss of or damage to the vehicles or devices, or any other accidental circumstances, we will enhance security arrangements by, for example, using security alarms and stationing security guards at the storage sites.

(7) Method of creating data sheets on pavement condition

Versatile data formats (such as Microsoft Excel, CSV or other text formats) will be adopted so that the data obtained can be used for various purposes in future. The data formats will be discussed with the counterpart and determined.

(8) Preparation of an operation plan to avoid weather-related risks in the rainy season

The survey will be conducted when the weather is fine to secure accuracy of the survey. In Hanoi, the monthly rainfall peaks in August, when the survey is scheduled to commence. The weather may affect the schedule of the survey; therefore, weather conditions and reports will be studied to plan a flexible schedule to minimize the risk incurred by bad weather.

(9) Selection of routes and lengths

The routes and lengths of the survey will be determined during the discussion of the Inception Report. During the discussion, existing data and reference materials will be used to select the routes. The area is planned to be within the jurisdiction of RRMU2. The route planned is the national road with a length of 2,303 km--both ways are planned to be surveyed. The route will be confirmed with the counterpart, and the results will be summarized as a filed survey report (summary).

2.6 Operation Implementation Structure

The survey will be implemented by JICA, the couterpart, and the survey team. The following chart shows the structure of the survey implementation.

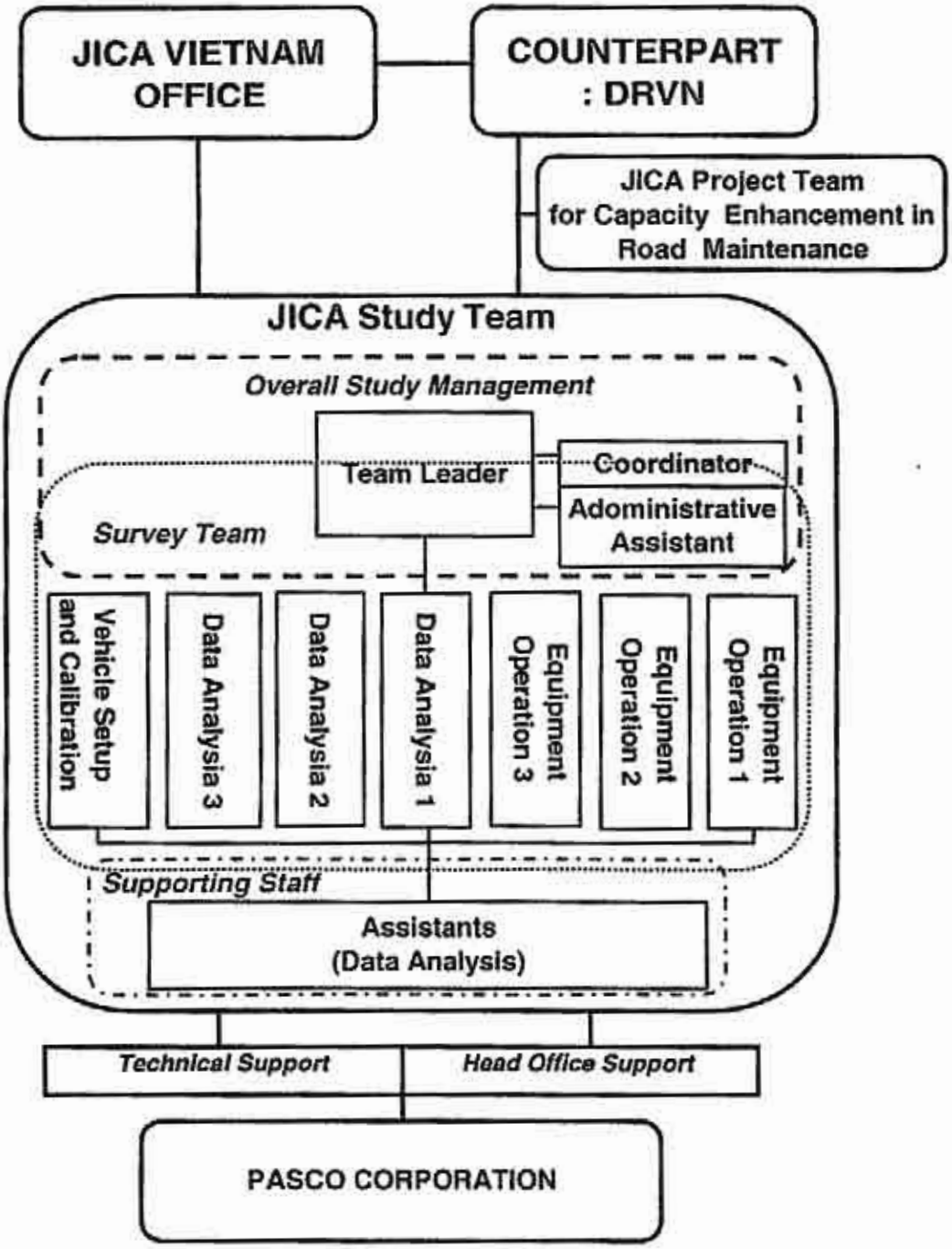


Figure 5 Survey Implementation Structure

3. Methods

3.1 Preparation of Inception Report (Work in Japan)

The Inception Report is prepared based on the TOR of JICA and studying the reference materials to formulate the overall implementation method and schedule of the survey. The basic policies for implementation, survey method, operation plan, manning schedule and technology transfer (support) and other necessary items of the survey implementation are included in the Inception Report. In the Inception Report, responsibilities of the Vietnam side, to be discussed and agreed, are specified, also.

3.2 Explanation and Discussion on the Inception Report (Work in Vietnam)

The contents of the Inception Report is explained, discussed and agreed. Especially, selection of the routes is discussed with the counterpart. The target routes and lengths are confirmed. The operation plan for the cooperative activities is discussed and prepared to be attached to the Inception Report.

