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A BASIC STUDY ON EVALUATION OF SPOTTED SURFACE DEFECTS BY A 3D FORMULATING SYSTEM USING TRANSVERSE PROFILE DATA

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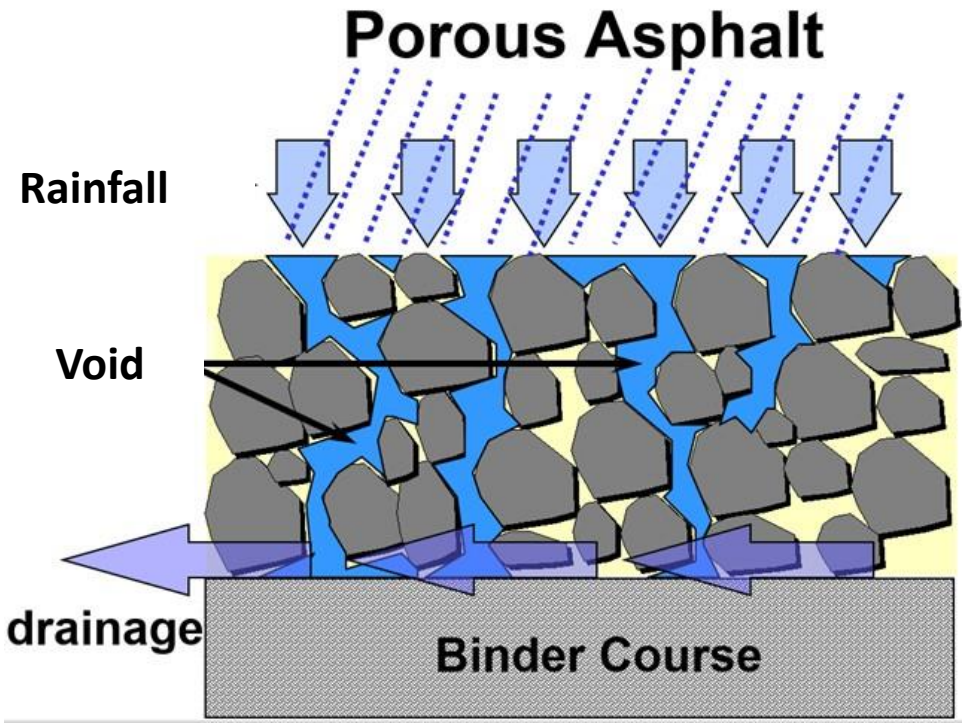
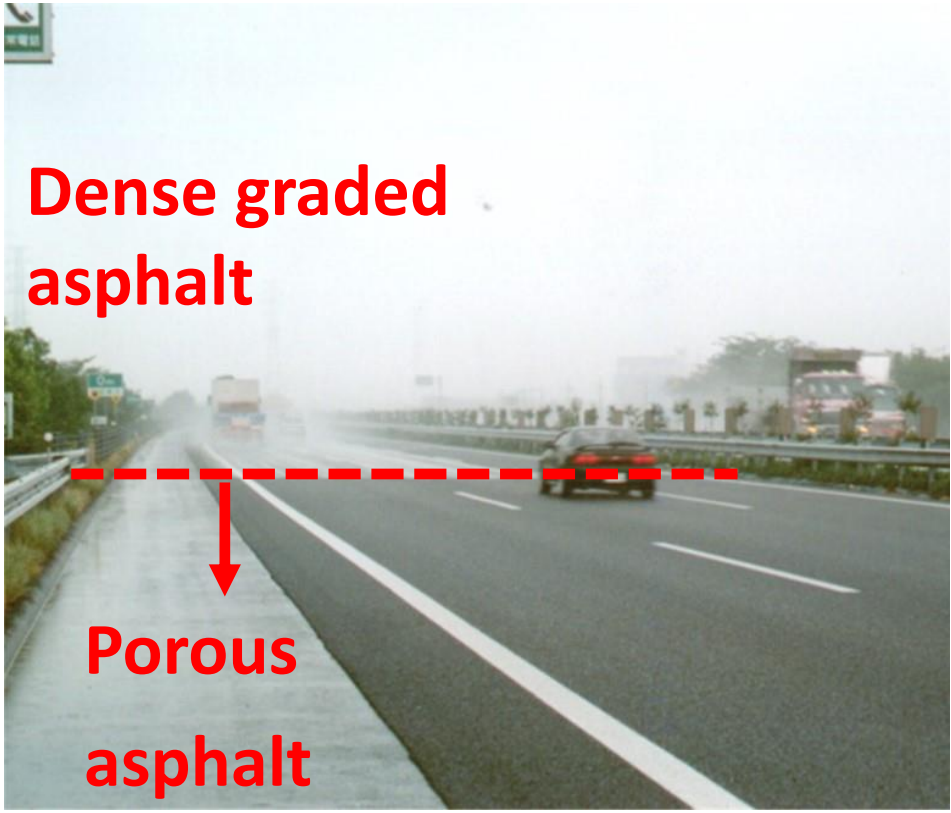
Background: Surface Course in NEXCO

Interurban expressways are operated by NEXCO.

