Technical Transfer and System Customization for Sustainable Implementation of Pavement Condition Survey – Case Study in Asia –

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PASCO CORPORATION
Road management technology in Japan

Many road Infrastructures were developed during high growth period (1954-1973). And now, Aging road Infrastructures have become serious issue in Japan.

Administrator have to conduct appropriate management of road Infrastructure.

In Japan, Administrator outsource the periodic survey to private companies.

Then, Private companies develop the technology of survey and analysis.
History of PASCO’s pavement condition survey

- Develop the survey technology from 1970’s
- Market leader in Japan (surveyed all National Highway)
- Possible to customization according to clients needs
- Provide the survey technology to foreign country
Situation of road management in Vietnam

Length of National highway of Vietnam is 17,385km in 2010.

Damages in pavement has appeared. Road administrator of Vietnam need the management and maintenance technology.

In Vietnam, HDM-4 and RoSy System had been introduced in early 2000s.

However, these systems are not used currently.
- these systems demand many data items.
- making of data takes labor.
Overview of technical transfer project in Vietnam

JICA decided to support one cooperation project for capacity enhancement in road maintenance.

Phase 1: From July 2011 to March 2014
Target area is RMB1

Phase 2: From February 2015 to January 2018
Target area are RMB2, RMB3 and RMB4

Activity item

1) Developing the road data base system

2) Developing the pavement maintenance planning system

3) Making the inspection guideline of road facilities and the pavement maintenance manual

4) Improvement of the procedure and institution of road maintenance
Role of PASCO in this project

PASCO is providing the inspection system and pavement management system (PMS). These systems have been customized to suit for Vietnam situation.

Role of PASCO in this project
1. Establishment of operation cycle about pavement condition survey
2. Developing the data base and input system for web system
3. Developing the PMS
Key point in this project

■ Point of view from project
Key word is “sustainability”

Main purpose of project is establishment of road management using the appropriate technology.

In order to continue the road management, it is important to develop human capacity, institution and implementation system.

■ Point of view from engineer
Introduction technology need to customize that suits Vietnam situation.

Needs discussion with counter part about customization point.
Recipient organization of technical transfer in Vietnam

In this project, Recipient organization of technical transfer is Directorate for Roads of Vietnam (DRVN). DRVN belong to Ministry of Transport (MOT) in Vietnam.

Inspection item of pavement are cracking, rutting and IRI.

Cracking and rutting are evaluated based on the method of Japan.

However, evaluation target of cracking also includes the potholes. Because many potholes are present in Vietnam road.

<table>
<thead>
<tr>
<th>Inspection method (use inspection vehicle)</th>
<th>Cracking</th>
<th>ratio of cracking + ratio of patching + ratio of pothole</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rutting</td>
<td>Measure the cross section of road at 20m intervals, and calculate the difference of highest and lowest point</td>
<td></td>
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<tr>
<td>IRI</td>
<td>Measure the longitudinal shape of road and calculate the IRI using quarter-car simulation</td>
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Inspection vehicle

1. GPS/IMU
   - Get position data (latitude, longitude)

2. 3CCD camera
   - Get high quality image of forward view

3. Laser scanner
   - Get crossing shape of road

4. Road camera
   - Get continuous road image using 4 camera

5. Laser Displacement Sensor
   - Get longitude deterioration from laser displacement sensor
Pavement condition survey outline

Site Survey

Pavement Condition Survey

Data analysis and processing
Work flow of site survey

1. Survey Plan
2. Operation check
3. Calibration
4. Field Survey
5. Data check
6. Data setting
7. Comparison table
Work flow of data analysis and processing

1. Data Conversion
2. Data Analysis
3. Creating The Location Data
4. Data Processing
5. Data Check
Division of role

JICA Team (Support)

DRVN RMBs

- Keep the reliable and accuracy of data
- Keep the safety
- Schedule management

RTC

- Implement the calibration
- Implement the pavement condition survey
- Implement the data analysis and processing
- Report the result of the pavement condition survey

* JICA support within the project
Training for supervisor

We held the workshop and OJT in each RMB (Road Maintenance Bureau).

Also we held the training in Japan. In the training, participants learn the management system, policy, and technology.
## Training for surveyor

<table>
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<tbody>
<tr>
<td>1. Conduct the short course and training</td>
</tr>
<tr>
<td>2. Conduct the OJT in the survey work</td>
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<tr>
<td>3. Surveyor conduct the survey. PASCO follow up and supervise the surveyor.</td>
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<tr>
<td>4. Surveyor conduct the survey. PASCO check the implementation status by report.</td>
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Technical transfer of check and Calibration about inspection vehicle

The data accuracy of inspection vehicle influence reliability of data base.

