

3. Road Condition Data Collection Survey

3.1 Overview

The objectives of pavement condition data collection, using the pavement condition survey vehicle, are to: take pictures of road surface for crack analysis; measure the crossing road profiles for rut; measure the vertical road profiles for IRI; record locations using GPS; and take pictures of forward views.

Table 3.1 Functions and Performance of Road Condition Survey Vehicle

| Functions | Performance |
|------------------------------------|---|
| Distance | Accuracy to within $\pm 0.5\%$ 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 $\pm 5\text{mm}$ 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 |

3.2 Personnel

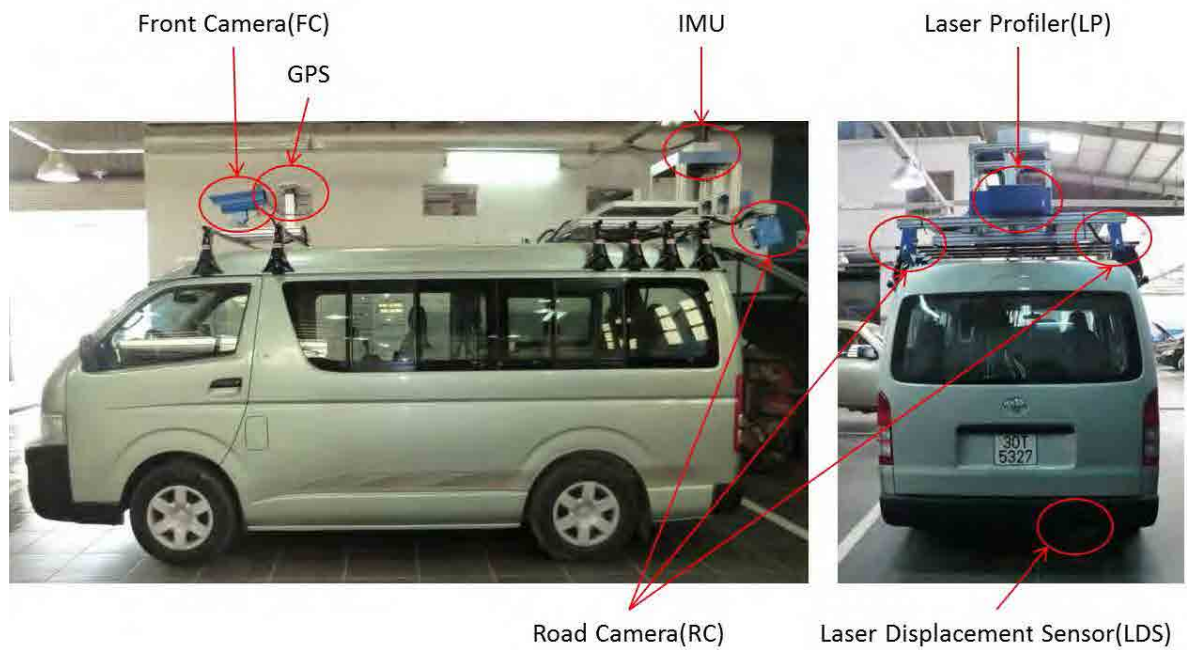
The team has: Leader; Operator 1; Operator 2; Navigator; and Driver. The leader shall have basic IT skills of Windows and MS Excel. Operator 1 handles the forward viewing; Operator 2 handles the road images; the navigator checks the routes.

3.3 Overview of the Road Condition Survey Vehicle

The road condition survey vehicle has the following sensors: front camera, GPS, IMU, Laser Profiler, road cameras, laser displacement sensors. The front camera record front images; GPS records locations; IMU and laser displacement sensor identify longitudinal profile; the road cameras record road images in black and white to identify cracks; the laser profiler records cross section profiles to identify rut depths. On the roof of the vehicle, a solar panel is installed to secure additional power to the on-board equipment.

All the sensors are mounted to the vehicle in a secure way. As the front camera needs to record the front view, the location of the front camera needs to be high enough not to include the front of the vehicle itself. The clearance of vehicle needs to be high enough to have sufficient space between the road surfaces to the laser displacement sensor. The vehicle needs to accommodate five persons: driver; navigator; leader; operator; and worker.

Figure 3.1 Outside of the Road Condition Survey Vehicle



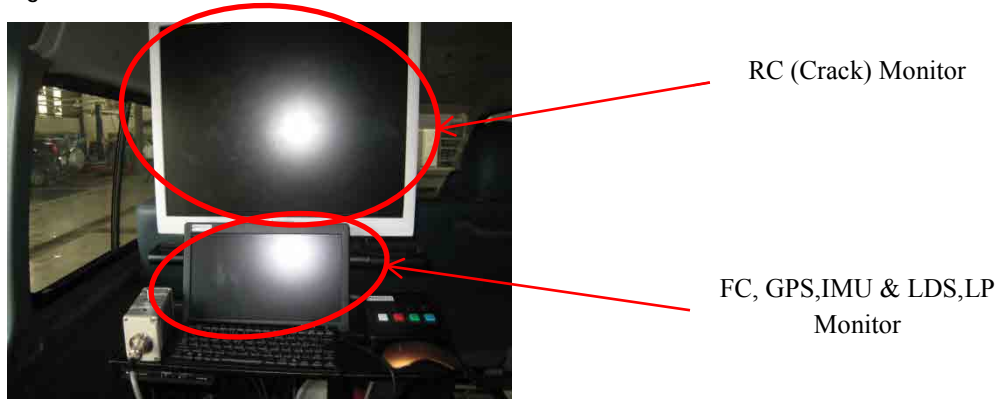
FC: Forward view images; GPS: Location of measurement point; IMU & LDS: Vertical Profiles (IRI); RC: Road surface images (Crack); LP: Crossing Profiles (Rut)

There are two computer monitors and control devices in the vehicle behind the driver seat. The bigger monitor shows the images from the road cameras. The small monitor shows the front view, data and information from GPS, IMU & LDS, and LP. The small monitor also shows the front view.

Figure 3.2 Inside of the Road Condition Survey Vehicle



Figure 3.3 Rear Camera Monitor and Front, GPS, IMU & LDS, LP Monitor



On the back of the vehicle various pieces of equipment are set-up and installed.

Figure 3.4 On-board Equipment in the Rear of the Vehicle

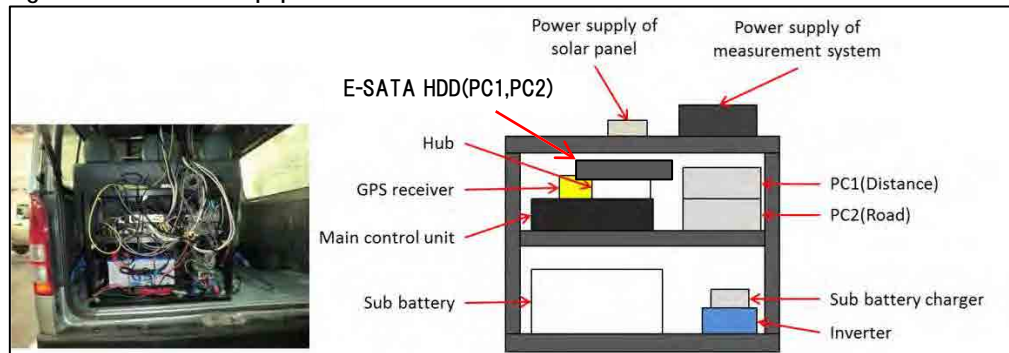


Table 3.2 On-board Equipment

| Name | Explanation |
|------------------------------------|---|
| Power supply of measurement system | Equipment which supplies stable electric power in order to prevent the malfunction according the output (100V AC) of an inverter to the instability of electric power to each equipment (Main Control Unit, E-SATA HDD, Hub, Monitor). |
| Power supply of solar panel | Equipment which transforms the electric power of solar panel into 12V AC electric power. This electric power is automatically supplied to sub-battery at the time of parking. |
| E-SATA HDD | The external storage for moving data to the data conversion PC data. Both PC1 and PC2 are equipped with one E-SATA HDD each. After the data collection survey, the data are transferred to the storage. |
| Hub | A hub for an interface to build a network with the road surface camera (four sets) and PC2 which are GigE, in order to record the images on PC2. |
| GPS receiver | Equipment which receives positioning electric wave to compute longitude, latitude, and altitude from positioning satellites. |
| Main Control Unit | Power-source supply is carried out to each equipment (Front Camera, Laser displacement Sensor, IMU, road Camera, Laser Profiler, PCs 1 and 2). The unit calculates distances based on the pulse data to be sent to PC1 and PC2. |
| Sub battery | It is the power source (dc-battery) of loading equipment. The battery using the sub-battery charger, it charges automatically and prevents unexpected failure of a dc-battery from the power generation machine with which the vehicle is equipped. |
| Inverter | The device transfers power of the sub-battery (12 V direct current) to 100 V alternative current. The AC power is supplied to the equipment after stabilized through the power supply measurement system. |
| Sub battery charger | The device supplies the power from vehicle to sub-battery. |
| PC1 | A PC to record GPS positioning data, travel distance, IMU data, data from Laser Displacement Sensor as it controls the sensors. It records the basic survey data such as starting and ending the survey. |
| PC2 | A PC for the road camera displaying to the monitor and records the road camera setting such as route, aperture and gain. |

3.4 Method

(1) Preparation of outside vehicle

Remove all the covers on the cameras and sensors and clean the lenses and sensors. Make sure that nuts and bolts are tightened.

(2) Preparation of Survey System

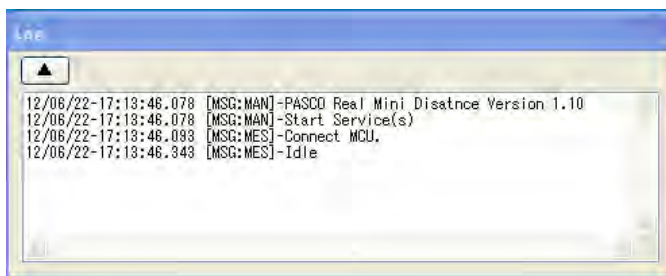
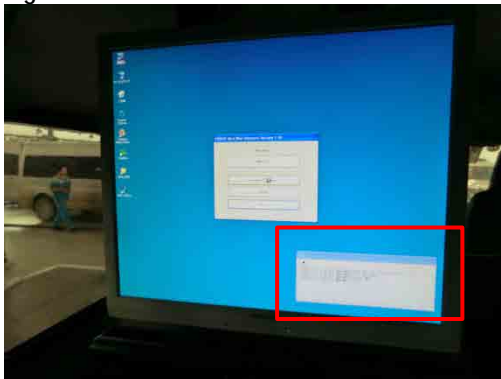
Turn on the power.

Figure 3.5 Main Control Unit Power-On



Check the activation of PC and Main Control Unit (MCU).

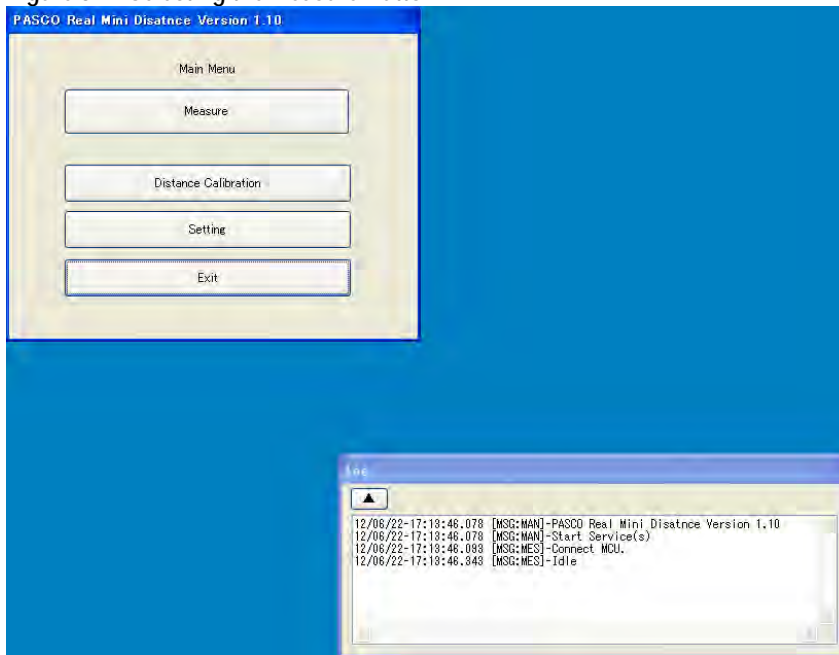
Figure 3.6 Main Control Unit Monitor



If PC and MCU is not connect, turn off power and turn on power. If the connection still cannot be confirmed, please check the slack of the wiring.

Click “Measure.”

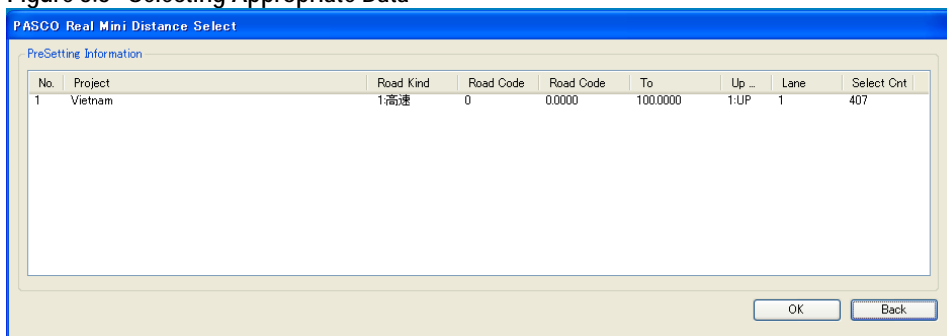
Figure 3.7 Selecting the Measure Button



Select "Vietnam" from the list.³

Press "OK."

Figure 3.8 Selecting Appropriate Data



Input the route information: The form has the text boxes to enter:

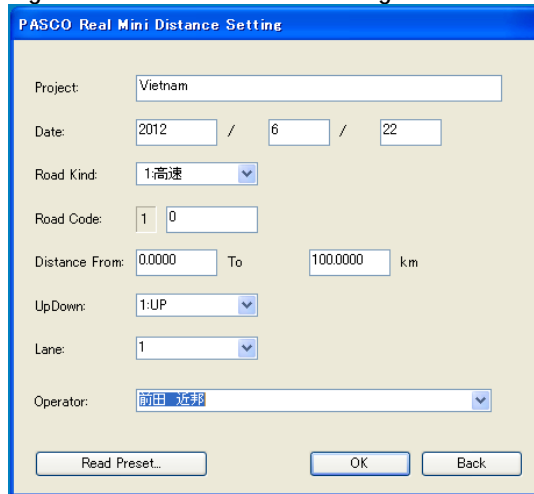
³ It show an example from the Vietnam project.

Table 3.3 Entering the Data to Text Boxes

| Text Box | Note |
|--|-------------------------------------|
| Project (Project name) | Automatic input |
| Date (Measurement date) | Automatic input |
| Road kind (Road kind) | Automatic input |
| Road Code (Code of measurement route) | Input the 5 digit number |
| Distance from to (KP information of measurement route) | Input KP of start and end |
| Up Down (Direction of route) | Select from the list (1 UP, 2 Down) |
| Lane (Number of lane) | Select from the list |
| Operator (Operator) | Select from the list |

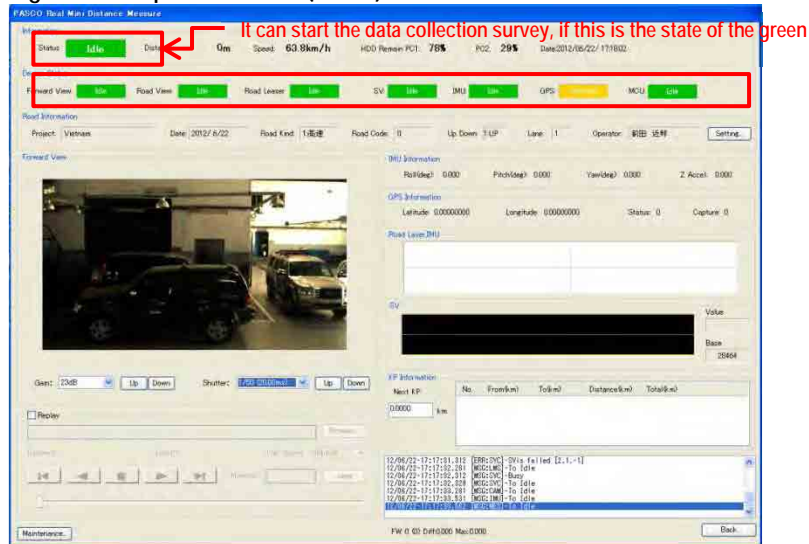
The dialogue box show like Figure 3.9

Figure 3.9 Route Information Dialogue Box



Check the connection with the road data collection devices.

Figure 3.10 Operation State (Green)



The colors indicate the connection conditions.

Table 3.4 Measurement Device Connection Status

| Colour | Condition |
|--------------------|----------------|
| Red (Busy) | Not connection |
| Yellow (Unsettled) | Search |
| Green (Idle) | Connection |

Measurement is possible even "Search" state of the GPS

If measurement is not connect, turn off power and turn on power

If the connection still cannot be confirmed, please check the slack of the wiring

Set the shutter speed and gain of the camera.

Figure 3.11 Shutter Speed and Gain Control 1

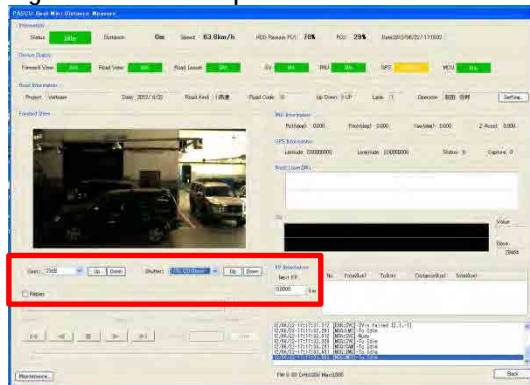


Figure 3.12 Shutter Speed and Gain Control (Enlarged 1)

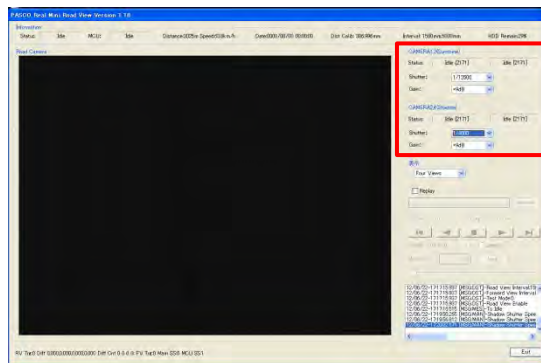
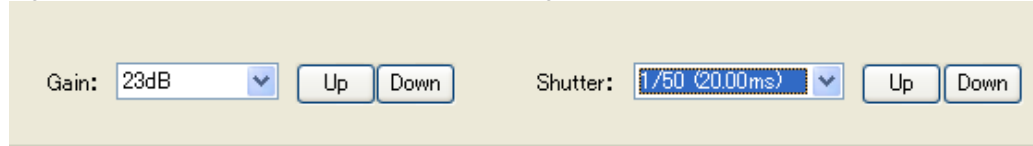
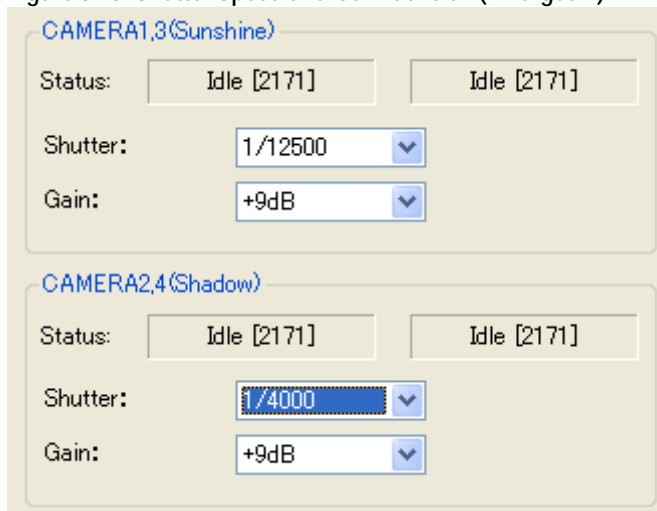


Figure 3.13 Shutter Speed and Gain Control (Enlarged 2)



Switch PC1 and PC2 using the selector when it is necessary.

Figure 3.14 Switching PC1 and PC2



(3) Road Data Collection Survey Procedure

A. Overview

Push the white button of the operation box. Check the translation to state "Ready." Start the measurement by push the white switch of control box.

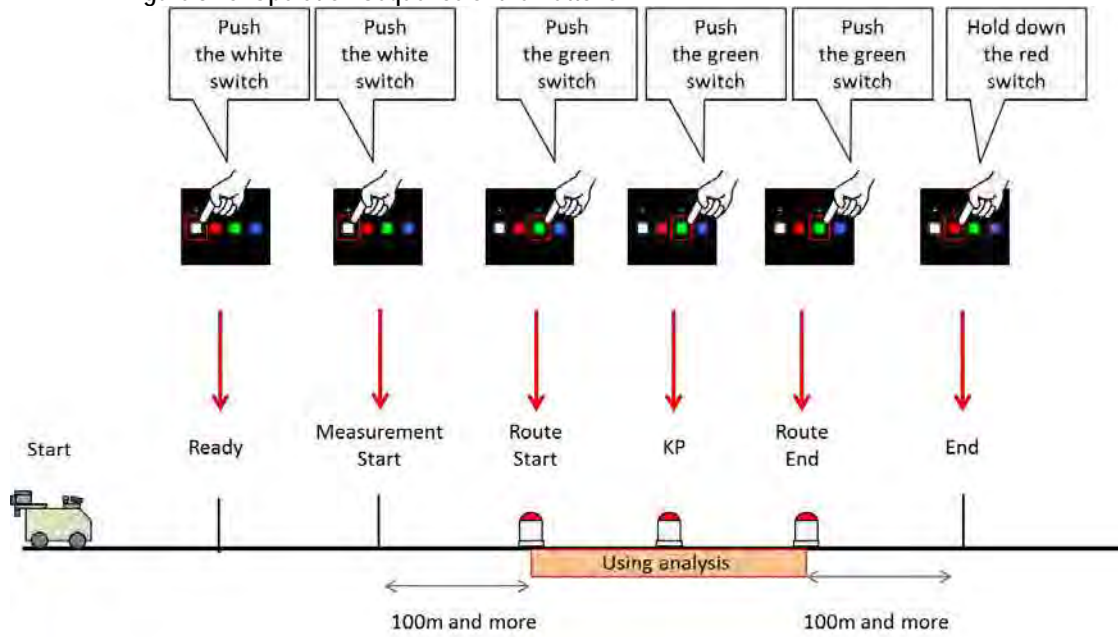
During measurement,

- Push the green switch of control box to register the kilometer post information.
- Change the camera settings to suit the image of state

End the measurement by hold down the red switch of control box

The road condition survey system need to start before 100m and more of route start. The road condition survey system needs to end more than 100 meters from the end point. When a capacity of HDD is small, the road condition data would not be collected.

Figure 3.15 Operation Sequence of the Buttons



B. Steps to measure the data

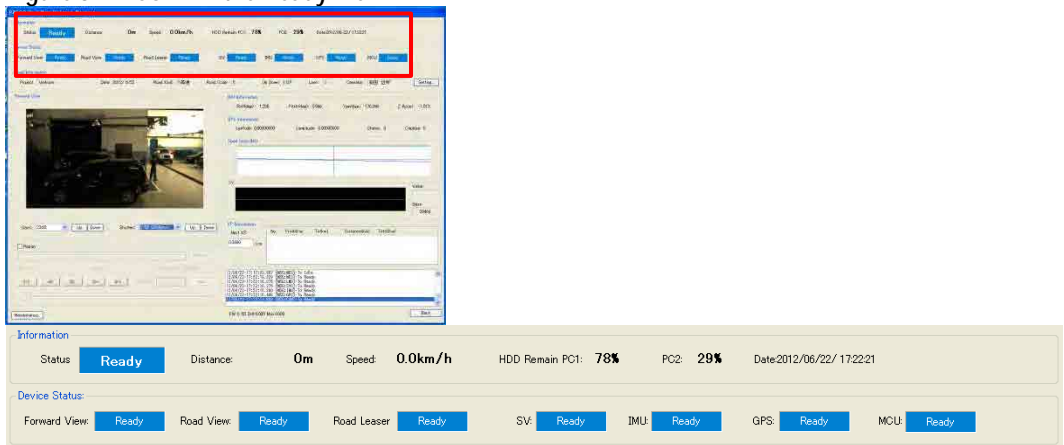
Push the white switch of control box to get ready.

