IRI MEASUREMENT BY VIMS IN CAMBODIA

Kyoto University Student Member ○Salpisoth Heng
Kyoto University Regular Member Yoshinobu Oshima
Kyoto University Regular Member Hirotaka Kawano

1. INTRODUCTION

Pavement is one of the important road structures that may easily damage or deteriorate due to increasing of traffics and loading. So therefore, it is necessary to monitor and evaluate properly the condition of pavement for road network management. In order to evaluate pavement condition, several indices have been proposed in the world such as IRI (International Roughness Index, Fig.1), PSI (Present Serviceability Index), PCI (Pavement Condition Index), PQI (Pavement Quality Index), MCI (Maintenance Condition Index) etc. Among these indices, IRI is adopted widely to represent the pavement roughness and riding comfort, which is proposed by World Bank.

In Cambodia, World Bank has developed once a year measurement of IRI using ROMDAS (Road Measurement Data Acquisition System) modular system, and also recommended to use HDM-4 system for road asset management including maintenance planning, budgeting and operations that is to ensure continued effective use of the road network in support of the economic development[2]. However, there are some difficulties in calibration and hard to handle with ROMDAS survey, moreover it has to remodel the measured vehicle to install equipment. In the meantime, simplified IRI measurement by VIMS (Vehicle Intelligent Measurement System) has been proposed by the University of Tokyo[3]. VIMS simply requires an accelerometer and GPS installed inside the vehicle and then IRI can be obtained by any vehicles after the vehicle is calibrated.

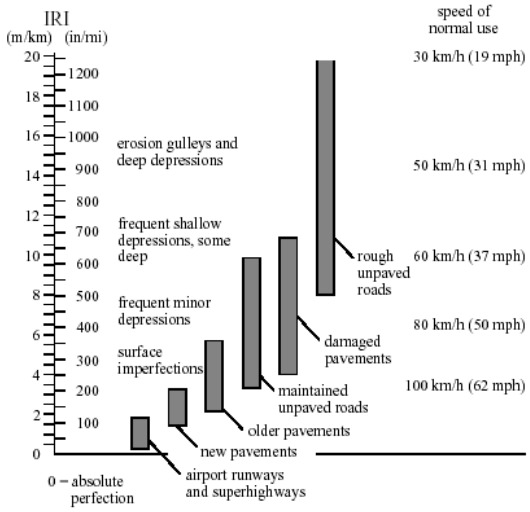

Fig. 1. IRI Spectrum (from "Little Book of Roughness")[1]

In this report, we aim to apply and study the suitability of IRI measurement by VIMS to Cambodia. Thus, herein after describe the outline and compare the result of IRI measurement by VIMS and ROMDAS, we report on the recent IRI measurement of some primary roads in Cambodia.

2. IRI MEASUREMENT BY VIMS AND ROMDAS

Roughness in IRI measured by ROMDAS was using a bump integrator roughness meter for paved and unpaved road. And the calibration includes distance calibration, road roughness calibration and GPS validation. The ROMDAS Proximity Sensor DMI Kit is connected to the vehicle's real left wheel. Thus to accurately measure distance, each vehicle needs to be calibrated against a known 1000m length measured by an electronic distance measurement device. For roughness calibration, road roughness was measured using dual ROMDAS bump integrators. As each vehicle responds differently to roughness due to variations in the springs, dampers and tires, it is therefore essential to calibrate each roughness survey vehicle against a standard roughness so that its measurements can be related back to a standard roughness by regression equations were calculated for each bump integrator against the 100m wheel path IRI readings for speeds of 30 and 50km/hr.

On the other hand, VIMS estimates IRI through the measurement of acceleration responses of a vehicle driving at any moderate speed within some range[3]. So it is only need to calibrate the measured vehicle by using portable humps to know its

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Contact address: C1-227, Kyoto Daigaku Katsura, Kyoto, 615-8540, Japan, TEL: +81-75-383-3321

mechanical characteristics and the transfer function for converting its response to IRI. One more simple calibration is to get transfer functions corresponding to the driving speed, which enables us avoid from the limitation of constant speed driving.

