Integrated Remote Sensing & Visualization (IRSV) -Applications for Bridge Management

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Outline

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- Commercial Remote Sensing (CRS) as Bridge Health Sensors
- IRSV Project Overview
- 3D Terrestrial LiDAR Applications
- Small Format Aerial Photography Applications

Commercial Remote Sensing (CRS) for Bridge Health Monitoring

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- CRS refers to imaging from a distance using nonintrusive sensors such as aerial or terrestrial photography, LiDAR, RADAR , Passive Infrared, etc.
- For bridge health monitoring, CRS is proposed as a periodic inspection tool that is rapid and cost-effective.
- Commercial satellites, airborne large format and medium format optical photos do not have the resolution (< 6 inch) or cost-effectiveness for bridge Structural Health Monitoring

Overview of IRSV Project

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- Project Goals:
  - 1) to introduce Commercial Remote Sensing technology applications to bridge management and preservation
  - 2) to develop quantifiable method for measuring bridge sustainability
  - 3) to demonstrate applications to industry-wide audience

- Research objective: to develop an **Integrated Remote Sensing and Visualization (IRSV)** system that uses CRS for bridge monitoring and assessment

- Output – cost-effective decision tool for application by bridge managers in determining structural health

3D Terrestrial LiDAR

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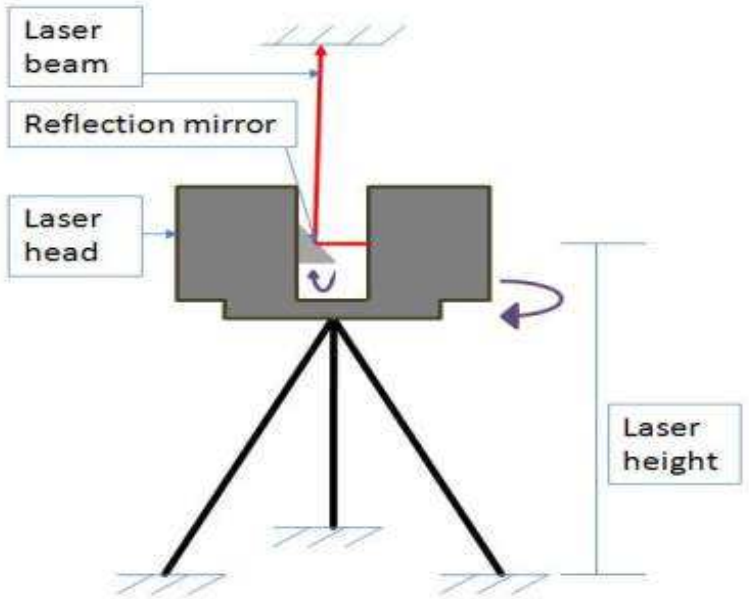
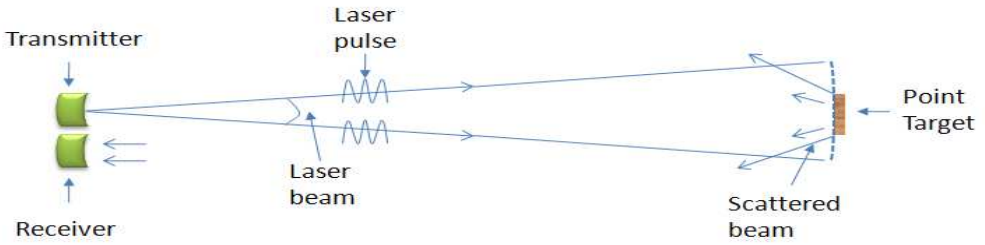
- Light Detection and Ranging System.
- Laser scan images obtained before and after (temporal) can be used to detect damages or displacements.





