JICA Road Asset Management / Knowledge Management Seminar

SIMPLE ROAD SURVEY TECHNOLOGIES **Smartphone Free Applications**









BumpRecorder Simple Road Survey Application





Pothole Repair & Patching Quantity Survey Application





Site Inspection **GPS** Mapping Application





~ LOW COST Road Survey Method ~

26 Apr. 2022

Required Tool

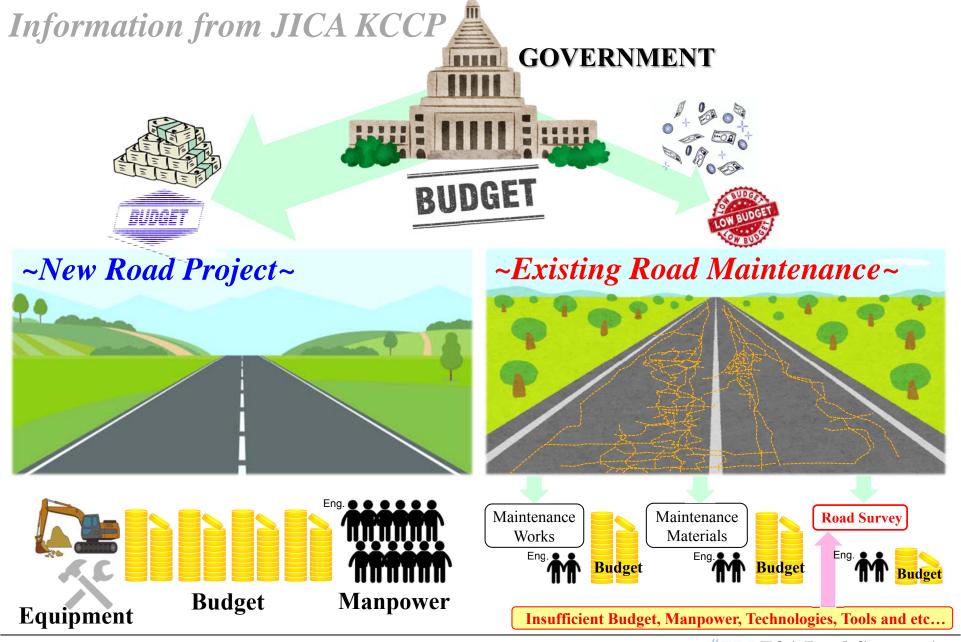
Smartphone only



TOA Road Corporation Construction Business Department

International Business Promotion Division Section Manager

KENJI MURAKAMI (村上憲司)

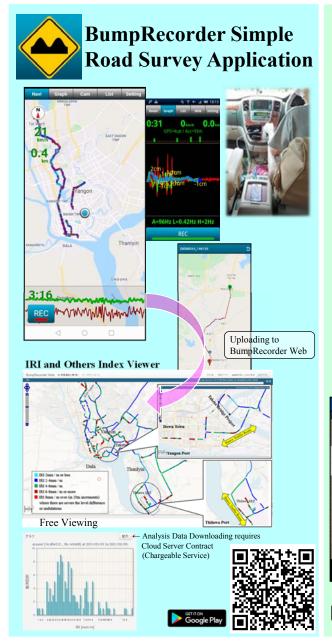


ROAD SURVEY TECHNOLOGIES

Required Tool Smartphone only

Free Smartphone Applications

Introduced by **TOA Road Corporation (JPN)**









Simple Survey **Technology**



BumpRecorder

Inc. IRI Data Evaluation

TOA Road Corporation

Solution to Issue

Free Application Server Fee only

- 1 Lack of budge for road maintenance and improvement in efficiency (Prioritizing and filtering)
- 2) Lack of investigation fee required for road maintenance (Mobile type is expensive, costly for maintenance and can be operated by limited member

(Overview)

- Technology to survey road surface characteristics using **Smartphone** easily and to Visualize and Quantify measured data
- Measuring technology of road surface characteristics to improve the efficiency of survey work with necessary but limited man power for road maintenance management and to support the prioritization considering road maintenance budget (Presented on JICA Road Asset Management Seminar on February, 2020)

(Features)

- Possible for Anyone Easily to measure road surface characteristics regardless the use of measuring vehicle or setting style of smartphones (Free application of Google Play)
- •Measuring Accuracy of Class-III (Class-III for CSIR or other smartphone application) (attached with **Auto Calibration** function to meet the difference of car models)
- Easy to pick up damaged parts by visualizing road surface characteristics (Possible to share uploaded data to WEB Site using either of English or Japanese version among the own group in the cloud)
- Applicable for finished form management of completed road surface

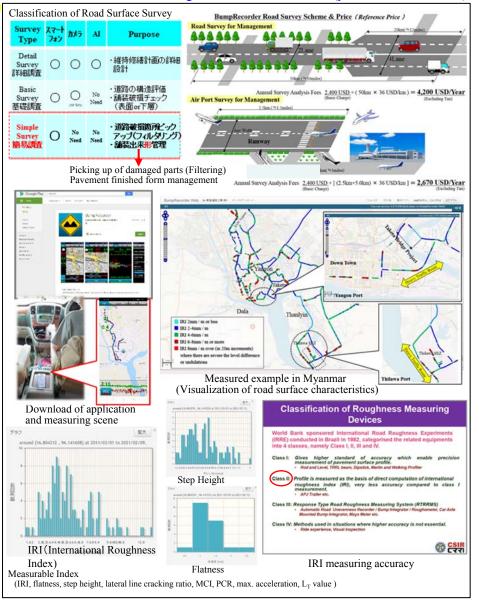
[Effects]

- Prioritization of road maintenance management (Improve Filtering efficiency)
- •Capable of database construction of road surface survey with Small Budget of maintenance management (No maintenance fee of measuring vehicle and easy to organize the data as CSV format)
- Capable of road surface characteristics survey and road maintenance patrol simultaneously

(Achievements)

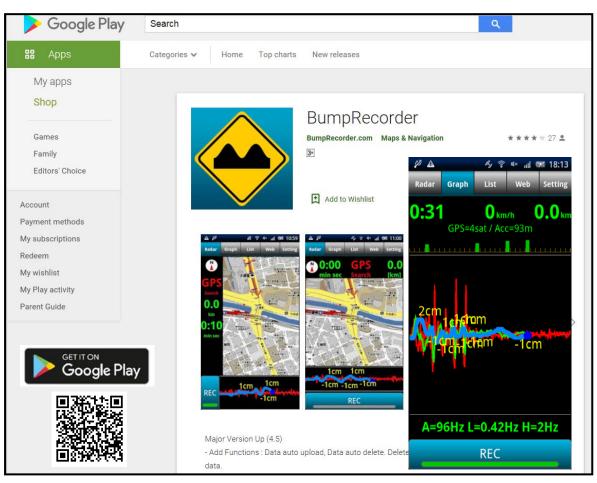
- Cuba: JICA Technical Cooperation
- Myanmar: JICA Technical Cooperation in progress
- Japan: Many records through nation wide.
 - In Aizu area, test survey using AI in progress

