Joint Transportation Research Program

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Field Test Bed for Evaluating Embedded Vehicle Sensors with Indiana Companies

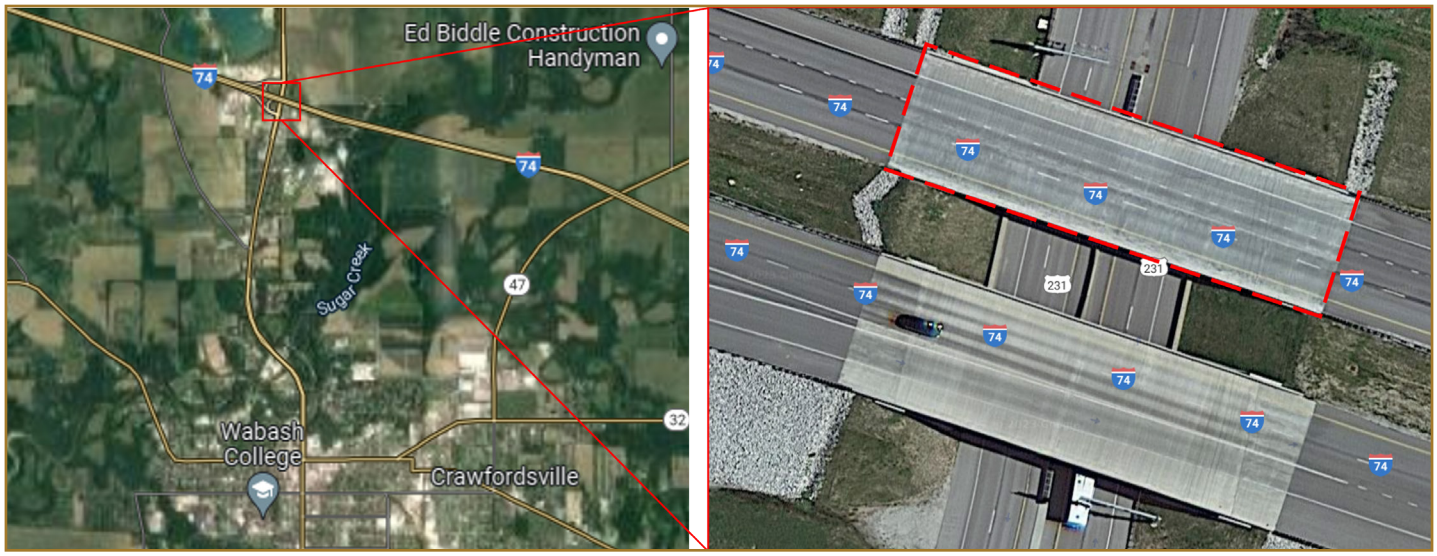
Introduction

Indiana is fortunate to have a relatively dense InCORS differential correction network that provides high accuracy GNSS positions for a variety of use cases, such as mobile mapping, forestry and agriculture. However, when distance from the base station increases or satellite occlusions occur due to structures, vegetations, urban canons, and power lines the spatial accuracy decreases.

The objectives of this project were to identify limitations in the precision and accuracy of the GNSS/INS-based geo-referencing for mobile mapping systems; evaluate the current InCORS network to ensure GNSS accuracy; and develop mitigation measures for degraded/occluded GNSS areas to provide high quality mobile mapping.

Findings

Without additional sensors, such as high-quality inertial navigation sensors and LiDAR sensors, situations such as a steel overpass, concrete bridge overpass, electromagnetic interference, and heavy canopy cover can significantly degrade the baseline GNSS positioning capability of vehicles due to signal attenuation, noise, and multi-path issues. Although inertial navigation sensors



Public transportation infrastructure.

can provide short duration compensation, high quality inertial navigation systems are often prohibitively expensive. In contrast, integrating LiDAR data into the mobile mapping environment allows the vehicle to leverage well known feature characteristics to provide compensation. This report details several of these mathematical techniques and validates them with traditional surveying techniques.

Implementation

Throughout this study, these techniques were used across a number of INDOT mapping projects with degraded GNSS, including the following.

- Bridge deck thickness mapping.
- Indoor salt pile mapping.
- Semantic segmentation of bridge components and road elements.
- More results are available through the following links: https://youtu.be/5zd-L9fvFbs and https://youtu.be/Op3jjxn1Oi0.

Furthermore, the team supported the INDOT surveying department to fabricate brackets for new antennas as InCORS nodes were updated and brought back online. Beyond serving these short-term use cases, the fundamental techniques will advance basic autonomous technology.

Recommended Citation for Report

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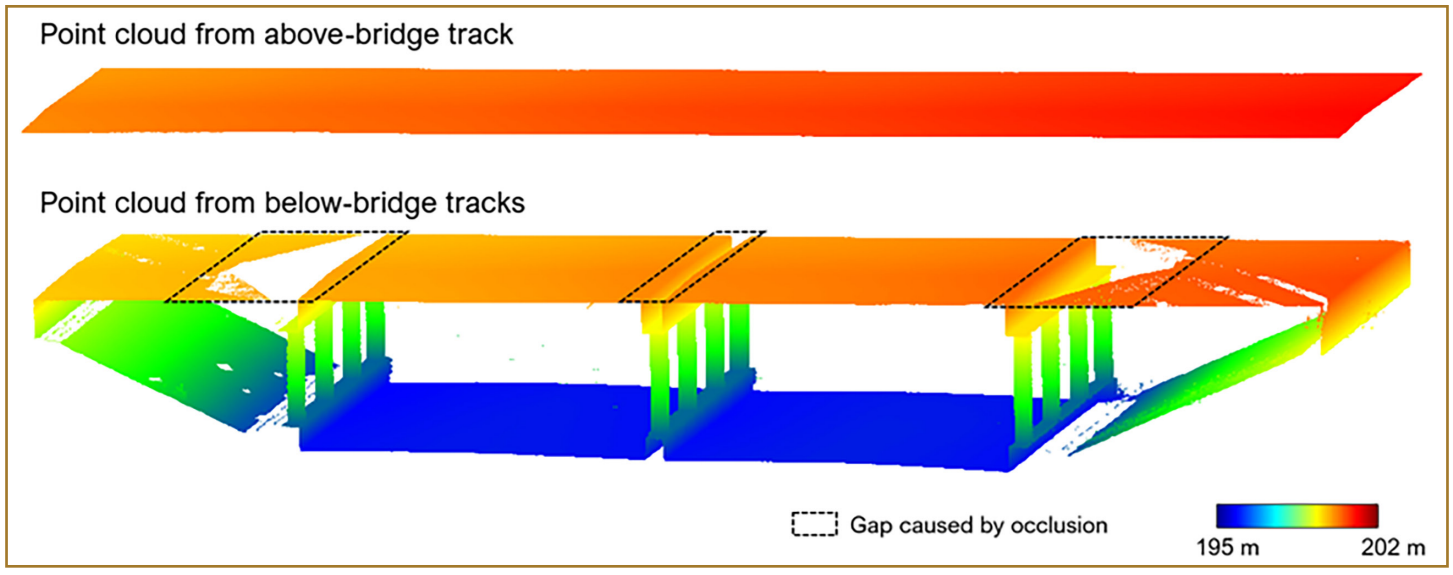

3D mapping of a bridge deck.