Figure 3.16 White Button (Ready)



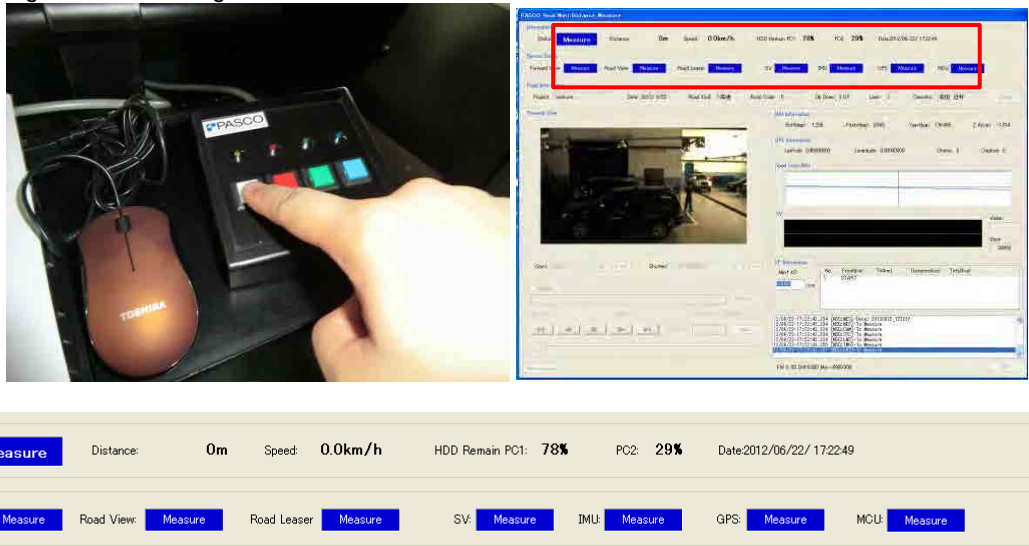
Check the translation to state “Ready”

Figure 3.17 Confirm the Ready View



Start the data collection survey by pushing the white button of the control box.

Figure 3.18 Pressing the White Button to Start the Measurement



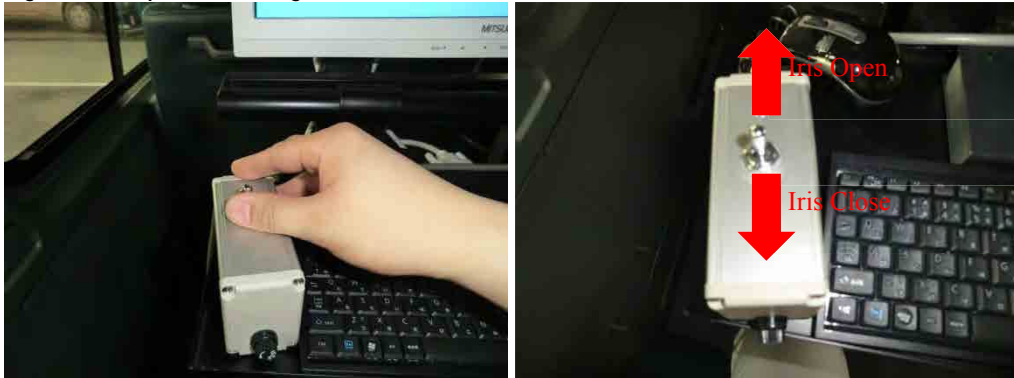
During the survey, push the green button to register the kilometer post information

Figure 3.19 Kilometer Post Recording



Change the camera settings to suit the image of state by controlling the switch as in Figure 3.20. The front camera changes the iris of the lens by lens controller.

Figure 3.20 Aperture Setting



The shutter speed and gain of the rear cameras can be changed by change the parameters of the control program.

Figure 3.21 Changing the Shutter Speed and Gain of Rear Cameras (Screen Image)

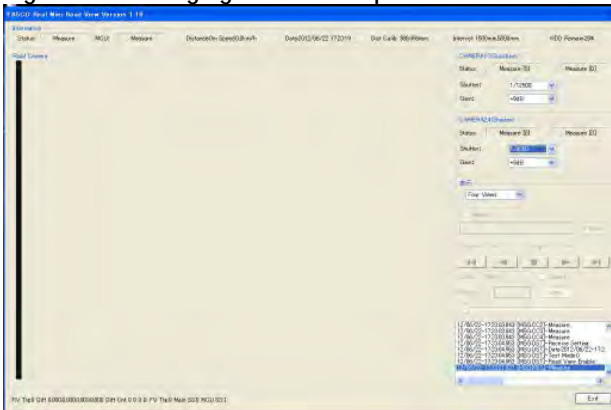
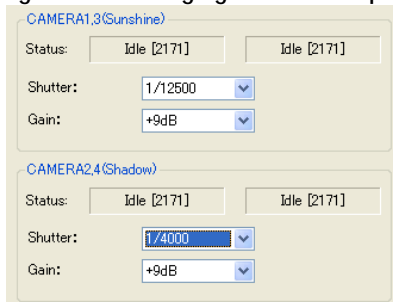


Figure 3.22 Changing the Shutter Speed and Gain of Rear Cameras (Enlarged View)



End the survey by hold down the red button.

Figure 3.23 End Road Condition Survey



(4) Check the Survey Data

Select the check box [Replay]. Select the data folder. Replay the data.

Figure 3.24 Check the Survey Data

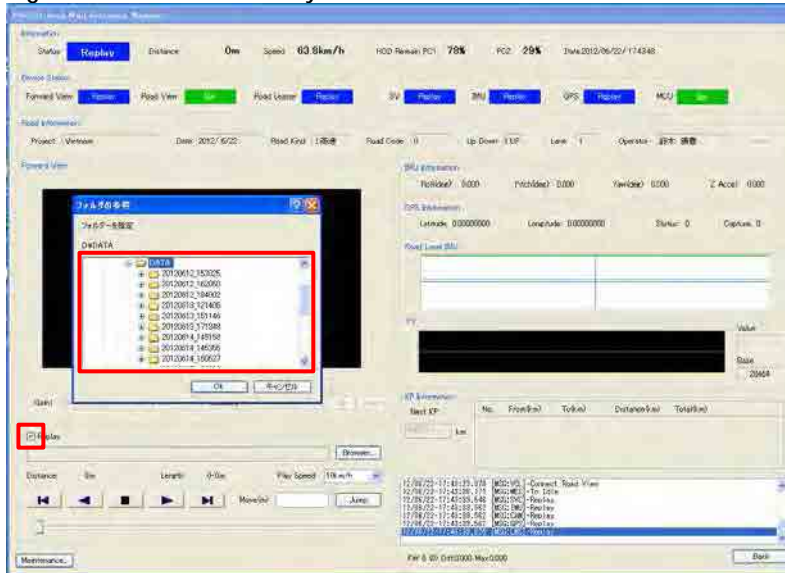
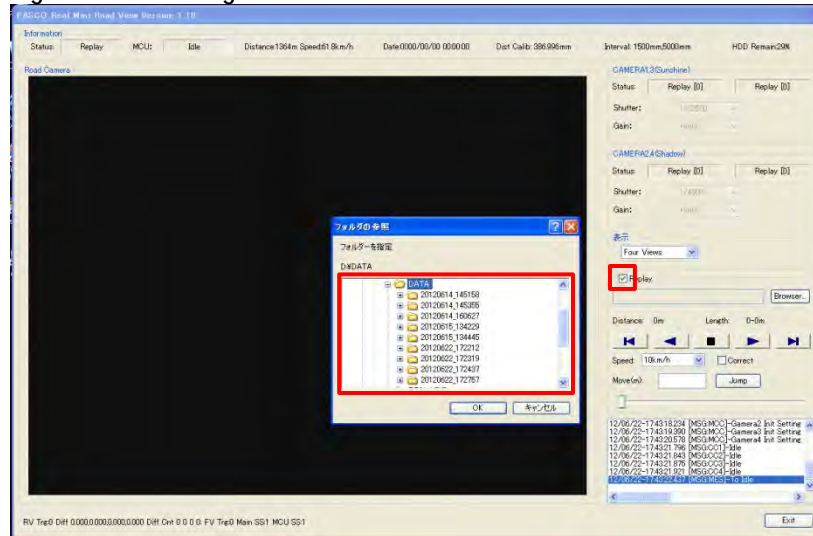


Figure 3.25 Selecting a Folder

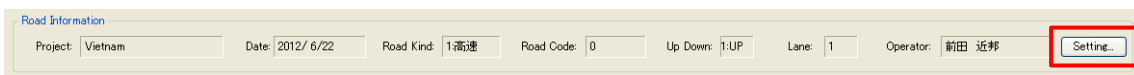
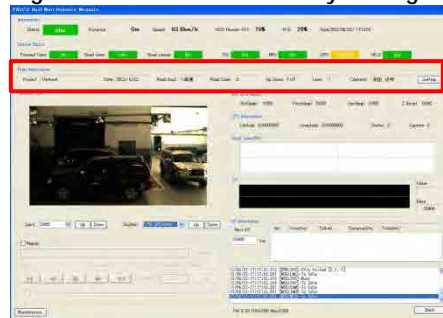


(5) After measurement

A. Continuous Survey

Click “Setting.”

Figure 3.26 Continuous Survey Setting

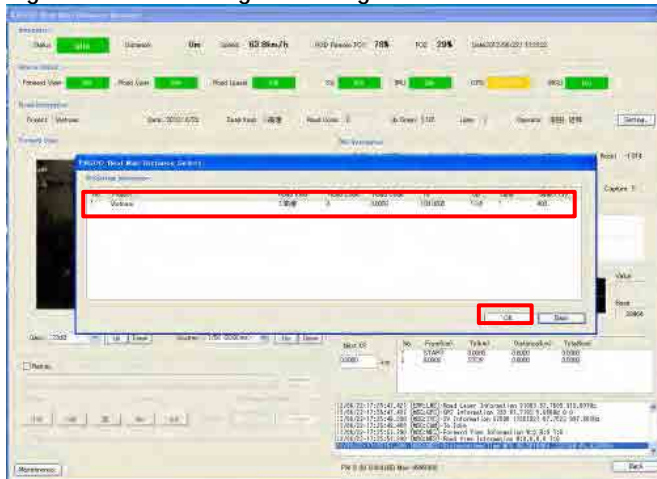


Select “Vietnam” from the list.⁴

Click “OK.”

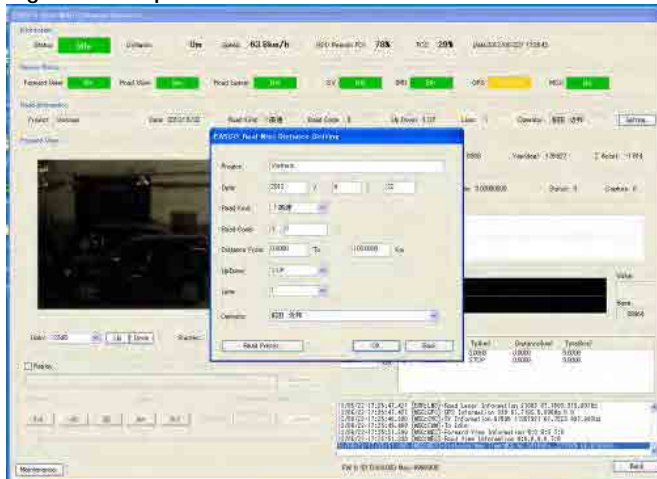
⁴ An example from the Vietnam project.

Figure 3.27 Confirming the Setting



Input the route information.

Figure 3.28 Input Route Information



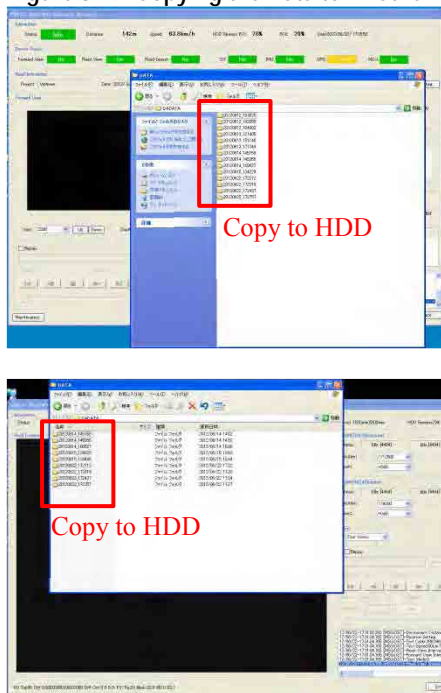
Follow the steps to end the survey.

B. Termination of Data Recording

Copy the survey data to HDD.

Data folder => D: \DATA\

Figure 3.29 Copying the Data to Another HDD.



After copying the data, shut down the system and tidy up the tools and equipment.

(6) Tidy up the equipment

Shut down the system.

Figure 3.30 Shutting Down the System



Put the cover to the road camera and laser profiler.

Figure 3.31 Closing the Covers of RC and LP



Close the cover of the laser displacement sensor.

Figure 3.32 Cover of the LDS



Cover the vehicle with the vehicle cover.

4. Pavement Damage Interpretation

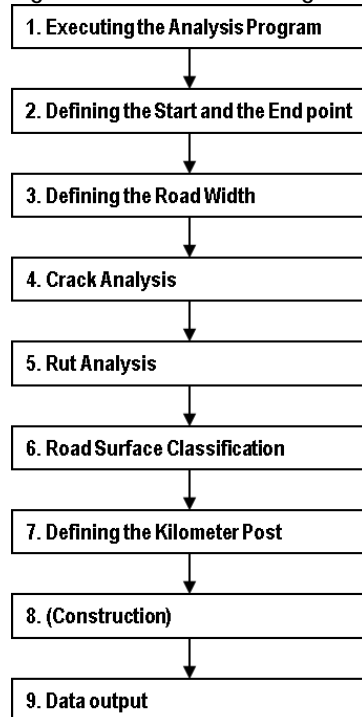
4.1 Introduction

The major objective of this process is to interpret the pavement damage conditions. Along with the damage interpretation, kilometer posts and other road structure data are registered. Road width and surface type registrations are other major activities in this process.

4.2 Work Flow

The road surface investigation analysis flow is shown below.

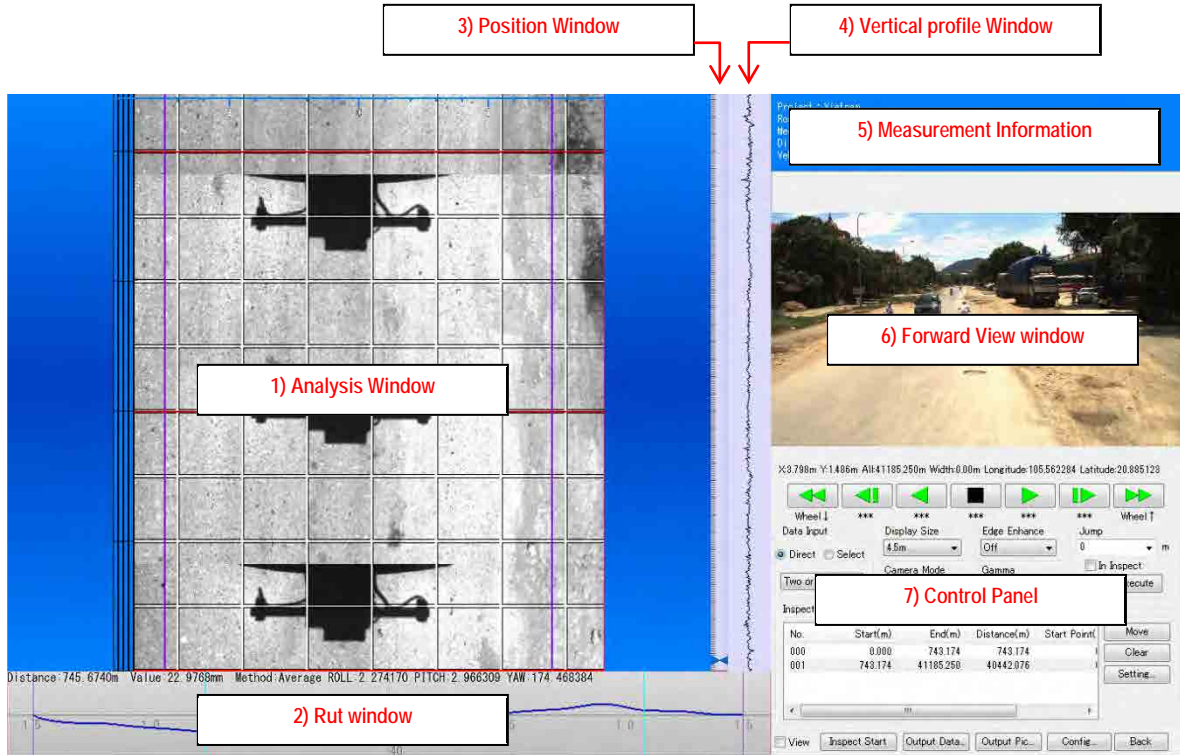
Figure 4.1 Pavement Damage Interpretation Work Flow



4.3 User Interface

The following figure shows the user interface of the system.

Figure 4.2 User Interface Windows and Control Panel



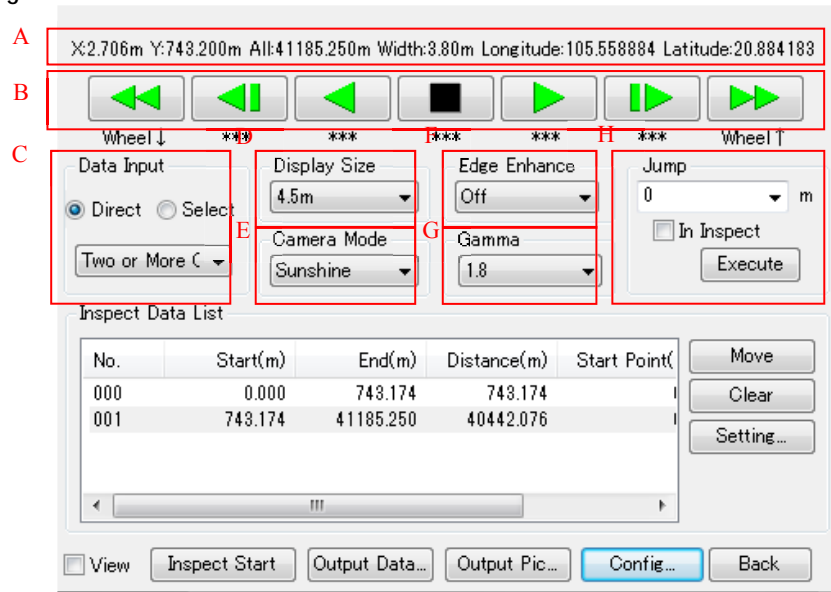
The user interface has the following windows:

Table 4.1 User Interface Windows

| Window | Function |
|-------------------------|--|
| Analysis window | Display the road surface images |
| | To define meshes where cracks exist |
| Rut window | Display the rut shape |
| Position window | Display the position of analysis data |
| | Left Click position window, we can move the any position of data. |
| Vertical profile window | Display the vertical profile of road |
| Measurement Information | Display the Informaiton of measureaent (Project name, Road kind, Measurement date, ...etc) |
| Forward View window | Display the forward view images |
| | To enlarge the 'Forward View', double click the forward view window. |
| Control Panel | |

The control panel has the informaiton section and button control section.

Figure 4.3 Control Panel in the User Interface



The button control controls the vising locations.

Figure 4.4 Description of Interface


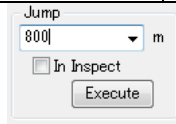
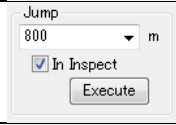

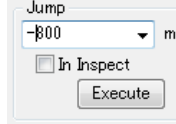
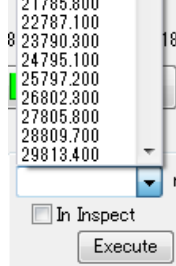
| Letter | Function Name | Description |
|--------|----------------|--|
| A. | Information | The information section shows the X and Y position and longitude and latitude of cursor and the road width. |
| B. | Button Control |  [Frame Back] [Piece Back] [Back] [Stop] [Replay] [Piece Forward] [Frame Forward] |
| C. | Data Input | Select way of crack Classification - Direct : Use the mouse and keyboard - Select : Use the mouse only |
| D. | Display Size | Select the size of road surface image |
| E. | Camera Mode | Select the camera mode - sunshine : setting for sunshine - shade : setting for shade - compose : mix of sunshine and shade |
| F. | Edge Enhance | Setting the edge enhance of the road surface images |
| G. | Gamma | Setting the gamma of the road surface images |

Figure 4.5 Description of Interface (Jump)

| Letter | Function | Description | Explanation |
|--------|----------|--|--|
| H. | Jump | | Jump to position of the input number |
| | |  | Jump to 800m from start of data |
| | |  | Jump to 800m from start point of analysis area |
| | |  | Jump to 800m from this position |
| | |  | Back to 800m form this position |
| | |  | Jump to select list position |

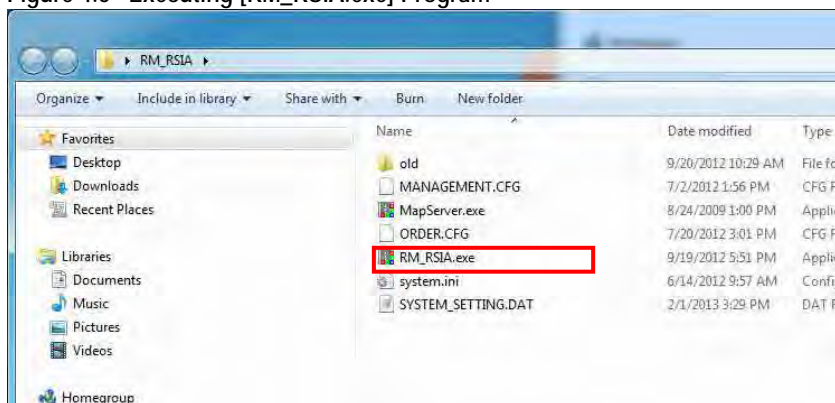
4.4 Method

(1) Execute the Interpretation Program

Execute the Analysis Program then choose the route which candidate for analysis.

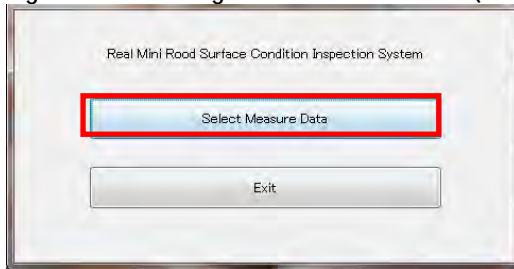
Execute the [RM_RSIA.exe].

Figure 4.6 Executing [RM_RSIA.exe] Program



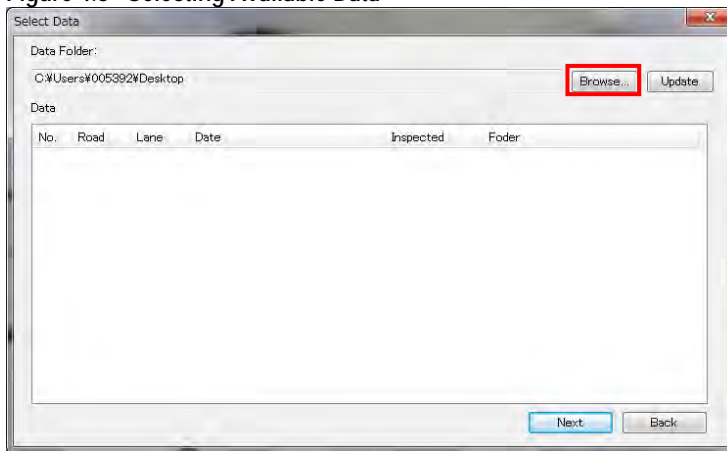
Left Click [Select Measure Data].

Figure 4.7 Selecting the Observation Mode (Select Measure Data)



Left Click [Browse] to open the output data of the Convert program.

Figure 4.8 Selecting Available Data



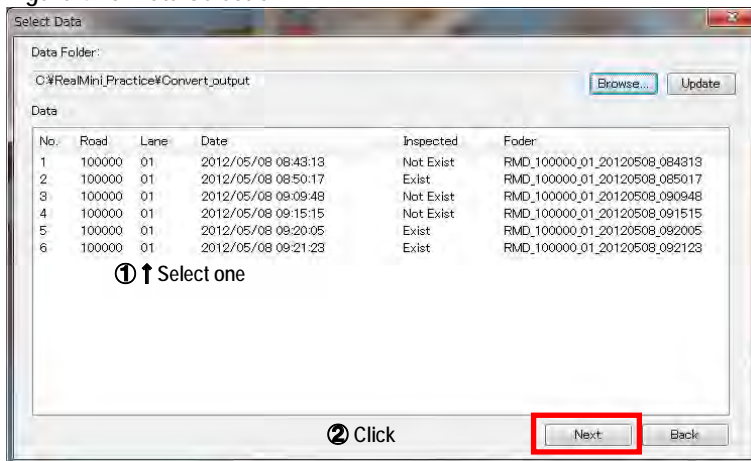
Select the folder which reserved as the export data in the convert program.

