UNIVERSITY OF CAMBRIDGE

Digital Twin-Driven Structural Health Monitoring of Roads

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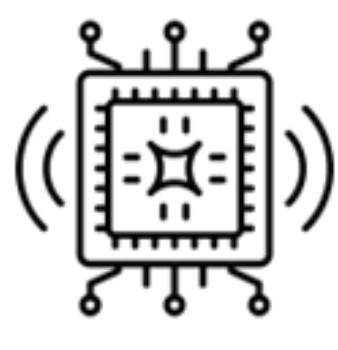### *Email address: zs442@cam.ac.uk

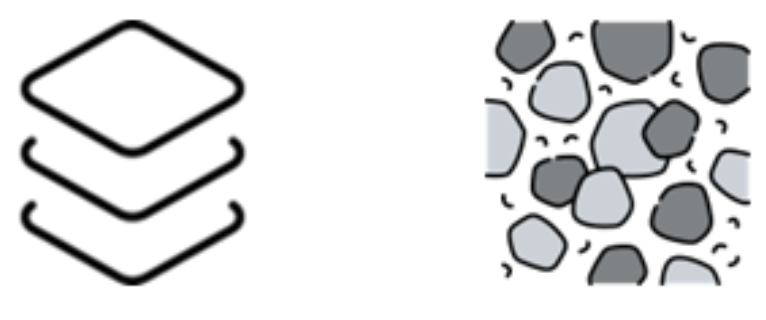## Research motivation and objective

- **Motivation**: In the process of creating a digital twin of roads, the structural health information of existing roads is an important component to help formulate accurate maintenance and rehabilitation strategies.

- **Objective**: This research aims to obtain the structural health information of roads in service by analysing Non-Destructive Testing (NDT) results.

Expected research outcome and impact

- **Expected outcome**: In this research, a tool which can evaluate the structural health and predict the remaining life of existing roads will be developed.

- **Impact**: The research outcome can be used as a module to create and update a digital twin of roads, which helps maintain the high service performance of existing roads and improve people's quality of life.

Literature review

An overview of the commonly used methods for the structural health evaluation of roads was prepared.

| Structural health monitoring of roads	Non-destructive testing of roads	Theoretical modeling methods of roads	Techniques for parameter identification
➤ Electrical resistance strain gauges ➤ Laser distance sensors ➤ Accelerometer ➤ Fiber optic sensors	➤ Falling Weight Deflectometer test ➤ Traffic Speed Deflectometer test ➤ Ground Penetrating Radar test	➤ Theoretical modeling of road structures ➤ Theoretical modeling of road materials	➤ Minimization algorithms ➤ Statistical methods ➤ Machine learning methods

Development of a theoretical road model

A theoretical model of the Traffic Speed Deflectometer (TSD) test of roads is being developed and validated.

