

**Number 25-24**

**Proposed Title: Leveraging UAS for Construction Inspection**

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.

Construction inspectors at Oregon Department of Transportation are required to evaluate, catalog project progress and verify payments for contractors. In order to accurately record all aspects of a construction project, inspectors use a variety of record keeping techniques but are limited to manual, in person inspection. These methods make it time intensive and costly to solve contractor quantity disputes. It requires the inspector or survey crews to spend excess time on disputed aspects of the projects while balancing continual obligations to construction progress. In 2019, SPR811 recognized these challenges and outlined how to utilize LiDAR to monitor construction projects in a 4D model (3D physical and 4D for time and schedule). This project would use the framework of SPR811 to track project progress but use collection methods and produce deliverables that are more practical to our construction crews.

Using UAS photo documentation will not only be important for field inspectors but project managers for updates and create “As-Constructs” that may be referenced for asset inventory and survey base maps. As-Constructs document phases and progress of construction, importantly, the location and orientation of underground utilities. Locating these assets post construction can be time intensive and often inaccurate which can disrupt maintenance tasks and future construction projects. The data collected over the project life will be cataloged and easily accessible for future reference within ODOT.

2. Document how this **transportation issue** is important to Oregon and will meet the [Oregon Research Advisory Committee Priorities](#)

The Oregon Department of Transportation is tasked with ensuring proper documentation and evaluation of construction projects. Measurements in the field verify contractor building compliance as well as solve disputes for payment. Contractor discrepancies are costly to the agency and finding fast, effective and accurate means to solve disputes will save agency funding on construction projects. By building a process for construction crews, supported by regional survey offices to utilize a UAS program, a partnership between these departments will strengthen workplace development and further utilize technology available at ODOT.

When utilizing UAS systems, field inspectors and surveyors can be physically removed from hazardous sites within the project. Exposure to high traffic, unstable slopes and other dangerous aspects of the construction site can be monitored from remote sensing applications. Continuous collection of imagery for the lifespan of the construction project may be used for As-Constructs and project As-Built records. This 2D and 3D documentation can be used for cataloging assets in the project that are located below the surface reducing future labor and the liability of inaccurate utility locating.

**3. What final product or information** needs to be produced to enable this research to be implemented?

The final product will be an established workflow that can be applied to but not limited to, 2D and 3D site evaluation and construction progress monitoring. Training will be necessary to develop the skillsets of the construction offices across the state to fully utilize the available resources. ODOT Region 4 has numerous local projects that can be used to provide a proof of concept. A partnership between Region 4 construction, Region 4 Survey, Engineering Technology Advancement and Data Solutions will build the foundation of implementing this practice statewide.

To create a 3D point cloud from 2D photos using structure from motion, the process takes considerable computing power and creates large files. As ODOT moves to a cloud-based data storage and sharing platform, processing and archiving this data in a cloud environment will be beneficial to the success of this project. Utilizing a cloud platform will also offer opportunities for automated processing and standardization across the agency. Training from Engineering Technology Advancement will ensure construction offices will be able to leverage these tools and processes.

**4. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.**

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**5. Other comments:**

Since the publication of SPR811 in 2019, ODOT has adopted some new systems that will aid in the development of this program. TopoDot is a software package that may automate some of the feature extraction from the 2D and 3D deliverables that is now regularly used in survey departments. Many of the regions across the state currently have drones with photogrammetry collection capabilities that are ready to be deployed on projects. Data management is cited as an area of improvement in SPR811. ODOT has now adopted a cloud-based storage system that can be instrumental in this project's success.

While there are commercial products available that explore UAS monitoring of construction sites, analytics of civil data and as constructed models is not available and limit the capabilities of these products. By using MicroStation Open Site Designer (OSD) and UAS collected data, construction crews will be able to perform site verifications that interact with the project design such as grade verification and station offset reports.

There are some downstream effects of this project if proven successful. The same methodology developed for construction monitoring could be used for natural disaster response in terms of site evaluation, recovery progress monitoring and improve the safety of response crews. UAS response to natural disasters has been studied and proven effective. Having the workflow to collect and analyze this data already established and practiced at ODOT would greatly improve its effectiveness in a critical situation.

**6. Corresponding Submitter's Contact Information:** [1 individual]

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