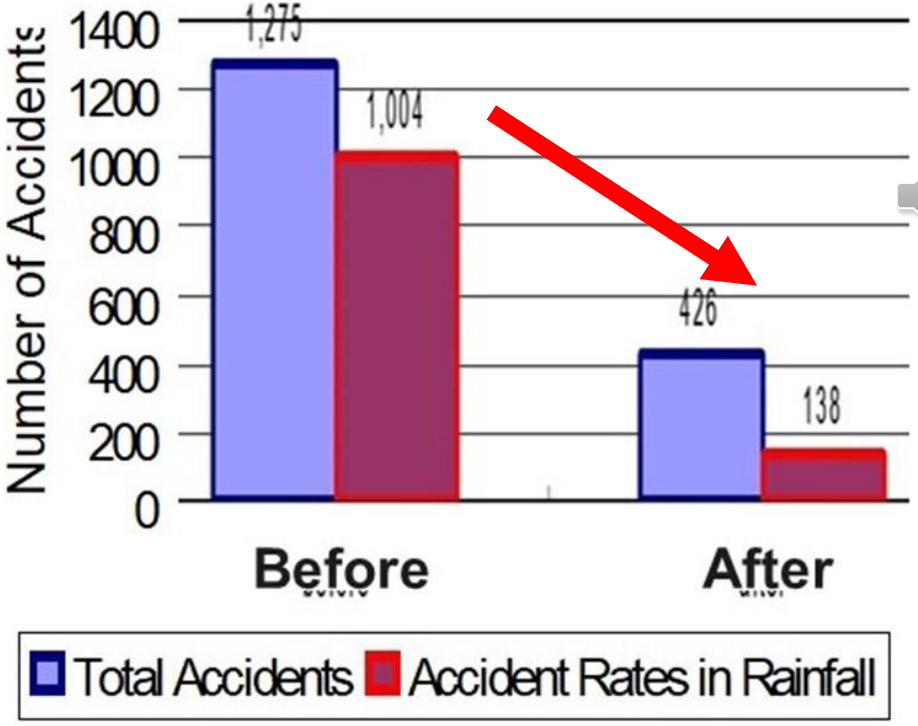


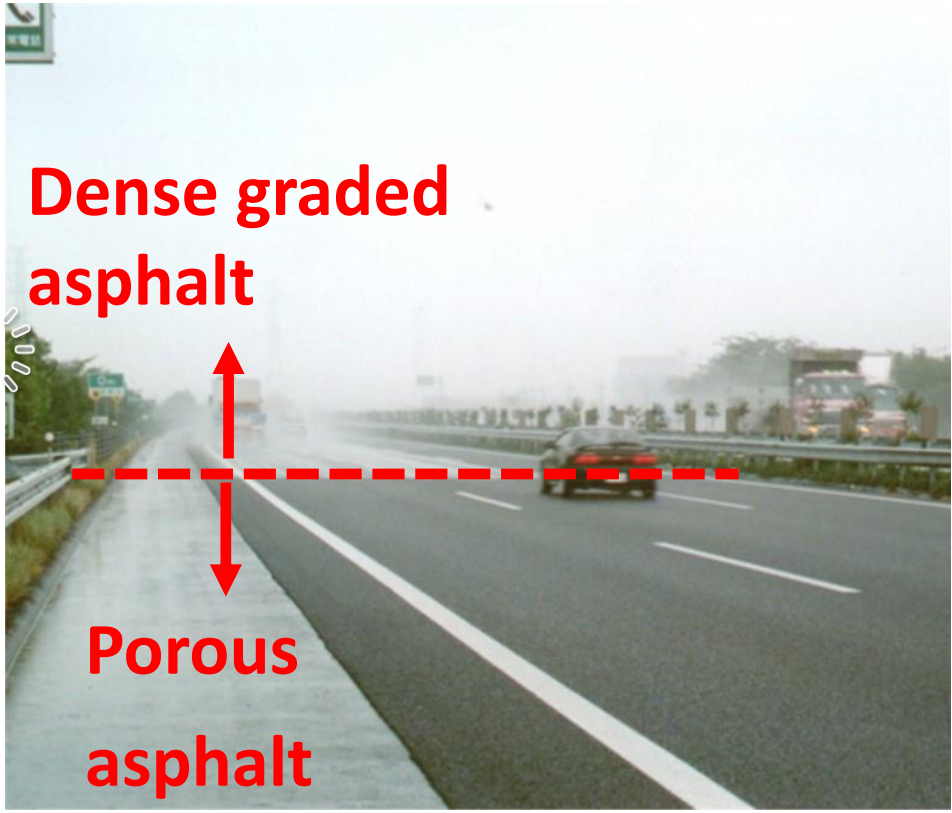


Standard surface course

：Porous　Asphalt (Since 1999)

Background: Surface Course in NEXCO





⇒ **Accidents on rainy days were significantly reduced.**

Background: Deformation of Porous Asphalt

Frequent deformation of porous asphalt : Pumping

・Fine-grained fractions on a subbase spurt to the surface from a crack below the binder course.