Figure 4.9 Browsing a Folder



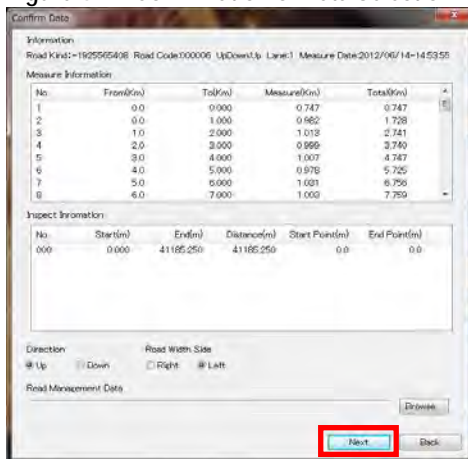
We can see the folder exported from the Convert Program. Choose one then left click [Next].

Figure 4.10 Data Selection



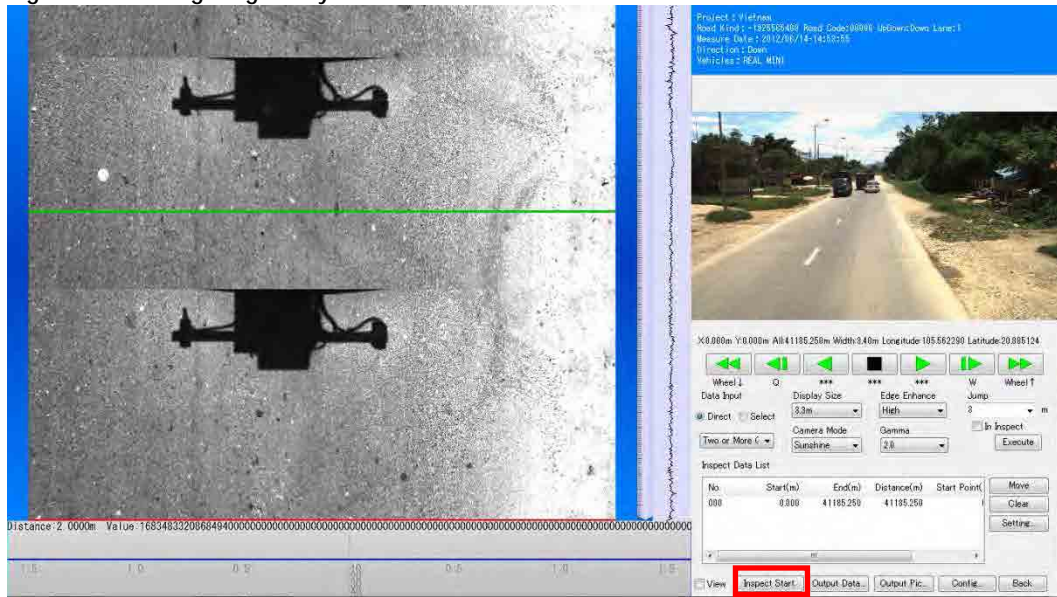
Left Click [Next].

Figure 4.11 Confirmation of Data Selection



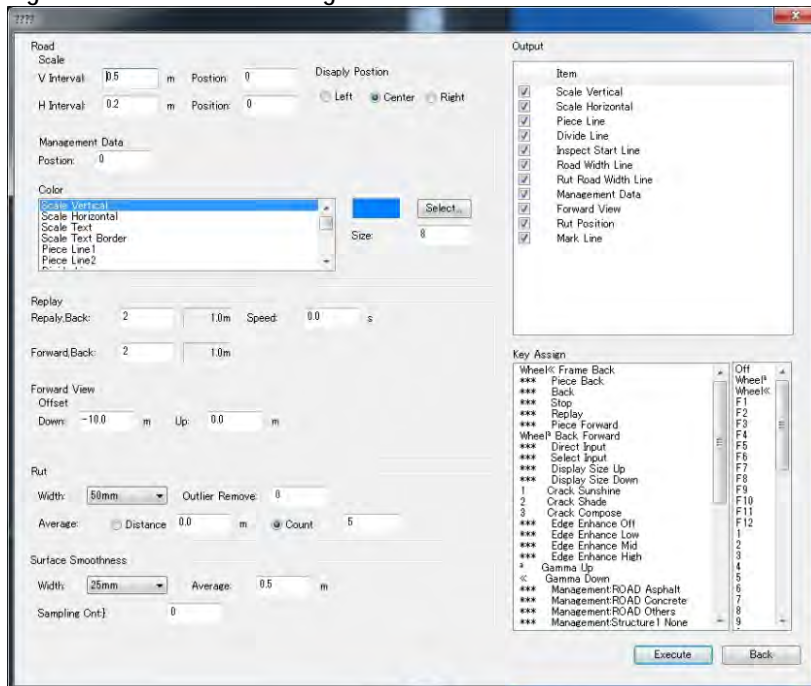
(7)Left Click [Config], we can edit the keyboard assign.

Figure 4.12 Configuring the System



Choose the item to display on the analysis window (like a 'Piece line', 'Rut Position') or edit the keyboard assign (like a 'Piece Forward', 'Piece Back').

Figure 4.13 The Form of Configuration

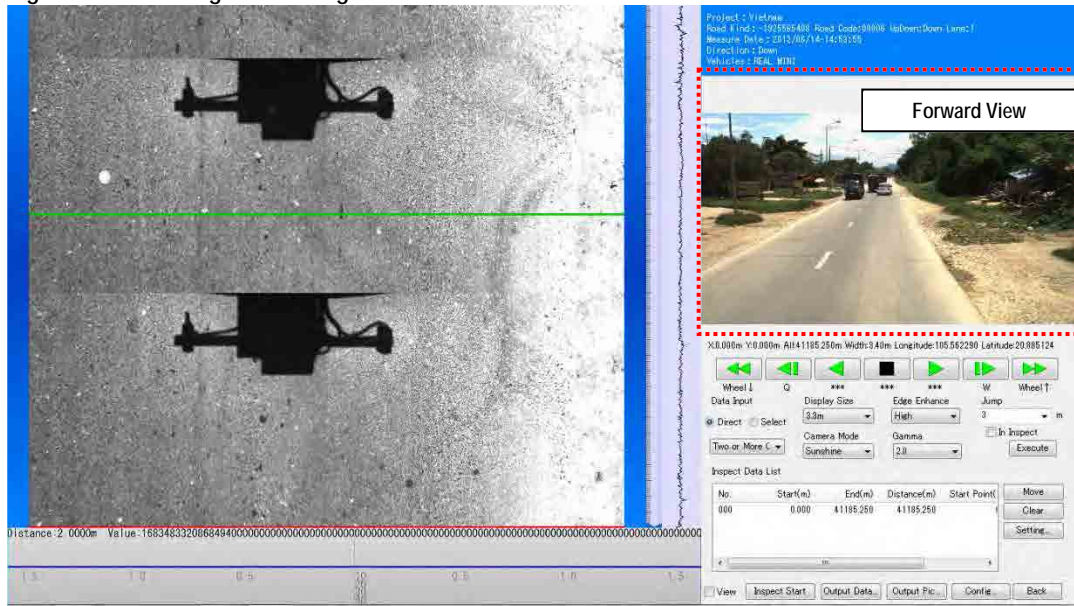


(2) Defining the Start and the End Point of Interpretation

A. Setting Start and End Positions

Before starting the road damage interpretation, the interpreter needs to define the start and end positions. In this example, use the shadow of the electric line.

Figure 4.14 Defining the Starting Line



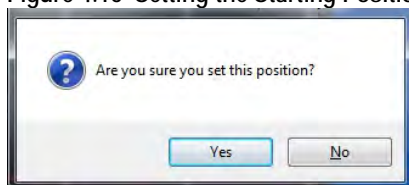
Left click [Inspect Start] and move the cursor in the analysis window, a red line appears.

Figure 4.15 Adjusting the Red Line to be the Starting Position



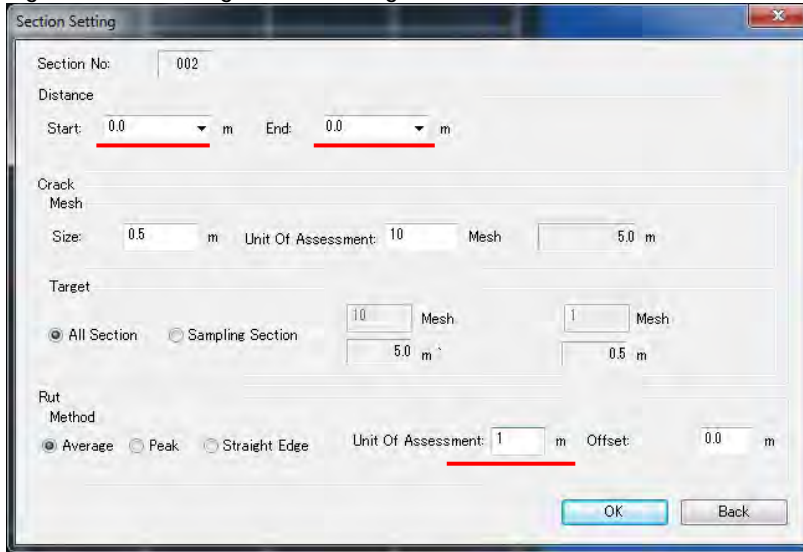
Confirm window appearing and left click [yes (Y)].

Figure 4.16 Setting the Starting Position



Check the values of red lined shown below.

Figure 4.17 Encoding Section Setting



If an analysis start setup is completed, the analysis section is divided and the line of the “Inspect Data List” is increasing. If it moves to an analysis starting position, the display of a ‘Rut Position’, ‘Management Data’ and etc... will appear in an analysis window, and preparation of analysis will be completed. The method of the end position of the analysis is same method of starting position.

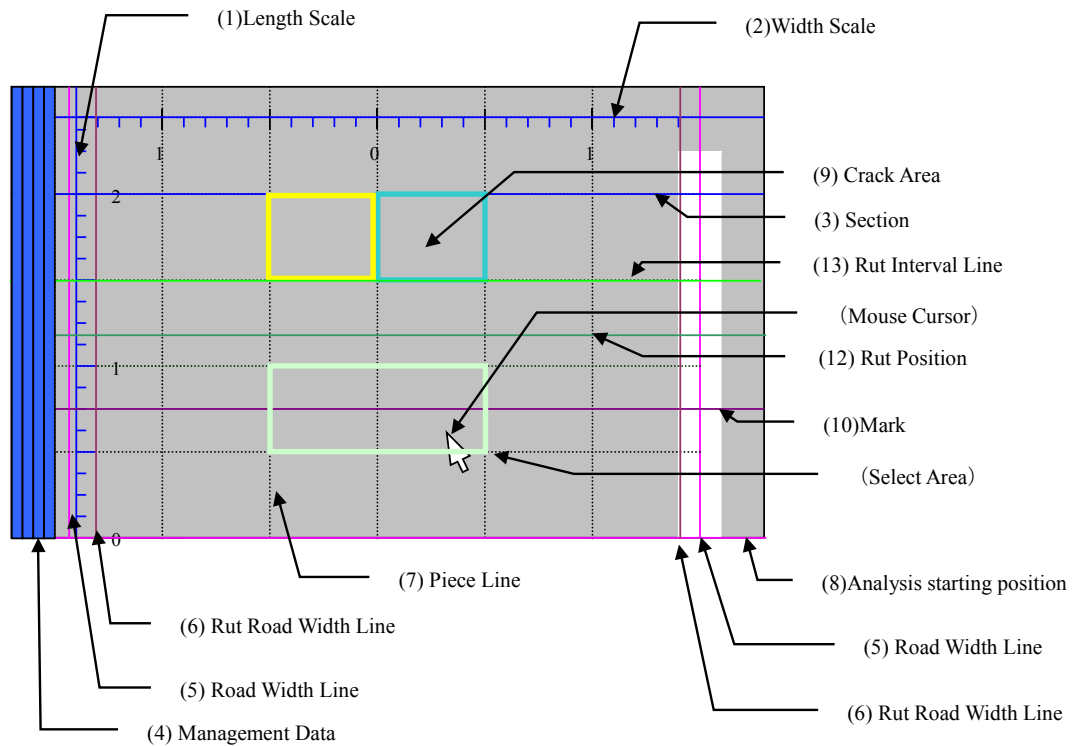
Figure 4.18 Starting Position Screen Image





Defining the start and the end point, these lines appear in the analysis window.

Figure 4.19 Indicators at Start-End Definition



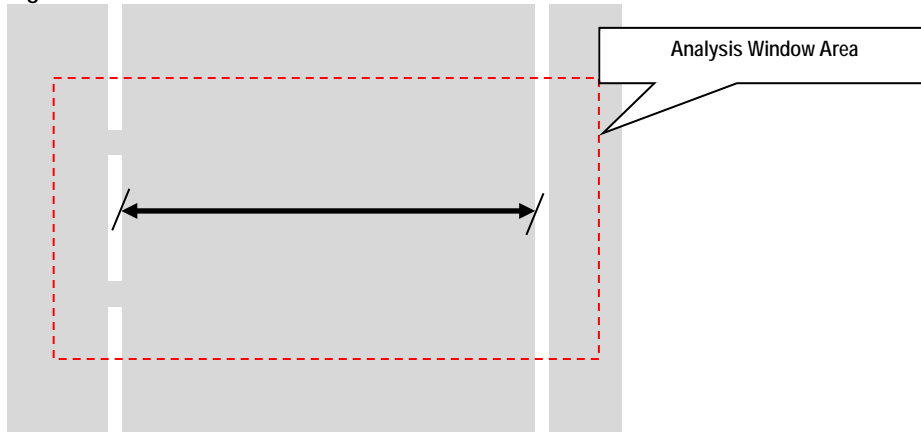
(3) Defining the Road Width

A. Examples of Road Width Setting

1) Case 1-Two white lines

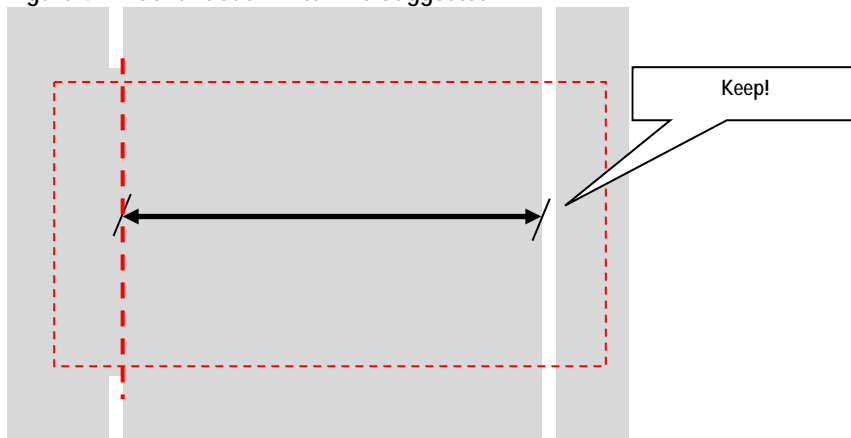
If two white lines are visible, the road width defines the inner side of a white line.

Figure 4.20 White Lines



The definition of width is not moved when the dashed line is continuing.

Figure 4.21 Continuous White Line Suggested



2) Case 2-One White Line

If one white line is visible, the road width defines from a line to the maximum width.

Figure 4.22 Road Width Determination without the Right White Line

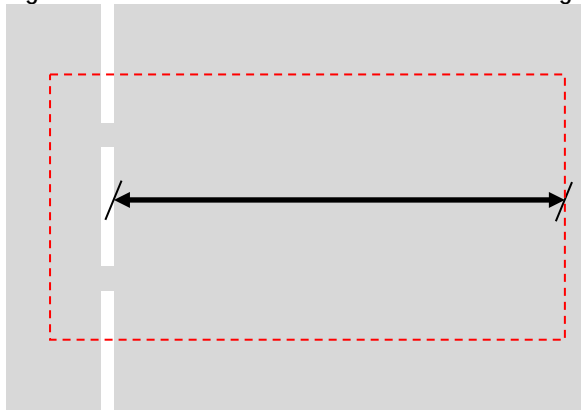
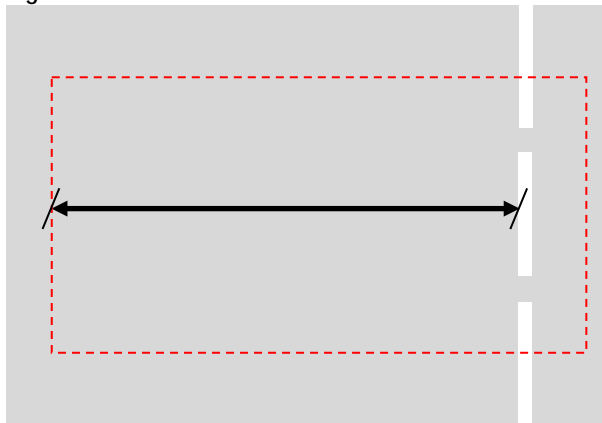


Figure 4.23 Road Width Determination without the Left White Line



If one white line is visible and another side is unpaved, the road width defines from a line to the end of pavement.

Figure 4.24 Determining the Road Width One Side Paved 1

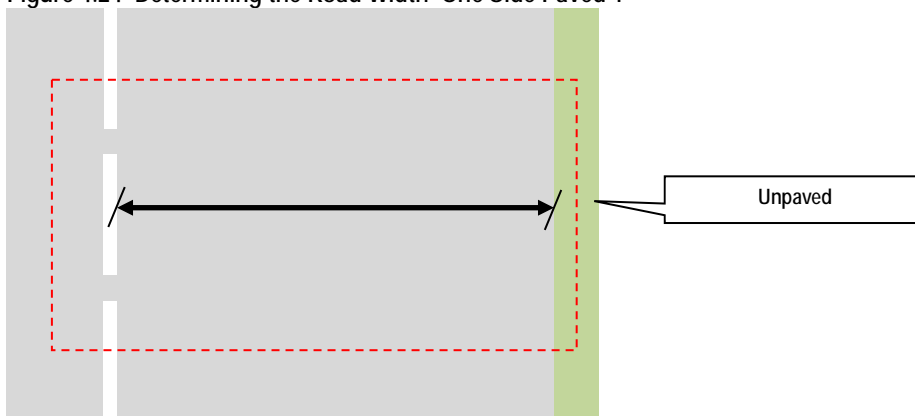
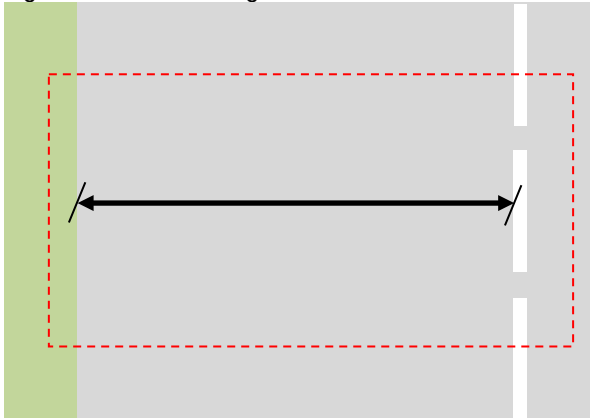


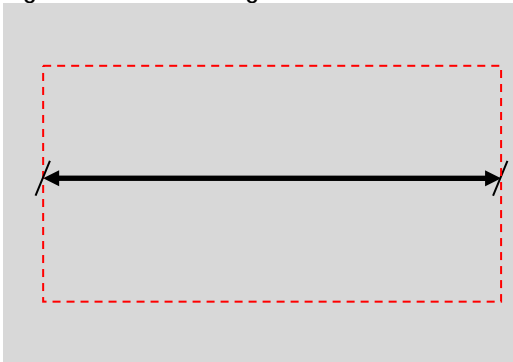
Figure 4.25 Determining the Road Width One Side Paved 2



3) Case 3-No white line

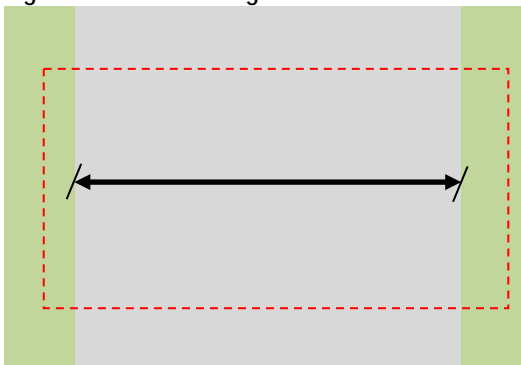
If there is no white line, the road width defines the maximum width.

Figure 4.26 Determining the Road Width Without the White Lines 1



If there is no white line and one side or both sides are unpaved, the road width defines the full width of pavement.

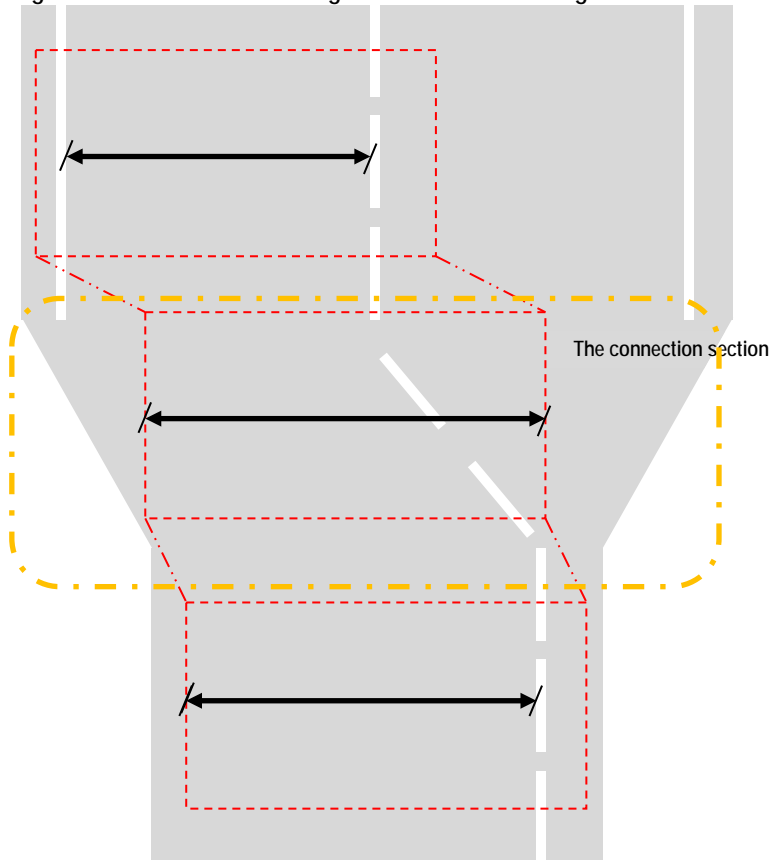
Figure 4.27 Determining the Road Width Without the White Lines 2



4) Case 4-A lane increases or decreases

If the number of lane increases or decreases, the connection sections road width defines the maximum width. However, when there is unpaved, the road width defines the full width of pavement.

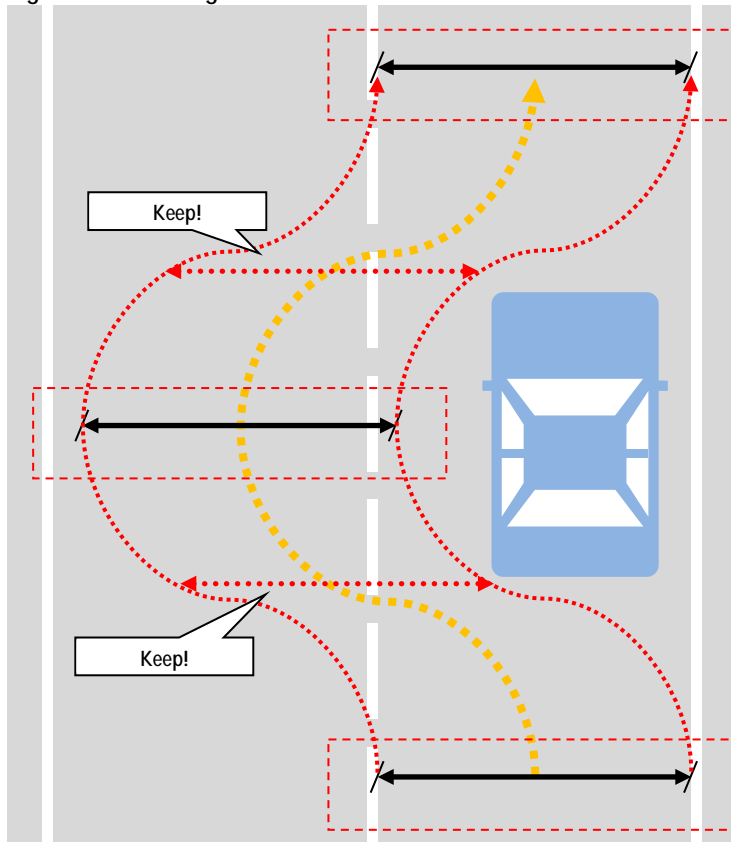
Figure 4.28 Schematic Drawing of Lane Number Change



5) Case 5- Passing a Vehicle

If the survey vehicle passes a car, the road width and rut width keep the width of the last session.

