

# MPC-462

April 1, 2014- July 31, 2017

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## **Project Title:**

Implementation of Aerial LiDAR Technology to Update Highway Feature Inventory

## **University:**

Utah State University

## **Principal Investigator:**

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## **Research Needs:**

UDOT's Maintenance Feature Inventory, housed inside the Operations Management System (OMS), was largely populated in 2012 as a result of a Mobile LiDAR (Light Detection and Ranging) data collection effort conducted by Mandli Communications. The Feature Inventory, however, is not static, so it is imperative to identify cost-effective means to keep the data current. Mandli will be conducting a new Mobile LiDAR data collection in 2014 in an effort to identify differences in the asset inventory from the 2012 data set. However, a more cost-effective means of identifying differences may be by employing Aerial LiDAR in areas where large-scale changes may have occurred, such as where new construction activities may have occurred subsequent to the original data collection. Aerial LiDAR technology offers the advantages of a) less time spent in data collection (days rather than months), and b) a view of the roadway from a different perspective, allowing features to be viewed and identified that may have been hidden from the Mobile platform. A possible disadvantage may be lower resolution of the point cloud (fewer data points per square meter). This project is to test whether Aerial LiDAR data can be a) obtained accurately and quickly enough to be cost-effective as compared to a second Mobile run, b) successfully merged with the Mobile LiDAR point cloud such that differences in the asset inventory can be easily identified, and c) used as a tool to identify features that were not visible from the Mobile platform.

NCHRP Report 748, Guidelines for the Use of Mobile LiDAR in Transportation Applications will be used as a guide for the proposed research. UDOT is also currently undertaking an effort to investigate the best means of combining LiDAR data sets from multiple collection efforts, including work with Virtual Geomatics, and with the Utah Automated Geographical Referencing Center (AGRC). AGRC is undertaking an effort to have the entire state surveyed by Aerial LiDAR. An important element of working with the AGRC data will be to develop a means to "clip" the data such that only the portion of the point cloud within a reasonable distance of the

roadway centerline is used for analysis. This research project therefore, will be conducted in full coordination with the Mandli, Virtual Geomatics, and AGRC efforts in order to insure that all efforts are in alignment.

### **Research Objectives:**

1. Evaluate the efficiency and precision of the Aerial versus Mobile LiDAR to capture changes in the highway asset inventory as well as compare and contrast the accuracy of the different technologies compared to the ground survey data
2. Define a process for the collection and data processing and entering into the UDOT feature inventory.
3. Development of techniques for the matching of mobile and Aerial LiDAR data collection.
4. Assess the cost-effectiveness of Aerial LiDAR technology in providing updates to the feature inventory system over ground field inventory programs.

### **Research Methods:**

This research will use geospatial and statistical analysis to determine the relative accuracy of aerial LiDAR in comparison to other methods of feature inventory update. The following tasks will be undertaken:

1. Conduct a comprehensive literature review of LiDAR implementations by Departments of Transportation
2. Acquire Aerial LiDAR survey data over designated areas as follows:
  - Interstate 84 from Mountain Green to Morgan County/Summit County
  - Interstate 15 – Payson to Springville
  - Interstate 15 – Region 2
3. Post-processing of data. Point cloud and geo-TIF imagery delivery to USU and UDOT.
4. Conduct of analysis to determine the cost per mile of the technologies for future application.
5. Image and point cloud analysis to determine the number of assets that are acquired by the Aerial LiDAR.
6. Use of ArcAnalyst to compare data from Aerial LiDAR and Mandli data. Discussion of the differences in horizontal and vertical positioning and capability for asset management usage (OMS) and survey grade data.
7. Compilation of report showing the efficiency, accuracy of Aerial/Mobile Lida Methods to capture changes over the highway inventory system. Also submit a one page article for a UDOT research newsletter including pictures and major findings. Also include a power point presentation as part of the final deliverable.

### **Expected Outcomes:**

1. Added knowledge of the capability of aerial LiDAR to update feature inventory of a DOT Maintenance Division.
2. Decision support for investment of asset management
3. Better use of limited maintenance budgets for asset management

### **Relevance to Strategic Goals:**

This project is in direct relation to the state of good repair strategic goals of having a transportation infrastructure that is in good repair. The secondary benefit to this work is having an infrastructure that is safe and well maintained.

**Work Plan:**

The proposed research will be carried out in a period of 18 months with the following schedule:

<b>Tasks</b>	<b>Durations</b>
Literature review	1 months
Acquire Aerial LiDAR survey data	3 months
Post-processing of data	2 months
Conduct of analysis to determine the cost per mile of the technologies for future application	2 months
Image and point cloud analysis	4 months
Use of ArcAnalyst to compare data from Aerial LiDAR and Mandli data	3 months
Report writing	3 months

**Project Cost:**

Total Project Costs: \$266,665

MPC Funds Requested: \$130,582 (subcontract to Virginia Tech: \$50,000)

Matching Funds: \$136,083

Source of Matching Funds: UDOT Project and LTAP Funds

**TRB Keywords:**

Asset Management; Aerial LiDAR; Feature Inventory.