JICA Road Asset Management Technical Seminar (presented on Feb. 2020)



"BumpRecorder" Simple Road Surface Survey Method by Smart Phone

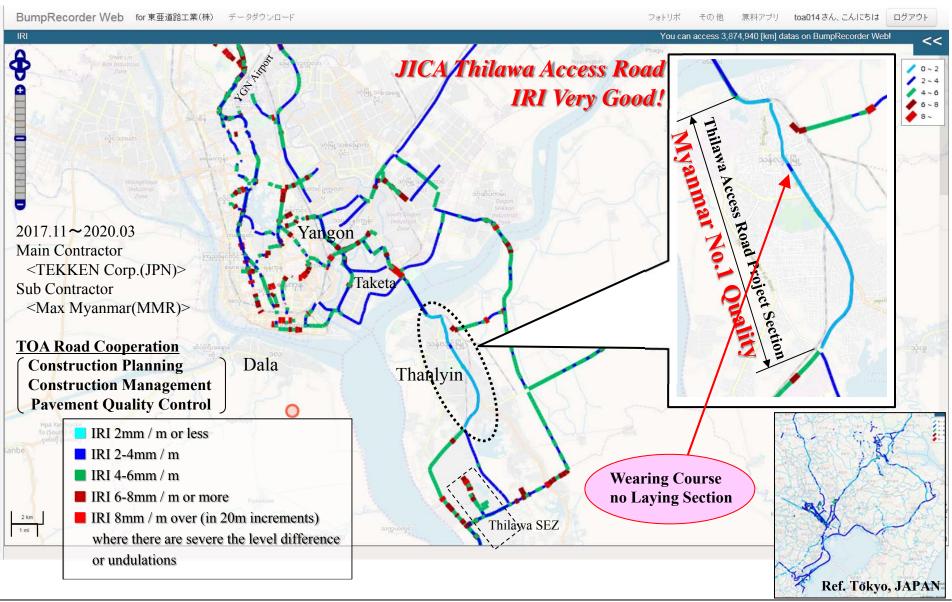
Easy to Summary Road Data; Visualization





@Yangon City, Myanmar (Thilawa Access Road Project)

Data as of 2019 December





BumpRecorder → BR



SURVEY Quantity

STEP.1 簡易調査 Filtering Survey

STEP.2 基礎調査 **Basic Research**

STEP.3 補修設計のための 詳細調査 **Detail Research**

For Maintenance Design

Low Cost

Google Application (Free) Simple Survey





Simple Survey with Al Camera

& Al Analysis

COST

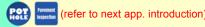


Expensive



1milion USD for a Vehicle & Annual Car Maintenance Fees

Site Inspection ←TOA Supporting Smartphone App. (Free) (Free) (refer to next app. introduction)



Basic Survey (Monitoring, Checking, Quantity Calculation and Analysis of Road Damages)

Cracking, Pothole, Rutting and others BR with using Smartphone Camera can be used Practically without additional cost