3.3 Discussion on the Specifications (Work in Vietnam)

The specifications of the pavement data files to be prepared during the survey shall be discussed with the counterpart and agreed. The principle of the specification shall be the Manual for Pavement Survey and Its Measuring Methods (Japan Road Association). The contents in Table 1 will be confirmed with the counterpart, also.

Table 1 Data Items to be Acquired

Category	Item to be acquired
Common	Code of RRMU
	Route number
	Classification of current, old and new roads
	Branch number
	Classification of upbound and downbound
	Kilometer posts (starting and ending points)
Road administration data	Classification of road administration (offices, local stations, etc.) Data concerning administrative classifications Data concerning distances among kilometer posts
Management attribute data	Traffic lane compositions Road structures Crossroads
Data by surface type	Surface type

3.4 Field Reconnaissance (Work in Vietnam)

(1) Collection and Review of Existing Reference Materials

Before the field reconnaissance, basic information--reference materials, inventory data and related maps--shall be collected and reviewed.

(2) Implementation of Field Reconnaissance

During the field reconnaissance, a vehicle, other than the specialized survey vehicle, is used to

record and confirm conditions such as segments of routes like locations of kilo-posts for: 1) the pavement data collection survey; 2) extraction and analysis of the survey data; and 3) preparation of the data files.

The data collection shall be conducted in accordance with Section 3.2 and 3.3.

3.5 Compilation of the Field Reconnaissance Results (Work in Vietnam)

A summary of the findings of the field reconnaissance include: implementation policy and the method of pavement data collection resulted after series of meetings with government officials and related parties with relevant projects; conditions of the routes; and points to be noted for implementation. Based on the results, selection of the routes are finalized with an agreement.

3.6 Pavement Condition Survey (Machine measurement) (Work in Vietnam)

(1) Set-up and calibration of the survey vehicles

Prior to the pavement data collection, the experts will set-up and calibrate the survey vehicle to meet conditions of the roads in Vietnam.

(2) Implementation of pavement data collection

With the survey vehicle, the pavement conditions (cracking rate, rutting depth (IRI: International Roughness Index)) will be measured and recorded. Training for the operation of the vehicle will be conducted by the Japanese experts to the counterpart. The function and accuracy of measurements and overview images of the vehicle are shown in Table 3 and Figure 2, respectively.

Table 2 Functions and Performance of Pavement Survey Vehicle

Functions	Performance
Distance	Accuracy to within ±0.5% for values actually measured by tape
Cracking	Accuracy to be able to detect any crack of 2 mm or more in width
Rutting	Accuracy to within ±5mm for values actually measured in the cross-sectional profile graphs
International Roughness Index, IRI	Devices to measure cross-sectional profiles satisfy the accuracy of Class 2. (complying with the "Handbook for Pavement Survey and Test Methods")
Road images	Full high-vision CCD cameras (1,920 (w) x 1,080 (h))
GPS data	Accuracy of point positioning, and measurement of longitude, latitude and altitude

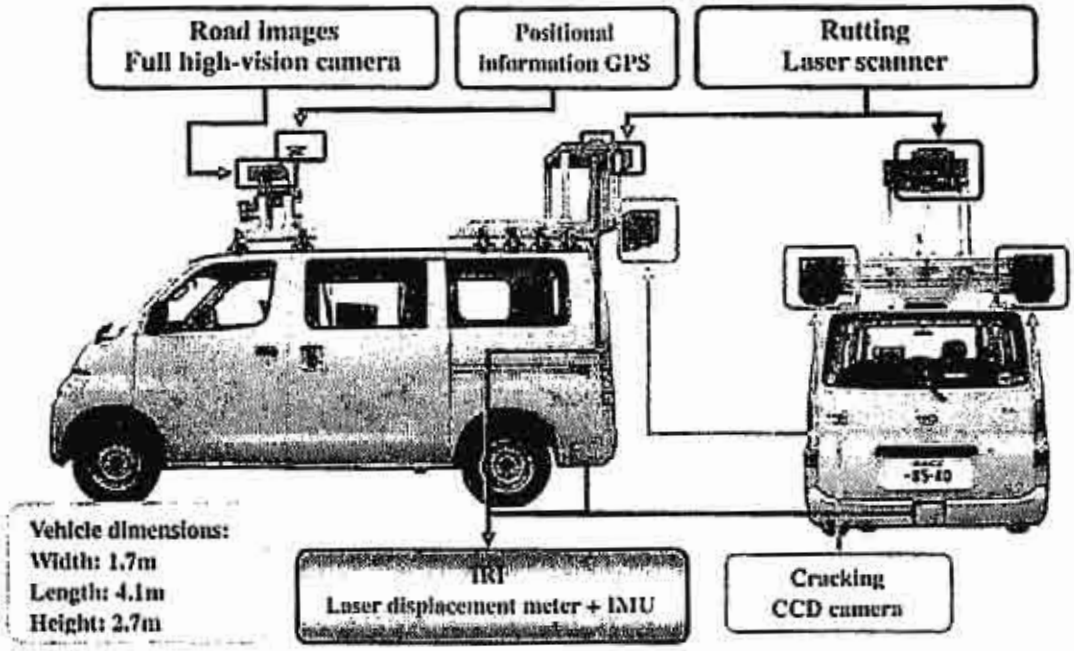


Figure 6 Overview Image of the Pavement Survey Vehicle

3.7 Data Extraction and Analysis (Work in Japan and Vietnam)

The data will be extracted and analyzed. The method for analysis will be in accordance with the specifications determined during the discussion on the specification.

The analysis of data concerning the pavement conditions will be carried out simultaneously both in Japan and Vietnam to process large amount of data in a limited time period and for the technology to be used in future in Vietnam.

For data analysis in Vietnam, a multiple sets of analytical systems will be adopted for efficient implementation. At the same time, operation manuals for the analytical systems will be prepared, and training for data extraction and analysis will be conducted to standardize the operation and to transfer the technology.

For the analysis of data on pavement conditions, the analytical system shown in Figure 8 will be used. The system can view both the images of pavement and the front view allowing confirmation of surrounding areas.