Figure 4.29 Passing a Vehicle

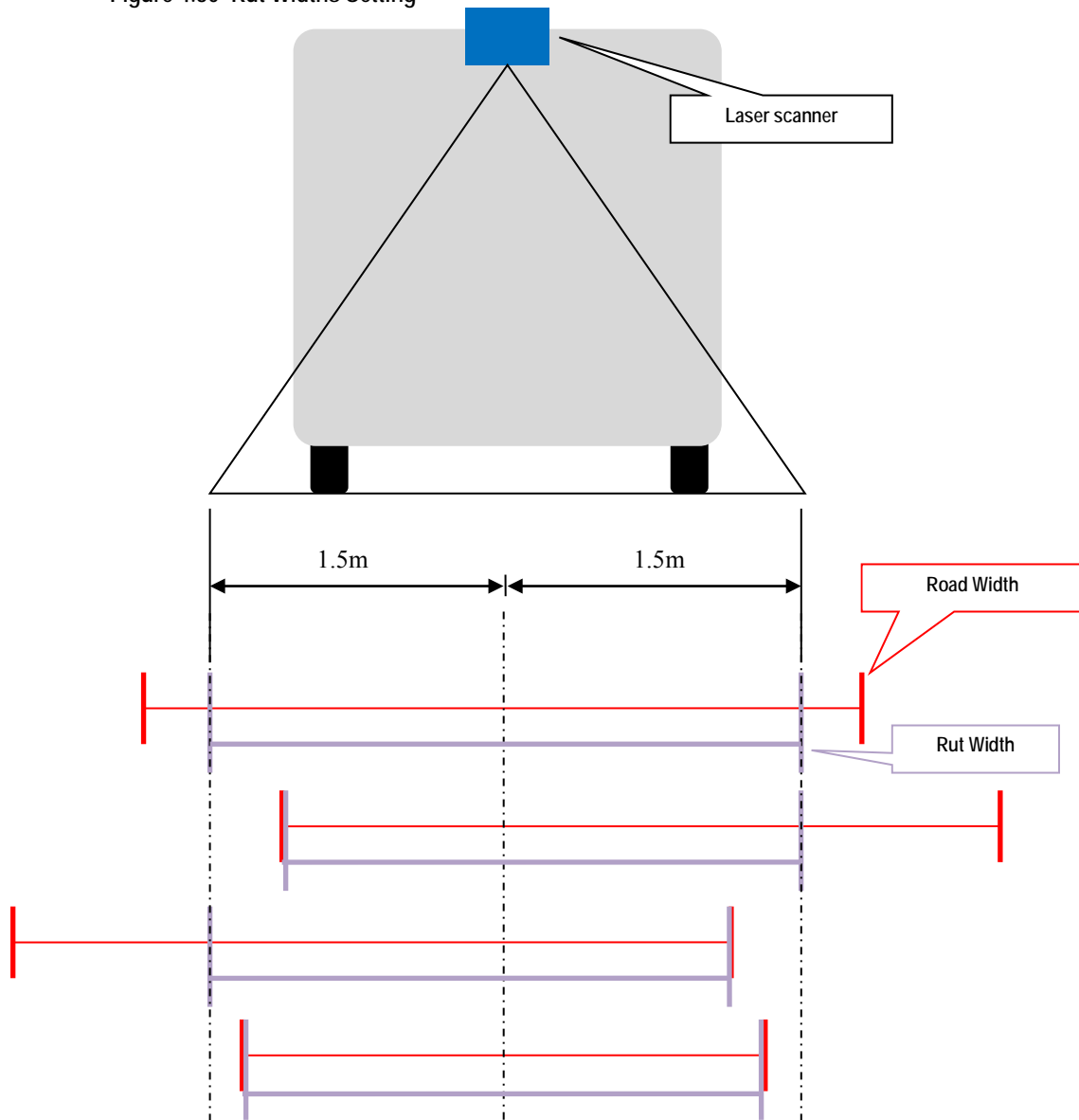


B. Setting the Rut Recording Widths

When the width of the road is wider or equal to 3.0 meters, set the rut recording width to 3.0 meter or less. If the width of the road is less than 3.0 meter, then set the rut width equal to the road width.

Road Width $\geq 3.0\text{m}$ \rightarrow Rut Width $\leq 3.0\text{m}$ (One side max: 1.5m)
 $< 3.0\text{m}$ \rightarrow = Road Width

Figure 4.30 Rut Widths Setting



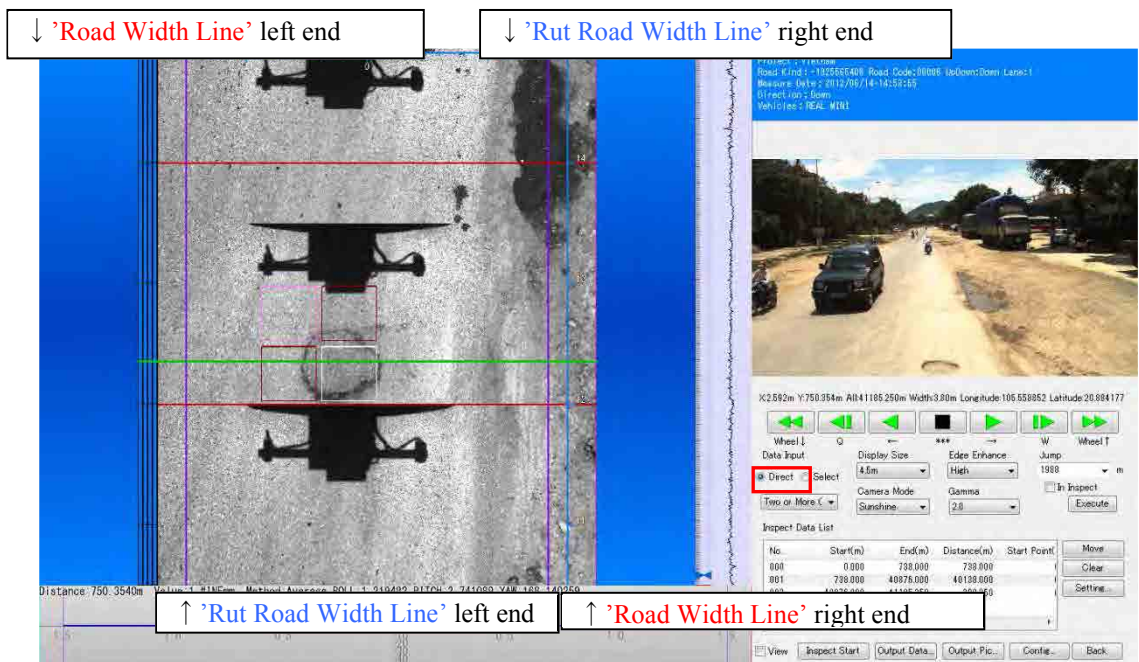
C. Road Width Setting for Interpretation

Change the [Display Size] 2.7m to 3.3m.

Figure 4.31 Road Width Setting



Defining the road width 'Road Width Line (3.8m)' and 'Rut Road Width Line (3.0m)'









Defining the road width Tips

<Crack Road Width>

Using the mouse, Ctrl and Shift keyboard input.

Table 4.2 Road Width Setting

| | | | |
|------------------|------|---|---|
| <Crack Width> | Road |  | When the mouse cursor looks like this, left and right side road width can change narrow or wide. |
| | |  | When the mouse cursor pushing the Ctrl key looks like this, left and right side road width of 1 sector can change narrow or wide. |
| | |  | When the mouse cursor pushing the Shift key looks like this, the road width moved by parallel translation. |
| | |  | When the mouse cursor pushing Ctrl + Shift key looks like this, the road width of 1 sector moved by parallel translation. |
| <Rut Road Width> | |  | When the mouse cursor pushing the Alt key looks like this, left and right side rut road width can change narrow or wide. |
| | |  | When the mouse cursor pushing Alt + Ctrl key looks like this, left and right side rut road width of 1 sector can change narrow or wide. |

(4) Crack / Patch / Pothole Interpretation

A. Examples/Cases of Crack/Patch/Pothole

Cracks, patches and potholes are interpreted and classified into thirteen categories. To each category, one key is assigned.

Table 4.3 Key Assignment

| No. | KEY | Classification | Explanations |
|-----|-----|----------------------|--|
| 1 | A | Two or More Crack | There are two or more cracks in the mesh |
| 2 | S | One Crack | There is one crack in the mesh |
| 3 | D | Patching 75% | Patching occupies an area of more than 75% of the mesh |
| 4 | F | Patching 25% | Patching occupies an area of more than 25% to less than 75% of the mesh |
| 5 | Z | Pothole 75% | Pothole occupies an area of more than 75% of the mesh |
| 6 | X | Pothole 25% | Pothole occupies an area of more than 25% to less than 75% of the mesh |
| 7 | C | Pothole | Pothole occupies an area of greater than 0% to less than 25% of the mesh |
| 8 | Q | Concrete Crack 25cm | Total length of crack in the mesh are more than 25cm to less than 50cm |
| 9 | W | Concrete Crack 50cm | Total length of crack in the mesh are more than 50cm to less than 75cm |
| 10 | E | Concrete Crack 75cm | Total length of crack in the mesh are more than 75cm to less than 100cm |
| 11 | R | Concrete Crack 100cm | Total length of crack in the mesh are more than 100cm to less than 125cm |
| 12 | T | Concrete Crack 125cm | Total length of crack in the mesh are more than 125cm to less than 150cm |
| 13 | Y | Concrete Crack 150cm | Total length of crack in the mesh are more than 150cm |

1,2 : Asphalt only

3~7 : Asphalt and Concrete

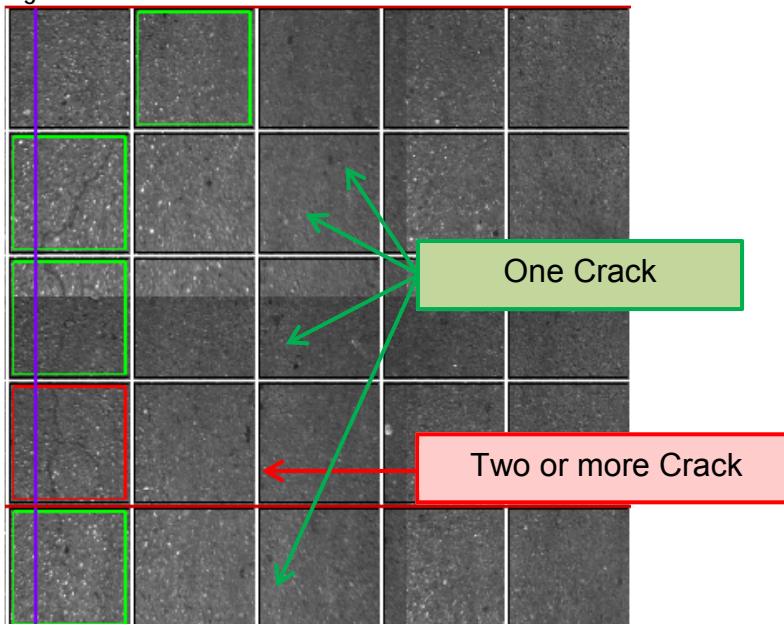
8~13 : Concrete only

Figure 4.32 Keys Assignment (Graphical Presentation)



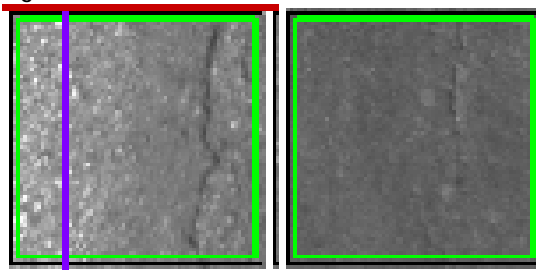
The following image show an example of one crack and two or more cracks in one mesh.

Figure 4.33 Crack Observation



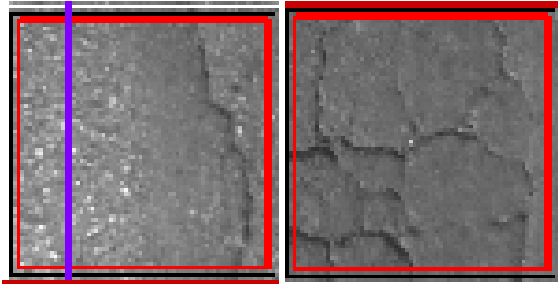
One crack is observed.

Figure 4.34 One Crack



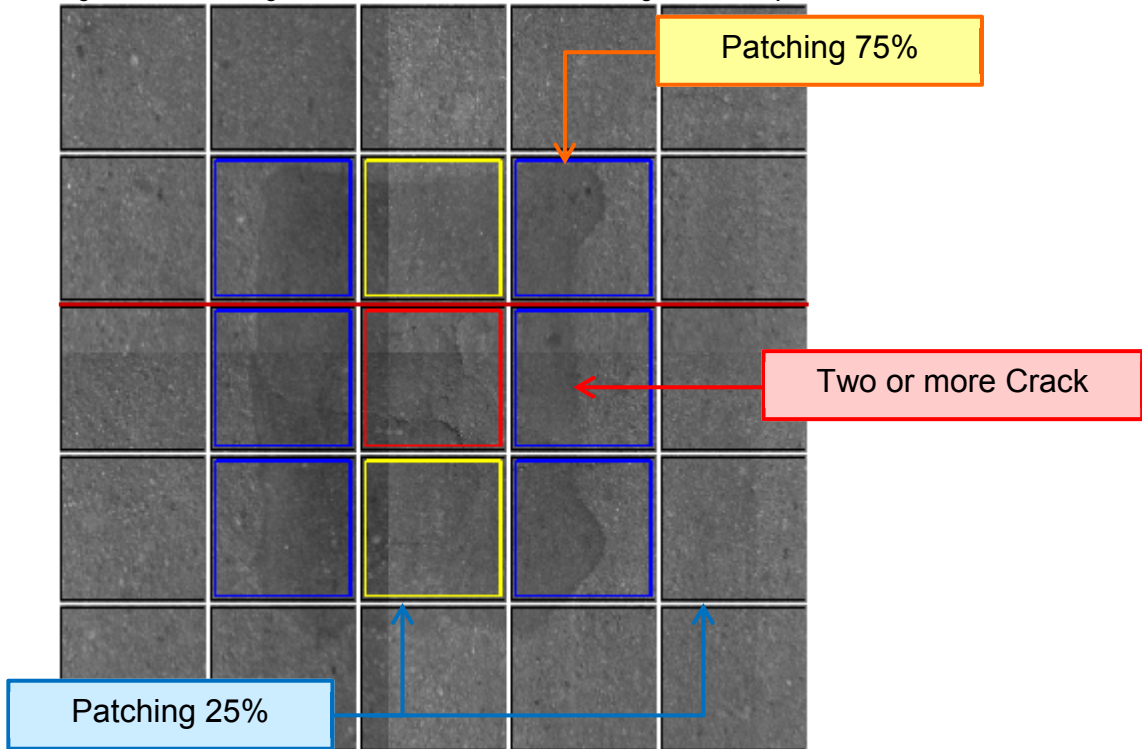
Two or more cracks are observed.

Figure 4.35 Two or More Crack



Following examples show the cases of Patching 75% and Patching 25%.

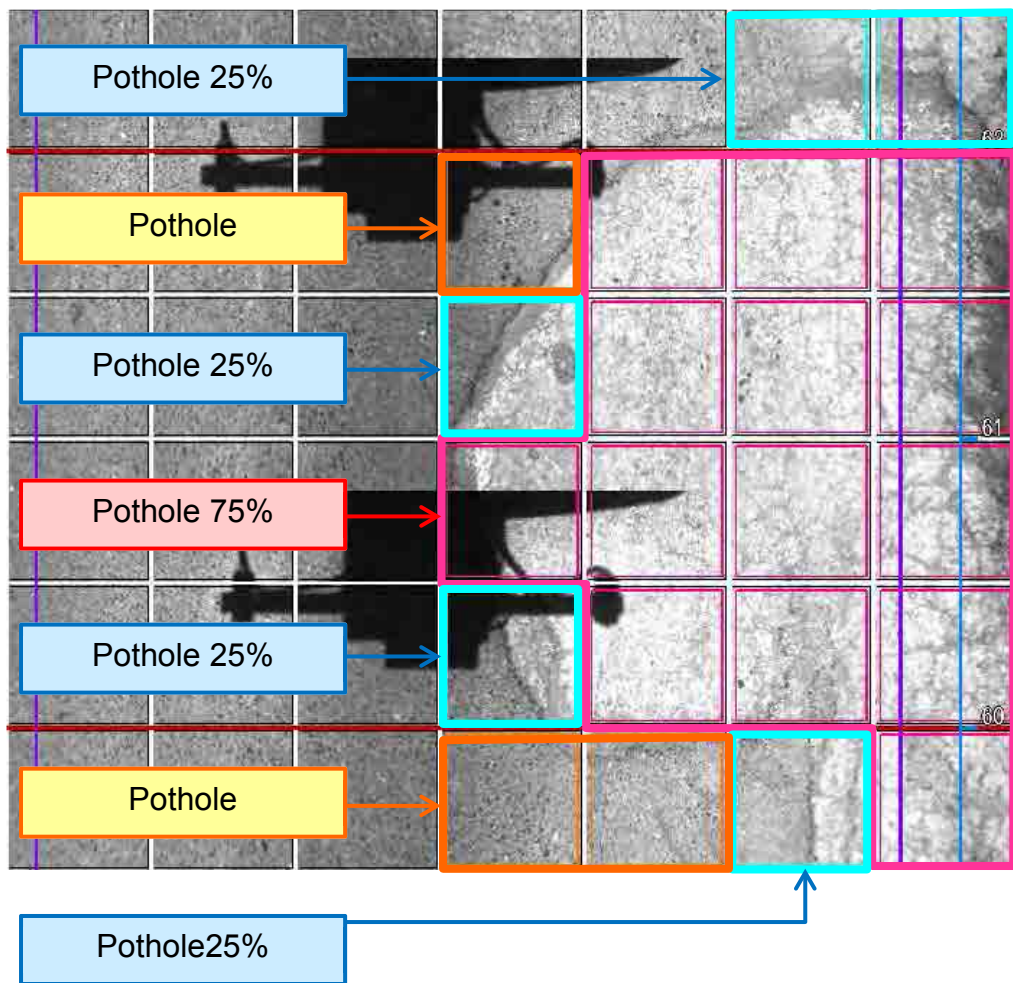
Figure 4.36 Patching 75%, Two or More Cracks, Patching 25% (Example)



If there is a crack in the patching, the classification is “One Crack” or “Two or More Crack.”.

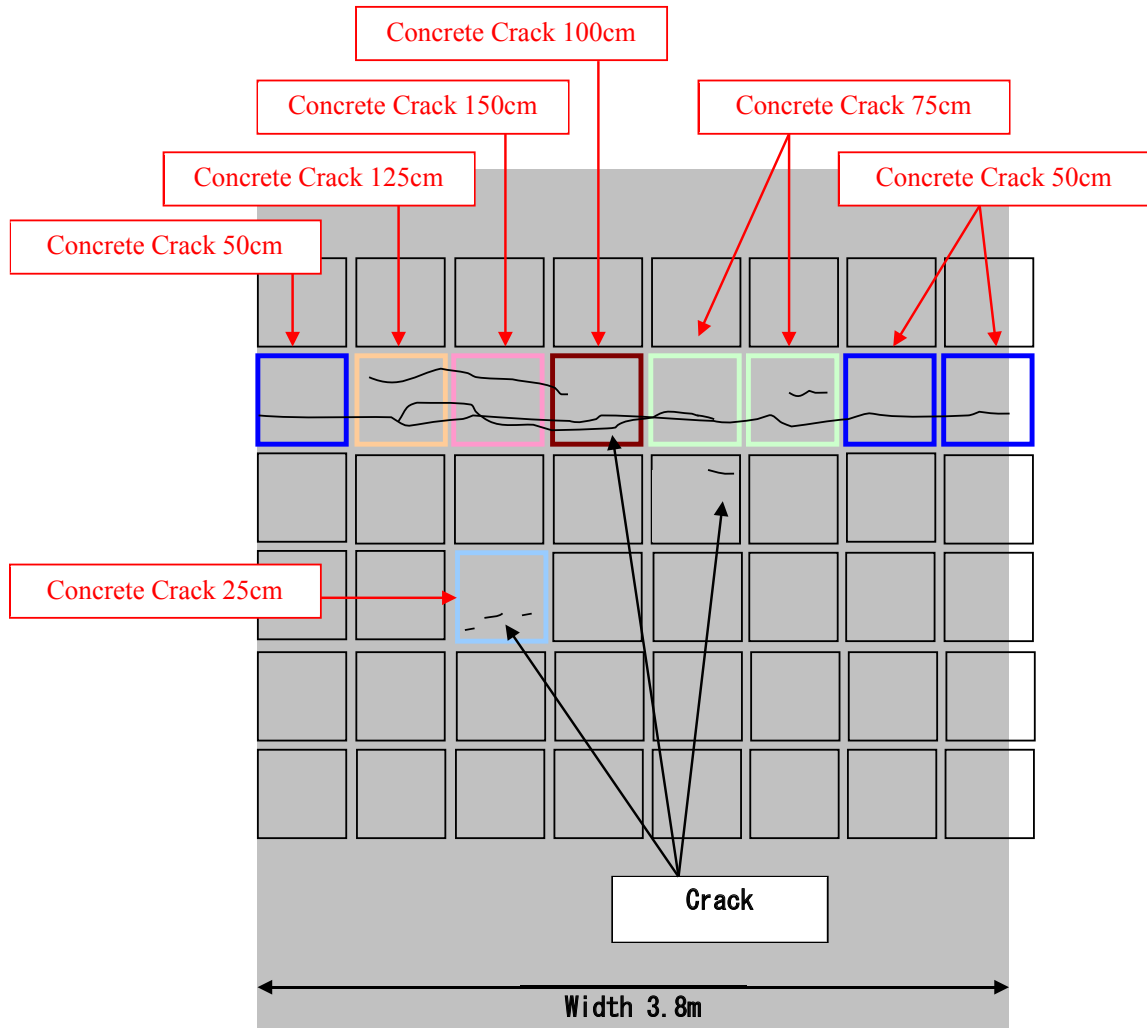
Following examples show: Pothole 75%, Pothole 25%, and Pothole.

Figure 4.37 Pothole - Front View,



The next examples show Concrete Crack 25cm, Concrete Crack 50cm, Concrete Crack 75cm, Concrete Crack 100cm, Concrete Crack 125cm, Concrete Crack 150cm.