・Spurting of fine-graded fractions on the subbase causes local settlement.

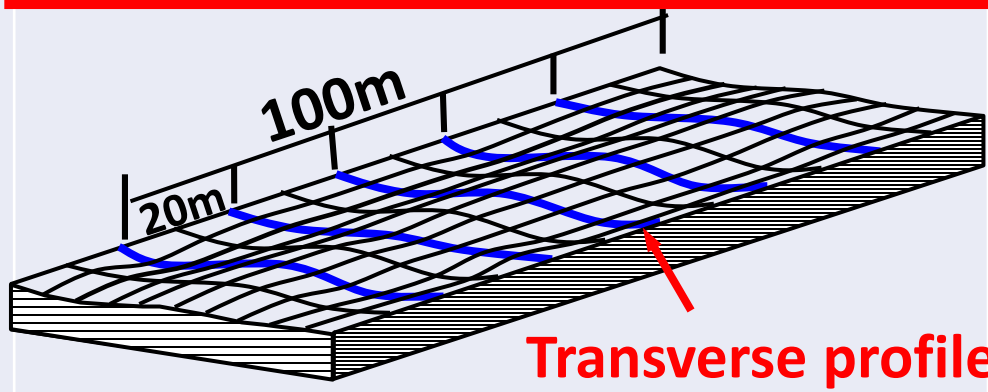
→In order to select a point to be repaired, it is necessary to measure the amount of local settlement on the surface course and assess it.

Selection of Surface Detector

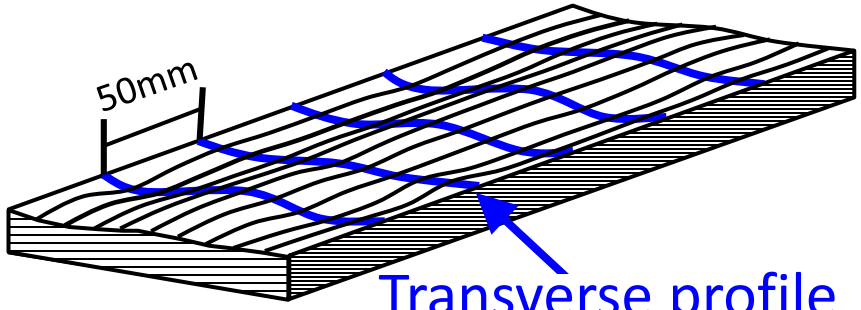
NEXCO periodically measures the surface course using a profiler.

→We used this transverse profile to investigate the assessment of local deformation on the surface course.

Indicator	Cracking rate	Amount of rutting
Measured data	Road surface image	Transverse profile
Acquired data	Confirm deformation from an image.	Confirm deformation from height of road surface.