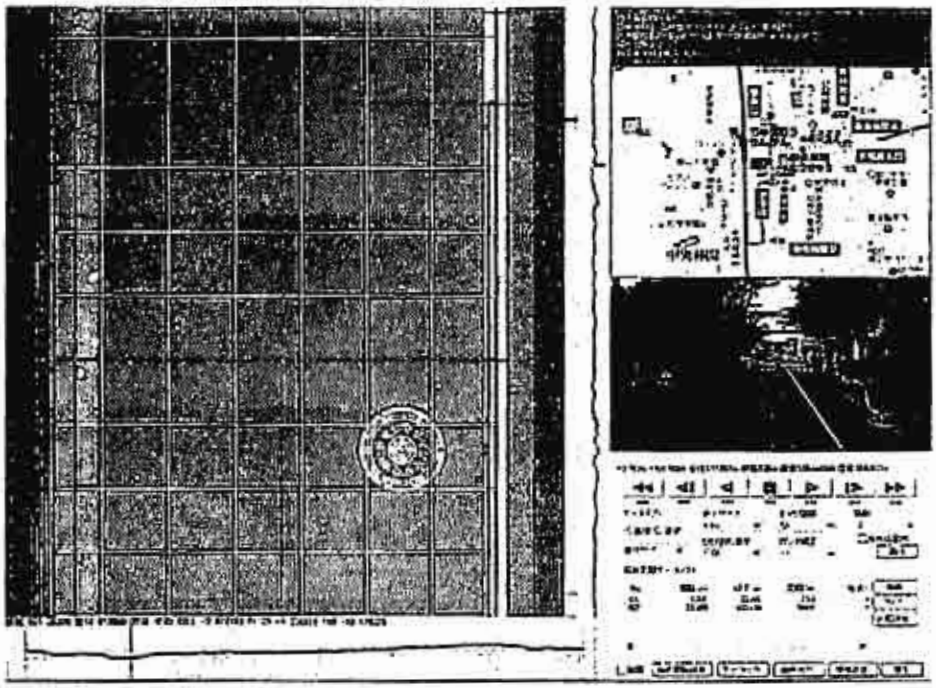


Figure 7 Pavement Data Analysis System (Screen Image)

3.8 Preparation of Data Files on Pavement Cconditions

Data files on pavement conditions will be prepared by combining the field reconnaissance (road administration data, data concerning special characteristics for administration, data by nature of pavement, etc.) and analysis (cracking, rutting and IRI data). Data concerning road images will be edited by route with GPS data. Table 3 shows the contents of the data file.

Table 3 Format of Data Files for Pavement Conditions (Example)

Office code	Local station code	Local station	Route			Upbound or downbound	No. of lanes subject to surveys	No of lanes	Zone		Zone length (m)	Structure		Point name	Province
			No.	Branch No	Current, Old or New				Starting point (m)	Ending point (m)		1	2		
30	83	National Road Maintenance	19			Downbound	2	2	34k 115	34k 165	50				
30	83	National Road Maintenance	19			Downbound	2	2	34k 165	34k 200	35				
30	83	National Road Maintenance	19			Downbound	2	2	34k 200	34k 300	100				
30	83	National Road Maintenance	19			Downbound	2	2	34k 300	34k 390	90				
30	83	National Road Maintenance	19			Downbound	2	2	34k 390	34k 400	10	B			
30	83	National Road Maintenance	19			Downbound	2	2	34k 400	34k 405	5	B			
30	83	National Road Maintenance	19			Downbound	2	2	34k 405	34k 500	95				
30	83	National Road Maintenance	19			Downbound	2	2	34k 500	34k 600	100				
30	83	National Road Maintenance	19			Downbound	2	2	34k 600	34k 700	100				
30	83	National Road Maintenance	19			Downbound	2	2	34k 700	34k 800	100				
30	83	National Road Maintenance	19			Downbound	2	2	34k 800	34k 900	100				
30	83	National Road Maintenance	19			Downbound	2	2	34k 900	34k 960	60				
30	83	National Road Maintenance	19			Downbound	2	2	34k 960	34k 1000	40				
30	83	National Road Maintenance	19			Downbound	2	2	34k 1000	34k 1005	5				
30	83	National Road Maintenance	19			Downbound	2	2	35k 0	35k 10	10				
30	83	National Road Maintenance	19			Downbound	2	2	35k 10	35k 60	50				
30	83	National Road Maintenance	19			Downbound	2	2	35k 60	35k 100	40				
30	83	National Road Maintenance	19			Downbound	2	2	35k 100	35k 200	100				
30	83	National Road Maintenance	19			Downbound	2	2	35k 200	35k 300	100				
30	83	National Road Maintenance	19			Downbound	2	2	35k 300	35k 315	15	B			
30	83	National Road Maintenance	19			Downbound	2	2	35k 315	35k 400	85				
30	83	National Road Maintenance	19			Downbound	2	2	35k 400	35k 445	45				

3.9 Cooperative Activities and Technology Transfer (Work in Vietnam)

The field reconnaissance, pavement survey, and extraction and analysis of the data will be implemented together with engineers in Vietnam for them to learn the survey methods and uses of data among other matters in operation. Manuals and other documents necessary for the cooperative activities will be prepared both in English and Vietnamese.

Prior to the pavement survey and extraction/analysis of the data, basic training on the survey and operation using the vehicle will be carried out for engineers from relevant organizations in Vietnam.

3.10Workshop (Work in Vietnam)

The workshop will be held with the counterpart to proliferate the method to be used continuously in Vietnam. The contents of the workshop include: the contents of the data files and their uses; implementation procedure of the survey for pavement data collection; results of the survey; and findings of the survey operation.

The vehicle, equipment and system will be presented and demonstrated to enhance knowledge on the survey and uses of the data.