IRI Visualized Mapping only No-Data

IRI & Others Data

IRI & other many Data

Superior Analysis

[NEXT] Method Statement for IRI Data Practical Using to Real Road Maintenance

Excavation Survey













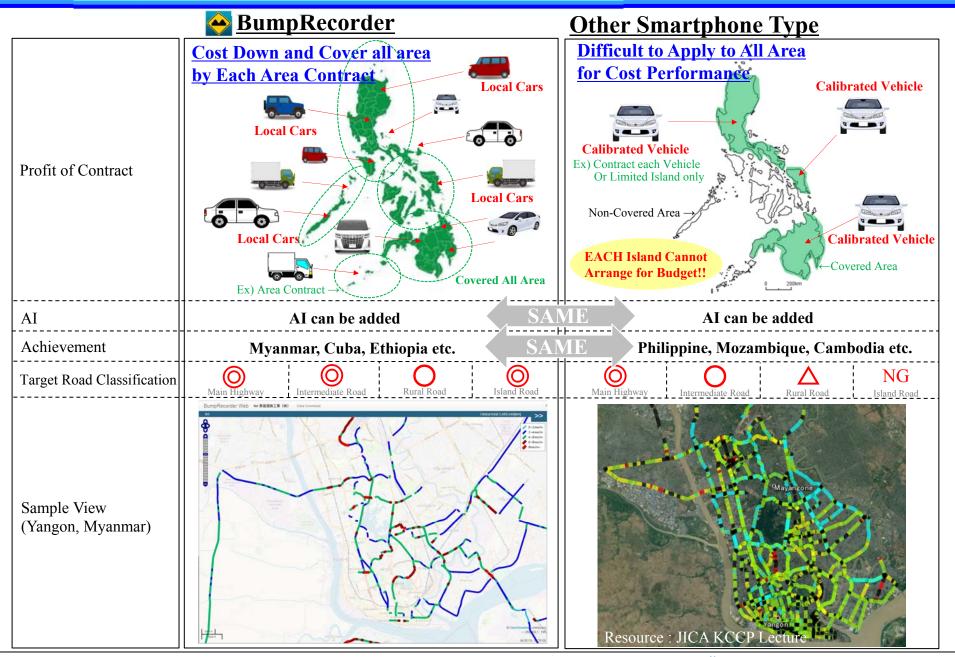




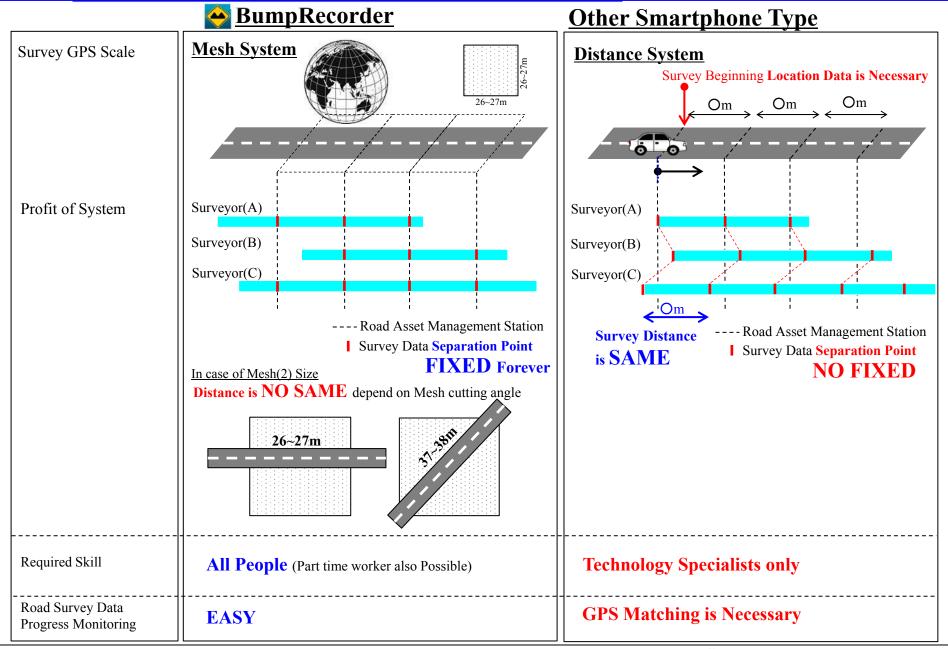


	BumpRecorder	Other Smartphone Type
Cost	Server Usage Fee (Data storage @Cloud Server)	Server Usage Fee (Data storage @Cloud Server) Vehicle Maintenance Fee × Ocars Calibration Fee × Ocars
Survey Vehicle	All Vehicle Type No Limited by Calibration **Keep Weight Constant is Necessary**	All Vehicle Type Limited Vehicle by Calibration Calibrated Vehicle Calibrated Vehicle
Traveling Speed	20~120km/h (1~20km/h Possible) Acc.↓	ME 15~100km/h
Accuracy (CSIR)	Class-II SA	ME Class- II
Simplicity	Automatic Calibration (Require Distance: 2km) Smartphone Set only	Need Calibration (Pre-Setting is Necessary) GPS Accelerometer PC Requirement : Calibration with Vehicle
Ref. Movie URL	https://www.youtube.com/watch?v=U1s9yoe-2eg	https://www.jip-ts.co.jp/drims/

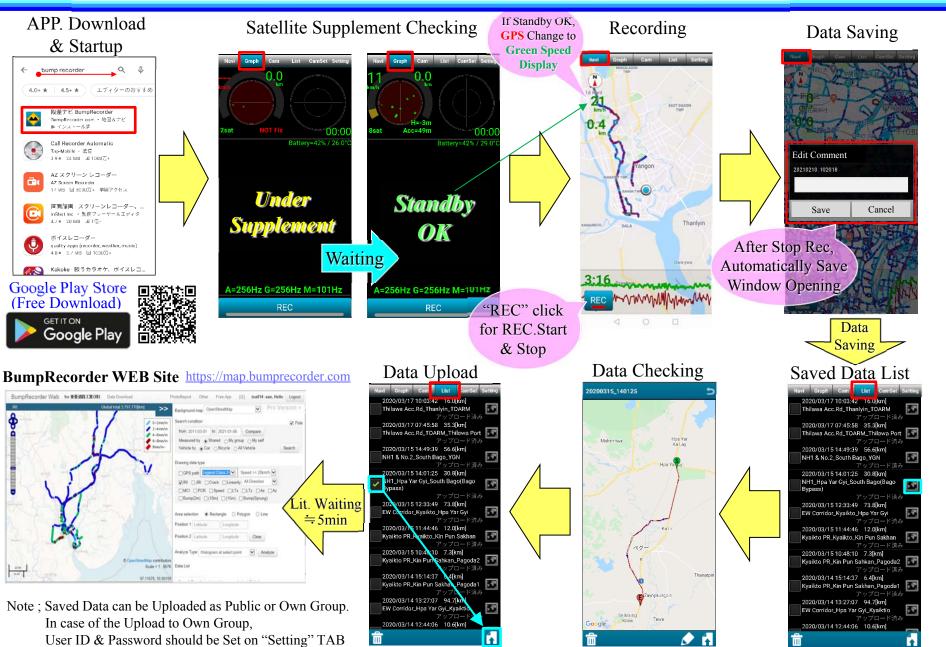
Simple Road Survey Method Comparison (2)

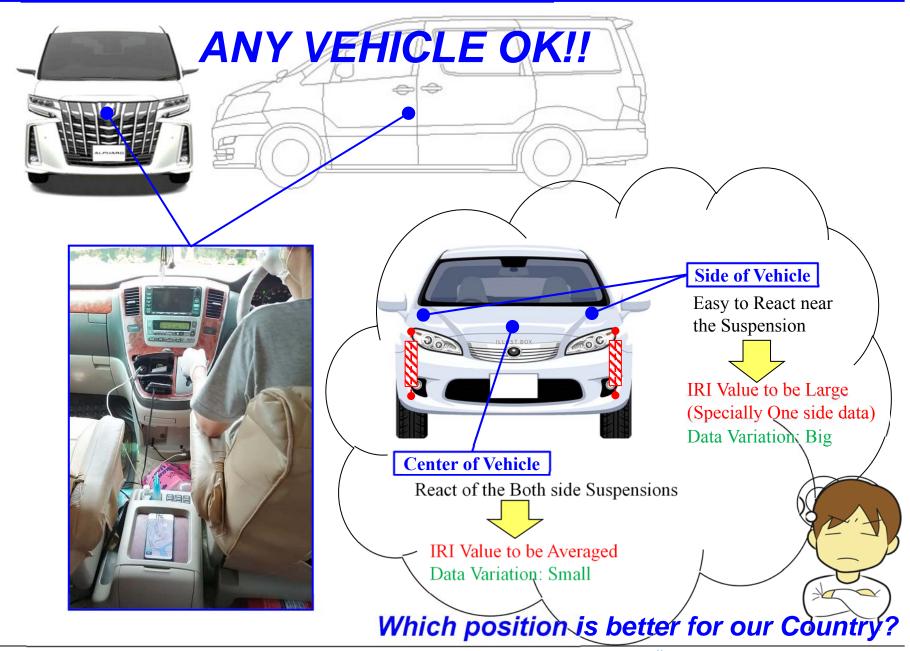


Simple Road Survey Method Comparison (3)



