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New Jersey Department of Transportation
Bureau of Research

Technical Brief

High Mast Drone Inspection

The purpose of this report is to provide a comparative analysis between a traditional, ground-based asset management approach and an approach utilizing unmanned aerial systems (UAS) for the structural inspection of 244 high mast light poles as conducted by the New Jersey Department of Transportation (NJDOT). The goal of this research was to document and, to the best extent possible, quantify the benefits of using UAS compared to a traditional approach across four project evaluation criteria: safety, efficiency (highway and data), time, and cost.

Background

The NJDOT Bureau of Research is aiding the Bureau of Aeronautics quantify the benefits of deploying UAS for the inspection of 244 high mast light poles in the State and compare it to a traditional, ground-based asset management approach. Use of UAS in the United States is growing across a wide range of activities including inspection/asset management, incident response and management, and construction project management. This research will help NJDOT remain a leader in UAS and serve as a test bed for future deployments in other fields.

Research Objectives and Approach

The objective of this research was to quantify to the best extent possible the benefits of using an UAS approach to high mast light pole inspections compared to a traditional, ground-based approach across four project evaluation criteria: safety, efficiency (highway and data), time, and cost. This research utilized interviews with relevant NJDOT personnel to understand the different approaches to inspection, created case studies to explore inspection scenarios, and conducted a benefit-cost analysis to quantify the costs and savings of the various identified approaches.

Findings

The traditional inspection approach requires an initial inspection of all high mast light poles in the state by two engineers with binoculars. If any potential defects are noted, a second inspection using a bucket truck is required. Depending on the location of the pole, the secondary inspection may require a shoulder or lane closure and disturbance of a guiderail with associated impacts on highway safety and efficiency, personnel time and cost. The UAS inspection approach has a higher time requirement and cost during the initial inspection phase but eliminates the need for a secondary inspection and any associated traffic or safety impacts, leading to an overall cost savings. Finally, these approaches are briefly compared to a prior bucket truck approach which required a bucket truck for every high mast light pole initial inspection in the state. These benefits and costs are summarized in Table 1.

Table 1 - Summary of Benefits/Costs

Criteria	Bucket Truck Approach (For all Initial Inspections)	Traditional Approach (Bucket Truck for Secondary Inspection Only)	UAS Approach
Time (Labor-hours)*	3,312	1,264 – 1,552	1,476
Cost*	$477,022	$167,600 - $177,667	$186,025
Safety (cost)	$2,162 per pole requiring a lane closure (6)	$2,162 per pole requiring a lane closure (maximum 6)	$0
Efficiency (cost)	$1,736 per pole requiring a lane closure (6)	$1,736 per pole requiring a lane closure (maximum 6)	$0
Total Cost	$500,410	$190,988 - $201,055	$186,025

Note: * Assumes 10% of high mast light poles require a secondary inspection using the traditional approach.

In addition, the benefits of using UAS are not fully captured in the above numbers. Additional considerations include:

- Value of higher quality photographs of potential defects for analysis and documentation;
- Fewer safety risks, lower vehicle emissions, and less time spent due to reduced trips to/from poles for secondary inspections;
- Eliminate safety and traffic impacts of a shoulder closure due to no secondary inspections; and
- Reduced injury exposure to workers (both in work zones and in bucket trucks).

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A final report is available online at: http://www.state.nj.us/transportation/refdata/research/. If you would like a copy of the full report, send an e-mail to: Research.Bureau@dot.state.nj.us.

High Mast Drone Inspection
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High Mast Light Pole Inspections

Comparative Analysis

INTRODUCTION

This project compares the relative benefits of using unmanned aerial systems (UAS) versus traditional visual inspection methods for the structural inspection of 244 high mast light poles used by the New Jersey Department of Transportation (NJDOT).

Traditional Inspection

1 Initial inspection with binoculars

2 Secondary inspection with bucket truck if potential defect found

UAS Inspection

1 Initial inspection with UAS

2 NO secondary inspections

WHAT ARE THE BENEFITS/COSTS?

CRITERIA	BUCKET TRUCKS (All Initial Inspections)	TRADITIONAL	UAS
Time (labor hours)	3,312	1,264 – 1,552	1,476
Cost	$477,022	$167,600 – $177,667	$186,025
Safety	$2,162 per pole requiring a lane closures	$2,162 per pole requiring a lane closures	$0
Efficiency	$1,736 per pole requiring a lane closures	$1,736 per pole requiring a lane closures	$0
Total Cost	$500,410	$190,988 – $201,055	$186,025

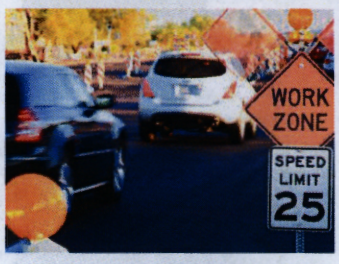
Note: Assumes 10% of poles have a potential defect.

ADDITIONAL BENEFITS

The UAS approach offers additional benefits that could not be quantified, such as:

HIGHER QUALITY PHOTOGRAPHS for analysis and documentation

Fewer **SAFETY RISKS**, lower **VEHICLE EMISSIONS**, and less **TIME** – no driving to secondary inspections



Eliminate safety and traffic impacts of a **SHOULDER CLOSURE** – no secondary inspections

Reduced **INJURY EXPOSURE** to workers (both in work zones and in bucket trucks)

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