New 3D Data as Assessment Method

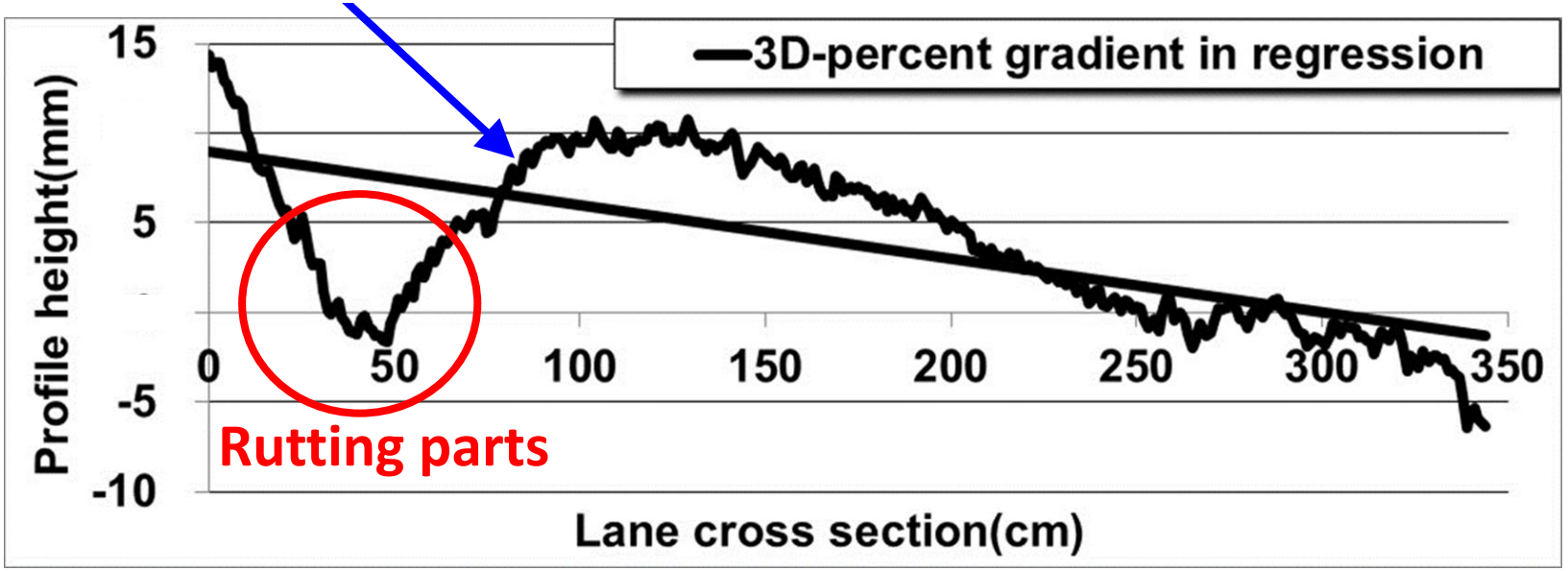


Transverse profile

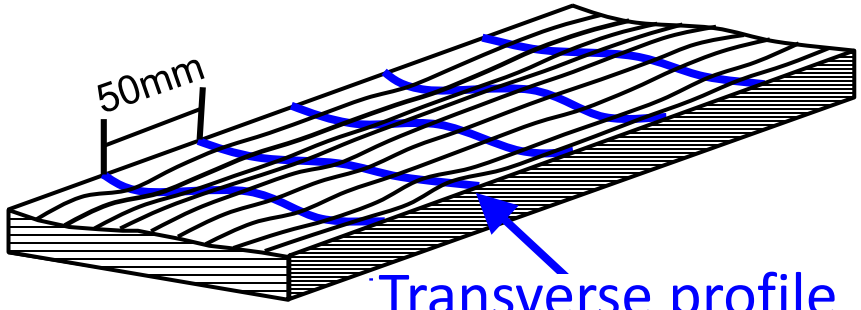
【Data Processing】

Transverse profile arranged in order.