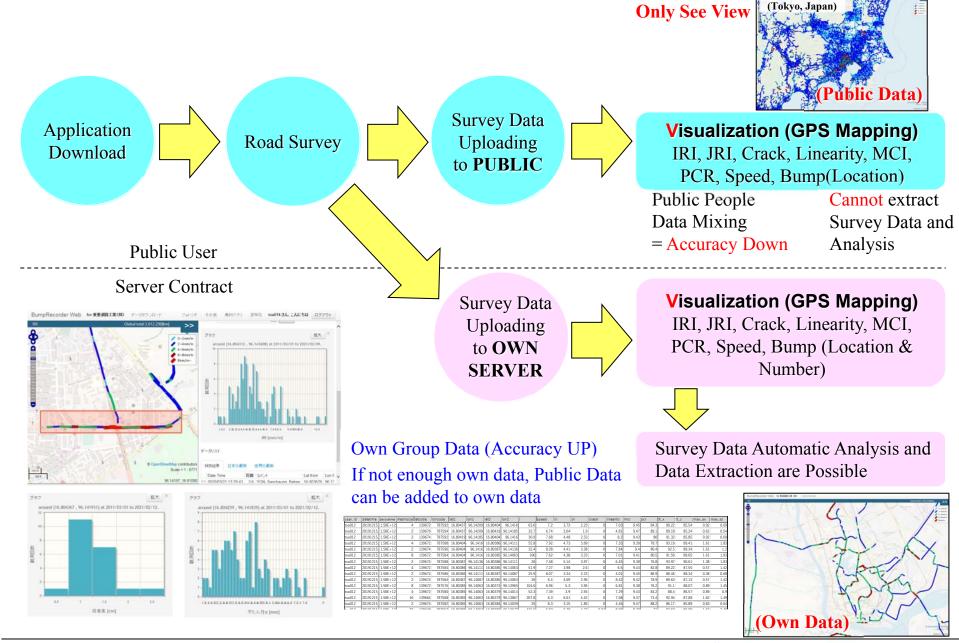
How to Use? (Application Download ~ Survey Data Update)











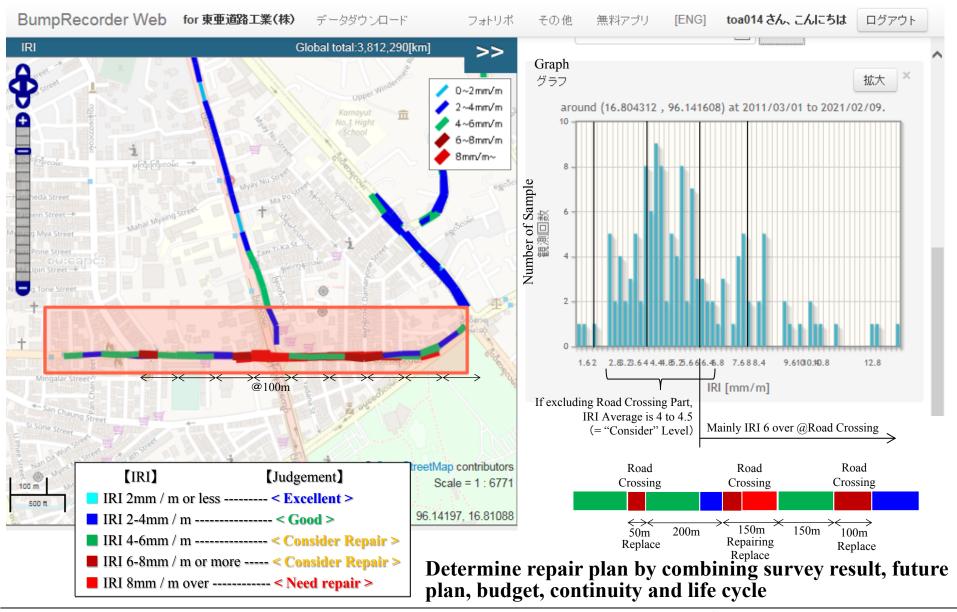
Example View in Rwanda

Rwanda As of 29.Mar.2022 PhotoReport Other Free App [日] toa014 -san, Hello Logout BumpRecorder Web for 東亜道路工業 (株) Data Download → Pro Version × Background map OpenStreetMap 0 Search condition 0~2mm/m ☑ Pale 2~4mm/m from 2011-03-01 to 2022-03-29 Compare ♦ 6~8mm/m Measured by Shared My group My self Vehicle by @ Car Railway Bicycle All Vehicle Search Drawing data type ☐GPS path Legend Class 2~8mm Speed >= 20km/h ☑ IRI □ JRI □ Crack □ Linearity All Direction □MCI □PCR □Speed □LTx □LTz □Ax □Az □ Bump(2m) □ (10m) □ (15m) □ Bump(Sprung) Area selection Rectangle Polygon Line Position 1 Latitude Longitude Position 2 Latitude Longitude Analyze Type Histogram at select point Analyze Search Result Latest Japan Latest Global Lat from Lon f 2022/03/27 18:17:14 -1.950415 30.12 -1.933935 30.09 2022/03/27 13:44:02 -1.936577 30.07 2022/03/27 13:18:56 -1.956022 30.07 2022/03/27 12:57:20 2.7 -1.964427 30.0€ 2022/03/27 10:56:57 -1.934053 30.09 100m Scale 100m Scale

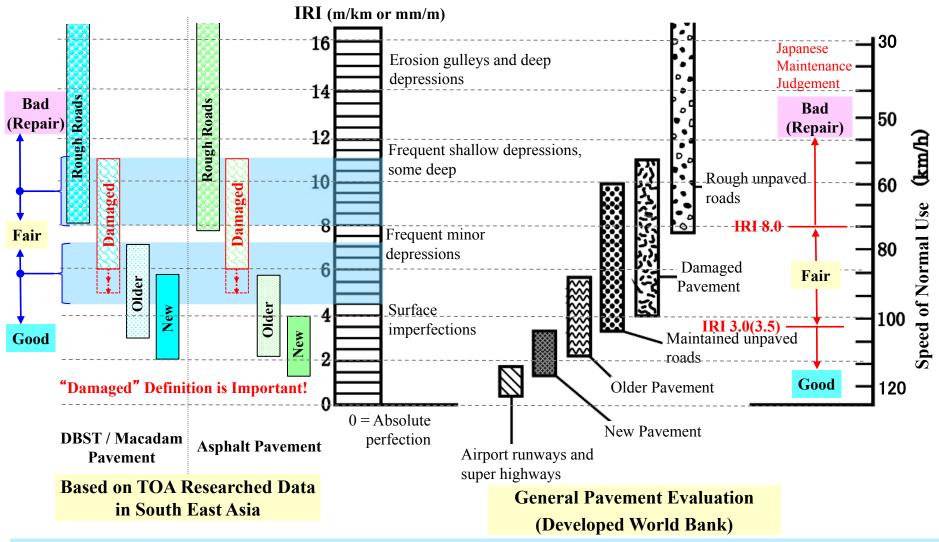


FIDA BumpRecorder Filtering Method (using IRI Data Analysis)

IRI (International Roughness Index) Sample View @ Yangon, Myanmar



IRI is General Pavement Indicator developed by the World Bank



Maintenance Judgement Line should be determined with considering Pavement kinds, Survey results, Budget allocation, Prioritization and other conditions in each countries.