The TSD device

$$P_z(X - ct, Y) = p_z(x, y)$$
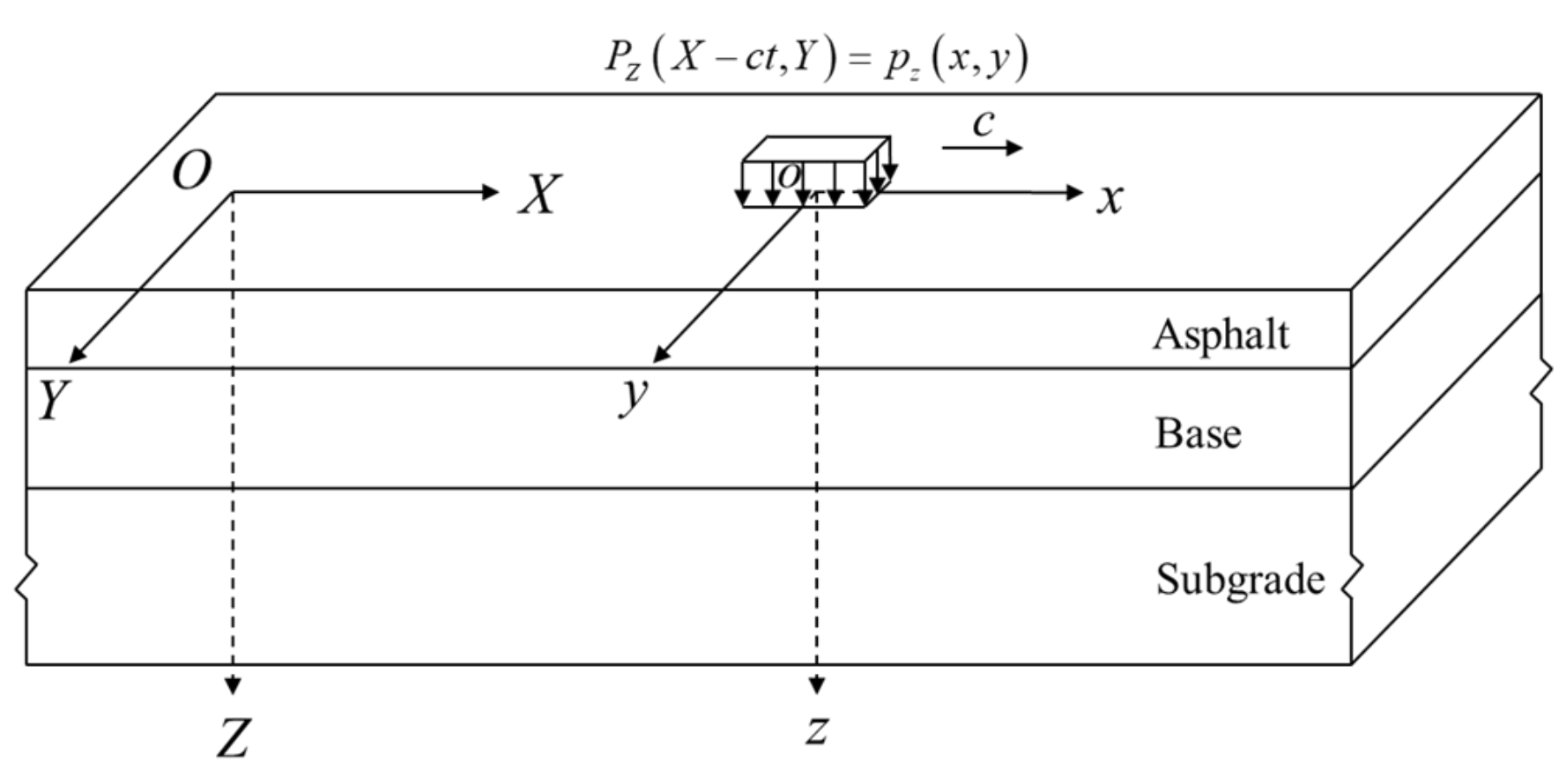
A theoretical model of the TSD test
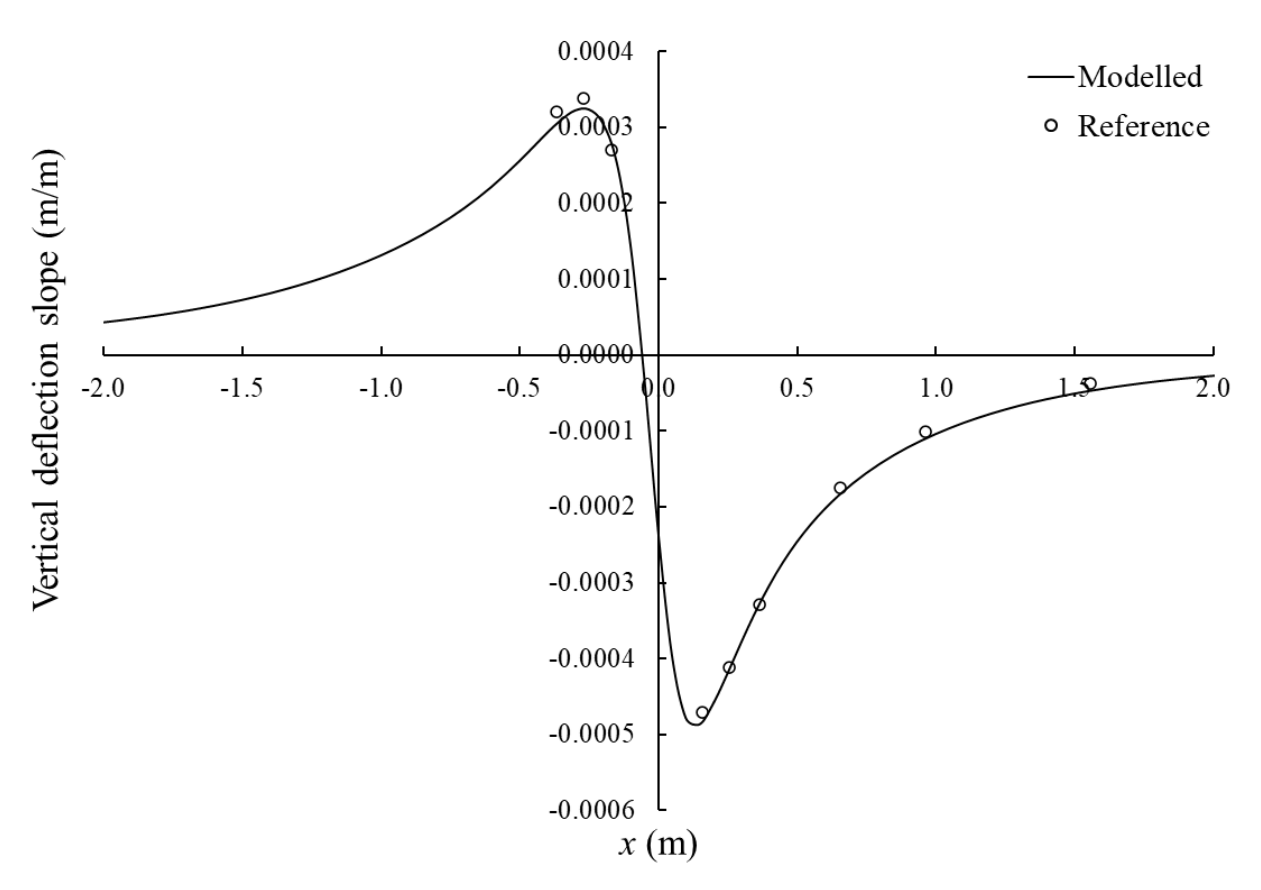
Preliminary model validation

What's next?

The following tasks will be completed in the coming period:

- Develop a theoretical model of the TSD test with all-round performance.

- Validate the practical performance of the developed model with TSD field measurements.

Acknowledgements

References

- Zhaojie Sun, et al. An overview of methods for structural health evaluation of roads.

European Commission | COLAS | ARCADIS | amey | ferrovial construction | TRL | RAMBOLL