

# Non-contact Evaluation of Coating System Re-deterioration in Steel Sheet Pile Canal

Yuto Takahashi<sup>1</sup>, Kazuma Shibano<sup>1</sup>, Taiki Hagiwara<sup>2</sup>, and Tetsuya Suzuki<sup>3</sup>

<sup>1</sup> Graduate School of Science and Technology, Niigata University, Japan

<sup>2</sup> Graduate School of Sciences and Technology for Innovation, Yamaguchi University, Japan

<sup>3</sup> Institute of Agriculture, Niigata University, Japan



## Introduction

Steel sheet piles in drainage canals are susceptible to localized corrosion, particularly around the water level fluctuation zone. In Japan, various repair methods have been applied to aging facilities. However, **re-deterioration is observed in some of the repaired coatings**. In this study, the re-deterioration of repaired coating systems (**peering, blistering and cracking**) is evaluated in a non-contact measurement using point cloud data obtained by **Terrestrial Laser Scanning (TLS)** and thermal images captured by an **infrared camera**.

### Re-deterioration of repaired coating systems

- Peering (thin-film epoxy resin coating, ultra-thick polyurethane-resin coating system)
- blistering (ultra-thin urea-urethane coating)
- cracking (precast concrete pane lining system).

### Non-contact evaluation by TLS and infrared camera

## Study site



Study site and targeted steel sheet piles



① Ultra-thin-urethane coating



② Thin-film epoxy resin coating



③ Ultra-thick polyurethane-resin coating system



④ Precast concrete panel lining

In this canal, several coating systems have been applied to the steel sheet piles as repair methods. These coatings are intended to protect the steel from localized corrosion in the water level fluctuation zone, and the corrosion is accelerated by repeated wetting and drying. The coating systems differ in material and film thickness, and this difference affects their protective performance in the corrosive canal environment.

## Measurement methods



Acquiring point cloud data



Acquiring thermal images

## Results and Discussion

### Point cloud data acquired by TLS



Ultra-thin-urethane coating



Thin-film epoxy resin coating



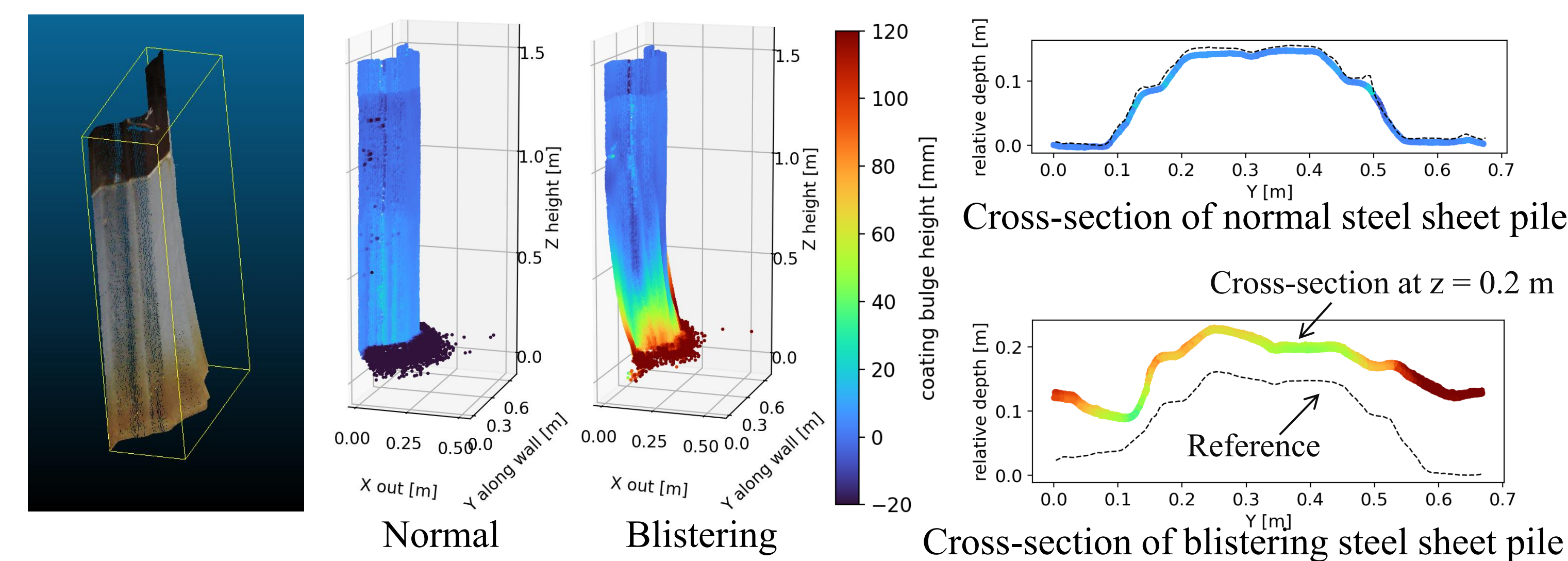
Ultra-thick polyurethane-resin coating system