IRI = 2 mm/m around: new road level





IRI = 4 to 5 mm/m: a little roughness felt





IRI = 7 to 8 mm/m: roughness further felt





IRI = 9 to 10 mm/m: roughness further felt and some defects seen





IRI = 9 to 10 mm/m: roughness further felt and pothole or patching



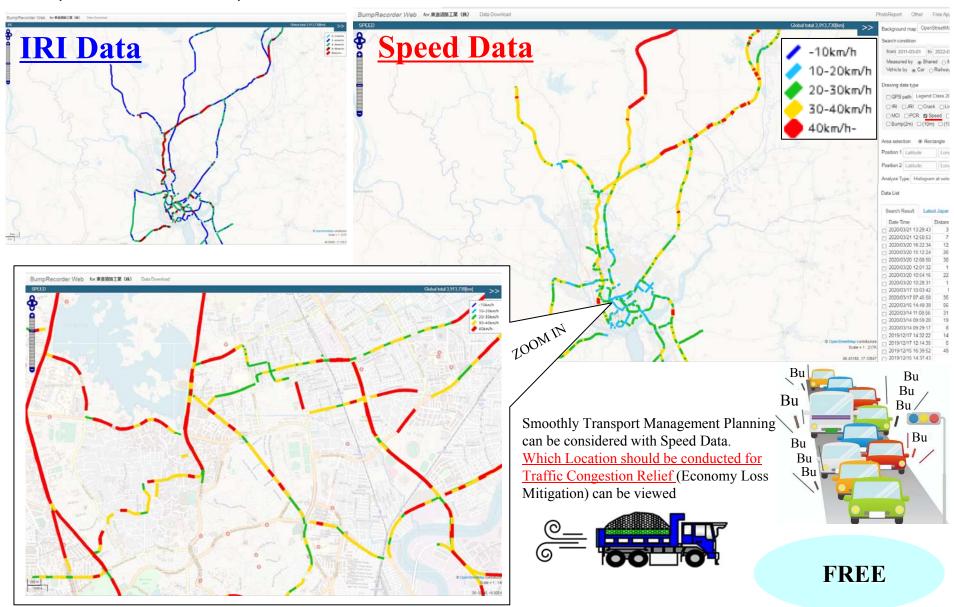


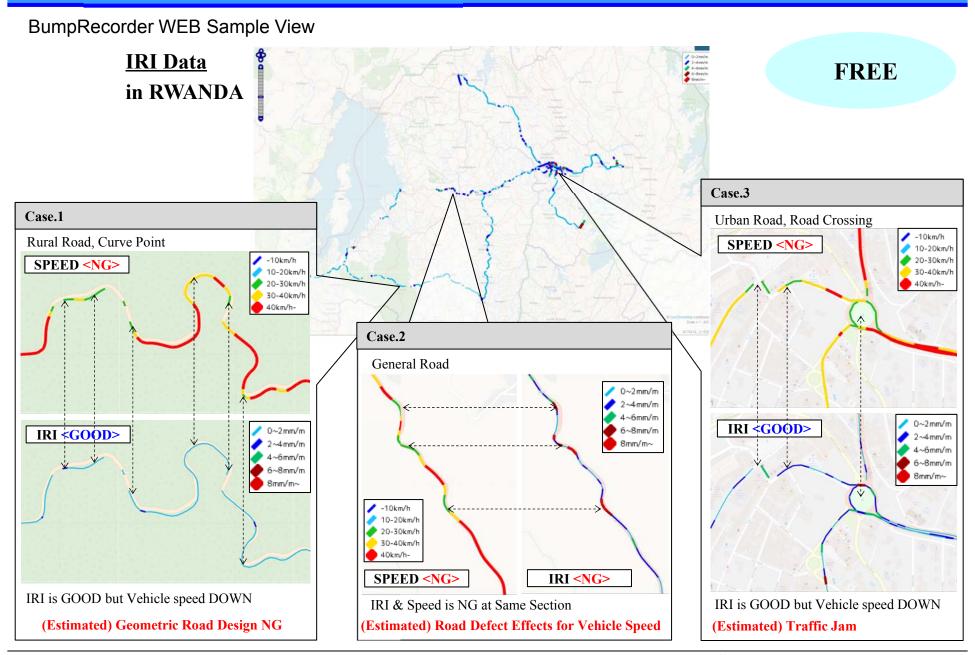
Source: Pavement Inspection Manual (JPN MLIT)

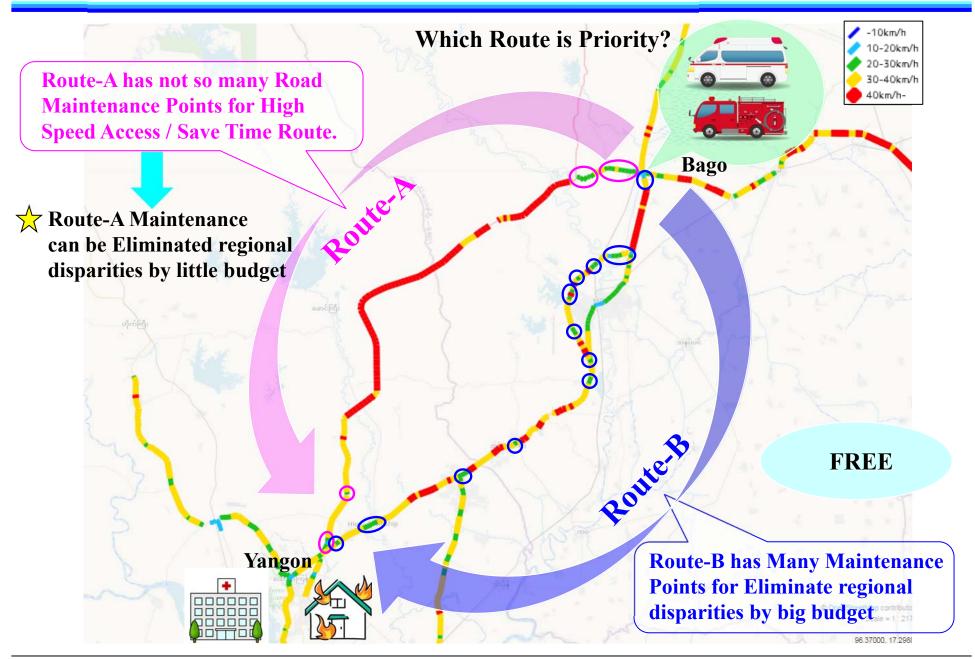
Regarding Cracking Level and Rutting level, Survey Supporting Technologies will be explained!