A workshop will be held in around February, 2012, when data files of the pavement conditions are completed. About 50 will be invited to take part in the event. Participation from the Planning & Investment Department, the Infrastructure Department, the Directorate for Roads, RRMU2, and the RTC-CENTRAL of the Ministry of Transport, as well as academics are expected.

3.11 Report Preparation (Work in Japan)

The outputs of the survey are listed in Table 4. The final outputs will be the items (2) and (3).

Table 4 Outputs

Outputs, etc.	Notes	No. of copies	Submission
(1) Work plan (Inception Report)	Basic policy, methods and work schedule, personnel plan and other implementation plans	10 Copies (Japanese) 10 copies to be submitted to the Vietnam government out of 15 copies (English)	At the time of commencement of the survey
(2) Field Reconnaissance Report (Summary)t	Results study and review; results of discussion on the survey and analysis with the Vietnam side until the end of the field reconnaissance	10 Copies (Japanese)	During the last ten days of June
(3) Survey report	Overall outputs of the survey, and achievements of technical transfer	10 Copies (Japanese) 15 Copies (English)	During the middle ten days of March, 2013
(4) Data file for pavement conditions	A set of data from the survey	One (1) CD-R submitted to the Vietnam government out of three CD-R: discs.	Mid-March, 2013

4. Requests to the Vietnam Side

For smooth implementation of the survey, the following items will be requested from the Survey Team to the Vietnam side.

Table 5 Requests to the Vietnam Side

Item	Descriptions
Providing data and information for route selection; providing IDs for the members	To implement the field reconnaissance survey and the data collection, the Vietnam side shall provide following materials: (1) Road management documents and maps (2) Road ledger and related forms (3) Digital topographic maps (MONRE) (3) IDs for the team members (4) Others that are deemed necessary
Administrative support on importing and operating the vehicle and equipment	Administrative support in importing the vehicle and equipment Supporting procedural requirements for operating the survey vehicle and conducting the survey to appropriate government agencies.
Providing staff for cooperative activities and technology transfer	Staff for cooperative activities and technology transfer: (1) Field reconnaissance—two (2) persons (2) Pavement data collection--one (1) person (3) Survey data extraction and analysis—eight (8) persons
Supporting the Workshop	Invitation to the workshop to participants: the Planning & Investment Department; the Infrastructure Department, the Directorate for Roads; RRMU2; and RTC-CENTRAL of the Ministry of Transport. Preparation of a participant list. Other supporting activities for holding the workshop such as registration.

Attachment B.

Table of Collaboration Work Schedule and Members

PAVEMENT DATA COLLECTION SURVEY
IN
THE SOCIALIST REPUBLIC OF VIET NAM

WORK SCHEDULE

FOR

COLLABRATION WORKS

AND

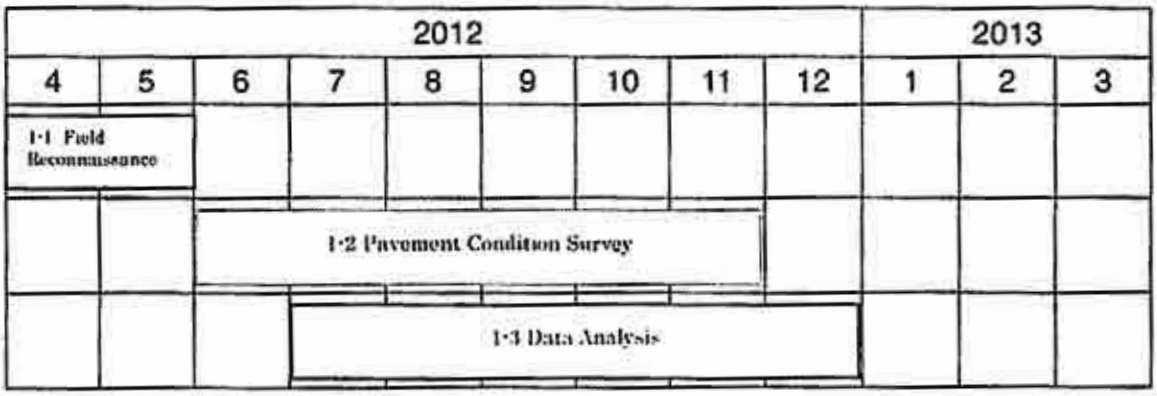
TECHNOLOGY TRANSFER

March 2012

PASCO Corporation

1. Work Plan

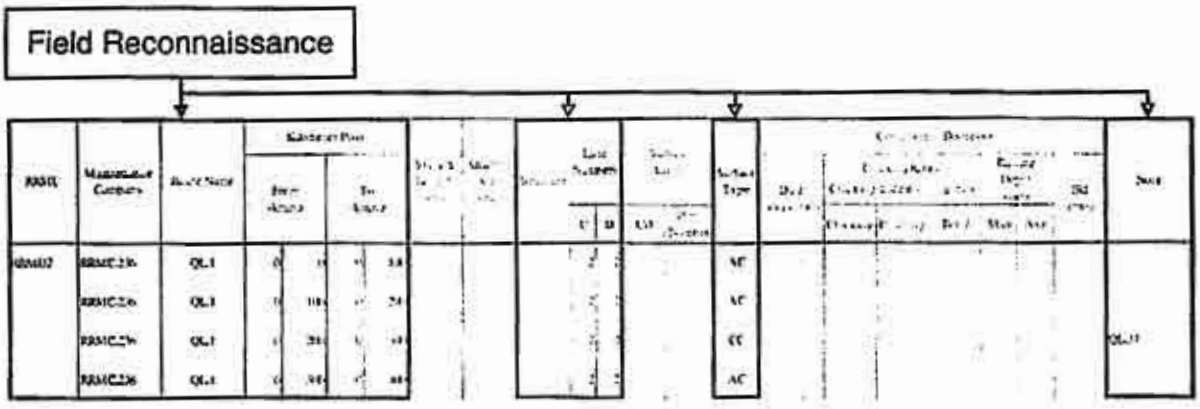
This work plan is prepared for the Pavement Data Collection Survey in accordance with the work schedule and methods of Inception Report. The survey work consists of 1-1 Field Reconnaissance,1-2 Pavement Condition Survey and 1-3 Data analysis as shown in the following work plan table.