Fig. 2 shows IRI result that was measured by ROMDAS[4] on April 2011 and by VIMS on July 2011 over the national road no.5 in Cambodia. From the figure, it can be said the IRI result was measured by VIMS have enough accurate and a good agreement comparing to those measured by ROMDAS.

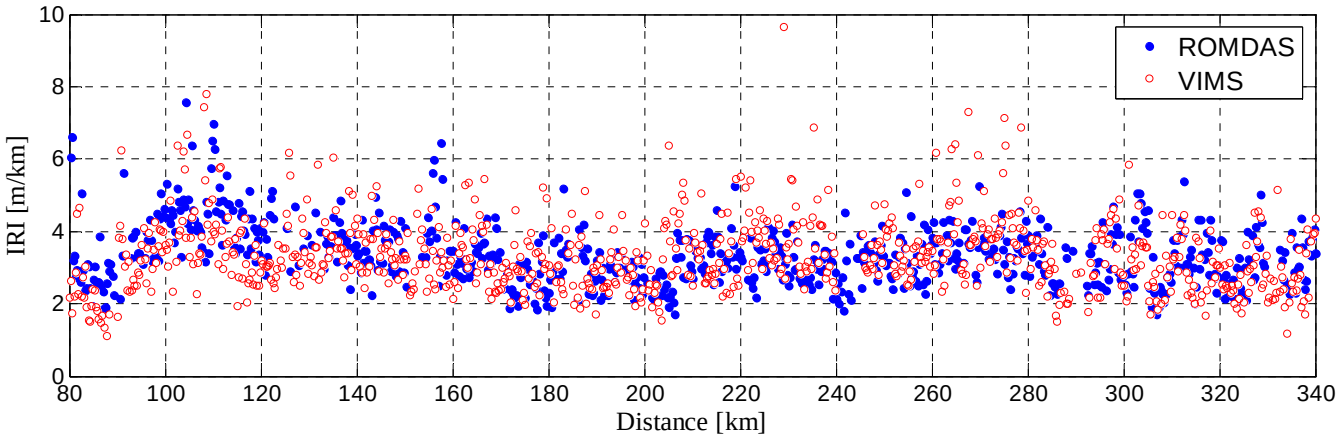

Fig. 2. NR.5 IRI measurement result by VIMS and ROMDAS

3. RECENT IRI MEASUREMENT IN CAMBODIA

On January 2013, we have measured IRI of 4 national roads (no.3~6) by VIMS to know the present condition of the pavement in Cambodia. Fig. 3 shows the result of IRI survey plotted on Google earth map. In this figure, the location of each measurement point shows the value of IRI and its color indicates the level of IRI. It is clearly shown the condition of some site of national road no.5 deteriorate due to the flood effect last year. And high IRI value can be found on the site of national road no.3 which, however, has just rehabilitated in recent years. For national road no.4 and no.6 the deterioration progress of pavement seems to be moderate.

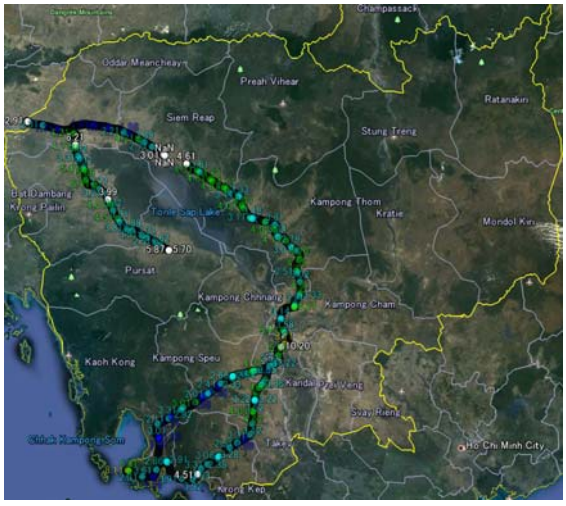

Fig. 3. IRI mapping in Google earth

4. SUMMARY

This report has discussed about the IRI measurement in Cambodia by using both of ROMDAS and VIMS system and it shows IRI estimated by VIMS has a good enough accuracy compare with the IRI measured by ROMDAS. Recent IRI measurement of some primary roads in Cambodia are also presented and commented.

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