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VEHICLE TERRAIN PERFORMANCE LABORATORY

Large High-Resolution Display for Terrain Visualization

RPUG 2010

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Vehicle Terrain Performance Lab

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Large High-Resolution Display for Terrain Visualization

RPUG 2010

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Outline

Background on VTPL

Motivation for LHRD

Scope

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Vehicles

- Passenger cars and trucks
- Commercial off-road and military vehicles
- Motorcycles
- Race cars
- Chassis components
  - Tires
  - Springs, dampers, bushings,…

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Scope

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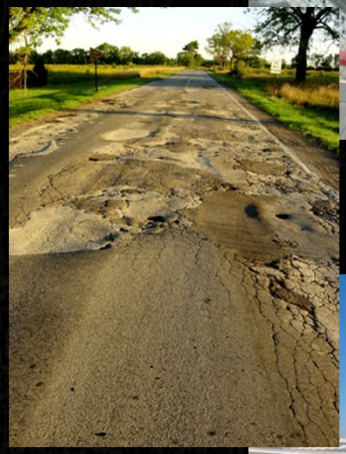
Terrain

- Highway and public roads
- Race tracks
- Off-road
- Proving Ground

Performance

- Ride
- Handling
- Mobility
- Durability
- Reliability



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Terrain Measurement

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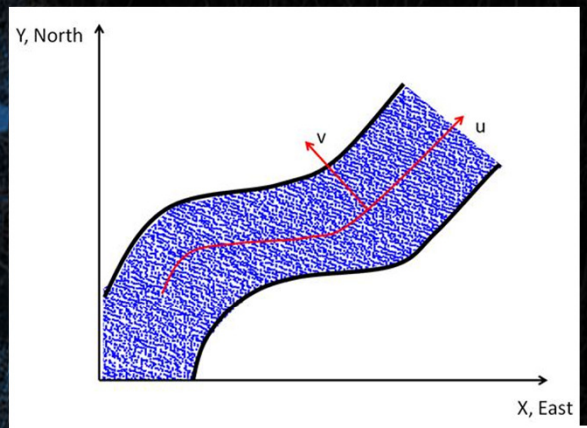
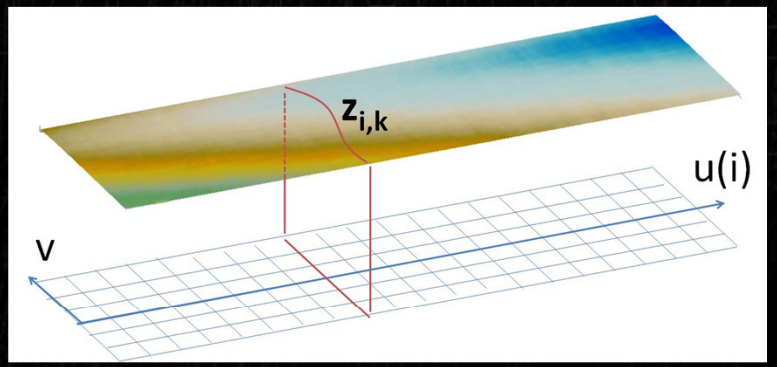
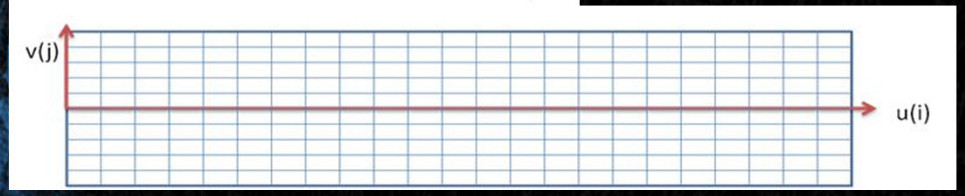
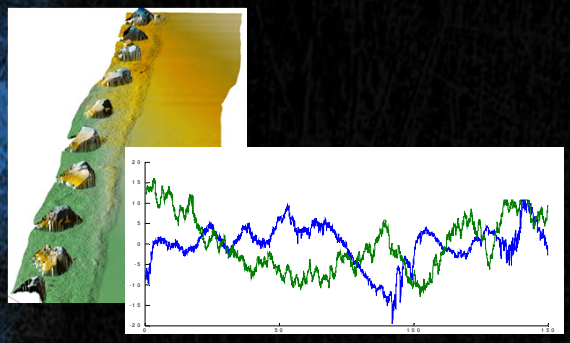
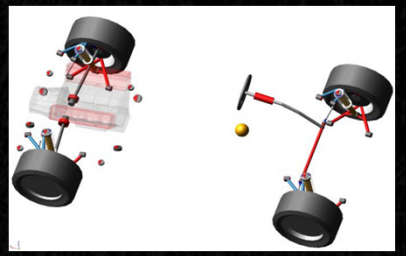
Terrain Modeling