The work volumes, work schedule and assignment schedule for the survey work are presented in this work plan.

1-1 Field Reconnaissance

Data Acquisition Item



① Work Volume

Table of expected work volume

ID	Route Name	From (km)	To (km)	R_Length (km)	Work days (50km/day)
1-0	NH.1	0	285.4	285.4	6
1-1	Connecing route between NH.1 and NH.5(Cau tau)	0	2.7	2.7	1
2	NH.2	30.6	312.5	281.9	6
3	NH.3	33.3	344.4	311.1	7
4	NH.3B	0	129.0	129	3
5	NH.4E	0	44.2	44.2	1
6	NH.5	11.1	92.5	81.4	2
7	NH.6	38	383.3	345.3	7
8	NH.10	0	173.3	173.3	4
9	NH.15	0	20.0	20.0	1
10	NH.18	0	46.3	46.3	1
11	NH.37	61	98.2	37.2	1
12	NH.38	0	84.5	84.5	2
13	NH.43	26	79.7	53.7	2
14	NH.70	0	198.1	198.1	4
15	NH.279	0	116.0	116.0	3
17	NB-BN	0	31.1	31.1	1
18	HCM	409	503.0	94.0	2
1-2	PVCG	181.6	213.6	32.0	1
20	NH.35B	0	45.0	45.0	1
	Total	-	-	2412.2	58

② Work Schedule

Table of work schedule

Geoup1		1st W Apr.		2nd W Apr.		3rd W Apr.		4th W Apr.		1st W May		2nd W May		3rd W May		4th W May		5th W May	
1.Training of Field Reconnaissance																			
2.Field Reconnaissance																			
R. Name	R. Length(km)																		
NH.2	281.9																		
NH.3	311.1																		
NH.3B	129																		
NH.4E	44.2																		
NH.6	345.3																		
NH.15	20.0																		
NH.43	53.7																		
NH.70	198.1																		
NH.279	116.0																		
Total	1,499																		
3.Compilation of the Field Reconnaissance Results																			

Group2		1st W Apr.		2nd W Apr.		3rd W Apr.		4th W Apr.		1st W May		2nd W May		3rd W May		4th W May		5th W May	
1.Training of Field Reconnaissance																			
2.Field Reconnaissance																			
R. Name	R. Length(km)																		
NH.1	265																		
Connecting route between NH.1 and NH.6(Cau lau)	2.7																		
NH.5	81.4																		
NH.10	173.3																		
NH.18	48.3																		
NH.37	37.2																		
NH.38	84.5																		
NB-BT	31.1																		
HCM	94.0																		
PVCG	32.0																		
NH.360	45.0																		
Total	912.9																		
3.Compilation of the Field Reconnaissance Results																			

③ Assignment Members

Group1	Members
Group Leader	Syoichi KITAGAWA
Counterpart (DRVN/RRMU2)	
Interpritor	Pham Quang Son
Driver	Nguyae Quang Tuan

Group2	Members
Group Leader	Yoshiyasu TSUCHIYA
Counterpart (DRVN/RRMU2)	
Interpriter	Do Hong Phong
Driver	Vu Hong Quang

1-2 Pavement Condition Survey

① Work Volume

Table of expected work volume

ID	Route Name	From (km)	To (km)	S_Length (km)	Work days (50km/day)
1-0	NH.1	0	285.4	570.8	12
1-1	Connecting route between NH.1 and NH.6(Cau lau)	0	2.7	5.4	1
2	NH.2	30.6	312.5	563.8	12
3	NH.3	33.3	344.4	622.2	13
4	NH.3B	0	129.0	258	6
5	NH.4E	0	44.2	88.4	2
6	NH.5	11.1	92.5	162.8	4
7	NH.6	38	383.3	690.6	14
8	NH.10	0	173.3	346.6	7
9	NH.15	0	20.0	40	1
10	NH.18	0	46.3	92.6	2
11	NH.37	61	98.2	74.4	2
12	NH.38	0	84.5	169	4
13	NH.43	26	79.7	107.4	3
14	NH.70	0	198.1	396.2	8
15	NH.279	0	116.0	232	5
17	NB-BN	0	31.1	62.2	2
18	HCM	409	503.0	188	4
1-2	PVCG	181.6	213.6	64	2
20	NH.38B	0	45.0	90	2
	Total	-	-	4,824	106

② Work Schedule

Table of work schedule

Pavement condition Survey		Jun.		Jul		Aug		Sep		Oct		Nov	
1.Training of Pavement condition Survey													
2.Pavement condition Survey													
R_Name	Survey Length(km)												
NH.2	570.8												
NH.3	5.4												
NH.3B	563.8												
NH.4E	622.2												
NH.6	258.0												
NH.1S	88.4												
NH.43	162.8												
NH.70	690.6												
NH.279	346.6												
Total	40.0												
Connecting route between NH.1 and NH.6(Cau lau)	92.6												
NH.5	74.4												
NH.10	169.0												
NH.18	107.4												
NH.37	396.2												
NH.38	232.0												
NB-BN	62.2												
HCM	188.0												
PVCG	64.0												
NH.38B	90.0												
Total	1,476.8												
3.Compilation of the Pavement condition Survey													