→**Obtain a series of 3D data plots.**



New 3D Data as Assessment Method

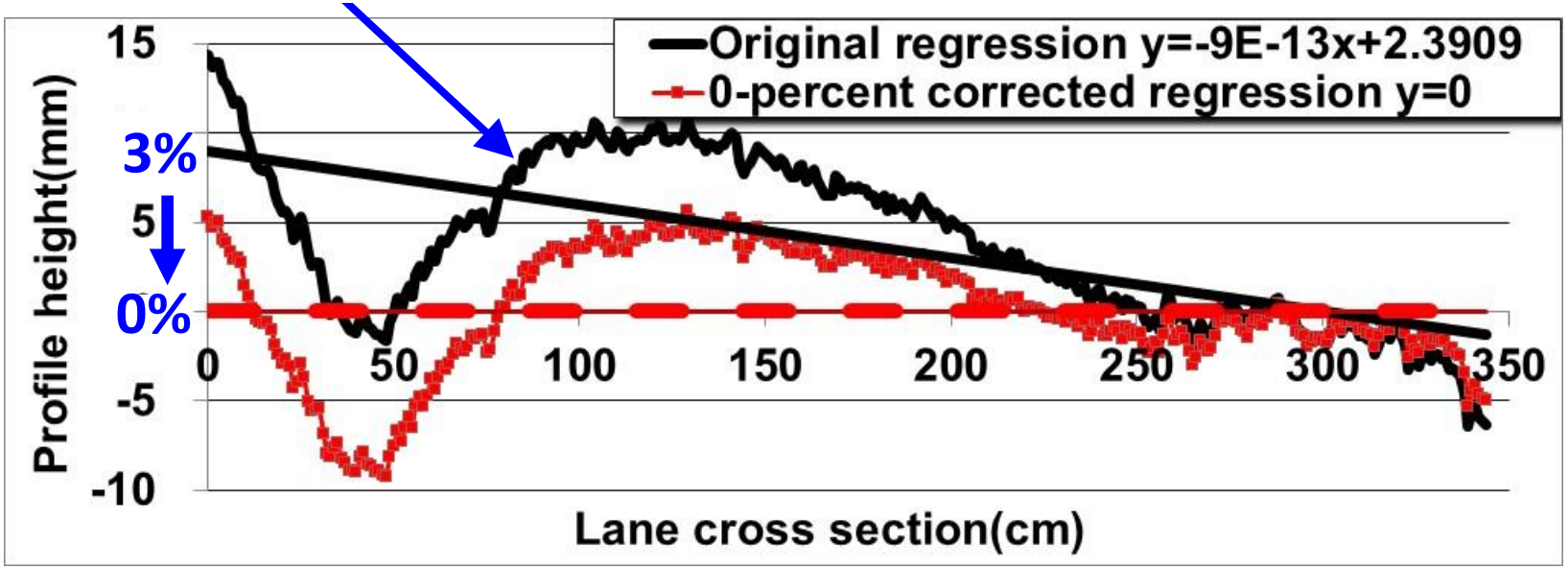


Transverse profile

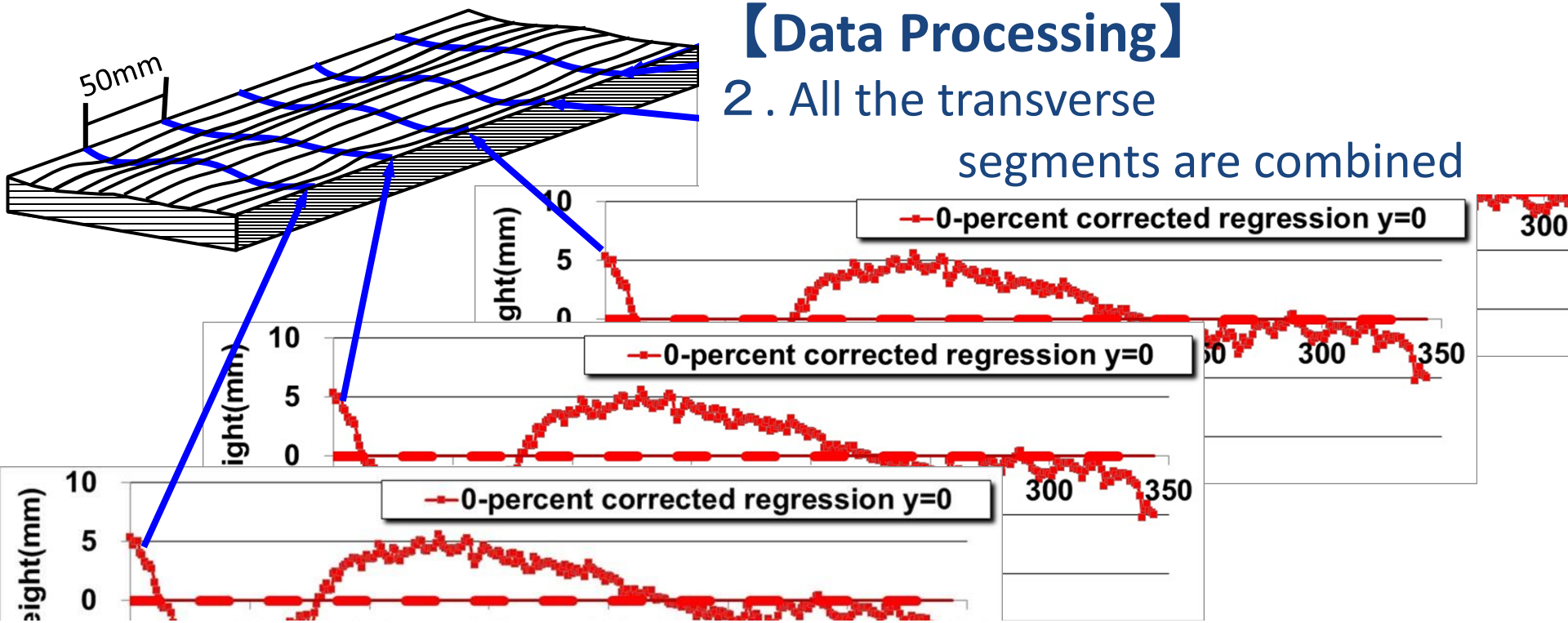
【Data Processing】

1 . Correction of transverse gradient

Transverse gradient 3%→0%



New 3D Data as Assessment Method



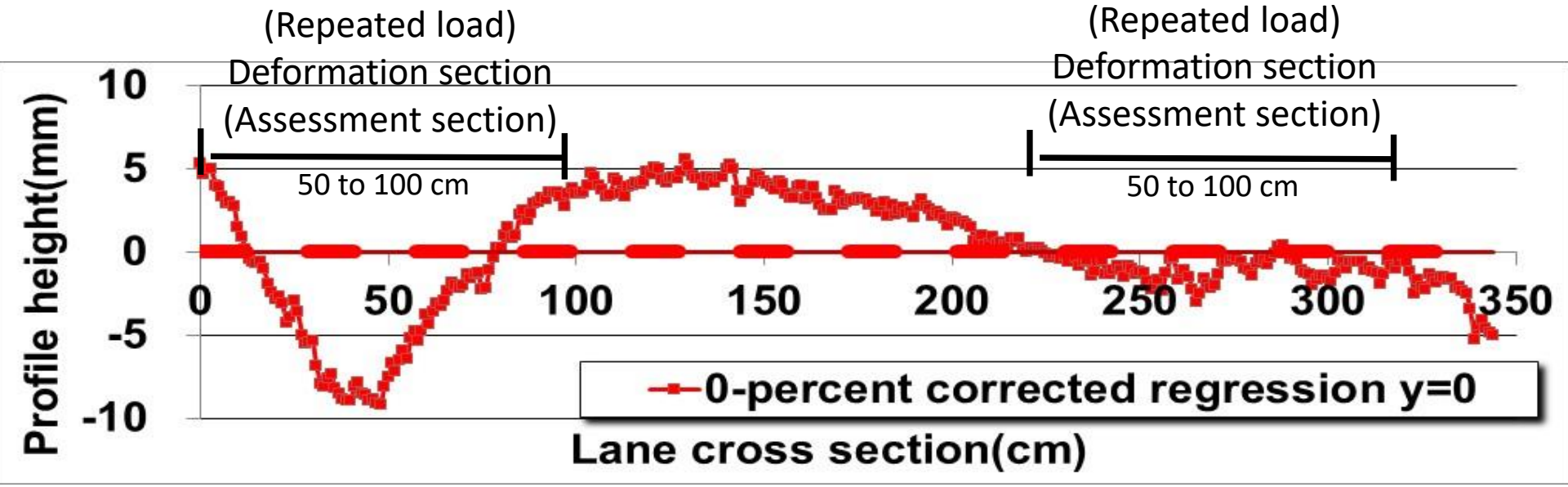
Corrected transverse profile

→ Practically used as a quasi-3D profile

New 3D Data as Assessment Method

【Identification of distress】