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Vehicle Modeling

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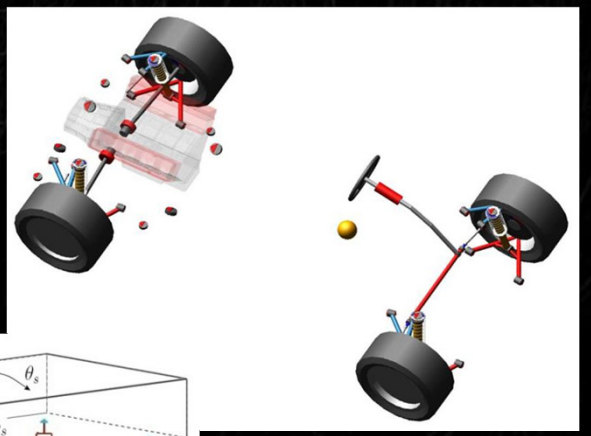
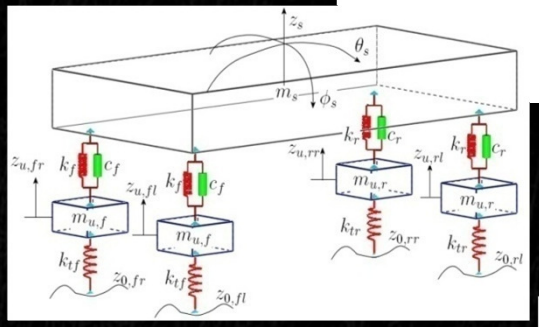
Multi-Body Dynamics

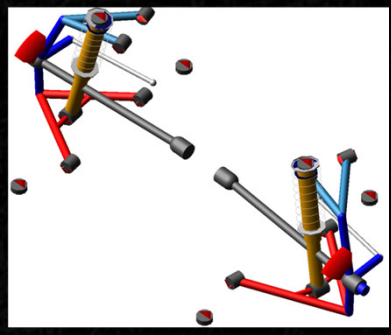
- ADAMS
- CarSim
- MATLAB/Simulink

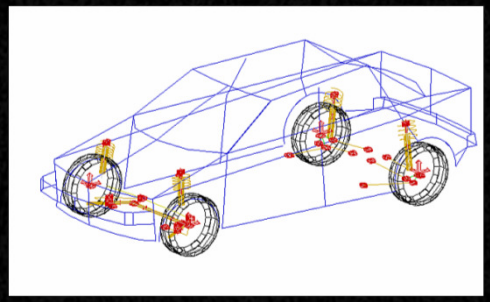
Finite Element Analysis

- MSC/Nastran
- Abaqus / Simulia
- Ansys









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Performance Prediction

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Objective

Make informed decisions early in design process

Applications

- Ride and handling metrics
- Durability test schedules
- Reliability-Based Design

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Motivation

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- The pavement distortions should be inspected properly to monitor the health, safety and potential ride quality of roads.
- The inspectors mainly depend on visual inspection and visually decide which pavement should be repaired

Problems

- Physical, *in situ* inspection is costly, requires that the road be closed to traffic
- Dangers to the inspector posed
- Post measurement inspection is less costly but is still based on 2D
- Automated methods for computer detection and analysis of cracks required for conducting validation and verification testing

Goals

- New method for pavement surface condition inspection that combines
  - Ability of physically inspection of in situ inspection
  - Speed, safety and a wider field of view and very high resolution offered by post-measurement inspection
- Fusing video data with high-fidelity terrain topology measurements
- Visualizing them on LHRD
- Provide quantitative data to eliminate or supplement components of current visual inspection procedures

VTMS Data

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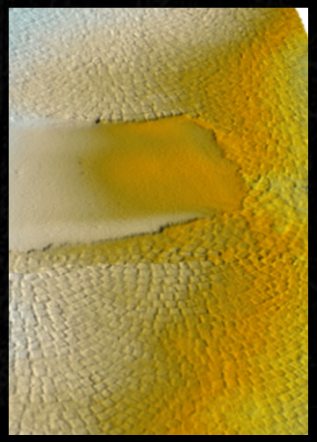
- A single dataset includes several millions of points.
- Difficult to visualize multiple VTMS datasets in small displays and desktop systems
- Massive amounts of computing power are required to render the high-fidelity VTMS data
- The resolution of the VTMS datasets is easily beyond the capability of current computer display and graphics systems
-