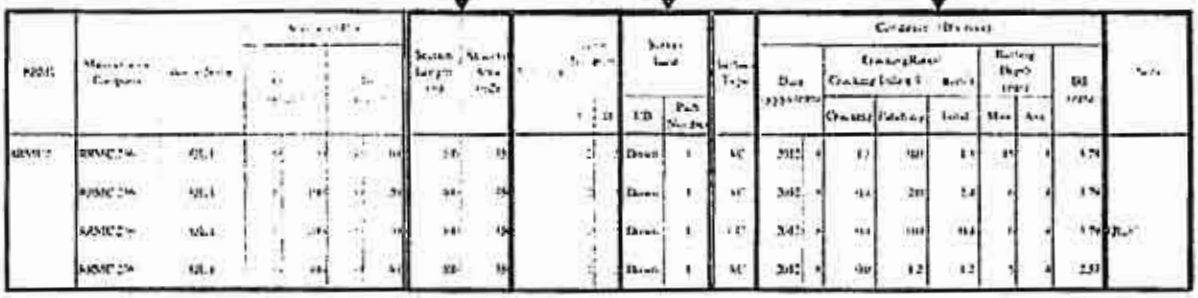
③ Assignment Members

Group1	Members
Group Leader	Yoshiyasu TSUCHIYA(3M/M), Syoichi KITAGAWA(2M/M)
Counterpart (DRVN/RRMU2)	
Interpriter	Pham Quang Son
Driver	Nguyae Quang Tuan

1-3 Data Analysis

Data Acquisition Item

Data Analysis



① Work Volume

Table of expected work volume

ID	Route Name	From (km)	To (km)	S_Length (km)	Work days 25km/(8menbers*day)
1-0	NH.1	0	285.4	570.8	23
1-1	Connecing route between NH.1 and NH.6(Cau lau)	0	2.7	5.4	1
2	NH.2	30.6	312.5	563.8	23
3	NH.3	33.3	344.4	622.2	25
4	NH.3B	0	129.0	258	11
5	NH.4E	0	44.2	88.4	4
6	NH.5	11.1	92.5	162.8	7
7	NH.6	38	383.3	690.6	28
8	NH.10	0	173.3	346.6	14
9	NH.15	0	20.0	40	2
10	NH.18	0	46.3	92.6	4
11	NH.37	61	98.2	74.4	3
12	NH.38	0	84.5	169	7
13	NH.43	26	79.7	107.4	5
14	NH.70	0	198.1	396.2	16
15	NH.279	0	116.0	232	10
17	NB-BN	0	31.1	62.2	3
18	HCM	409	503.0	188	8
1-2	PVCG	181.6	213.6	64	3
20	NH.38B	0	45.0	90	4
	Total	-	-	4,824	201

② Work Schedule

Table of work schedule

Group1	July	August	September	October	November	December
1.Training of Data Analysis						
2.Data analysys						
R. Name / Analysis Length(km)						
NH.2 563.6						
NH.20 258						
NH.4E 29.4						
NH.6 850.6						
NH.15 40.0						
NH.43 107.4						
NH.70 399.2						
NH.279 232.0						
Total 2,376						
3.Compilation of the Data Analysis Results						

Group2	July	August	September	October	November	December
1.Training of Field Reconnaissance						
2.Field Reconnaissance						
R. Name / Analysis Length(km)						
NH.1 571						
Connecting route between NH.1 and NH.6(Cau lau) 5.4						
NH.3 622.2						
NH.5 162.6						
NH.10 348.6						
NH.18 32.6						
NH.37 72.4						
NH.39 169.0						
NO-BN 62.2						
HCM 188.0						
PVCO 64.0						
NH.389 90.0						
Total 2,448.0						
3.Compilation of the Field Reconnaissance Results						

③ Assignment Members

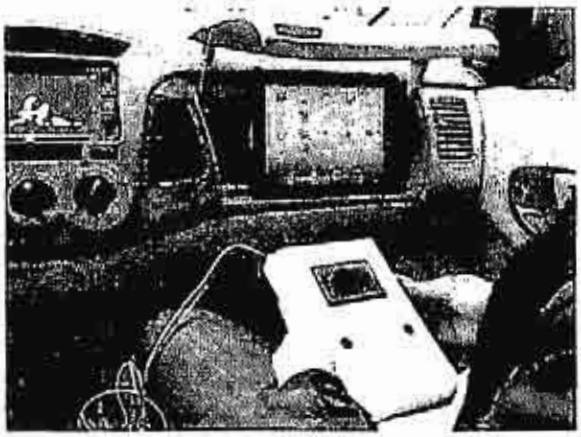
Group1(JPN)	Members
Group Leader	Kaoru SAWADA
Analyzing Operator	Eight(8)monbers

Group2(VN)	Members
Group Leader	Joel F.CRUZ , Kohei SAKAI,and Gaku SAITO
Counterpart 1 (DRVN/RRMU2)	
Counterpart 2 (DRVN/RRMU2)	
Counterpart 3 (DRVN/RRMU2)	
Counterpart 4 (DRVN/RRMU2)	
Counterpart 5 (DRVN/RRMU2)	
Counterpart 6 (DRVN/RRMU2)	
Counterpart 7 (DRVN/RRMU2)	
Counterpart 8 (DRVN/RRMU2)	
Interpriter	Do Hong Phong

List of Equipments

1. Field Reconnaissance

○Trip Meter



2. Pavement Condition Survey

○Real Mini Surveying System

3. Data Analysis

○Real Mini Analyzing Software

Attachment A. List of Attendants

DANH SÁCH ĐẠI BIỂU THAM DỰ CUỘC HỌP

Hà Nội, ngày 27 tháng 3 năm 2012

- **Chủ trì:** ..... Ông Nguyễn Bắc Cường .....
- **Nội dung:** ..... báo cáo chỉ đoán loại thuật - khai sác .....
..... P.AS.CO báo cáo .....
.....
.....