・Section in which local deformation is assessed (occurs)



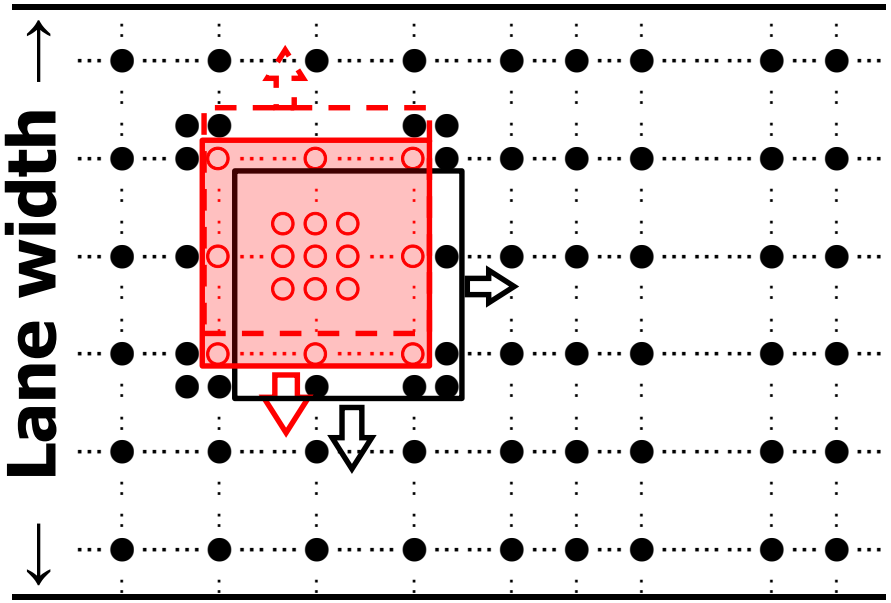
the scope of assessment

→Count section narrowed down to a section width of 50㎝

New 3D Data as Assessment Method

【Identification of distress】

・Method for extracting local deformation

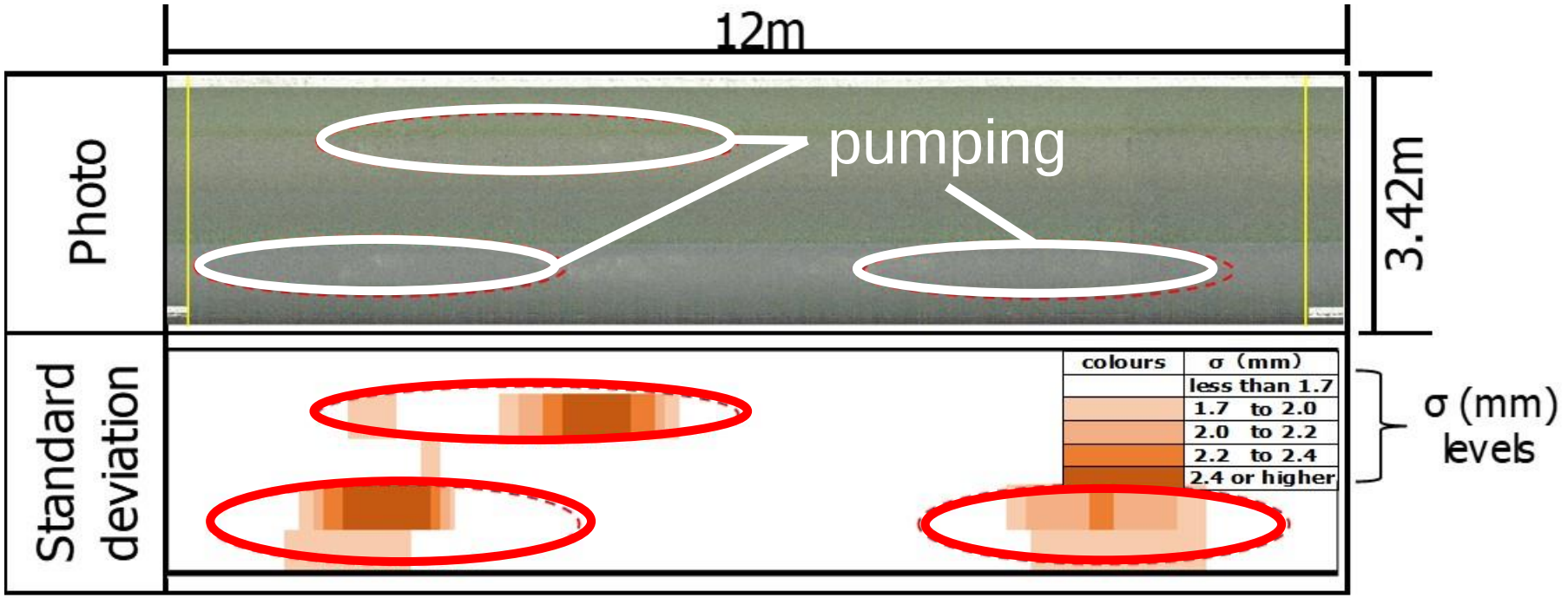
● Quasi 3-D profile	Assessment
	**Calculate standard deviation (σ) of profile data (○) within the 50 cm × 50 cm red square, while it is entirely covering around the section**