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Large High-Resolution Display (LHRD)

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- Much higher DPI (Dots Per Inch) than general displays
- Wider field of view to terrain data
- Terrain visualization on a scale comparable to real life

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Expected Benefits of the New Platform

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- A new method for 3D pavement condition inspection
- A new platform by which automated crack inspection and analysis software can be verified and validated
- An understanding of the run-to-run variation in roughness estimates
- Quality control and assurance procedures for pavement condition data collection

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Visualization Prototypes 1

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Visualization Prototypes 2

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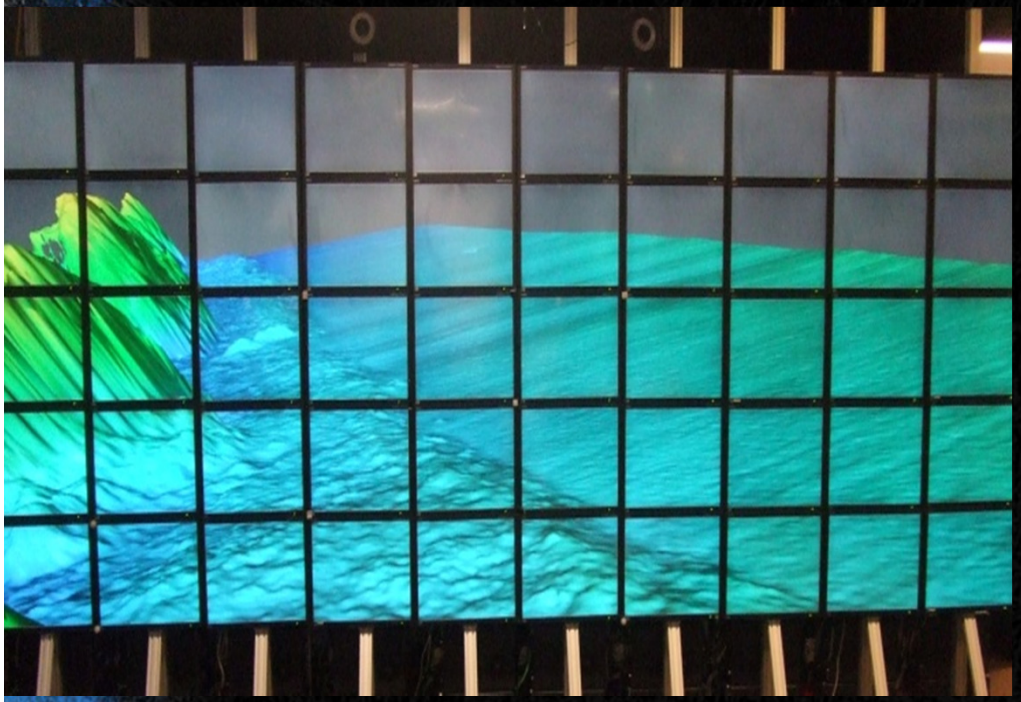

