RESEARCH in Progress

Forest Products Laboratory

Evaluation of Remotely Piloted Aircraft Systems as a Bridge Inspection Tool

The American Society of Civil Engineers (ASCE) investigated the structural integrity and performance of our nation's infrastructure. The December 2013 ASCE report card for America's infrastructure indicated that 11% of the nation's bridges were classified as structurally deficient and nearly 25% were classified as functionally obsolete. Although the percentage of structurally deficient bridges has slightly declined in the past few years, visual inspection for a significant number of such bridges is needed to better identify damage and determine the appropriate retrofit methods. Due to increasing costs and limited accessibility of bridge inspection with current inspection technology, the use of remotely piloted aircraft systems equipped with high-resolution cameras may provide an effective means for bridge inspection. Drone technology may provide a more efficient tool for improving or enhancing current bridge inspection practices for timber bridges with visible damage and decay in inaccessible areas that could cause structural degradation.

Background

A drone is an aircraft that is remotely controlled by a pilot from the ground and is armed with high-resolution sensor-enabled cameras that allow for recording of highly detailed images and videos. A drone is able to carry a broad range of imaging tools, which can provide a range of imaging capabilities including infrared imaging to detect an object's radiation image, thereby improving visibility in low-light environments. Drones represent a novel technology having numerous

Timber bridges located between highways US16 and US16A in Pennington County, South Dakota: Timber Girder Bridge and Keystone Wye Timber Arch Bridge.

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potential applications in structural engineering and other fields. For example, some state departments of transportation and the USDA Forest Service have conducted bridge inspection trials using drone technology. Overall, drone technology has high potential for efficiently identifying damage on bridge members in critical locations when structural inspections are needed.

Objective

The objective of this project is to evaluate the use of a remotely piloted aircraft as a supplemental inspection tool for timber bridges that present accessibility challenges for inspectors.

Approach

The project will begin with a complete literature review to gain information on the current state of the art and practice in drone-based bridge inspection. A review of commercially available drone devices will be conducted in order to acquire a reliable and cost-effective device for bridge inspections. In conjunction with the South Dakota Department of Transportation, drone-enabled field inspections will be conducted on two timber bridges in South Dakota, and high-resolution images from the drone inspection will be evaluated and compared with data available from conventional access methods. Any bridge damage will be detected by analyzing imagery data through commercially available photogrammetric software.

Expected Outcomes

A comprehensive final report will document the implementation of drone technology for timber bridge inspection. The final report will include recommendations for (a) a drone-based inspection procedure for timber bridges; (b) selection of good quality images necessary for damage investigation; (c) damage identification on bridges using drone imagery data compared to those recorded from past conventional inspection methods; and (d) a visual damage examination protocol using three-dimensional graphical representation of the bridges using images gained from the drone. The final report should be beneficial to bridge inspectors across the United States.

Timeline

Field activities, including drone-enabled bridge inspection, will be scheduled during early spring 2017. Imagery data investigation and comparison with conventional access inspection will be completed during late spring 2017. Drafting of the final report will be completed by June 2017.

Cooperators

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