LiDAR-Based Bridge Evaluation Applications

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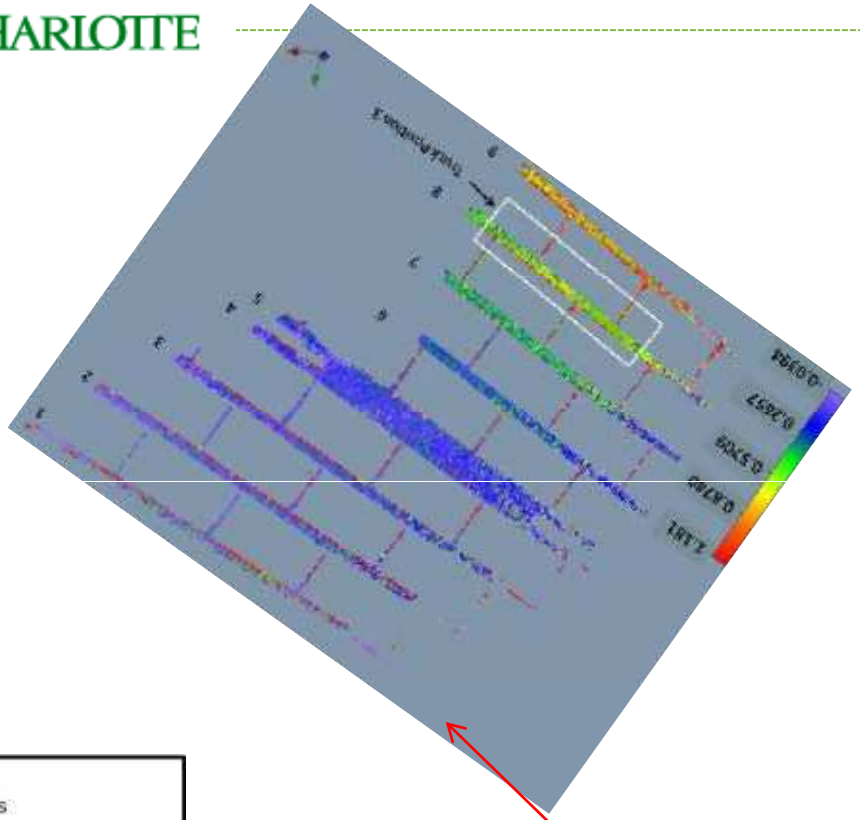
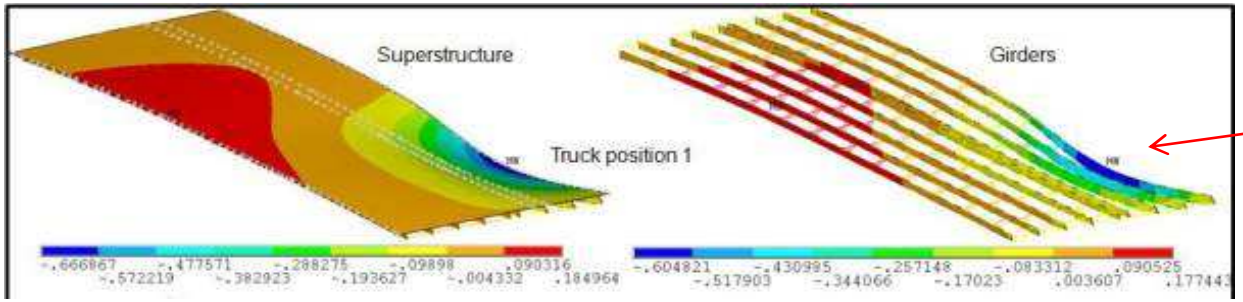
- Bridge Clearance Determination
- Bridge Surface Defect Quantification
- Bridge Displacement Measurement / Joint movement
- Blast Impact Monitoring
- Static Load Tests / Deflection Measurements

LiDAR Scan Results





LiDAR Deflection = 0.663 in
FEM Deflection = 0.605 in
LiDAR resolution = 0.12 in

Static Bridge Load Tests using LiDAR

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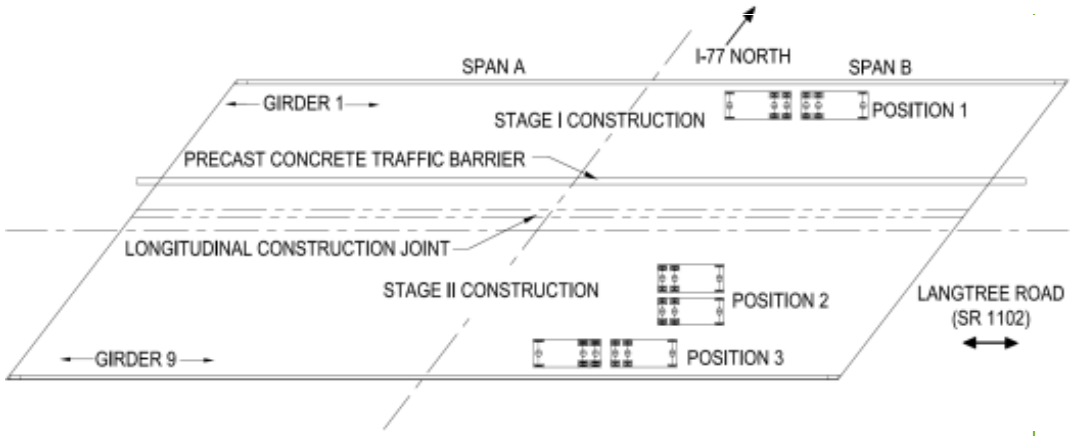