Speed Data Usage for Transport & Construction Planning

BumpRecorder WEB Sample View







TDA Important Note of BumpRecorder Road Survey

- ① Survey Possible and Easy by a Smartphone only
- 2 Survey with Traveling time (Performance Good)
- 3 Any Vehicle can be used for Survey

When Vehicle Weight changing time such as Passengers & Items Loading/Unloading and Fuel filling up, Survey should be stopped. After Vehicle Weight changing, New Survey need to start for Auto calibration.

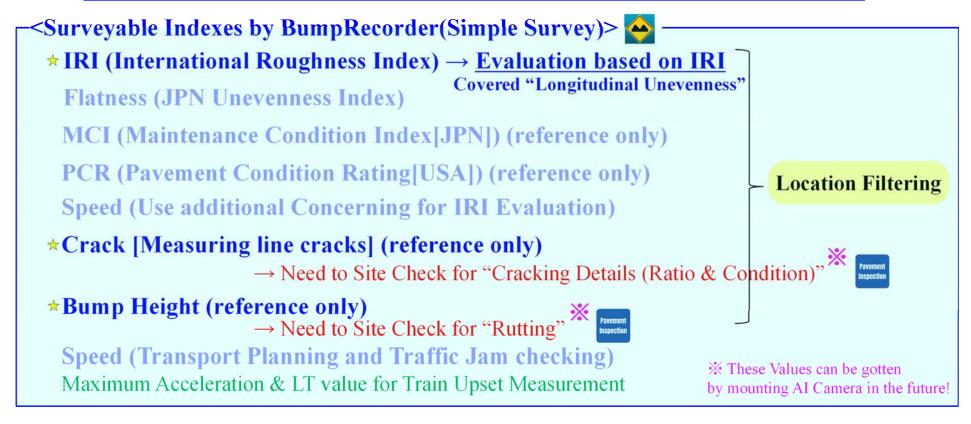


- 4 Pavement Damage is able to be Filtering, Visualization and Quantify easy for Road Maintenance Budget Calculation.
- (5) Anybody can use BumpRecorder Survey Easy BumpRecorder should be educated to users for Accuracy
- 6 Road Lane Data sometimes have mixed or separated conditions depend on GPS Received Status, but Survey data is **surely Separated depend on Traveling Direction**.
- (7) Shown Survey Data on BumpRecorder Web Site is based on new survey data. New Data will be pasted on Old Data. If not enough survey section, new data will be mixed old data.
- (8) Detail Survey also possible, if linked with **Smartphone Camera** or AI Camera.
- (9) BumpRecorder is required <u>5 Satellite Signals</u>, Survey limit length is approximately 1km in the Tunnel and Forest covered road. In this case, traveling speed should be kept constant as possible.









< Real Road Maintenance Planning Required Data>

- *Photo linked with IRI Data → Need to Survey (BR Smartphone Camera Setting)
- * Repair Material Quantity Calculation → Need to Site Survey
- **★** CBR Data & Existing Pave. Structure Checking → Need Excavation Survey Skid Resistance, Deflection, Drainage Function and others (if require)



Site Survey Works Supporting FREE Application produced by TOA Road Corp. (Refer to "Survey Supporting Technologies")





Road Inspection Supporting Technologies





Inc. Pave Analysis & Evaluation

e Survey Support Smar Quantity Auto Doad Repair Quantity

TOA Road Corporation

~ Smartphone Road Survey ~

Road Survey Support App. 100% Free



Mar.2020 Released on Google Store!!



POT HOLE MEASURE

Repair Quantity Measurement Application





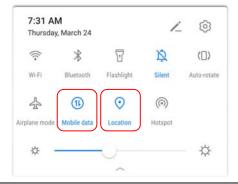


PAVEMENT INSPECTION

Pavement Inspection GPS Mapping Application







Before starting to use these application,

→ Mobile Data & Location (GPS) setting to "ON"



~ 海外での活用が想定される技術 ~

Solution to Issue

- **1** Lack budget for road maintenance
- 2 Disparity of measured result due to human factor (Experience and knowledge)
- **3** Efficiency and quantification of measuring (Measure and tabulation, management system)
- **4** Planning work support for maintenance and repair (Making Efficient)

[Overview]

Technology easily supporting survey work of road maintenance management by smartphone application. Only smartphone can perform road maintenance management by using along with pavement roughness measurement provided by BumpRecorder. To make effect the necessary and limited work for road maintenance and support the survey work without spending a lot of budget.

[Features]

Pothole Measure:

Smartphone application of Google. Quantity of material required for the repair is automatically computed, tabulated and recorded from measured data by this application

Road Survey:

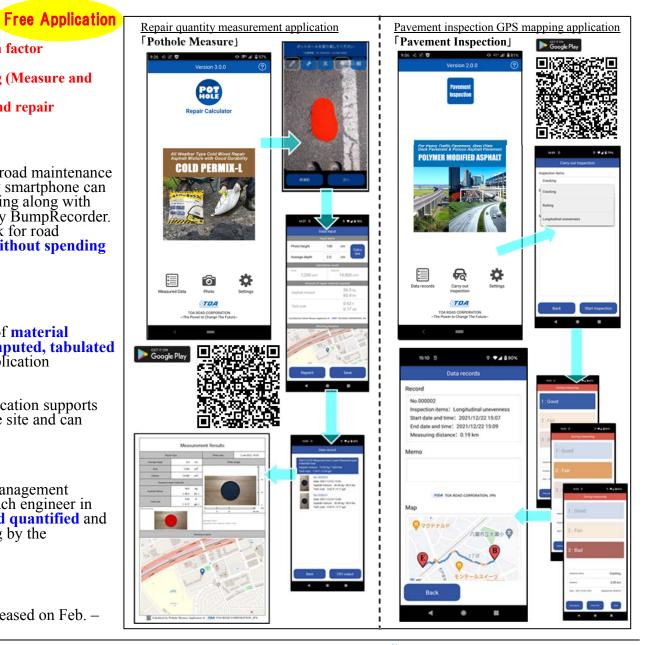
Smartphone application of Google. This application supports the survey work by maintenance engineer at the site and can **Visualize (GPS mapping) survey data**

[Effects]

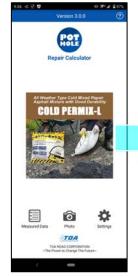
- By using this application, maintenance and management survey depending on personal capability of each engineer in least developed country can be visualized and quantified and support checking system and decision-making by the supervisor for the maintenance
- •No charge (Smartphone usage fee only)