STT	Họ và tên	Chức vụ	Ký nhận
1	Nguyễn Bắc Cường	PVT - Vụ QLGT - (PMU) - PRSP.	
2	Đinh Thị Thanh Huyền	Vụ KHCN-MT-HTQT-DMC	
3	Thiều Bá Long	PVT - Vụ KHCN-MT-HTQT-PRSP	
4	Đặng Công Chiến	GĐ Trung Tâm Thông Tin	
5	Chu Văn Thường	PP QLGT - Kiểm QLATGT	
6	Trần Minh Phương Khánh	CV P. QLGT - —	
7		TPT Vụ KCHT - MDR	
8	Dr. Bhoj Raj Panthi	Road Maintenance Specialist, JICA Team	
9	Mr. Yasushi Aoki	- do -	
10	Hisashi Hori	"	
11	Lê Văn Thanh	TT Sở Giao thông	
12	Yoshiyasu Tsuchiya	PECO	
13	Kazuya Aoki	"	
14	Yutaka Kokubu	"	
15	Kazuki Sano	"	
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DANH SÁCH ĐẠI BIỂU THAM DỰ CUỘC HỌP

Hà Nội, ngày 27 tháng 3 năm 2012

- Chủ trì: ....Ông Nguyễn Đức Công............

- Nội dung: ....bãi cầu Chỉ dẫn kỹ thuật khảo sát............
............PASCO bãi cầu............
....
....

STT	Họ và tên	Chức vụ	Ký nhận
1	Nguyễn Khánh Toàn	CV Vụ KCHT	
2	Quách Văn Khoa	Vụ Trg Vụ KCHT	
3	Hoàng Việt Hà	Ban QLDA HTVT	
4	Tạ Thu Thủy	CV - Vụ KHĐT	
5	Nguyễn Chí Hải Hà	CV - Vụ KHĐT	
6	Trịnh Xuân Sinh	CV - Vụ KHĐT	
7	Lưu Quang Tuấn	CV TTKTĐB	
8	Đinh Duy Tiến	CV - TT KTĐB	
9	Nguyễn Văn Khải	CV - TT KTĐB	
10	Nguyễn Vũ Phương	PGĐ - TTKTĐB	
11	Nguyễn Đức Thảo	Jica	
12	Nguyễn Thị Diệu Linh	Pasco	
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DANH SÁCH ĐẠI BIỂU THAM DỰ CUỘC HỌP

Hà Nội, ngày 15 tháng 3 năm 2012

- **Chủ trì:** ....Bà Tổng Cục Trưởng.....
- **Nội dung:** .....Tư vấn Pasco thực hiện hợp đồng ký kết.....
.....Chiều sáng mai thứ ba.....
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STT	Họ và tên	Chức vụ	Ký nhận
1	Phương Thị Thông	TPhòng KTCH - KHCĐDR	
2	Trần Văn Sinh	C1 - Vụ KHĐT	
3	Vũ Anh Tuấn	RTC DRVN	
4	Phạm Thanh Bình	Vụ tổ chức cán bộ	
5	Nguyễn Xuân Cường (Phó Tổng Cục Trưởng)	DR VN	
6	Đinh Thị Thanh Nguyên	DR VN PMU	
7	Nguyễn Đức Cường	DR VN - PMU	
8	Triệu Bá Long	Vụ KHCN - MT - HTQT - DRVN	
9	Nguyễn Anh Quân	KH QL DBTN	
10	Nguyễn Anh Tú		
11	Phùng Thị Hải		
12	Nguyễn Khánh Toàn	CV Vụ KCHTGTVTGT	
13	Hoàng Việt Hà	DRVN - PMU	
14	Nguyễn Việt Tuấn	Vụ KHCN - MT. HTQT - DRVN	
15	Toshiya MATSUDA	JICA CERM	
16	Hideyuki KANOSHIMA	JICA CERM	
17	Hisashi Hori	JICA CERM	
18	Yutaka Kokufu	PASCO	
19	Kensuke HIRABA	PASCO	
20	Koroku SOMA	PASCO	

DANH SÁCH ĐẠI BIỂU THAM DỰ CUỘC HỌP

Hà Nội. ngày 15 tháng 3 năm 2012

- Chủ trì: .....

- Nội dung: .....

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STT	Họ và tên/ Name	Chức vụ / Position	Ký nhận Signature
21	Kazuya AOKI	PASEC	
22	Yoshiyasu TSUKAYA	PASEC	
23	Nguyễn Thị Diệu Linh	PASEC	
24	Nguyễn Minh Thao	KITAMIA	

Meeting Record No. 3

March 16, 2012

Meeting on Discussion of draft Specifications

Meeting Room: the Project for Capacity Enhancement in Road Maintenance

MINUTES OF MEETING

Activity	Activity 2-1
Target:	Pavement Condition Survey
Time:	16th March 2012, Time: 15:00 – 17:00
Location	JICA Study Team Office
Participant	- Pavement Condition Survey (PCS) Team 1. Mr. Kokufu, Team Leader 2. Mr. Soma, Equipment Operation 1 3. Mr. Tsuchiya, Equipment Operation 2 4. Mr. K.Aoki, Coordinator
	- JICA study (CERM) team: Mr.Kanazawa, Mr. Mori, Mr.Pantha, Mr. Matsuda,
Handover material:	From PCS Team: Output Specification Updated Version (Japanese)

Major contents of meeting

CERM and PCS teams had a meeting on Friday 16th March, 2012 to confirm previous discussion held on 09th March 2012. The major contents are as follows:

1. Discussed the following terms/words to be used by PCS team:

   5) Up (km10… to km0) and Down (km0… to km10…) instead of Right or Left lane,

   9) & 10) PCS team said that measurement of Pavement and Carriageway widths are not conducted since the items are not included in their contract.

   11) Number of lanes will be estimated by visual survey if the road is not marking,

   12) Lane number will be recorded as Up 1, 2, 3… (count from center of the road) and Down 1, 2, 3…,

   13) Road facilities i.e. Bridge (measure at expansion joints at start and end points), Intersection (all national roads connected target roads – CERM opinion, and national rods which are included RRMU2 only – PCS team), Roundabout (as a point), Railway crossing (as a point), Viaduct (at start and end points).

   14) Road image data included video, longitude, latitude and elevation. Vertical curve is not included.
2. Regarding 5) Potholes, PCS team explained that it will be measured as Crack (unit: area m2) and it will not be separately recorded as Pothole and Crack.
3. Mr. Kokufu informed that the site reconnaissance will start by two teams from 1st April 2012. He also added that Specification meeting will be conduct next week at DRVN and the date will fix after submission of their letter.