Spatially-Integrated Small Format Aerial Photography

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- Cessna C210L plane
- Cannon 5D DSLR camera
- Approx. 1000ft altitude at approx. 100 MPH
- Orthogonal rectification not needed
- http://ncrst.uncc.edu/zoom/test.html - example from Los Angeles County

Large Format vs. Small Format Aerial Photography

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Large Format

Small Format

SFAP Bridge Evaluation Applications

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- Image Documentation
- Bridge Deck Cracking Monitoring
- Bridge Deck Joint Movement Monitoring
- Bridge Environmental Study / “Furniture”
- Bridge Inventory

Deck Cracking Monitoring

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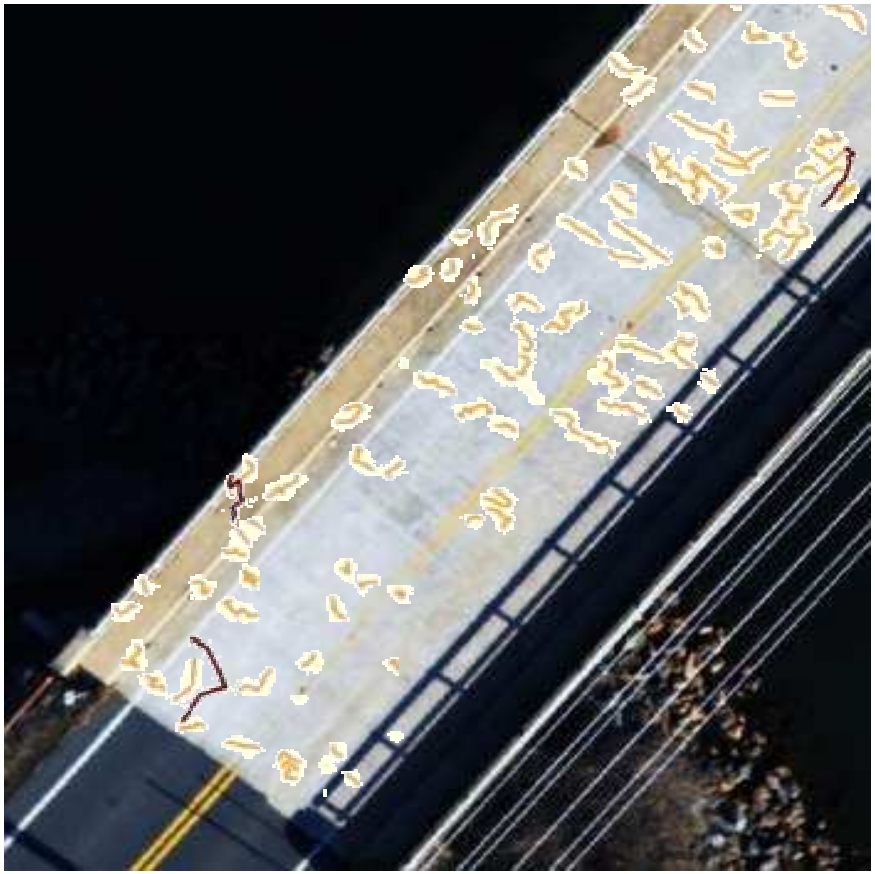

Joint Movement and Deterioration

Next Steps

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- Commercialization / Bridge Management Integration
  - Project included visual tools that can be used for bridge management and prioritization
- Further Research and Outreach
  - US DOT RITA project funding is coming to an end
  - Possible future Pooled Fund

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Questions

Thank you!

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