UNIVERSITY TRANSPORTATION CENTER

RESEARCH BRIEF

PROJECT TITLE: **Bridge Structural Inspections using Bridge Information Models (BrIM) and Unmanned Aerial Vehicles (UAVs)**

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INSTITUTION: OREGON STATE UNIVERSITY

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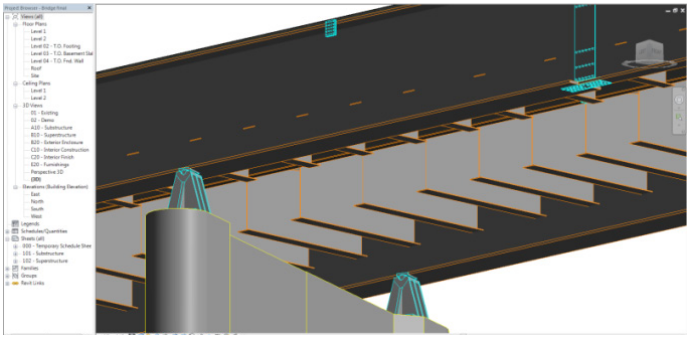
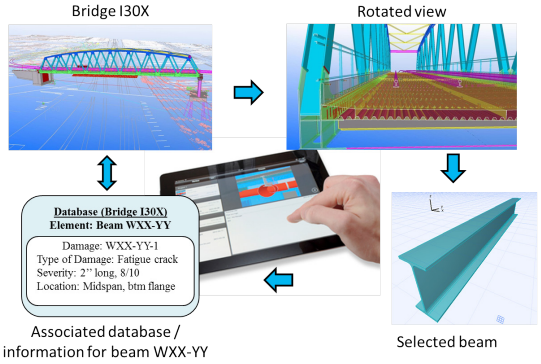
SPONSORS: THE PACIFIC NORTHWEST TRANSPORTATION CONSORTIUM, OSU

Background

Every four years, American Society of Civil Engineers (ASCE) releases a comprehensive assessment of the U.S. infrastructure. The most recent report card that was published in 2017 gave an overall grade of D+ (poor) for the nation's infrastructure, C+ (mediocre) for bridges (ASCE 2017) (Petroski 2016). Catastrophic events are rare, but the federal National Bridge Inventory classified 56,007 bridges out of 614,387 as structurally deficient. Nevertheless, in May 2013, the I-5 Skagit bridge, which was a through truss bridge built in 1955, near Seattle, WA collapsed into the river below when an oversized truck scraped several overhead girders of the bridge. The I-35W Mississippi River bridge suddenly collapsed during evening rush hour in 2007, killing 13 people and injuring 145. In 1990, federal government had rated this bridge as "structurally deficient" due to the significant corrosion in its bearings. In 2007, approximately 75,000 other US bridges had this rating. These numbers emphasize the urgent need for more frequent and comprehensive bridge inspections to prevent from any catastrophic events. However, the budget available for infrastructure is limited; therefore, there is a need for finding cheaper and faster ways to maintain and operate our bridges.





Research Project

This research project will develop a novel framework that implements Bridge Information Modeling (BrIM) and Unmanned Aerial Vehicle (UAV) technologies to improve current manual bridge inspection technique.

UAVs enable safe and rapid collection of visual bridge inspection data in the form of digital images. BrIM, on the other hand, enables storing all bridge data, including its drawings and 3D models, material specifications, inspection notes, images and others, in a central object-oriented database that can be accessed from both the office and the field. Computer vision algorithms will be used to detect cracks from UAV images automatically based on statistical learning theory. This information will be used to automate the creation or update of bridge database, i.e. 3D BrIM. Using the proposed framework would enable automated and remote assessment of bridge conditions. The framework will implement the state-of-the-art condition assessment codes and standards, and it should contribute to a) providing an improved means of accurately documenting the structural condition assessment data, b) eliminating errors resulting from data transcription, and c) providing more cost effective and safer bridge inspections. All of these factors should help assist in maintaining U.S. bridges in a state of good repair.