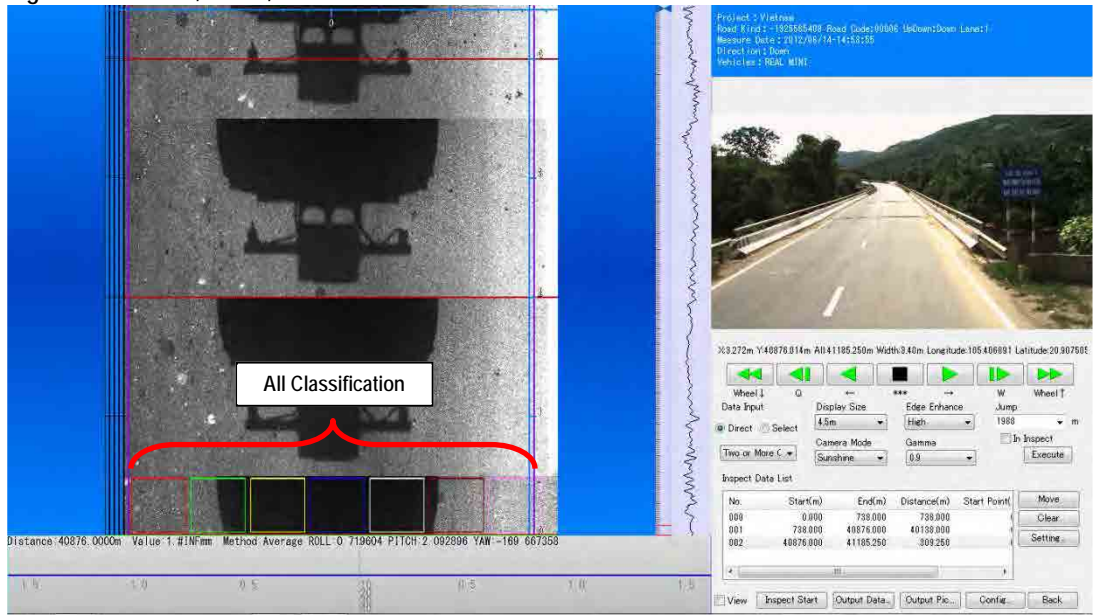
Figure 4.38 Schematic Presentation of Pavement Damage Interpretation (Cement Concrete)



B. Cracks/patch/pothole Interpretation

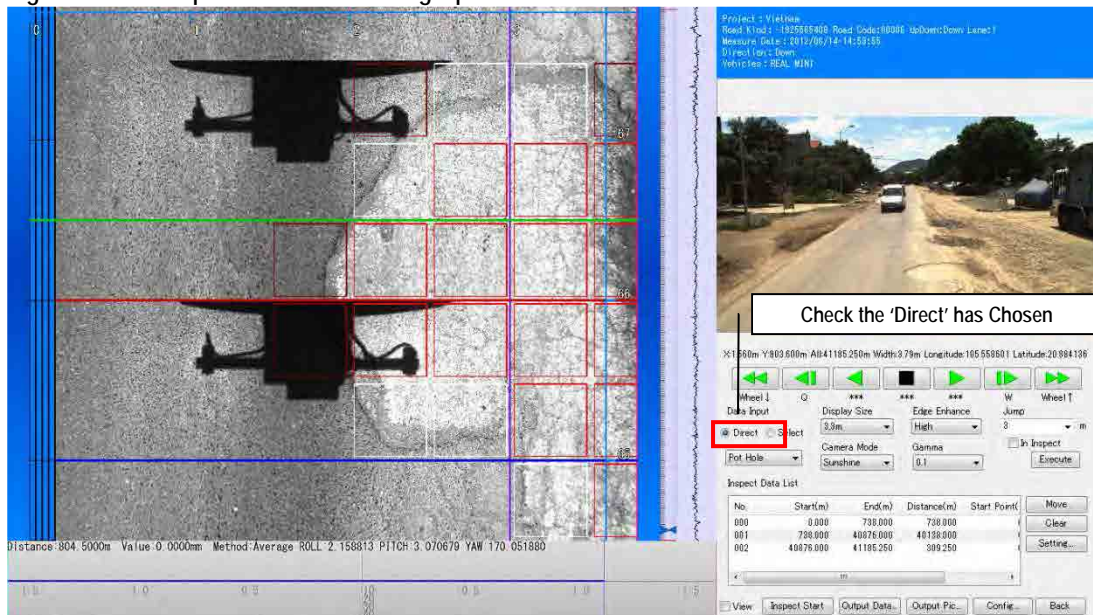
In the crack interpretation, we choose several crack classifications of the road surface. Classification are: 'Two or More Crack', 'One Crack', 'Patching 75%', 'Patching 25%', 'Pot Hole 75%', 'Pot Hole 25%' and 'Pot Hole'.

Figure 4.39 Crack, Patch, Pothole Classification



Several crack Classifications have assigned for a keyboard input. Moving the mouse cursor in the analysis window and input it from the keyboard. →Refer the Crack Reference.

Figure 4.40 Example of Crack Recording Operation

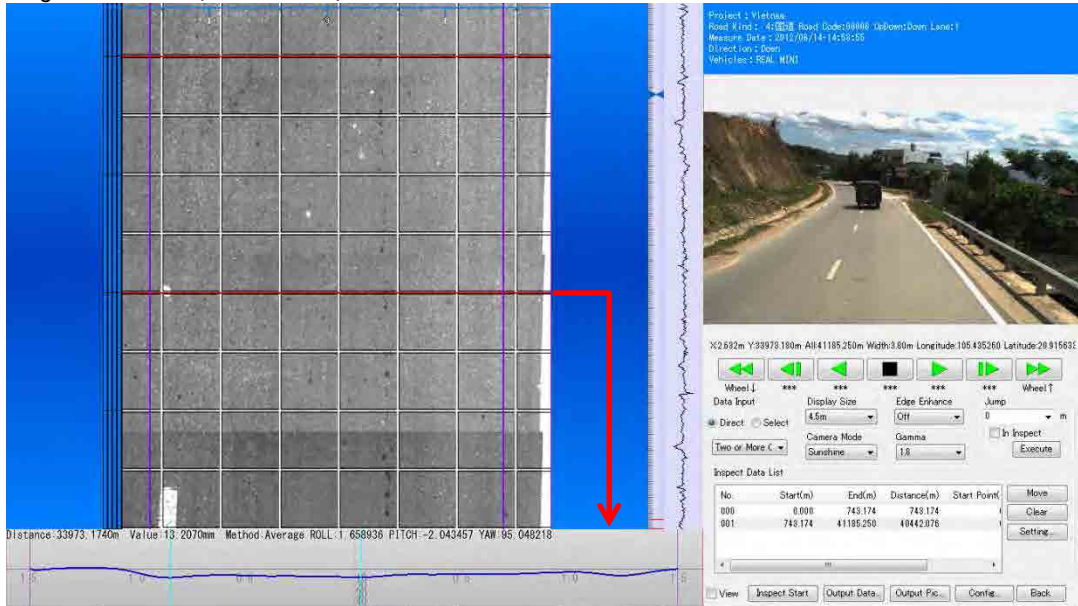


(5) Rut Analysis

A. Examples/Cases of Rut

When the road surface is dry, the sensor records the data normally.

Figure 4.41 Rut (Normal Case)



When there is puddle, the sensor does not record rut data accurately.

Figure 4.42 Rut (Abnormal Case)



The following image shows a case of deep rut.

Figure 4.43 Deep Rut



B. Rut Interpretation

Green colored line 'Rut Position' in the analysis window appears in the rut window.

Figure 4.44 Rut Position



Pushing the Ctrl key and left click the mouse can check the rut shape optionally. When the rut shape has a strange feature, change the rut position to the right position.

(6) Road Surface Classification

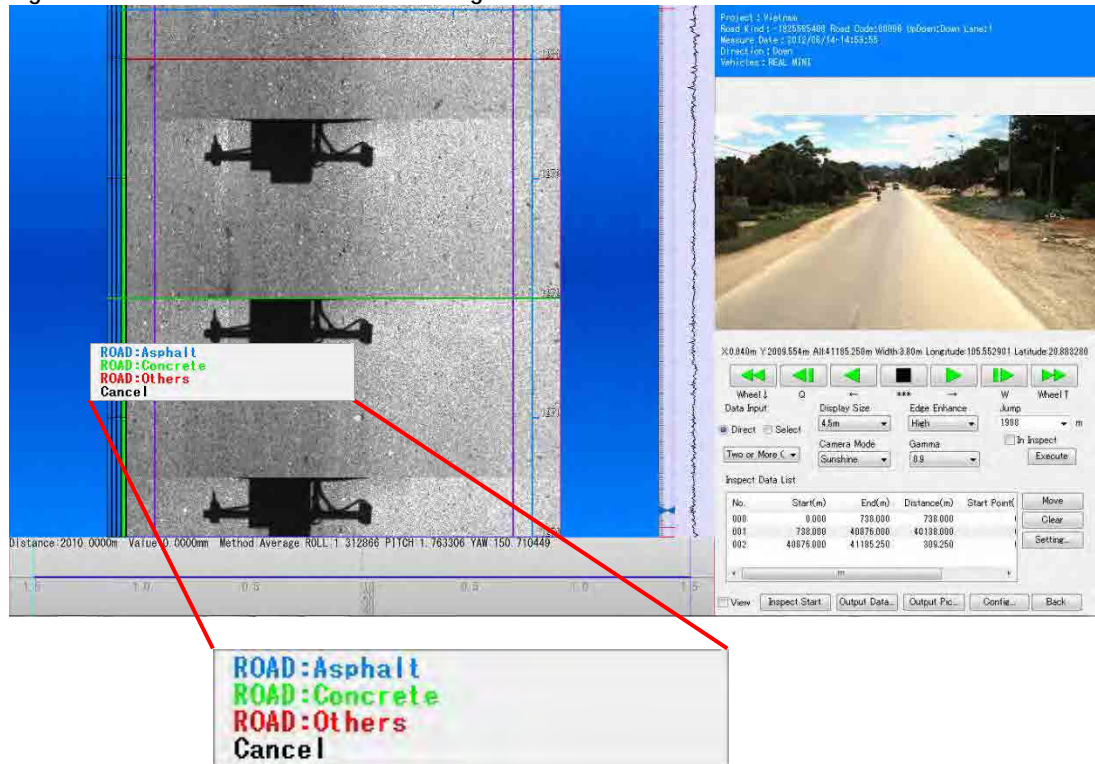
A. Examples/Cases of Road Surface Types

The following are samples of road surface types: asphalt; concrete; and others.

B. Classify road Surface Classification

Cursor the mouse to the left end of the 'Management Data' area appears "1". Then right click the mouse, appears the small window which can choose the road surface Classification. In an example shown below is Asphalt pavement so choose the 'ROAD: Asphalt'.

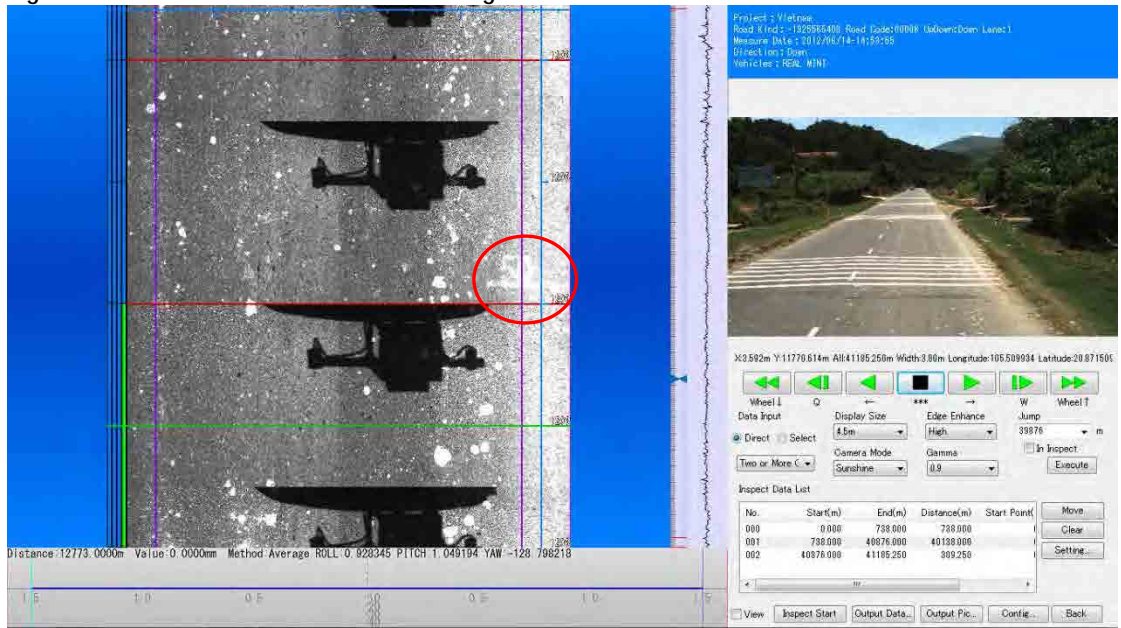
Figure 4.45 Road Surface Classification Images



(7) Identifying the Kilometer Posts

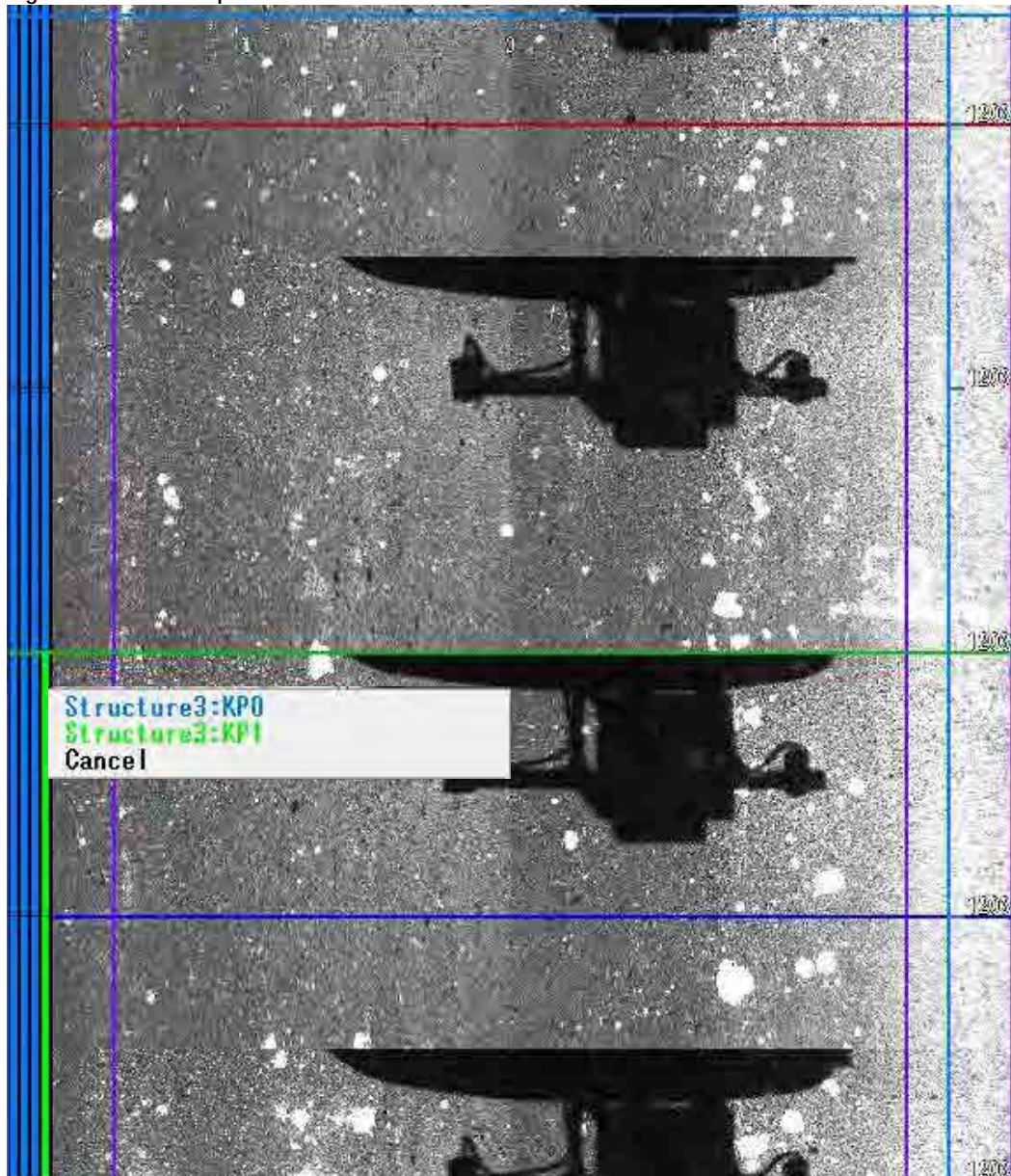
The road surface marking is seen on the road.

Figure 4.46 Kilometer Post View on Road Image



If you identified the marking on the road surface, set the kilometer post right click the right end of the 'Management Data'.

Figure 4.47 Color Representation of Distance Between the Kilometer Post



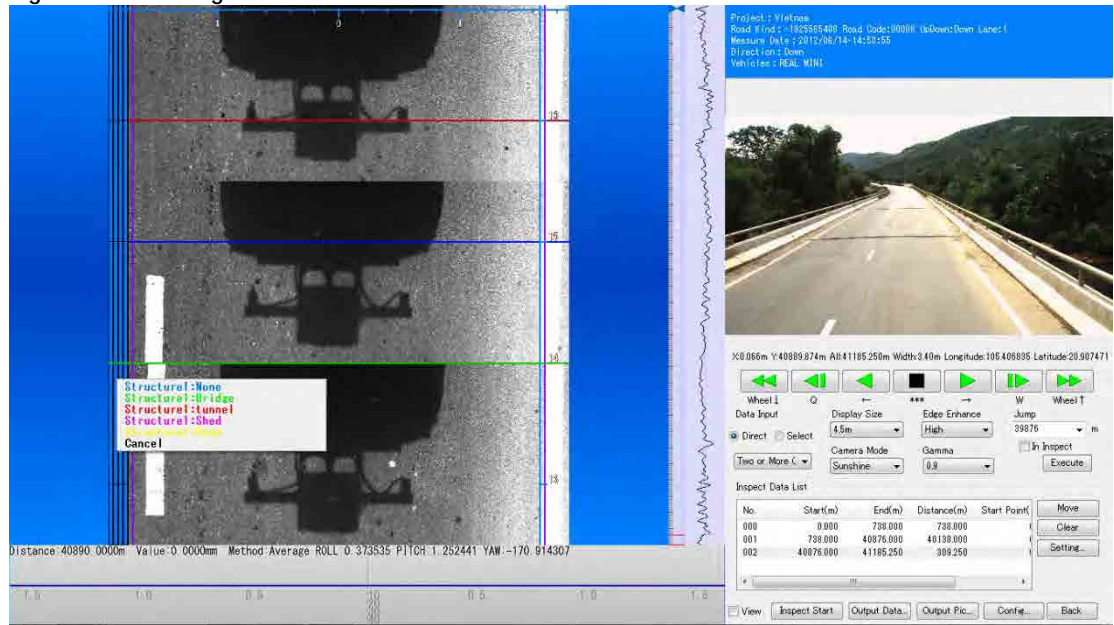
Green and blue are used alternatively to show road segments between kilometer posts. For example, the kilometer posts between 49 to 50, green is used, and from 50 to 51, blue is used.

(8) Defining Road Structure

A. Registration of Road Structures

Bridges and tunnels are examples of road structure. Classification of structures (like a bridge, tunnel, etc...) can be defined using from the right to the 2nd of the 'Management Data'. Reference the analysis window and the forward view; choose the Classification of the construction.

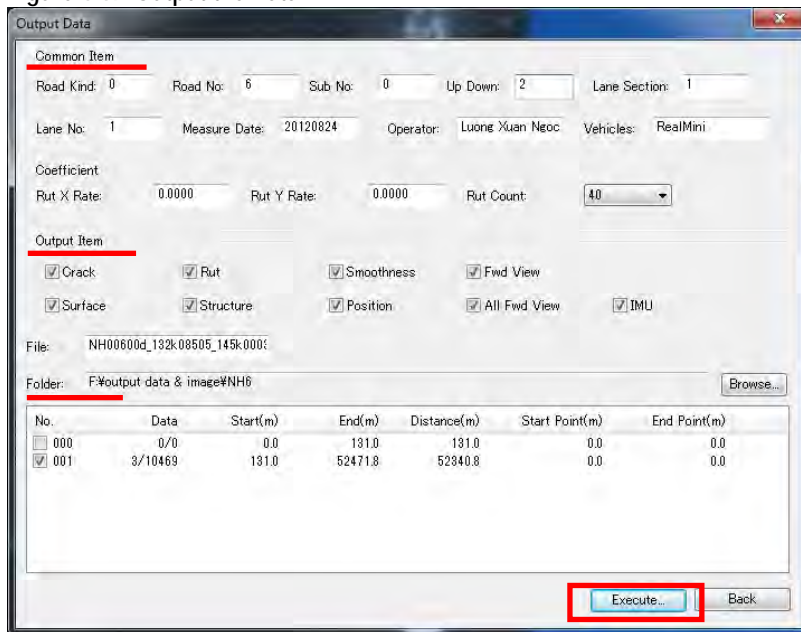
Figure 4.48 Defining Road Structures



(9) Output the Data

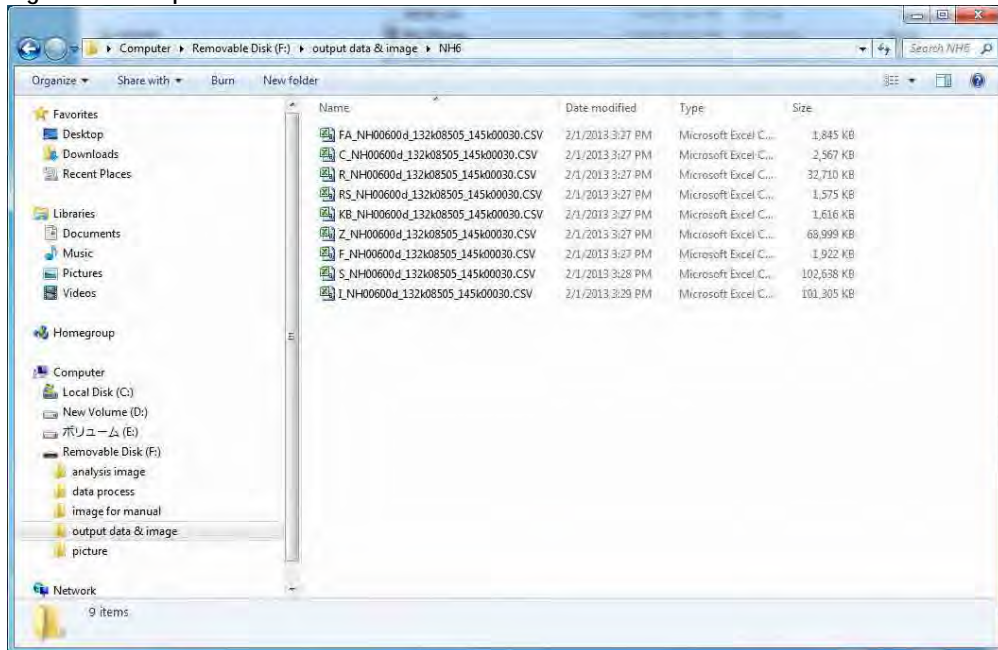
Input several pieces of information (like a 'Road Kind', 'Road No', 'Sub No', 'Up Down', etc...) in the 'Common Item.'

Figure 4.49 Output the Data



Check the 'Output Item' and 'Folder', left click [Execute]. Output data will be created to the folder reserved.

Figure 4.50 Outputs in a Folder



5. Road Condition Data Integration System

5.1 Final Output

The road condition data processing system is a semi-automatic system to produce the final output of the road condition survey--road surface condition data. Both raw data (csv format) and Excel data (formatted) data will be created.