The meeting was adjourned at 17:00.

Meeting Record No. 4

March 22, 2012

Meeting on Discussion of Pavement Condition Survey

Meeting Room: the Pavement Data Collection Survey Team

MINUTES OF MEETING

Activity	Activity 2-1
Target:	Pavement Condition Survey (Technical Meeting)
Time:	22nd March 2012, Time: 13:30 – 15:00
Location	PCS Team Office; 12th Floor Dacha Business Center, 360 Kim Ma
Participant	- Pavement Condition Survey (PCS) Team 1. Mr. Kokufu, Team Leader 2. Mr. Soma, Equipment Operation 1 3. Mr. Tsuchiya, Equipment Operation 2 4. Mr. K.Aoki, Coordinator
	- JICA study (CERM) team: Mr.Kanazawa, Mr. Mori, Mr.Pantha, Mr. Matsuda,
Handover material:	From PCS Team: List of expect items to be discussed during Technical Meeting (TM)

Major contents of meeting

CERM and PCS teams had discussed about results of pavement condition survey to be conducted during Technical Meeting of PCS on 26th March 2012. The summary of discussion is as follows:

1. Discussed based on a list of expected items to be discussed during TM prepared by PCS team. They are as follows:
   1) Evaluation result map of pavement condition
      Replied a question by CERM team about update the map, PCS team said that it is difficult to update. Although the difficult to update, those maps are important Mr. Kanazawa stated.
   2) Visual viewer system (linked map and video in the same screen)
      Mr. Kokufu expressed his opinion that item 1) and 2) can be integrated.
   3) Establishment of database for pavement condition
      Mr. Kanazawa explained that the data base will be established by CERM team as PMS and PMOS. Therefore, it will not necessary to prepare by PCS team.
   4) Index of pavement condition
      Mr. Aoki explained, this is same as Maintenance Control Index (MCI) using in Japan. Mr. Kanazawa said that it will be coved by WG3.
   5) Selection of FWD testing place
      Both teams concluded that it will be studied if the request made by DRVN.
   6) Conduct FWD test
      Both teams concluded that it will be studied if the request made by DRVN.
   7) Pavement condition repairing work method
      Mr. Mori explained that FWD is generally required. However, necessity of FWD for PMS should be decided based on discussion with WG3 and DRVN, he added.

8) Identification of location of traffic count survey

Mr. Pantha explained that they have already been prepared by available data provided by DRVN. There are following problems such as i) locations of traffic count stations are different in 2004, 2007, 2010 and 2011, and ii) data conversion from point to section data.

2. Other matters discussed are as follows:

1) Road width

Both teams are agreed to use in data by RoSy Base in 2007 for road width.

2) Potholes

As explained by PCS team during the previous meeting, pot holes will be measured as crack. However, CERM team insisted that they should be recorded separately since the repairing method and cost will be different.

3) Patching rate

CERM team explained the necessity of data for patching rate. To measure the patching rate or not will be answer from PCS team later on.

4) Measurement of Intersection

CERM team suggested to measure only major intersections with signal or roundabout of national roads and the name of the connected road are refer to maps with scale of 1:50,000. Moreover, they will be mentioned as Others if the names are not identify in the map,.

The meeting was adjourned at 15:00.

PAVEMENT DATA COLLECTION SURVEY

Minutes of Meeting

Subject	Technical Meeting of CERM and PDCS Team			
Date	March 22, 2012		Time	13:30 pm
Place	PASCO Office, Room No. 1208, 12th Floor, Daeha Business Center			
Participants	JICA Study (CERM) Team	Mr.Toshiya MATSUDA Mr.Toshinori KANAZAWA Mr.Hisashi MORI Dr.Bhoj Ray Pantha		
	Pavement Data Collection Survey (PDCS)Team	Mr.Yutaka KOKUFU - Team Leader Dr. Kazuya AOKI Mr.Koroku SOMA Mr.Yoshiyasu TSUCHIYA		
Agenda	1) Discussion of Pavement Condition Survey			

SUMMARY

- Both teams discussed and confirmed the following data items on Pavement Condition through Pavement Data Collection Survey.

Data Base Items(Draft) by CERM Team	Data File Items by PDCS Team (Yes or N/A)	Remarks of Data Files
· Road Inventory Data		
- Administrative Organization		
RRMU2	Yes	
RRMC	Yes	
- Administration Boundary		
Province	Yes	
- Route No.	Yes	
- Route Blanch No.	Yes	
- Light Lane or Left Lane	Yes	UP:Bound & DOWN:Bound
- Mile(kilo meter) post	Yes	
- Longitude, Latitude	N/A	
- Distance in section	Yes	
- Carriageway Width	N/A	
- Pavement width	N/A	
- No. of Lane	Yes	Visual judgment
- No. of Lane inspected	Yes	
- Road Facilities	Yes	
Bridge、Tunnel、Intersection、Roundabout、Railway Crossing、Viaduct	Yes	Intersection with Signal, Round-about, Viaduct
- Vertical Curve	N/A	
· Pavement Condition Data		
- Date to be inspected	Yes	
- Paved Type	Yes	
Cement Concrete、Asphalt concrete、Bituminous surface treatment、ravel、Earth	Yes	Asphart Concrete、Cement Concrete、Un-Paved
- Crack rate (%)	Yes	Cracking Ratio(%),Cracking Index(cm/㎡)
- Patching Rate (%)	Yes	Patching Ratio(%),Patching Index(cm/㎡)
- Pothole	Yes	Include Cracking

PAVEMENT DATA COLLECTION SURVEY

Minutes of Meeting

		Evaluation(%)
- Rut Volume (mm)	Yes	Rutting Depth, MAX, and Average
- IRI (mm/m)	Yes	
- Image data for each road route will relate with GPS data.	Yes	

- Meeting Adjourned 15:00pm.

Prepared by Yutaka .KOKUFU