→Calculate the standard deviation of profile data within the 50 by 50 cm

New 3D Data as Assessment Method

【Identification of distress】

・Visualized example of calculation of the standard deviation of the profile height



→Narrow down the count section, thereby enabling assessment of local deformation.

Validation Study

For the purpose of validating how this method can be used to identify pumping, rutting data were analysed for several sections of pavement.

- **The road profile data were analysed every 10 mm in the transverse direction and every 50 mm in the longitudinal direction.**
- **The transverse gradient was corrected to 0%.**
- **The standard deviation was calculated based on data collected for 50 cm × 50 cm sections.**

Validation Study

For the purpose of validating how this method can be used to identify pumping.

・The standard deviation data could be identify the areas of pumping.

・Standard deviation Level3 distress could be observed before pumping.

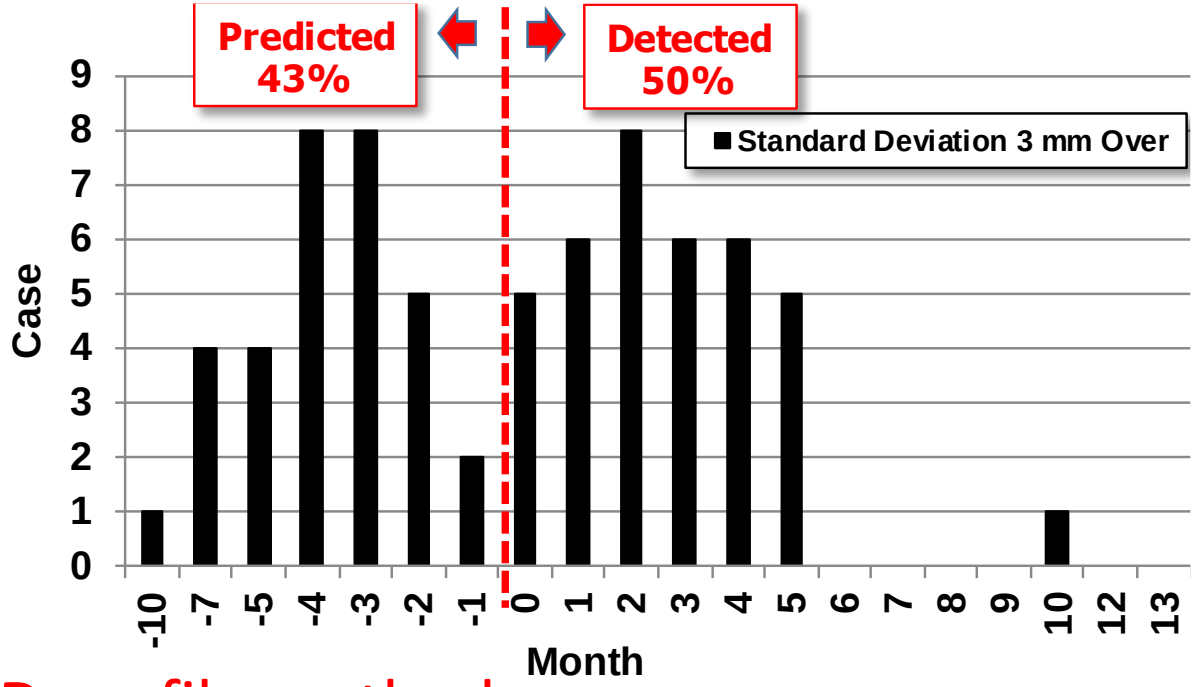
Date	Road Surface Photo	Standard Deviation	Remarks
October 10 2014			【Standard Deviation】 Level 3 (3 to 4mm)
March 2 2015			【Road Surface Photo】 Pumping
July 10 2015			【Standard Deviation】 Level 4 (3 to 5mm)
December 21 2015			【Standard Deviation】 Level 5(3mm or higher)

Validation Study

Pumping prediction and occurrence in time series

・Of the 74 sections identified where pumping had occurred, 93%could be detected.