Figure 5.1 Road Surface Condition Data (Raw Data - Example) -- the Final Output

| | | |
|----|--|--|
| 1 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,30,800,30,700,100,343,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,19,11,3,58,, |
| 2 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,30,700,30,800,100,330,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,21,12,2,13,, |
| 3 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,30,800,30,900,100,338,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,25,15,2,58,, |
| 4 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,30,900,31,0,30,103,2,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,21,13,2,56,, |
| 5 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,0,31,100,100,332,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,24,15,1,81,, |
| 6 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,100,31,200,100,340,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,28,16,2,48,, |
| 7 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,200,31,280,80,272,8,,1,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,19,3,19,U/N,, |
| 8 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,280,31,285,5,17,6,8,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,21,19,1,72,THANH GIA Brg,, |
| 9 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,285,31,300,15,52,4,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,48,22,2,28,, |
| 10 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,300,31,400,100,339,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,35,20,1,86,, |
| 11 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,400,31,500,100,325,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,24,17,2,07,, |
| 12 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,500,31,600,100,342,0,,1,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,33,18,2,25,U/N,, |
| 13 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,600,31,700,100,350,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,18,2,00,, |
| 14 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,700,31,800,100,343,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,20,2,47,, |
| 15 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,800,31,900,100,322,0,,,,,2,2,0,1,AC,2012,7,2,8,0,0,0,0,2,8,22,16,1,94,, |
| 16 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,31,900,31,1000,100,341,0,,1,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,19,2,24,U/N,, |
| 17 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,0,32,100,100,346,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,26,17,2,89,, |
| 18 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,100,32,200,100,348,0,,1,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,25,16,8,16,U/N,, |
| 19 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,200,32,300,100,338,0,,,,,2,2,0,1,AC,2012,7,2,8,0,0,0,0,2,8,25,19,2,61,, |
| 20 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,300,32,400,100,336,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,17,2,20,, |
| 21 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,400,32,500,100,339,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,24,17,2,53,, |
| 22 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,500,32,600,100,351,0,,,,,2,2,0,1,AC,2012,7,1,1,0,0,0,0,1,1,24,16,2,72,, |
| 23 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,600,32,700,100,346,0,,1,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,28,19,2,07,U/N,, |
| 24 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,700,32,800,100,340,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,26,16,2,31,, |
| 25 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,800,32,900,100,330,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,24,12,3,76,, |
| 26 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,32,900,33,0,45,168,3,,RA,,2,2,0,1,AC,2012,7,1,9,0,0,0,0,1,9,26,15,3,97,U/N,, |
| 27 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,0,33,100,100,342,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,26,16,3,79,, |
| 28 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,100,33,200,100,342,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,15,3,55,, |
| 29 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,200,33,300,100,344,0,,RC,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,27,14,7,20,U/N,, |
| 30 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,300,33,400,100,352,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,23,15,2,20,, |
| 31 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,400,33,500,100,371,0,,,,,2,2,0,1,AC,2012,7,3,0,0,0,0,0,0,0,3,0,21,13,2,60,, |
| 32 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,500,33,600,100,357,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,28,14,2,49,, |
| 33 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,600,33,700,100,367,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,25,14,3,51,, |
| 34 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,700,33,800,100,376,0,,RA,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,29,16,2,98,U/N,, |
| 35 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,33,800,34,0,90,324,9,,,,,2,2,0,1,AC,2012,7,1,8,0,0,0,0,1,8,29,16,4,00,, |
| 36 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,0,34,100,100,353,0,,,,,2,2,0,1,AC,2012,7,0,5,0,0,0,0,0,5,24,16,2,77,, |
| 37 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,100,34,200,100,354,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,24,16,2,42,, |
| 38 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,200,34,300,100,353,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,28,18,2,54,, |
| 39 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,300,34,400,100,337,0,,,,,2,2,0,1,AC,2012,7,4,0,0,0,0,0,4,0,28,16,2,20,, |
| 40 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,400,34,500,100,333,0,,,,,2,2,0,1,AC,2012,7,1,2,0,0,0,0,1,2,28,18,2,24,, |
| 41 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,500,34,600,100,337,0,,,,,2,2,0,1,AC,2012,7,0,0,0,0,0,0,0,0,26,17,2,30,, |
| 42 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,600,34,700,100,352,0,,,,,2,2,0,1,AC,2012,7,28,6,0,0,0,0,28,6,31,21,2,46,, |
| 43 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,700,34,800,100,337,0,,,,,2,2,0,1,AC,2012,7,26,3,0,0,0,0,26,3,39,24,2,49,, |
| 44 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,800,34,900,100,339,0,,,,,2,2,0,1,AC,2012,7,5,9,0,0,0,0,5,9,27,18,7,48,, |
| 45 | NORTHERN AREA,RRMU2,RRMC238,2,0,NATIONAL HIGHWAY | 2,34,900,35,0,100,339,0,,,,,2,2,0,1,AC,2012,7,5,9,0,0,0,0,5,9,27,18,7,48,, |

5.2 Data Used

To create the final outputs, following data are necessary:

Table 5.1 Data Required to Produce Road Surface Condition Data

| File Name | Type | Process Produced | Description | Note |
|------------------------------------|----------------------|----------------------|-----------------------------------|--------------------------------|
| 0001 | Road Management Data | Field Reconnaissance | Jurisdiction and Corporation | |
| 0003 | Road Management Data | Field Reconnaissance | Distances between kilometer posts | |
| 0004E | Road Management Data | Field Reconnaissance | Overlapping management | English |
| 0004VN | Road Management Data | Field Reconnaissance | Overlapping management | Vietnamese |
| 0005 | Road Management Data | Field Reconnaissance | Station Number note | |
| 0101 | Road Management Data | Field Reconnaissance | Lane structure | |
| 0104E | Road Management Data | Field Reconnaissance | Road structure | English |
| 0104VN | Road Management Data | Field Reconnaissance | Road structure | Vietnamese |
| 0105E | Road Management Data | Field Reconnaissance | Intersection | English |
| 0105VN | Road Management Data | Field Reconnaissance | Intersection | Vietnamese |
| 0201E | Road Management Data | Field Reconnaissance | Impassable segment | |
| 0201VN | Road Management Data | Field Reconnaissance | Impassable segment | |
| commonE | Common Data | Data Processing | | English |
| commonVN | Common Data | Data Processing | | Vietnamese |
| C_NH00100D_000k00010_051k00000.CSV | Crack Data | Analysis | | This data use for data process |
| R_NH00100D_000k00010_051k00000.CSV | Rut volume Data | Analysis | | This data use for data process |
| S_NH00100D_000k00010_051k00000.CSV | Profile Data | Analysis | | This data use for data process |

Data to be used are from the processes of Field Reconnaissance and Pavement Damage Interpretation.

The common data are prepared in this process of data integration.

(1) Common Data

The common data has two data codes: 02 and 03. The data structures of data codes 02 and 03 are expressed in Table 5.2 and Table 5.3.

Table 5.2 Geographical Area, Jurisdiction, Management Company (Data Code 02)

| Data Code | Geographical Area | Jurisdiction | Management Company | Description |
|-----------|-------------------|--------------|--------------------|-----------------------|
| 1 | 3 | 5 | 7 | 10 |
| 0 2 | 0 1 | 0 0 | 0 0 0 | N O T H E R N A R E A |
| 0 2 | 0 1 | 1 0 | 0 0 0 | R R M U 2 |
| 0 2 | 0 1 | 1 0 | 2 2 2 | R R M C 2 2 2 |

Table 5.3 Route Number, Branch Number, Route Name (Data Code 03)

| Data Code | Geographical Area | Blank | Route Number | Branch Number | Description |
|-----------|-------------------|-------|--------------|---------------|---|
| 1 | 3 | | 6 | 9 | 11 |
| 0 3 | 0 1 | | 0 0 1 | 0 0 | N A T I O N A L H I G H W A Y 1 |
| 0 3 | 0 1 | | 0 0 1 | 0 1 | S O U T H E R N R I N G R O A D 3 T O C A U D A C |
| 0 3 | 0 1 | | 0 0 2 | 0 0 | R R M C 2 2 2 |

Use the codes in Table 5.4 to express the geographical areas.

Table 5.4 Geographical Area

| Geographical Area | Code |
|----------------------|------|
| Northern Area | 01 |
| Northern Middle Area | 02 |
| Southern Middle Area | 03 |
| Southern Area | 04 |

The common data are created from the two tables. The codes used in the common data come from the following two tables. The jurisdiction code shall be selected and encoded from the following list.

Table 5.5 Jurisdiction Classification

| Jurisdiction | Code |
|--------------------|------|
| RRMU2 | 10 |
| RRMU4 | 20 |
| RRMU5 | 30 |
| RRMU7 | 40 |
| Province | 50 |
| Company | 60 |
| Under construction | 70 |

The three-digit codes are entered from the following list.

Table 5.6 Management Corporation Codes

| Management Company | Code |
|--------------------|------|
| RRMC222 | 222 |
| RRMC224 | 224 |
| RRMC226 | 226 |
| RRMC232 | 232 |
| RRMC234 | 234 |
| RRMC236 | 236 |
| RRMC238 | 238 |
| RRMC240 | 240 |
| RRMC242 | 242 |
| RRMC244 | 244 |
| RRMC248 | 248 |
| Other | 999 |

A commonE file is created as in the following example.

Figure 5.2 commonE (An Example)

```

1 02 1 0 0Northern Area
2 02 110 0RRMU2
3 02 110222RRMC222
4 02 110224RRMC224
5 02 110226RRMC226
6 02 110232RRMC232
7 02 110234RRMC234
8 02 110236RRMC236
9 02 110238RRMC238
10 02 110240RRMC240
11 02 110242RRMC242
12 02 110244RRMC244
13 02 110248RRMC248
14 02 110999Other
15 02 150 0Province
16 02 150999Other
17 02 160 0Company
18 02 160999Other
19 02 170 0Under Construction
20 02 170999Other
21 02 2 0 0Northern Middle Area
22 02 3 0 0Southern Middle Area
23 02 4 0 0Southern Area
24 03 1 1 0National Highway 1
25 03 1 1 1Southern Ring Road 3 to Cau Dau
26 03 1 2 0National Highway 2
27 03 1 3 0National Highway 3
    
```

(2) Field Reconnaissance Data

The outputs of the management data have been discussed in 2.5(6)Preparation of Road Management Data . The files required are summarized in Table 5.7.⁵

Table 5.7 Management Data Files

| File Name | Description | Note |
|-----------|-----------------------------------|------------|
| 0001 | Jurisdiction and Corporation | |
| 0003 | Distances between kilometer posts | |
| 0004E | Overlap | English |
| 0004VN | Overlap | Vietnamese |
| 0005 | Station No note | |
| 0101 | Lane structure | |
| 0104E | Road structure | English |
| 0104VN | Road structure | Vietnamese |
| 0105E | Intersection | English |
| 0105VN | Intersection | Vietnamese |
| 0201E | Impassable segment | |
| 0201VN | Impassable segment | |

(3) Analysis Data

The following three csv files are data examples of IRI, rut depths and cracks.

Table 5.8 Profile Data, IRI Data Structure

| No | Field | No | Field | No | Field |
|----|---------------------------|----|-------------------------|----|------------------------|
| 1 | Road Classification | 12 | Road Surface Type | 23 | Vehicle |
| 2 | Route Number | 13 | Structure1 | 24 | Name of Leader |
| 3 | Branch Number | 14 | Structure2 | 25 | Longitude (from) |
| 4 | Inbound, Outbound | 15 | Structure3 | 26 | Latitude (from) |
| 5 | Lane Classification | 16 | Displacement meter 1 | 27 | Altitude (from) |
| 6 | Lane Number | 17 | Displacement meter 2 | 28 | Longitude (to) |
| 7 | Analysis (from) | 18 | Displacement meter 3 | 29 | Latitude (to) |
| 8 | Analysis (to) | 19 | Flatness | 30 | Altitude (to) |
| 9 | Length (from) | 20 | Displacement Volume | 31 | GPS Flag |
| 10 | Length (to) | 21 | Profile | 32 | Managed Station Number |
| 11 | Surveyed Year, Month, Day | 22 | Analysis Segment Length | 33 | Management Number |

⁵ Vietnamese files are included, since this manual is based on an Vietnamese project.

Figure 5.3 IRI Data (from Road Surface Condition Data Interpretation and Encoding)

Table 5.9 shows the rut depth data structure.

Table 5.9 Rut Depth Data Structure

| No | Field | No | Field | No | Field |
|----|--------------------------|----|-------|-----|---------------------------|
| 1 | Road Classification | 26 | Y5 | 51 | Y17 |
| 2 | Route Number | 27 | X6 | 52 | X18 |
| 3 | Branch Number | 28 | Y6 | 53 | Y18 |
| 4 | Inbound Outbound | 29 | X7 | 54 | X19 |
| 5 | Lane Classification | 30 | Y7 | 55 | Y19 |
| 6 | Lane Number | 31 | X8 | 56 | X20 |
| 7 | Analysis (from) | 32 | Y8 | 57 | Y20 |
| 8 | Analysis (to) | 33 | X8 | - | - |
| 9 | Length (from) | 34 | X9 | - | - |
| 10 | Length (to) | 35 | Y9 | - | - |
| 11 | Surveyed Year Month Date | 36 | X10 | 175 | X80 |
| 12 | Surface Classification | 37 | Y10 | 176 | Y80 |
| 13 | Structure 1 | 38 | X11 | 177 | Analysis Method |
| 14 | Structure 2 | 39 | Y11 | 178 | Analysis Segment Distance |
| 15 | Structure 3 | 40 | X12 | 179 | Vehicle |
| 16 | Rut depth | 41 | Y12 | 180 | Leader |
| 17 | X1 | 42 | X13 | 181 | Longitude (from) |
| 18 | Y1 | 43 | Y13 | 182 | Latitude (from) |
| 19 | X2 | 44 | X14 | 183 | Altitude (from) |
| 20 | Y2 | 45 | Y14 | 184 | Longitude (to) |
| 21 | X3 | 46 | X15 | 185 | Latitude (to) |
| 22 | Y3 | 47 | Y15 | 186 | Altitude (to) |
| 23 | X4 | 48 | X16 | 187 | GPS Flag |
| 24 | Y4 | 49 | Y16 | 188 | Management Kilometer Post |
| 25 | X5 | 50 | X17 | 189 | Management number |

An example of rut depth data is shown in Figure 5.4.

Figure 5.4 Rut Depth Data (from Road Data Analysis)

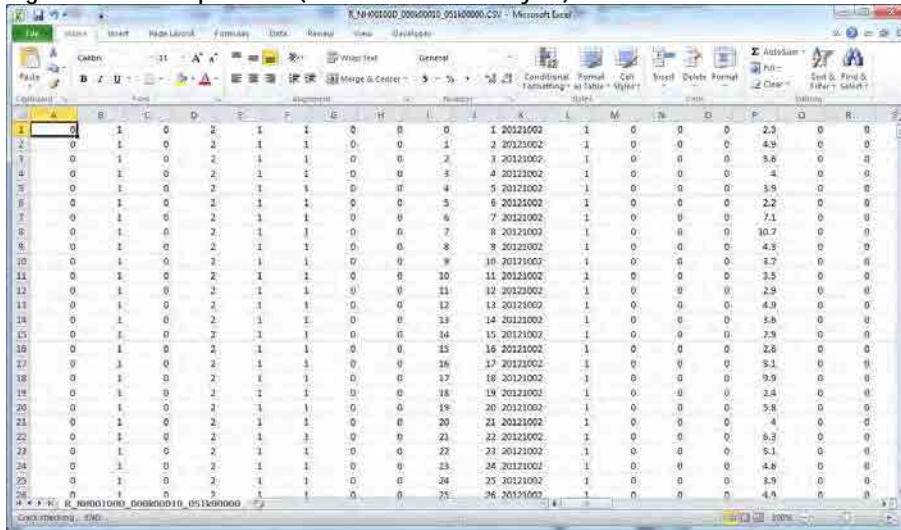


Table 5.10 shows the crack data structure.

Table 5.10 Crack Data Structure

| No | Field | No | Field |
|----|------------------------------|----|--|
| 1 | Road Classification | 36 | Reserve |
| 2 | Route Number | 37 | Residual Acquisition Unit: Pothole 75-100% |
| 3 | Branch Number | 38 | Residual Acquisition Unit: Pothole 25-75% |
| 4 | Inbound, Outbound | 39 | Residual Acquisition Unit: Pothole 0-25% |
| 5 | Lane Classification | 40 | Residual Acquisition Unit: Asphalt Two or more cracks |
| 6 | Lane Number | 41 | Residual Acquisition Unit: Asphalt Linear Crack |
| 7 | Analysis (from) | 42 | Residual Acquisition Unit: Concrete Crack Length 150cm |
| 8 | Analysis (to) | 43 | Residual Acquisition Unit: Concrete Crack Length 125cm |
| 9 | Length (from) | 44 | Residual Acquisition Unit: Concrete Crack Length 100cm |
| 10 | Length (to) | 45 | Residual Acquisition Unit: Concrete Crack Length 75cm |
| 11 | Survey Year, Month, Date | 46 | Residual Acquisition Unit: Concrete Crack Length 50cm |
| 12 | Analysis Lane Width | 47 | Residual Acquisition Unit: Concrete Crack Length 25cm |
| 13 | Road Surface Classification | 48 | Residual Acquisition Unit: Patching 75-100% |
| 14 | Structure1 | 49 | Residual Acquisition Unit: Patching 25-75% |
| 15 | Structure2 | 50 | Reserve |
| 16 | Structure3 | 51 | Reserve |
| 17 | Pothole 75-100% | 52 | Reserve |
| 18 | Pothole 25-75% | 53 | Reserve |
| 19 | Pothole 0-25% | 54 | Reserve |
| 20 | Asphalt: Two or More Cracks | 55 | Reserve |
| 21 | Asphalt: Linear Crack | 56 | Reserve |
| 22 | Concrete: Crack Length 150cm | 57 | Mesh size |
| 23 | Concrete: Crack Length 125cm | 58 | Analysis Segment Length |
| 24 | Concrete: Crack Length 100cm | 59 | Survey Vehicle |
| 25 | Concrete: Crack Length 75cm | 60 | Name of Leader (Road Condition Survey) |
| 26 | Concrete: Crack Length 50cm | 61 | Longitude (from) |
| 27 | Concrete: Crack Length 25cm | 62 | Latitude (from) |
| 28 | Patching 75-100% | 63 | Altitude (from) |
| 29 | Patching 25-75% | 64 | Longitude (to) |
| 30 | Reserve | 65 | Latitude (to) |
| 31 | Reserve | 66 | Altitude (to) |
| 32 | Reserve | 67 | GPS Flag |
| 33 | Reserve | 68 | Management Kilometer Post |
| 34 | Reserve | 69 | Management Number |
| 35 | Reserve | | |

An example crack data from the results of the road data analysis is shown Figure 5.5.

Figure 5.5 Crack Data (from Road Surface Condition Data Interpretation and Encoding)

The screenshot shows an Excel spreadsheet with columns labeled A through R. The data appears to be organized in a grid format, with rows numbered 1 through 26. The columns contain various numerical values, likely representing crack data as mentioned in the caption. The interface includes the standard Excel ribbon with tabs like Home, Insert, Page Layout, Formulas, Data, Review, and View.

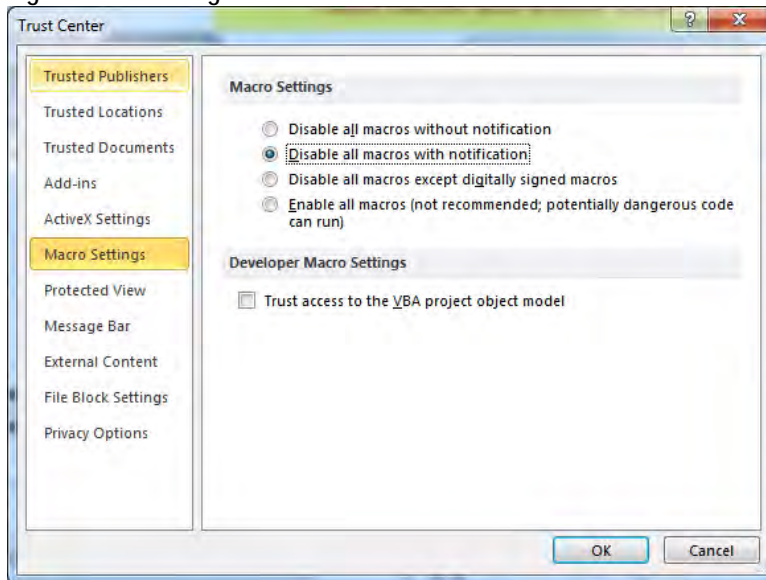
5.3 Preparatory Work

(1) Enabling the Macro Function in Excel

The system requires the MACRO function of MS-Excel. It is necessary to enable MACRO.

Set the Macro Setting to "Disable all macros with notification." If Excel 2003 is used, go to the menu bar. Select Tools, Macro, Security.

Figure 5.6 Enabling Excel Macro

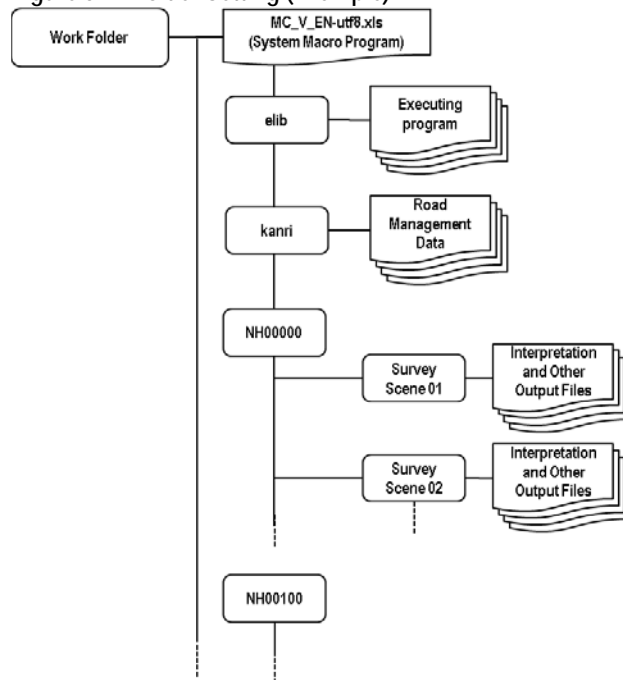


(2) Folder Setting

An folder setting example is shown in Figure 5.7. Create a work folder with an appropriate project name. Copy the MC_V_EN-utf8.xls file directly under the work folder. Copy provided elib folder directly under the work folder. Store the road management data from field

reconnaissance to the kanri folder. The pavement damage interpretation data and other recorded data are stored by scene.

Figure 5.7 Folder Setting (Example)



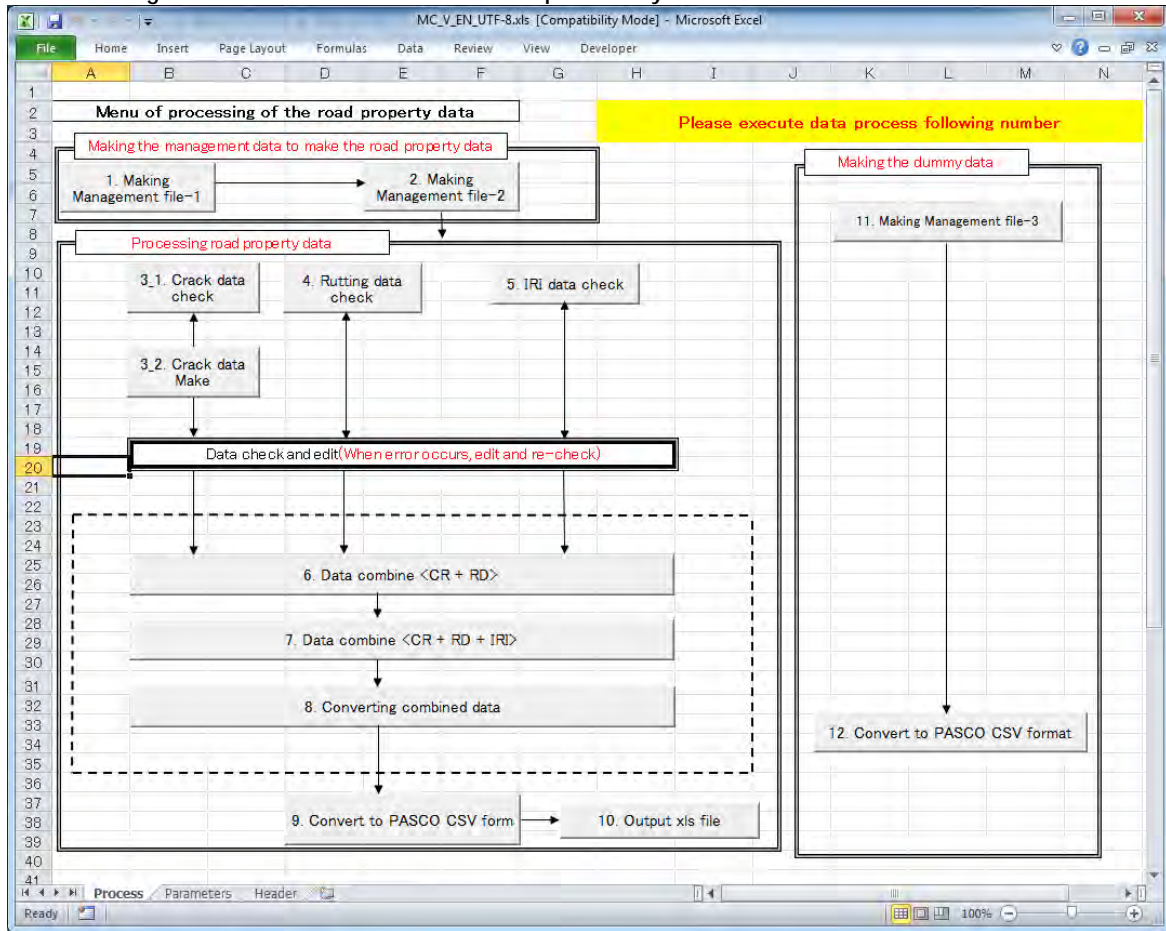
5.4 Method (Program Used)

The system uses the Notepad application to show dialogues. In order to continue, end the Notepad application.

(1) Program Interface

The Process sheet of MC_V_EN-utf8.xls looks like the following figure. The buttons are linked to the

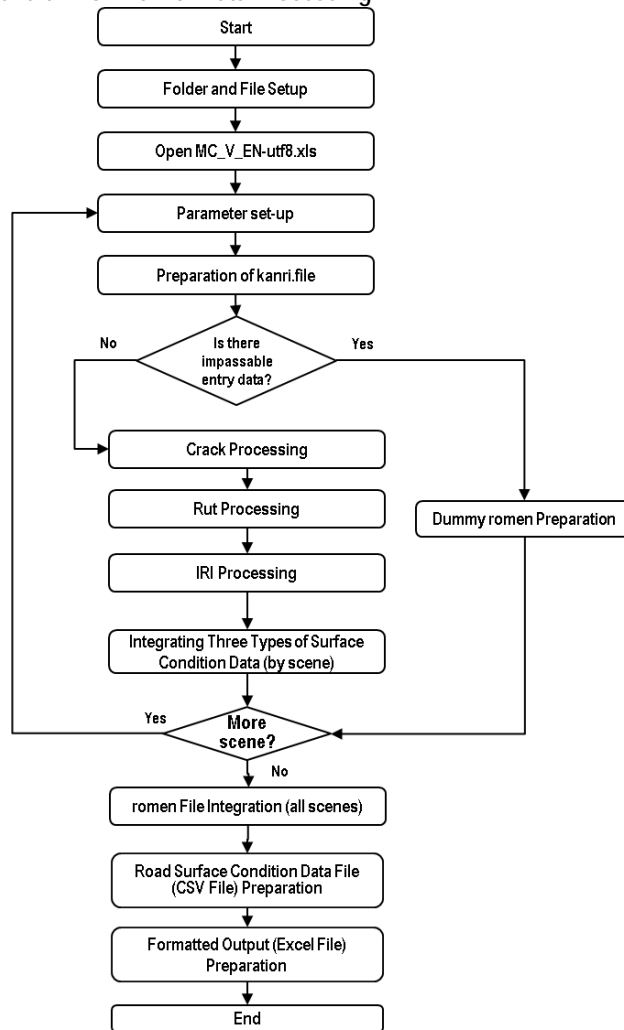
Figure 5.8 The Interface of the Data Preparation System



(2) Operation Flow

The general sequence of operation is as in the following flow chart.