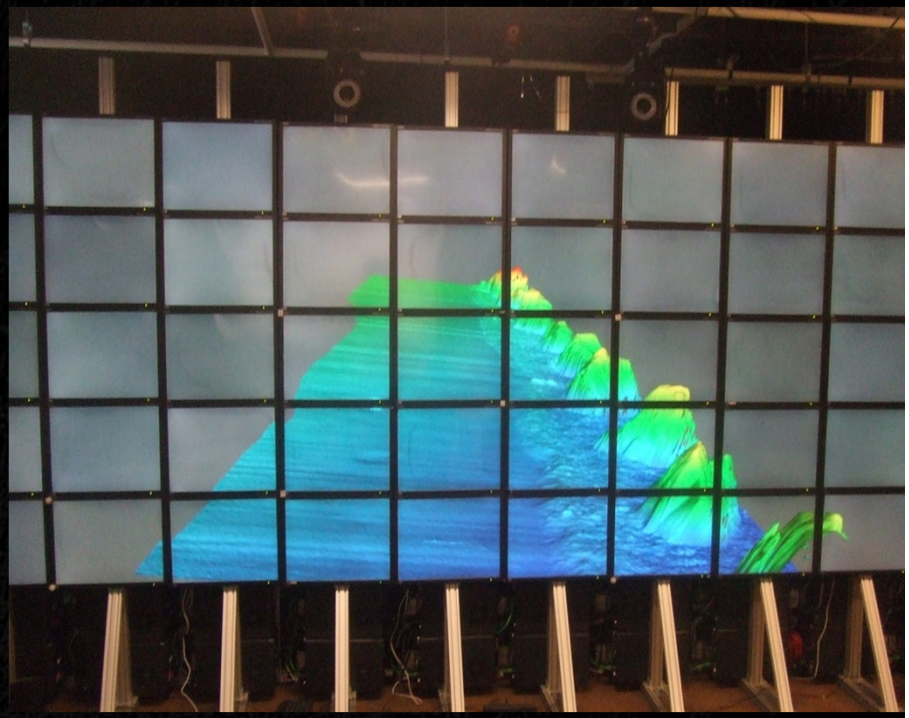

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Visualization Prototypes 3

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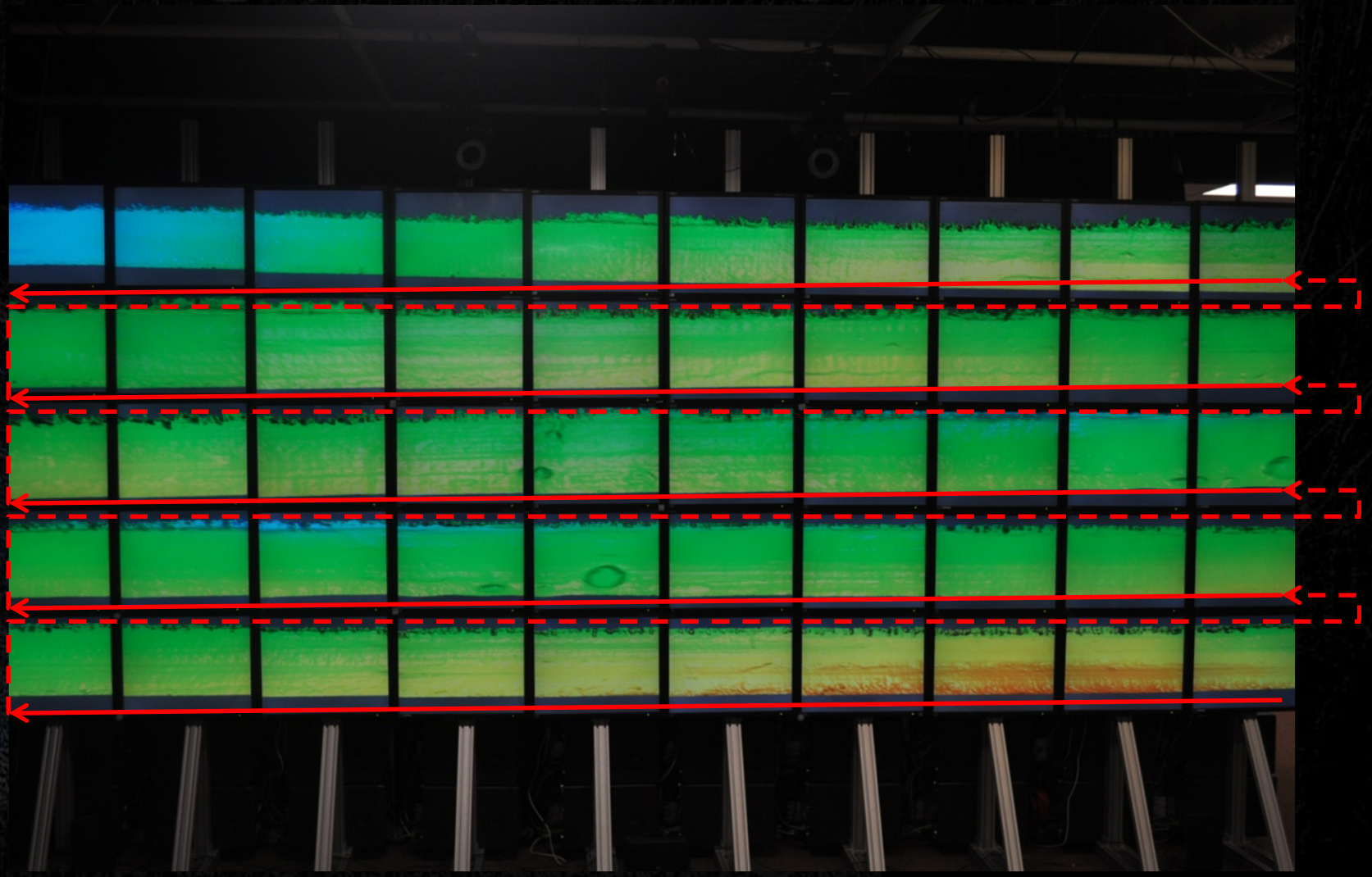