・The average prediction rate was three months.



The proposed quasi-3D profile method can adequately detect and predict pumping.

CONCLUSIONS

【Purpose of this study】

Develop methods for detection and prediction of pumping

Using data: Transverse profile (rutting data)

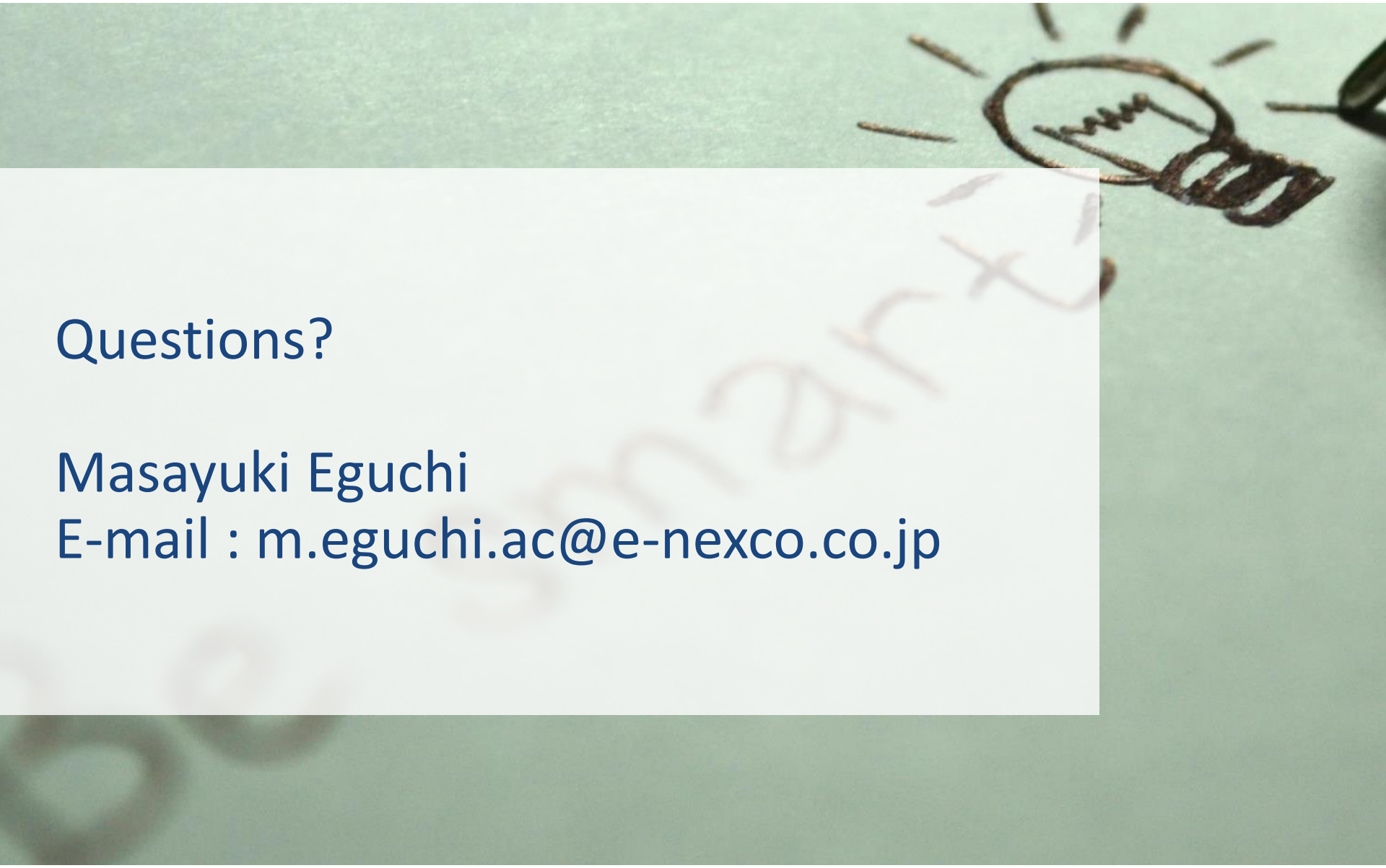
【Main findings of the study】

Identification of Distress

- Both transverse and longitudinal gradients were corrected for the rutting data. Pumping events were identified using the standard deviation of corrected data.

Validation Study

- 90% of pumping events could be correctly detected with the proposed method. Pumping was predicted most successfully 10 months before the actual occurrence of this event.



Questions?

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