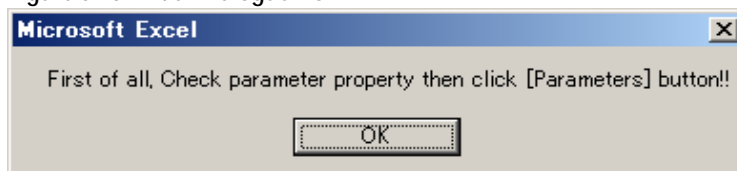
Figure 5.9 General Workflow of Data Processing



(3) Parameter Setting

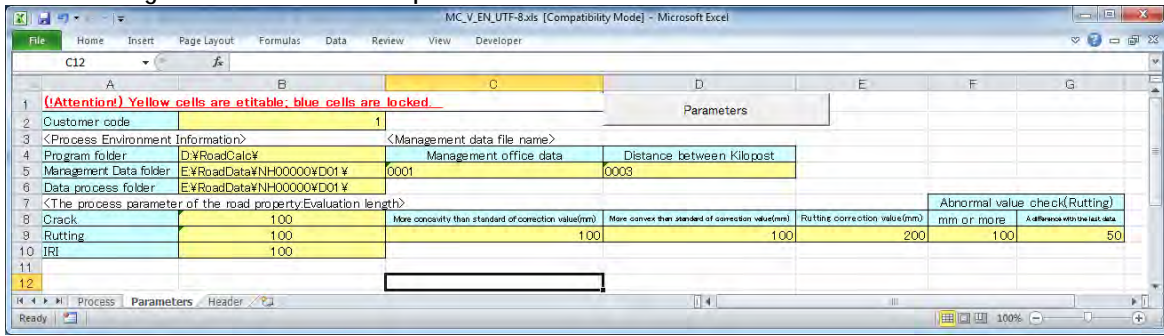
The program starts by opening the MC_V_EN-utf8.xls file. The system shows the following dialogue.

Figure 5.10 Initial Dialogue Box



Click OK and continue.

Figure 5.11 Parameter Setup Interface



The enlarged view with corresponding number for explanation is shown in the following table.

Table 5.11 The Interface (Enlarged View)

| | | | | | | |
|--|---------------------------|--|--|-----------------------------------|--------------------------------|---------------------------------|
| [1] Customer code | 1 | | | | | |
| [2]<Process Environment Information> | | [3]<Management data file name> | | | | |
| [2-1]Program folder | D: \RoadCalc\ | [3-1] Management office data | [3-2] Distance between Kilopost | | | |
| [2-1] Management Data folder | E: \RoadData\NH00000\D01\ | 0001 | 0003 | | | |
| [2-3] Data process folder | E: \RoadData\NH00000\D01\ | | | | Abnormal value check (Rutting) | |
| [4]<The process parameter of the road property: Evaluation length> | | | | | | |
| [4-1]Crack | 100 | [5-1] More concavity than standard of correction value(mm) | [5-2]More convex than standard of correction value(mm) | [5-3]Rutting correction value(mm) | mm or more | A difference with the last data |
| [4-2] Rutting | 100 | 100 | 100 | 200 | 100 | 50 |
| [4-3] IRI | 100 | | | | | |

The program would run with the default parameter setting. If it is necessary, the values can be adjusted.

[1] Customer code

The customer code can be set according to a customer management system of an organization.

[2] Process Environment Information

Prepare the working environment, and parameters are entered. According to the work environment, following folders shall be specified.

[2-1] Program folder: Set a path of working folder.

[2-2] Management Data folder: Set a path of the management data folder. Intermediate working files are stored.

[2-3] Data process folder: Set a path where the Analysis Output files are stored. Intermediate working files are stored.

[3] Management data file name

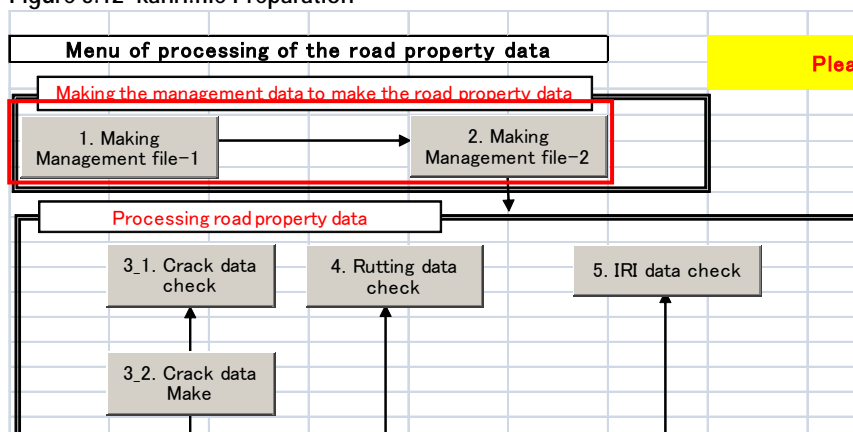
The following two road management data need to correspond to the survey segments of the analysis output files.

- [3-1] Management Office data file: Set the road management data "0001" –the file name- targeted for processing. [3-2] Distance between Kilopost: Set the road management data "0003" – the file name- targeted for processing.
- [4] The process parameter of the road property: Setting the Evaluation length
The evaluation lengths of surface condition data for [4-1] Crack, [4-2] Rut depth, [4-3] IRI are set based on the requirement of the pavement surface condition data to be prepared. The unit shall be the same for all conditions. In the example, the values are 100 meter.
- [5] Adjustment condition setting (Setting the automatic adjustment processing conditions)
The adjustment value for setting abnormal value of rut depth volume can be set by setting the following three values: [5-1] More concavity than standard of correction value (mm); [5-2] More convex than standard of correction value (mm); and [5-3] Rutting correction value (mm). If the more strict condition needs to be applied, smaller values need to be set. In this example values 100 mm, 100 mm and 200 mm are set for the three adjustment (correction) values.
- [6] Rut depth abnormal value check condition setting
Two values are set to identify abnormal rut depth values. When the conditions set are satisfied, the values are identified as abnormal. When more strict conditions are needed, smaller values need to be set. The example shows 100 mm and 50 mm for the rut depth value and the value of difference, respectively.
- [6-1] mm or more: A rut depth value at some location
- [6-2] A difference with last data: A difference of the rut depths between the one and one before.
- [7] After setting all the parameters, press the Parameter button. The view is changed to the Processing sheet.

(4) kanri.file Preparation

The road management data (0001, 0003, 0004, 0005, 0101, 0102, 0104) are integrated to prepare kanri.file. To prepare the kanri.file, use “1. Making Management file-1.”

Figure 5.12 kanri.file Preparation



The following message box appears. A dialogue box appears, and ask if the process is to be proceeded. Click yes.

Run “2.Making Management file-2” by pressing the button.

The following output appears. Check if the length is equal to the processing route length.

Figure 5.13 Check the Survey Route Length

```

159545 161000 1485
0248 1485
0248 1000
0248 1005
0248 1000
0248 1000
0248 1005
0248 1115
0248 1005
0248 1015
0248 995
0248 1005
0248 550
12180
ROUTE= 12180
SUM= 12180
    
```

Check the processing route length.

After confirming the length, close Notepad.

Check if each file is merged. The following case is OK.

Figure 5.14 Road Management Data Merged

```

<005> MERGE START
      END
<052> MERGE START
      END
<058> MERGE START
      END
    
```

The following output is an example of an error. Check the original road management data, if an error is found.

Figure 5.15 An Example of Road Management Data Not Merged

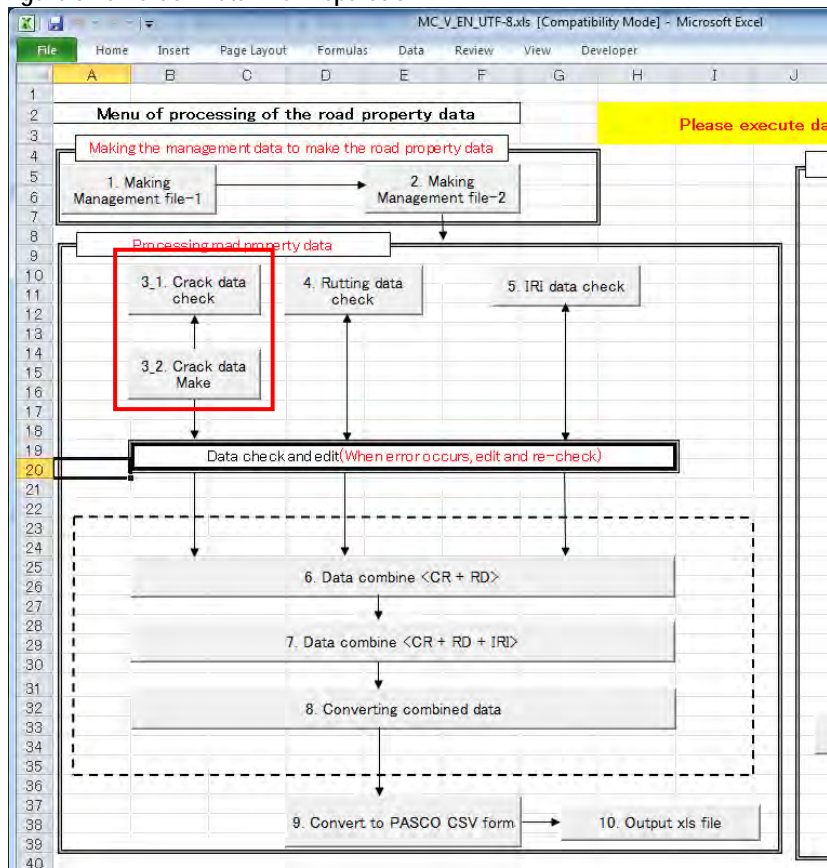
```

<005> MERGE START
      END
<??> MERGE START
      END
<058> MERGE START
      END
    
```

(5) Crack File Preparation

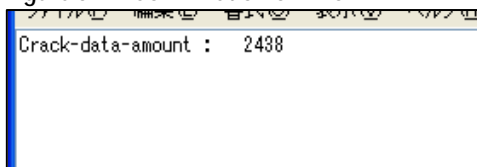
Create a crack file from the analysis output by pressing the buttons 3.1 and 3.2.

Figure 5.16 Crack Data File Preparation



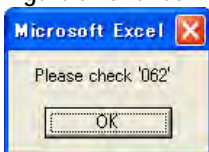
Press the “3_1. Crack data check” button. The following case does not have an error.

Figure 5.17 Confirmation of Error



Following dialogue appears.

Figure 5.18 Checking 062

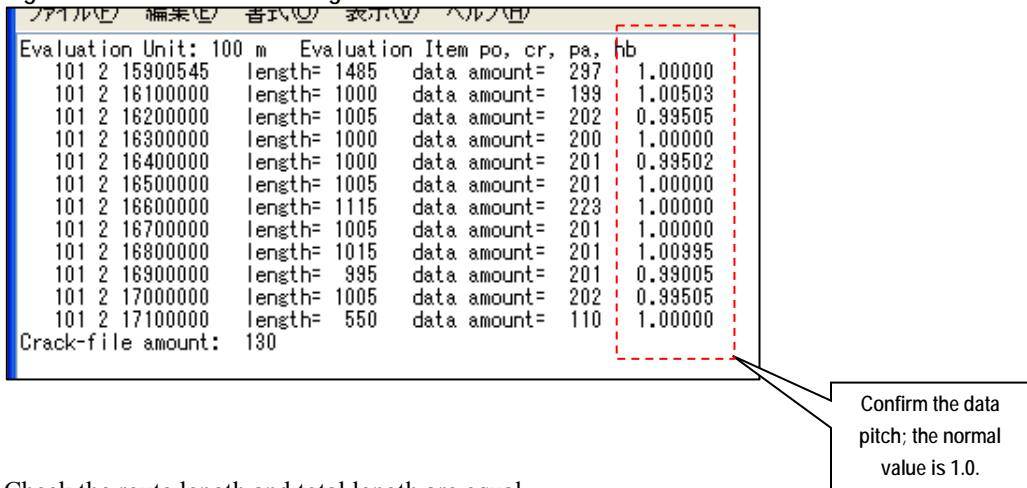


Click “OK” and continue.

Consistencies between the road-surface-classification file “062” created and the road structure files (0101, 0104, 0105) shall be checked.

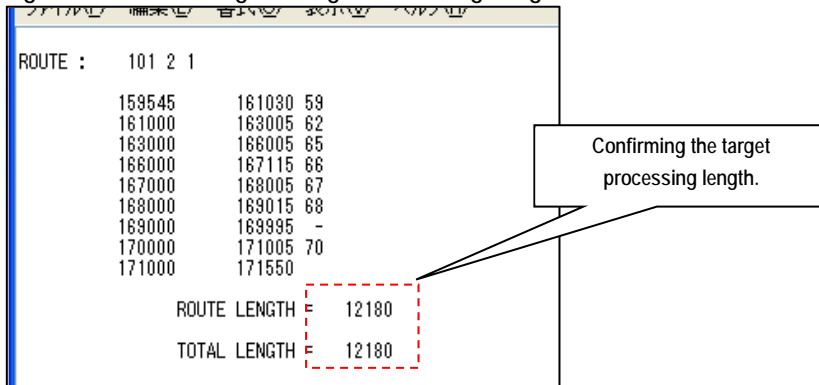
Press “3_2. Crack data make” after the consistency checking.

Figure 5.19 vmcr2-- Confirming the Data Pitch



Check the route length and total length are equal.

Figure 5.20 Confirming the Target Processing Length



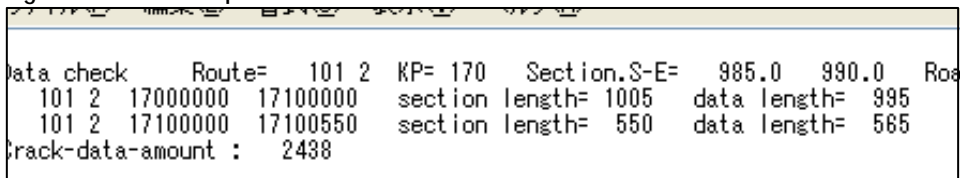
=====
 An Example of an Error
 =====

The following case is an example of an error on the crack data preparation.

The line 2: The surface is recorded as concrete is interpreted as asphalt.

The lines 3 and 4: The survey length in the analysis has more than ±1% discrepancy against the road management data. If this is the case the data on distances between kilometer posts or the analysis data need to be reviewed and corrected.

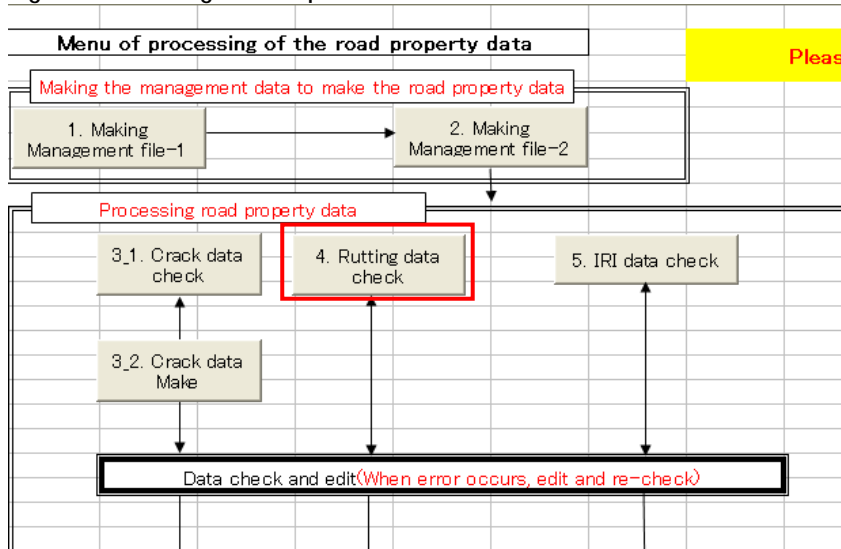
Figure 5.21 An Example of Error in Crack Data - the vmcr1



(6) Rutting Data File Preparation

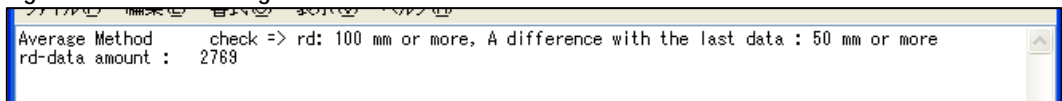
Press the 4. Rutting data check button to prepare the rutting data file.

Figure 5.22 Rutting Data Preparation



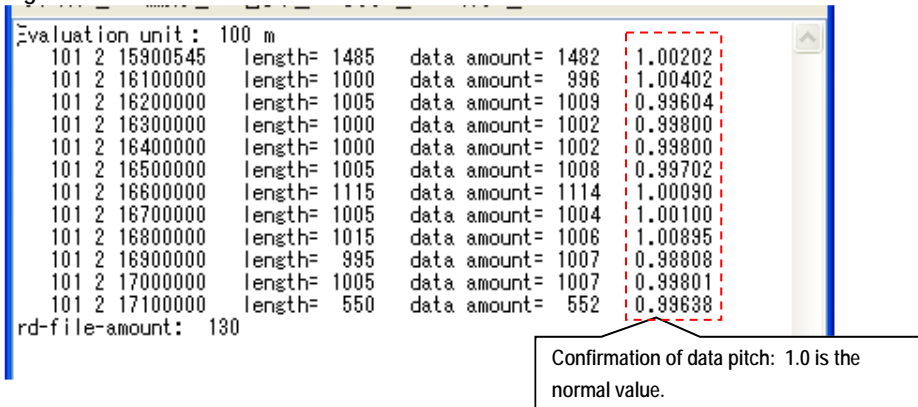
Confirm that there is no error in the process.

Figure 5.23 Error Message



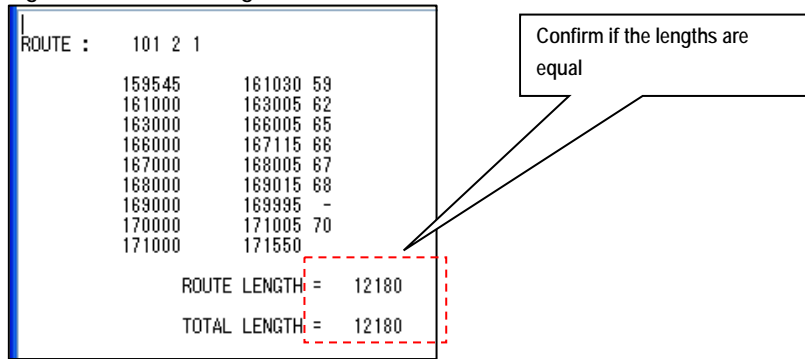
Confirm the data pitch for every segment between kilometer posts. If the pitches are significantly different, check the analysis data or the data on the kilometer post distances, and make necessary correction.

Figure 5.24 Confirmation of Data Pitch



Confirm that the processing length is right.

Figure 5.25 Route Length Check



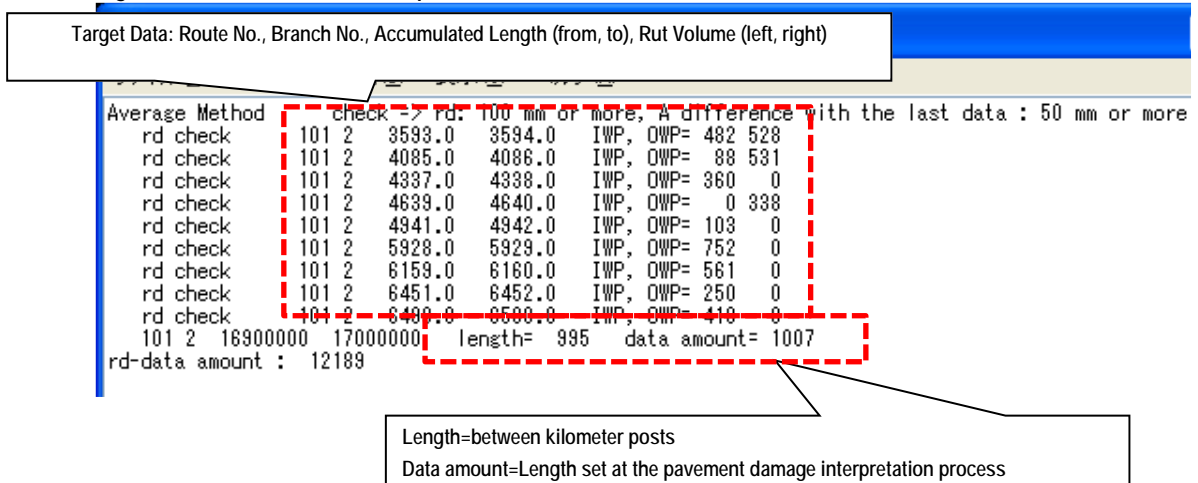
An Example of an Error

The following example is a case of error in the rutting data.

The lines from 2 to 10: An independent crack volume is more than 100 mm and the depth is 50 mm or more than the rutting depth locating before.

The line 11: The survey length in the analysis has more than $\pm 1\%$ discrepancy against the road management data. If this is the case the data on distances between kilometer posts or the analysis data need to be reviewed and corrected.

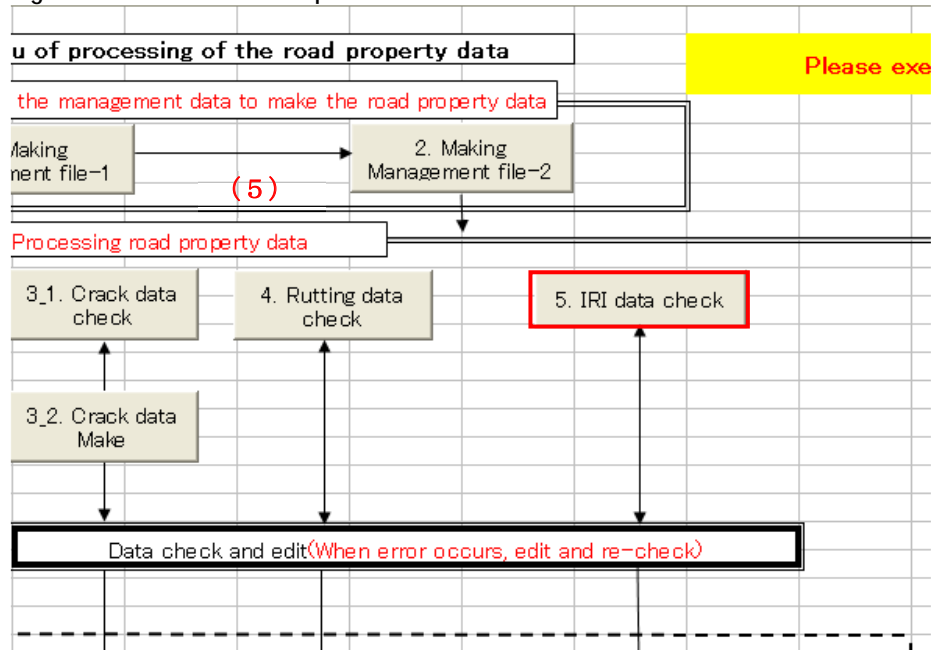
Figure 5.26 Error in the Rut Depth File



(7) IRI Preparation

IRI file is prepared from the analysis outputs. Press “5.IRI data check” and run the program.

Figure 5.27 IRI Data Check Operation



Press “5.IRI data check” and run the program. The Notepad shows the following data.

