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Pavement Condition Survey using Drone Technology

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Introduction

A drone can be used as a data collection device that takes high resolution digital photographs. These photographs capture digital information that can be processed to analyze many different types of projects. Drone usage is becoming more available for many project types. As drone technology becomes more advanced, different software is becoming more sophisticated and is able to handle various project needs. Previously, the data collection, processing, and analysis for several innovative pavement preservation projects were performed manually by the California Pavement Preservation Center. The crack lengths or other distresses were measured along a road using measuring wheels to quantify the distresses in the traveled lane. Then, results were recorded on grid distress mapping survey sheets. Drone technology has many advantages in surveying pavement conditions and monitoring pavement performances. Some benefits of using drone technology include:

- Speeding up the field data collection
- Improving accuracy of the survey
- Lessening the time that the surveyors are in the field
- Increasing repeatability of the survey
- Locating specific items in the photographs by GPS coordinates
- Improving safety
  - Lessening the time that the surveyors are exposed to traffic
  - Enabling survey to be conducted without traffic control
- Processing the distress mapping can be performed in an office environment
- Increasing ease of distresses summarization with software

Study Methods

Three pavement preservation case studies were reviewed both manually and by drone. The manual surveys required traffic control for staff to work on the highway to delineate

pavement evaluation sections (PESs) with ground control points (GCPs). Staff then map the pavement distresses by hand using measuring wheels and drawing the measurements on gridded graph paper while in the field. This method requires staff members to work in a lane closed to traffic, under traffic control. The drone survey still requires the PESs be delineated for the flight, and the placement of some ground control points. The drone flight is done in less than 10 minutes, while the manual mapping of a PES may take as long as an hour or more. After the data is captured in the field, a photogrammetry program is used to process and stitch the photos together. As for the analysis of the pavement distresses, this phase is completed in an office environment by reviewing and annotating the stitched photos and summarizing the data.

In many cases, the costs of performing the data capture, processing, and analysis through photogrammetry may substantially decrease surveying costs.

Findings

Usage of a drone for capturing data and photogrammetry software for processing the data allow images to be accurately measured and analyzed. The details captured in a series of photos can be converted into an accurate 2D or 3D output and tied to GPS coordinates. The flights can be programed, using the same flight path, for survey repeatability.

Policy Recommendations

This report validates the three case studies that the CP2 Center used drone technology to capture data for processing and analyzing pavement distresses. This report will make it easier for others to utilize the advantages of drone technology in pavement condition survey.

About the Authors

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To Learn More

For more details about the study, download the full report at transweb.sjsu.edu/research/2202

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