Precast concrete panel lining system

### Evaluation of deterioration conditions by TLS

#### Blistering (Ultra-thin-urethane coating)



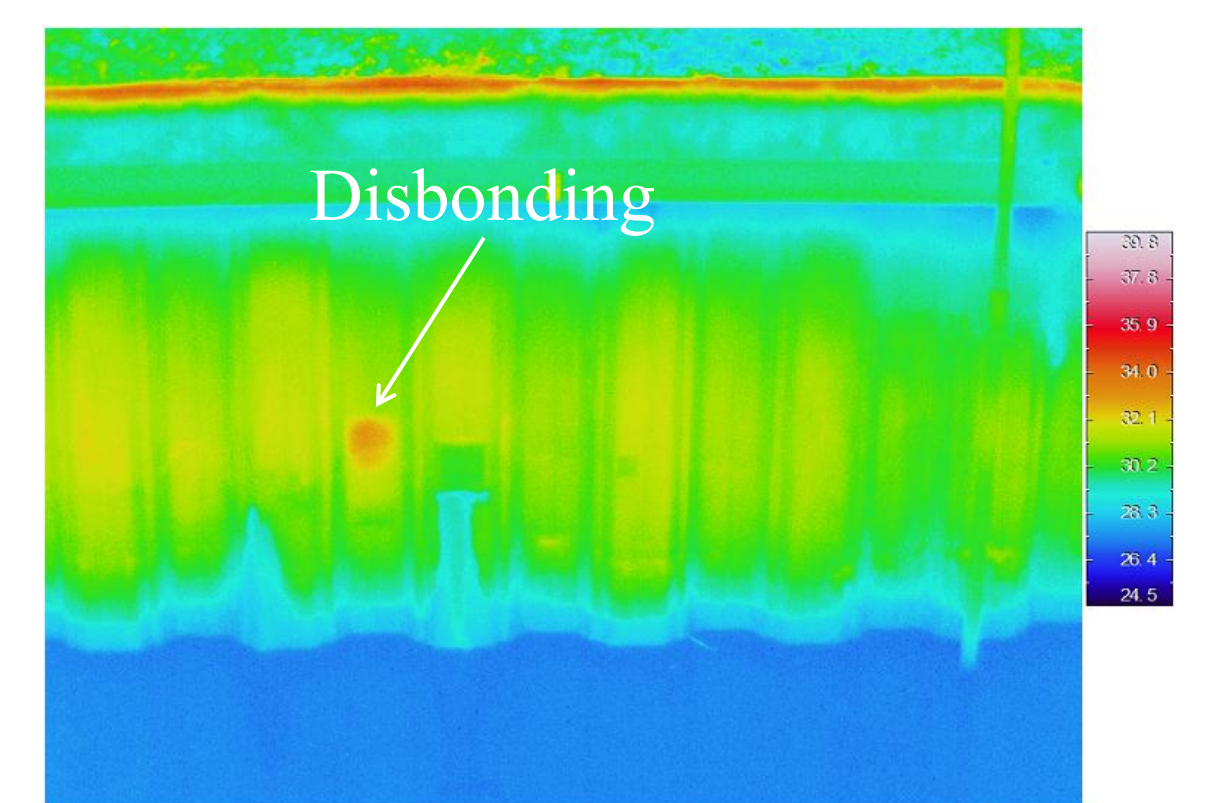
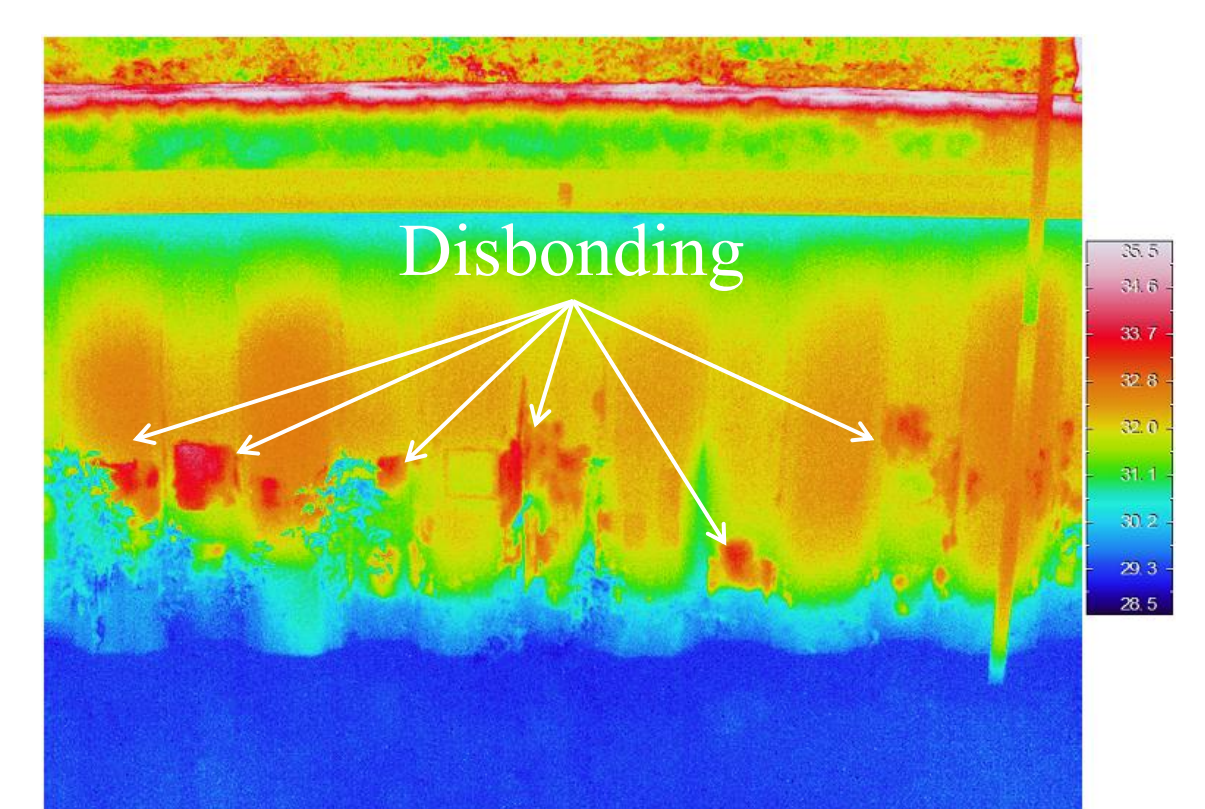
- The right figure compares the reference, defined as the average cross-section of the upper 10% of the steel sheet pile, with the cross-section at a height of 0.2 m from the bottom.
- From this comparison, **the blistering of the coating system can be evaluated** by point cloud measurement using TLS.

### Evaluation of deterioration conditions by infrared camera

#### Disbonding (Thin-film epoxy coating)



#### Disbonding (Ultra-thin polyurethane-resin coating)



- From the infrared measurement, **the blistering of the coating and the rust staining** can be detected.

## Conclusion

- In this study, the re-deterioration of the repaired coating systems is evaluated by non-contact measurement using TLS and infrared imaging.
- From the TLS point cloud, the blistering of the coating is evaluated by comparing the cross-sections with the reference cross-section.
- From the infrared images, the blistering of the coating and the rust staining are detected.