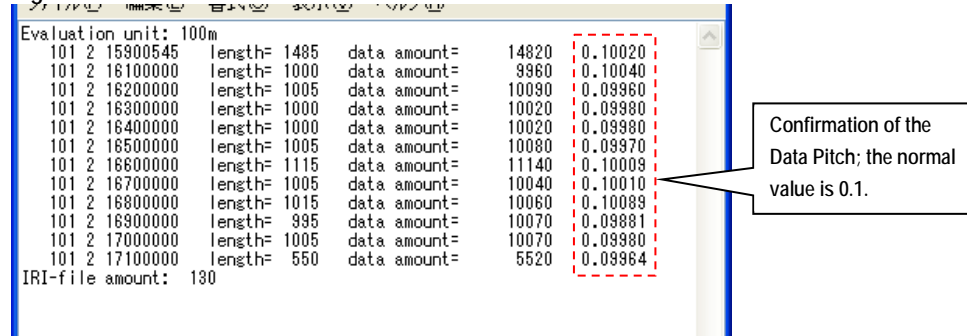
Figure 5.28 IRI Data Check Image

```

101 2 1 kp= 159 545
101 2 1 kp= 161 0
101 2 1 kp= 162 0
101 2 1 kp= 163 0
101 2 1 kp= 164 0
101 2 1 kp= 165 0
101 2 1 kp= 166 0
101 2 1 kp= 167 0
101 2 1 kp= 168 0
101 216900000017000000 section length= 995 data amount= 1007
101 2 1 kp= 169 0
101 2 1 kp= 170 0
101 2 1 kp= 171 0
IRI-data amount : 121890
    
```

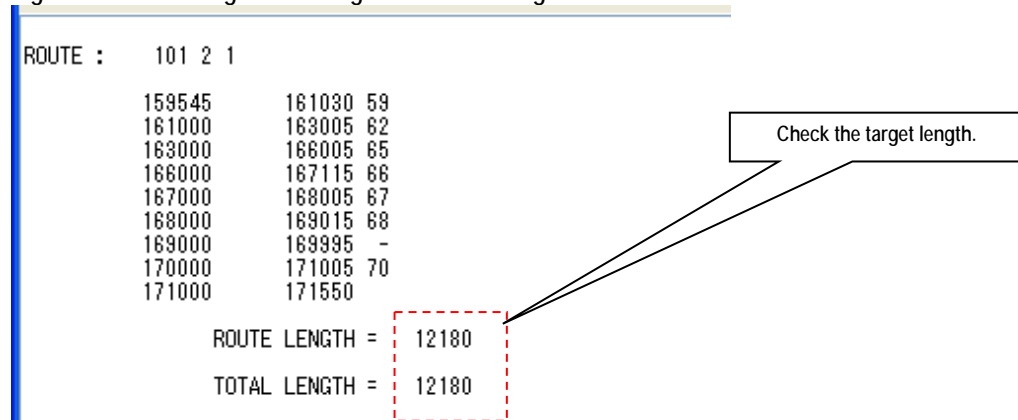
Confirm the pitch of IRI in every distance between the kilometer posts. When the pitch is significantly different, the analysis data or the distance data between the kilometer posts shall be corrected.

Figure 5.29 Confirmation of the Data Pitch



Confirm the length of processing.

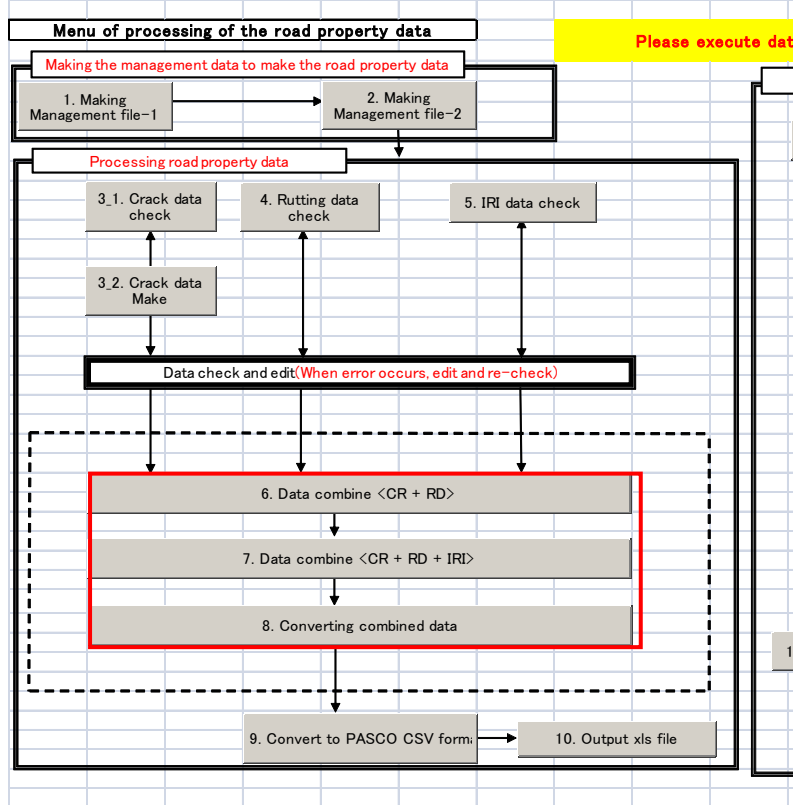
Figure 5.30 Checking Route Length and Total Length



(8) Integrating the Three Files

Integrate the three files prepared in the processes (4), (5) and (6) to prepare the romen file.

Figure 5.31 romen File Preparation



Press “6.Data combine <CR+RD>” and run the program to combine the crack and rutting data. Check the text file message to confirm there is no error.

Figure 5.32 Combining the Crack and Rut Data

```

***** merge start cr + rd *****
***** merge end ok *****
    
```

Press “7.Data combine <CR+RD+SV>” to combine the combined data, crack and rut, and IRI. Check the text message to confirm there is no error.

Figure 5.33 Confirm No Error

```

***** merge start cr + sv *****
***** merge end ok *****
    
```

Press the “8.Converting combine data” to run the program. To the combined file with the three types of road condition data--crack, rut and IRI data--the basic data (geographical areas etc.) are combined.

Figure 5.34 Adding the Management Data to the Combined File

| | | | | | | | |
|-------|--------|---|--------|---|-----|---|--------|
| route | 101 | 2 | 1 | | | | |
| 16 | 161000 | 5 | 161030 | 5 | --- | > | 161000 |
| 37 | 163000 | 6 | 163005 | 6 | --- | > | 163000 |
| 68 | 166000 | 6 | 166005 | 6 | --- | > | 166000 |
| 80 | 167100 | 6 | 167115 | 6 | --- | > | 167000 |
| 91 | 168000 | 6 | 168005 | 6 | --- | > | 168000 |
| 102 | 169000 | 6 | 169015 | 6 | --- | > | 169000 |
| 112 | 169900 | | 169995 | | --- | > | 170000 |
| 124 | 171000 | 7 | 171005 | 7 | --- | > | 171000 |

An Example of an Error

Following is an example of data integration error.

There are road segment data errors between: the data elements of crack and rut depth; or crack + rut depth and IRI. When this type of error occurred, the road management data or road structure data need to be reviewed and the data need to be corrected if necessary.

Figure 5.35 An Example of Data Integration

| | | | | | | | |
|---------------------------------|-----|---|---|--------|--------|----------|----------|
| ***** merge start cr + sv ***** | | | | | | | |
| i | 101 | 2 | 1 | 164300 | 164400 | 16400300 | 16400400 |
| j | 101 | 2 | 1 | 164300 | 164350 | 16400300 | 16400350 |
| i | 101 | 2 | 1 | 164600 | 164700 | 16400600 | 16400700 |
| j | 101 | 2 | 1 | 164600 | 164620 | 16400600 | 16400620 |
| ***** merge end ok ***** | | | | | | | |

The segment CR+RD is expressed [164kp+300]-[164kp+400], but the target road segment is from 164kp+300-164kp+350.

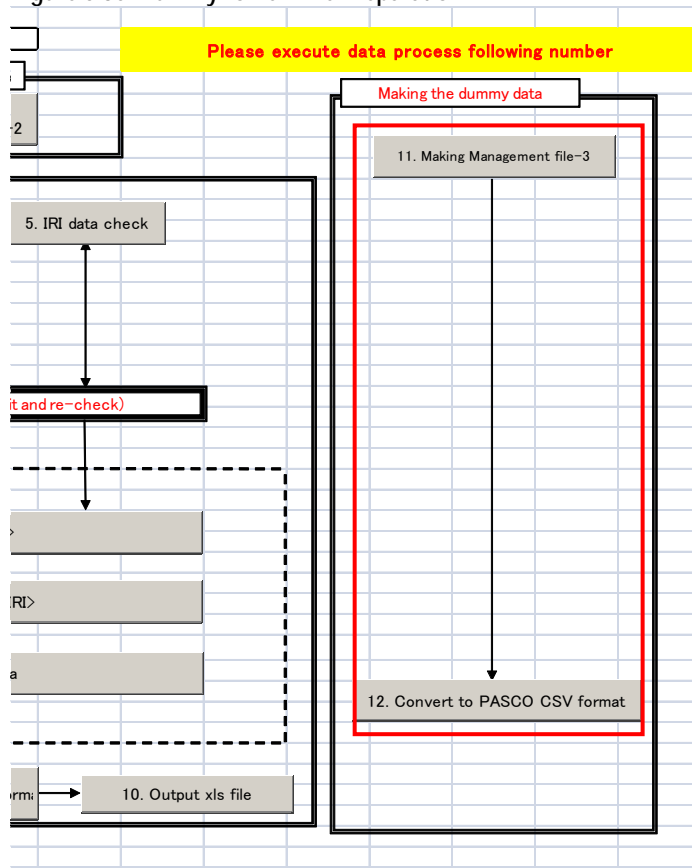
This is the end of processing one-scene. The process from the parameter setting shall be repeated and applied to all the scenes for all the routes.

(9) Dummy romen File Processing

When there is a segment that does not have the digital data or where the survey vehicle could not enter to capture the digital data, special treatment will be necessary. If this is the case, create dummy-romen data. If there is no such segment, skip this process of “Dummy romen File Processing.”

Go back to the parameter setting and set necessary parameters and prepare a kanri.file. After the kanri.file is prepared, create the Dummy romen file by pressing 11. Making Management file-3.”

Figure 5.36 Dummy romen File Preparation



As in the other operation, the parameters need to be set up. The kanri.file needs to be prepared, also. Press the button, 11.Making Management File-3. Check the correct length.

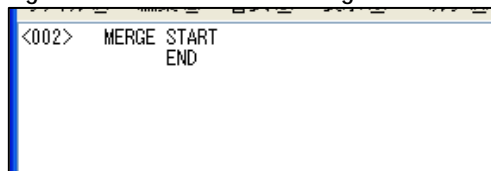
Figure 5.37 Targeted Road Length Confirmation

| | | | | | | | |
|-----|---|---|----|----|----|--------|----|
| 100 | 1 | 0 | 10 | 10 | 10 | ROSEN= | 10 |
| 100 | 2 | 0 | 10 | 10 | 10 | ROSEN= | 10 |
| | | | | | | GOKEI= | 20 |

Confirm the targeted road segment length.

Confirm the end of merge.

Figure 5.38 Confirmation of Merge



Press “12.Convert to PASCO CSV format” to generate the csv file for the road segments that has not no digital data.

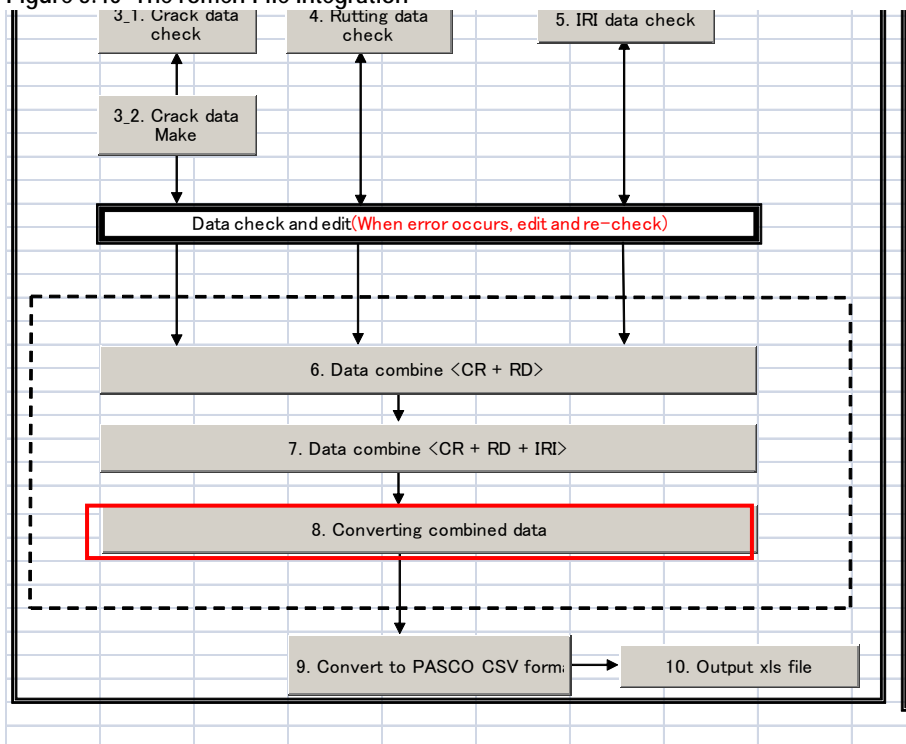
Figure 5.39 Road Surface Condition Data Output (CSV)

| | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|-------|-------|----|----|---|----|----|----|-----------|----|----|----|----|----|----|----|----|----|----|----|------|----|----|----|----|----|
| 1 | 10236 | 10011 | -1 | -1 | 0 | 10 | 10 | -1 | -10000000 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -100 | -1 | -1 | -1 | -1 | -1 |
| 1 | 10236 | 10021 | -1 | -1 | 0 | 10 | 10 | -1 | -10000000 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -1 | -100 | -1 | -1 | -1 | -1 | -1 |

(10) The romen File Integration

The romen files have been prepared by scene. The process integrates all the romen files created by scene. To integrate the files, press “8. Converting combine data.”

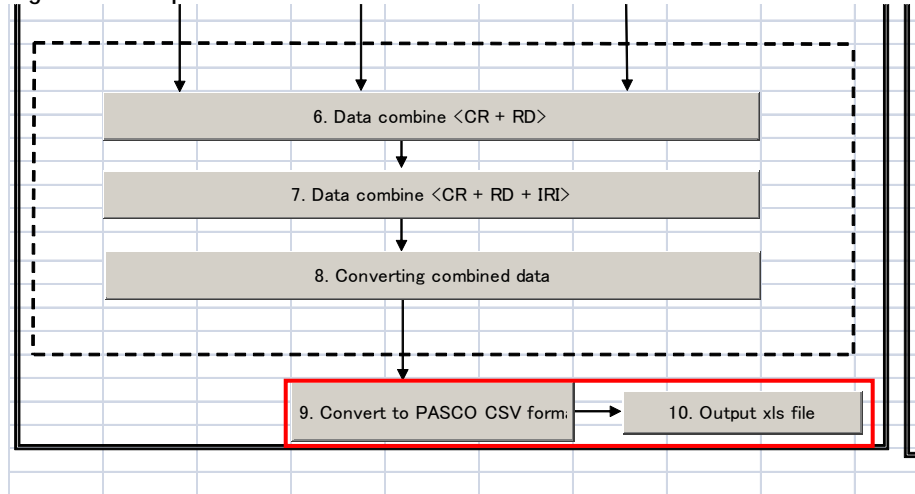
Figure 5.40 The romen File Integration



(11) Road Surface Condition Data File (CSV files) Preparation

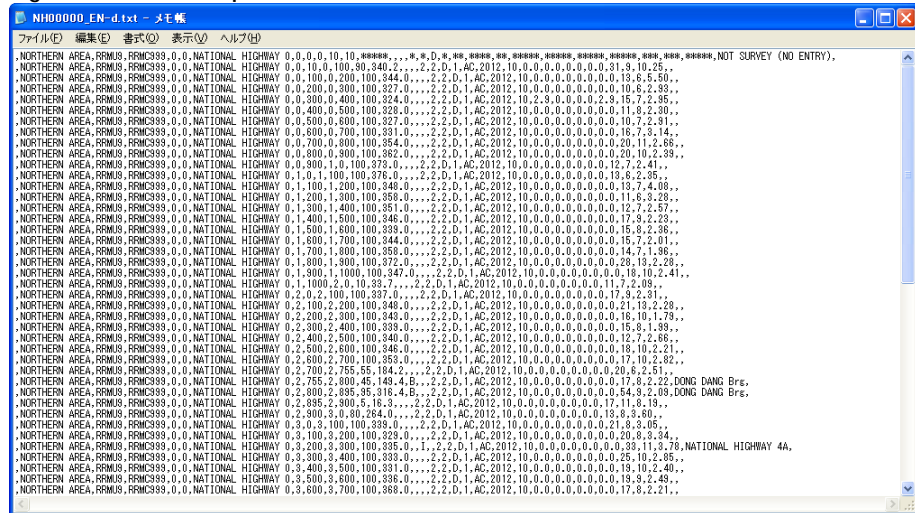
Now the all the romen files by scene were integrated. The integrated file is ready to be converted to output in the csv file format.

Figure 5.41 Preparation of CSV Files



Press “9.Convert to PASCO CSV format” to create the following files.

Figure 5.42 Final Output - Pavement Condition Data - Unformatted







(12) Pavement Road Surface Condition Data File (Excel file) Preparation

Press the “10.Output.xls file” button and run the macro program. An Excel file is produced. Name the file according to the file name standards.

Forms

Form_FR02_Vehicle Inspection

| Road Condition Survey Vehicle | | | |
|---|-------------------------|--|-------|
| inspection date | / / | | |
| Group No | | | |
| survey period | / ~ / | | |
| plate number | 30T - 5327 | | |
| inspection name | | | |
| operate name | | | |
| check vehicle exterior | | | |
| kindication symbol dent scratch (fill in red pen) | | | |
| | |  | |
| | |  | |
| | |  | |
| | |  | |
| Drive sheet | inspection point | inspection content | check |
| | Brake | treat on degree | |
| | Parking brake | pull degree | |
| | Fuel equipment | remaining amount of fuel | |
| Engine room | Lubrication equipment | engine oil volume | |
| | Radiator | fluid volume | |
| | | fluid leak | |
| | Fan belt | Tension degree | |
| | | Damage | |
| | Win dow wash | fluid volume | |
| | Battery | fluid volume | |
| | | Specific gravity | |
| | transmission | fluid volume | |
| around vehicle | lamp | Brake lamp | |
| | | Blinker lamp | |
| | | Damage | |
| | Wheel | air pressure | |
| | | Crack / Damage | |
| | | Wear | |
| another equipment | MOT test sheet | | |
| | spare wheel, jack, tool | | |
| | | | |
| | | | |
| other | | | |
| | | | |
| | | | |

Safety Meeting

| | | | | |
|--|-------|------------------|--------------------|-------------|
| work subject | | | | |
| hazard point in today's work | | | | |
| provision for hazard point | | | | |
| actual happening hazard point ※If happen, write right space | Where | What doing | When happen | provision |
| join member | | | | |
| Name | age | health condition | specific condition | disposition |
| | | good · bad | | |
| | | good · bad | | |
| | | good · bad | | |
| | | good · bad | | |
| | | good · bad | | |

Form_FR03_Safety Meeting Record

Form_FR04_Field Note

| Administration Unit | | | | | | | | | | Maintenance | | | | | | | | | | Route Name | | | Page | | | | | | | |
|---------------------|-----|---------|------|------|---|--------|---|------|----------|-------------|----------|---------|---|---|----------|---|---------|------|-----------|------------|------|------------|------------|--|----------|-----|----|---|---|---|
| F.R. | | Date | | Name | | R.C.S. | | Date | | Name | | Remarks | | | Position | | | | | | | | | | | | | | | |
| Outbound | | | | | | | | | | Inbound | | | | | | | | | | | | | | | | | | | | |
| Structure | | Surface | Type | 5 | 4 | 3 | 2 | 1 | Distance | Kilometer | Distance | 1 | 2 | 3 | 4 | 5 | Surface | Type | Structure | | Code | Remarks | | | Position | | | | | |
| Start | End | | | | | | | | | | | | | | | | | | Start | End | | KP Exist ? | | | Yes | No | R | C | L | |
| | | | | | | | | | | 0 | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L | |
| | | | | | | | | | | 1 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 2 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 3 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 4 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 5 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 6 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 7 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 8 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 9 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 0 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 1 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 2 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 3 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 4 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 5 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 6 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 7 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 8 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |
| | | | | | | | | | | 9 | | | | | | | | | | | | | KP Exist ? | | | Yes | No | R | C | L |

Daily Activity Report

measurement item : Craking • Rutting depth • IRI • Forward view

Name : ① ② ③ ④ ⑤ ⑥ ⑦

| date | survey | Route | wether | road surface | survey section | | | survey period | | | | mileage | | | driver's name |
|------|--------|--------|--------|--------------|----------------|-----|------------|---------------|-----|-----------|-----------|---------|-----|------------|---------------|
| | detail | number | | | start | end | difference | start | end | work hour | rest hour | start | end | difference | |
| / | | | | | | | | | | | | | | | |
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| | total | | | | | | | | | | | | | | |

Form_FR05_Daily Activity Record

Appendices

App.1 Jurisdiction and Management Company (English, Vietnamese)

| Geographic Area Code | Jurisdiction Code | Management Company Code | English | Vietnamese |
|----------------------|-------------------|-------------------------|----------------------|------------------------|
| 1 | 0 | 0 | Northern Area | Miền Bắc |
| 1 | 10 | 0 | RRMU2 | Khu Quản Lý Đường Bộ 2 |
| 1 | 10 | 222 | RRMC222 | Công Ty 222 |
| 1 | 10 | 224 | RRMC224 | Công Ty 224 |
| 1 | 10 | 226 | RRMC226 | Công Ty 226 |
| 1 | 10 | 232 | RRMC232 | Công Ty 232 |
| 1 | 10 | 234 | RRMC234 | Công Ty 234 |
| 1 | 10 | 236 | RRMC236 | Công Ty 236 |
| 1 | 10 | 238 | RRMC238 | Công Ty 238 |
| 1 | 10 | 240 | RRMC240 | Công Ty 240 |
| 1 | 10 | 242 | RRMC242 | Công Ty 242 |
| 1 | 10 | 244 | RRMC244 | Công Ty 244 |
| 1 | 10 | 248 | RRMC248 | Công Ty 248 |
| 1 | 10 | 999 | Other | Khác |
| 1 | 50 | 0 | Province | Tỉnh |
| 1 | 50 | 999 | Other | Khác |
| 1 | 60 | 0 | Company | Công ty |
| 1 | 60 | 999 | Other | Khác |
| 1 | 70 | 0 | Under Construction | Đang xây dựng |
| 1 | 70 | 999 | Other | Khác |
| 2 | 0 | 0 | Northern Middle Area | Bắc Trung Bộ |
| 3 | 0 | 0 | Southern Middle Area | Nam Trung Bộ |
| 4 | 0 | 0 | Southern Area | Miền Nam |

App. 2 Route Names

| Route Number | Branch | English | Vietnamese |
|--------------|--------|---|---------------------------------------|
| 1 | 0 | National Highway 1 | Quốc Lộ 1 |
| 1 | 1 | Southern Ring Road 3 to Cau Dau | Đường Vành Đai 3 Phía Nam tới Cầu Dấu |
| 2 | 0 | National Highway 2 | Quốc Lộ 2 |
| 3 | 0 | National Highway 3 | Quốc Lộ 3 |
| 3 | 1 | National Highway 3B | Quốc Lộ 3B |
| 3 | 2 | National Highway 3 (The old road branch) | Quốc Lộ 3 (Đường nhánh cũ) |
| 4 | 0 | National Highway 4E | Quốc Lộ 4E |
| 5 | 0 | National Highway 5 | Quốc Lộ 5 |
| 6 | 0 | National Highway 6 | Quốc Lộ 6 |
| 6 | 1 | National Highway 6-1 (The old bypass road) | Đường Vòng Tránh 6-1 |
| 6 | 2 | National Highway 6-2 (The old bypass road) | Đường Vòng Tránh 6-2 |
| 6 | 3 | National Highway 6-3 (The old bypass road) | Đường Vòng Tránh 6-3 |
| 10 | 0 | National Highway 10 | Quốc Lộ 10 |
| 10 | 1 | Connecting National Highway 1 with Ninh Phuc Port | Đoạn nối QL1 với Cảng Ninh Phúc |
| 15 | 0 | National Highway 15 | Quốc Lộ 15 |
| 18 | 0 | National Highway 18 | Quốc Lộ 18 |
| 18 | 1 | Route Noi Bai - Bac Ninh | Tuyến Nội Bài - Bắc Ninh |
| 21 | 0 | Ho Chi Minh Route | Đường HCM |
| 37 | 0 | National Highway 37 | Quốc Lộ 37 |
| 38 | 0 | National Highway 38 | Quốc Lộ 38 |
| 38 | 1 | National Highway 38B | Quốc Lộ 38B |
| 43 | 0 | National Highway 43 | Quốc Lộ 43 |
| 70 | 0 | National Highway 70 | Quốc Lộ 70 |
| 279 | 0 | National Highway 279 | Quốc Lộ 279 |

App. 3 Input Data

| Data Code | Code | English | Vietnamese |
|-----------|------|-----------------------|-----------------------------------|
| 0104 | B | Bridge | Cầu |
| 0104 | T | Tunnel | Hầm |
| 0104 | R | Rock Shed | " Hầm " phòng đá lăn |
| 0104 | O | Other | Khác |
| 0105 | | U/N (UnKnown) | Chưa xác định |
| 0201 | 1 | Not Survey (No Entry) | Không khảo sát (không vào được) |
| 0201 | 2 | Not Survey (Other) | Không Khảo sát (các lý do khác) |