(Achievement)

• For domestic only. English version will be released on Feb. – Mar., 2022







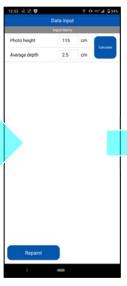
Tap to "Photo"



Take photo



Paint Repair Area



Height & Thickness Put-in and "Calculate"



Calculate Results



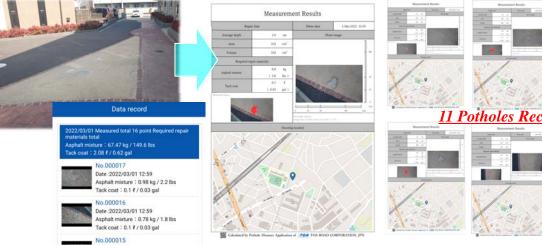
After saving data, can check on data list



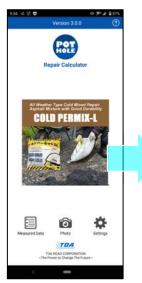
After saving data, can check on data list

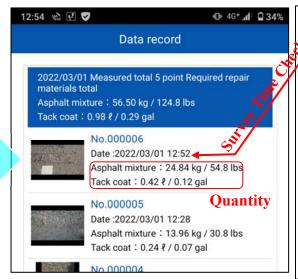
(Example) Pothole Quantity Survey & Records (5~7min)













In case of Big POTHOLES,

Scale Setting and Typical Location Survey

DATE, TIME and Number of multiple should be recorded when you survey.



After Survey, Quantity will multiply with location number.

Asphalt Mixture

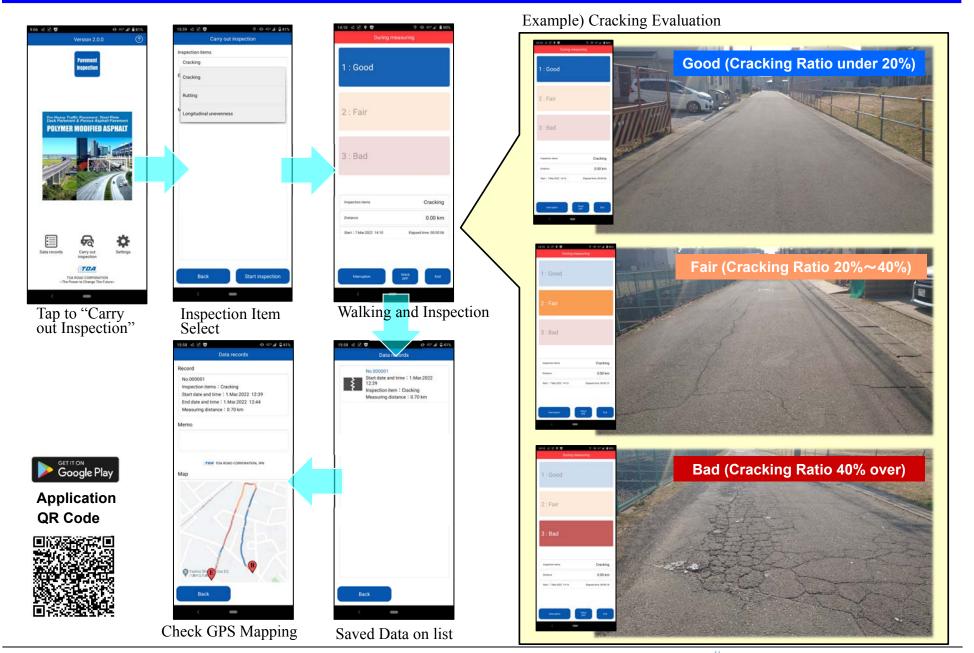
24.84 kg/loc. * 5 loc. = 124.20 kg

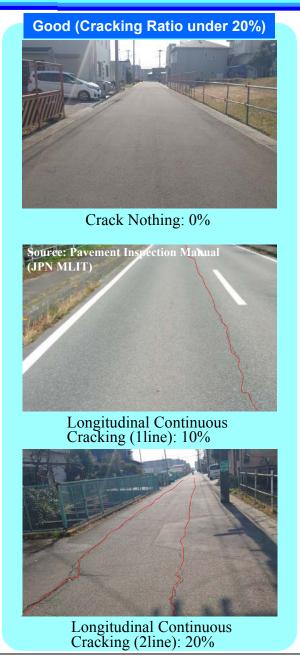
Tack Coat

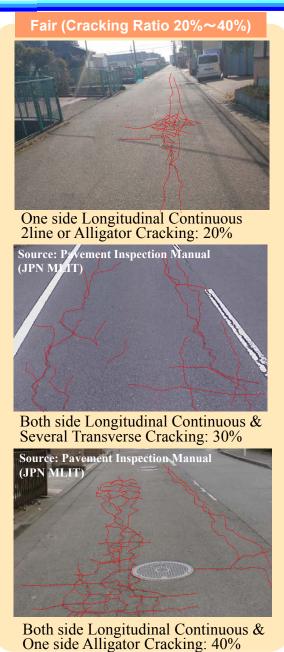
0.42 L/loc. * 5 loc. = 2.1 L

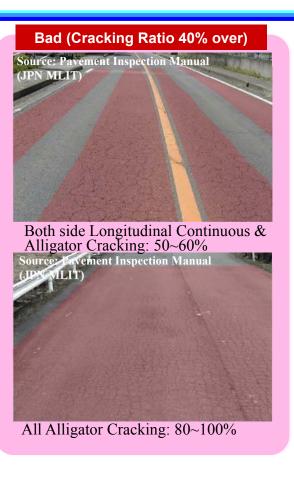
In case of Too Many Potholes, Approximately Quantity also can be estimated easy by the same as this method.









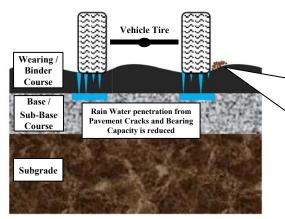


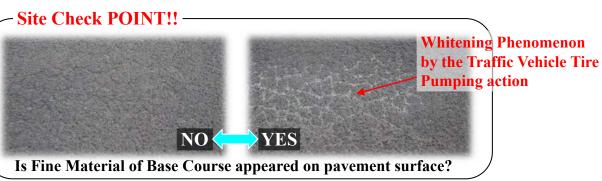


Source: Pavement Inspection Manual (JPN MLIT)

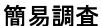








Regarding Longitudinal Unevenness, Evaluation can be used by BumpRecorder IRI data.