User of inspection vehicle needs to implement the periodic check and calibration for keeping the good accuracy condition of inspection system.

In this project, We conduct the technical transfer of check and calibration to RTC.
Check and Calibration of Inspection Vehicle

Before the pavement condition survey, User implement the check and calibration of inspection vehicle.

1. Vehicle
- Check the tire inflation pressure
- Check the direction indicators
- Check the light
- Check the engine oil
- Check the fan belt
- Check the mileage of vehicle

2. Measurement system
- Check the condition of system
- Collect the system log
- Check the wiring
- Update of measurement program
- Check the voltage of battery
- Clean up the equipment
- Check and change the screw
- Calibrate the focus of Lens (FV, CR)
- Calibrate the angle of view (FV, CR)
- Check the accuracy of Laser Displacement sensor
- Check the laser scanner data
- Calibrate the distance coefficient
- Test survey
Case study of check and calibration (Laser scanner)

1. Look for the site and decide the measurement place

2. Measure the rutting shape by Laser scanner

3. Measure the rutting shape by manual method

4. Compare the rutting shape and value
Case study of check and calibration  (Rutting)

1. Look for the site and decide the measurement place

2. Measure the rutting shape by Laser scanner

3. Measure the rutting shape by manual method

4. Compare the rutting shape and depth

User don’t have the special site in Vietnam. So User have to find the site at first.

- Low Traffic
- Rutting depth = 15mm – 20mm
Case study of check and calibration (Rutting)

1. Look for the site and decide the measurement place

2. Measure the rutting shape by Laser scanner

3. Measure the rutting shape by manual method

4. Compare the rutting shape and value

Profile width : 3m
Measurement profile : 6 line

Inspection vehicle stop and measure at the each transverse profile.
Case study of check and calibration (Rutting)

1. Look for the site and decide the measurement place

2. Measure the rutting shape by Laser scanner

3. Measure the rutting shape by manual method

The manual method is leveling string method.
A leveling string is stretched along the length of the measuring line, and the height from the leveling string to the road surface is measured at 10 cm intervals.

4. Compare the rutting shape and depth
Case study of check and calibration (Rutting)

1. Look for the site and decide the measurement place

2. Measure the rutting shape by Laser scanner

3. Measure the rutting shape by manual method

4. Compare the rutting depth and shape

User compare the difference between the reference value (leveling string method) and the measured results from inspection vehicle.

within -6mm to +6mm = OK

Next, User compare the difference of rutting shape. We judge the shape from visual inspection.
Evaluation of project

1. Introduce the inspection system and PMS suitable for Vietnam situation
Prior to developing the system, PASCO clarified the customization point of system by discussion with road administrator and surveyor. And We answered the customization demands.

2. Collaboration with ambitious organization about introduction of technology
RTC is government organization. However, they also have business license. They needs to secure a budget themselves. In order to get the new project, they have high motivation to introducing the new technology.

3. Establish the support system
Continuous support is need for establishing the technology. In order to establish the support system, PASCO employ young Vietnamese engineer in first project. And PASCO started a company in Vietnam. And now, Vietnamese engineers have become the important people for supporting the introduction system.
Future plan in Vietnam  (Inventory survey)

Road administrator of Vietnam conduct the management of road facilities.

However, They have some problems.
Information of road facilities is not enough.
Information is not up to date.
They need the time for making the report. So, decision making needs time.

In order to conduct the efficient management, it is need to develop the road facilities data base at first.

■ Method of developing the data base

① Developing the data base using the existing information

② Conduct the site survey about the dearth of information

Need the efficient measurement technology
Inventory survey technology

Road located along road space: Road sign, Road signal, Light, and so on...

⇒

Requirement technology:
- Measurement image have wide view angle
- It is possible to calculate the facilities position from the measurement image

① MMS (Mobile Mapping System)

Advantage: Position is accurate.
Disadvantage: Cost is high.
   Data processing is need the time.

② 360 degrees image camera

Advantage: System is simple. Cost is not high.
Disadvantage: The system need the calculation method about the measurement of accurate position from the image.

It is necessary to determine the technology to be introduced in consideration of the advantages and disadvantages.
Thank you for your attention!!