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Visualization Protypes 4

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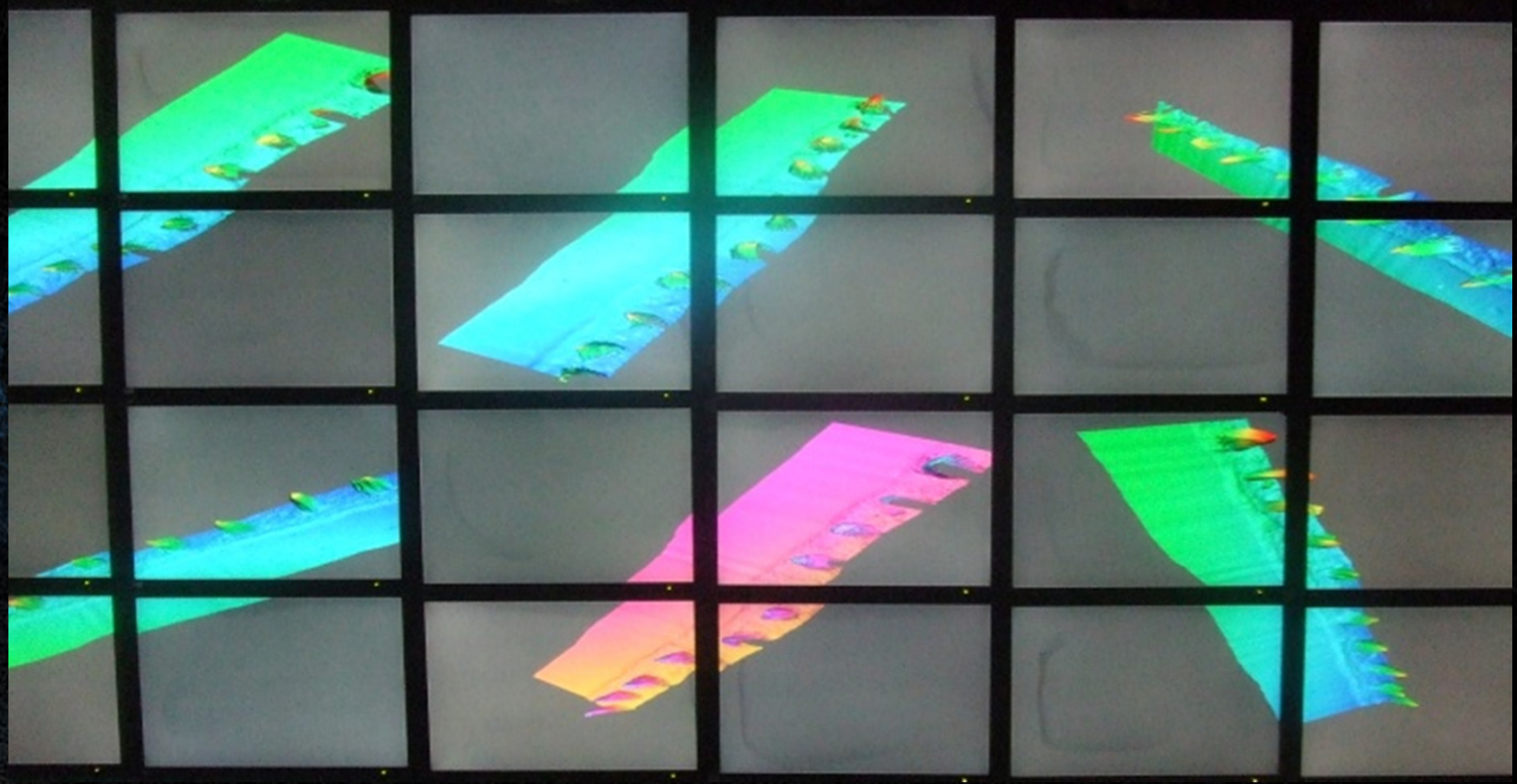

Summary

- Developing a new method for pavement surface inspection
- VTMS data and LHRD provides a novel platform to inspect pavement interactively
- Understanding of the run-to-run variation in roughness estimates
- Support quality control and assurance procedures for pavement condition data collection.