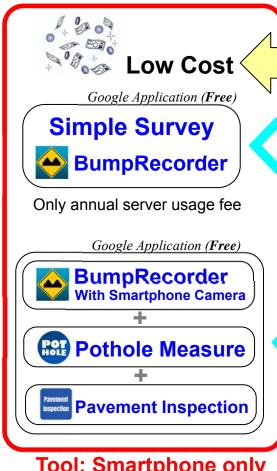
STEP.1 Filtering Survey

基礎/詳細調査

STEP.2 **Detail Research**

補修設計のための 追加調査

STEP.3 **Detail Research**



SURVEY COST

Simple Survey

with AI Camera

Expensive

Road Survey Car

1milion USD for Survey Car & Annual Car Maintenance Fees

Excavation Survey

FWD

1milion USD for Survey Car & Annual Car Maintenance Fees

Tool: Smartphone only

Limited Excavation Survey



Application QR Code





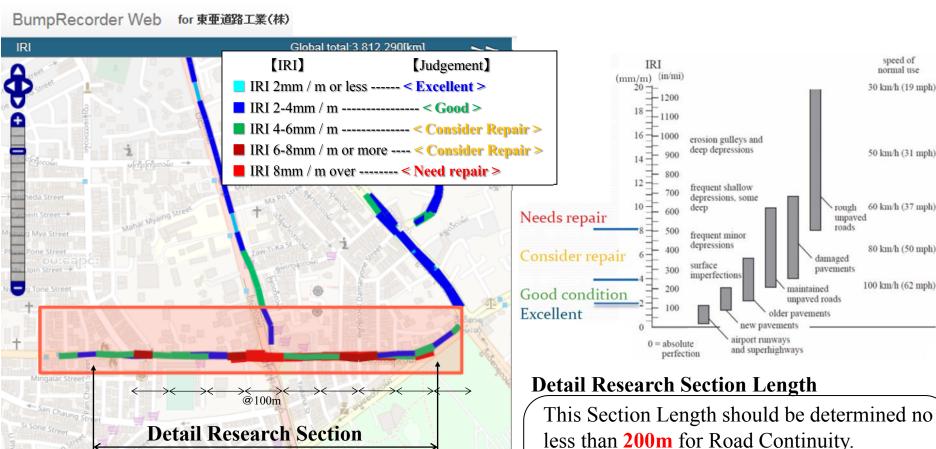








BumpRecorder Sample View, IRI (International Roughness Index) Data Filtering of Simple Pavement Characteristics Survey Result



© OpenStreetMap contributors

Scale = 1:6771

96.14197, 16.81088

500 ft

After Length Decision, BumpRecorder with

Inspection App. Recommend to use for Cheap

Camera, Pothole Measure and Pave.

Road Survey.

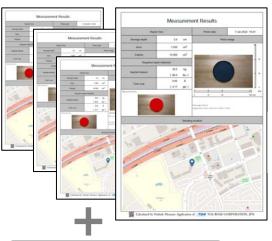
Joint Use of IRI Survey Result and Maintenance **Management Support Application BumpRecorder**With Smartphone Camera around (16.804312, 96.141608) at 2011/03/01 to 2021/02/09 觀測回数 IRI [mm/m] If excluding Road Crossing Part, IRI Average is 4 to 4.5 Mainly IRI 6 over @Road Crossing (= "Consider" Level) Road Road Road Crossing Crossing Crossing <> < 50m 150m 150m 100m 200m

Repairing

Replace

Replace





Aggregation of pavement repair volume



Study of repair material & method

Pavement Inspection



Aggregation of visual inspection result

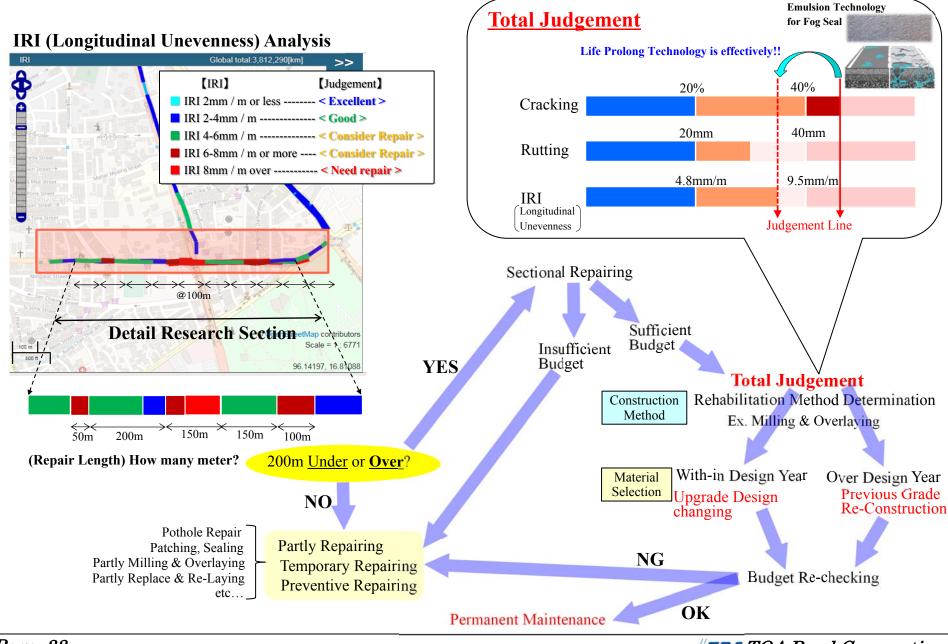


Final study of repair area

Determine repair plan by combining survey result, future plan, budget, continuity and life cycle

Replace

STEP.3 Road Maintenance Consideration with All Data (inc. Excavation Survey)

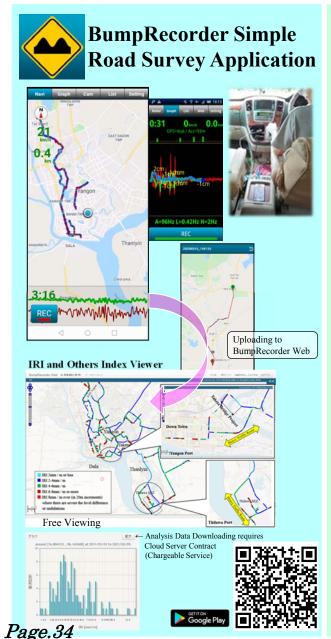


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Required Tool Smartphone only

Free Smartphone Applications

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TOA Road Survey Technologies Introduction



THANK YOU FOR YOUR ATTENTION!

If you have any questions, Pls inquire to us anytime!

< Inquiry >



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