

# DRISI

CALTRANS DIVISION OF RESEARCH,  
INNOVATION AND SYSTEM INFORMATION

# Research Notes

Equipment

MAY 2024

Project Title:  
Investigating Teleoperated Equipment  
for Use in Caltrans Operations

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## Investigating Teleoperated Equipment for Use in Caltrans Operations

Investigating the operations of non-line-of-sight remote control technology for Caltrans operations.

### WHAT IS THE NEED?

Advances in the field of teleoperated / autonomous vehicles has shown potential for new and innovative applications that could change how State Departments of Transportation (DOT's) maintain roadways and roadside vegetation, and roadway and roadside construction, among other operations. Mowing of medians and right-of-way is an important vegetation management practice for Caltrans, but it is labor intensive and requires expensive and specialized equipment.

With the advent of teleoperated/ autonomous vehicles, it may be possible to reduce worker's exposure and risk by utilizing driverless tractors for mowing operations. In addition, cost savings are also possible by utilizing one operator to control more than one mower.

### WHAT ARE WE DOING?

The research will assess ease of use, safety, and appropriateness of non-line-of-sight, remote control/autonomous technology for Caltrans maintenance operations. The project tasks include:

1. Literature Review
2. Draft Specifications/Requirements
3. Assess and Verify Industry Capability
4. Caltrans demonstration

### WHAT IS OUR GOAL?

The goal of this study is to demonstrate in the field, a vehicle capable of meeting the requirements for teleoperated / autonomous vehicles as requested by the Division of Equipment.



DRISI provides solutions and  
knowledge that improves  
California's transportation system

## WHAT IS THE BENEFIT?

The benefit of this research to California is increased worker safety. Implementation of this technology would allow a maintenance worker to control the vehicle (i.e., mower in this instance) from a safer location while mowing “steep” grades along the state right of way. Furthermore, labor costs may be reduced by having one operator controlling multiple mowers.

## WHAT IS THE PROGRESS TO DATE?

- Agreed to extend project through September 30, 2024
- Continue to talk to vendors to assess product capability (original equipment manufacturers (OEM) and retrofit vendors)
- Continue work on draft test criteria to evaluate both OEM and retrofit equipment
- The researchers continue on working to get a vendor to California to demonstrate for CALTRANS the technology. The demonstration will be set up June 2024

## IMAGES



Image 2: Example of Obstacle for Testing (Inflatable Car with Foil Inserts)

Performance Measure	Minimum Specification	Preferred Value
Grade on which mowing can occur	Operate safely at a minimum of 6% grade	Operate safely at a grade greater than 6%
Cross slope	Operate safely at a minimum 1V:3H slope	Operate safely at a 1V:2H or steeper slope
Mowing height (if mower is part of unit)	Mow to a minimum of 4"	N/A
Obstacles (fixed)	Be able to identify and appropriately act or avoid the following obstacles (at a minimum): <ul style="list-style-type: none"> <li>• Barriers (guardrail or sound walls)</li> <li>• Signposts</li> <li>• Bridges</li> <li>• Culverts</li> <li>• Drainage ditches &amp; rip-rap</li> <li>• Signposts and structures</li> <li>• Trees &amp; tree stumps</li> <li>• Survey markers</li> <li>• Fungus</li> <li>• Environmentally sensitive areas</li> <li>• Utility poles</li> <li>• Guide markers</li> <li>• Well heads</li> <li>• Large rocks</li> <li>• Steep drop-offs</li> <li>• Foreign/unknown objects</li> <li>• Electrical boxes</li> </ul>	Can be geocoded for most or all of these.
Obstacles (mobile)	Identify and appropriately act to obstacles (at a minimum): <ul style="list-style-type: none"> <li>• Humans</li> <li>• Homeless encampments</li> <li>• Stalled vehicles</li> <li>• Roadside debris</li> <li>• Large rocks</li> <li>• Large litter and debris from illegal dumping (e.g., mattress)</li> <li>• Foreign/unknown objects</li> </ul>	Critical!
Fire detection & mitigation	Must be able to identify sparks and have a means to suppress if ignition happens	
Safety Features	Include at a minimum a safety shutdown switch, a tipping sensor and real-time engine readings	
Efficiency	Able to operate at a rate similar to the rate of manually operated tractors or be cost effective enough that multiple units can operate at the same rate.	
Other Features	<ul style="list-style-type: none"> <li>Tractor System</li> <li>Autonomous Driving System</li> <li>Other Feature</li> <li>Combination of Tractor and Autonomous System</li> </ul>	<ul style="list-style-type: none"> <li>• 4-wheel drive or track</li> <li>• Able to mow around under guardrail and near culvert outlets</li> <li>• Ability to pull bag wags mowers</li> <li>• Spot weed control</li> <li>• If mowers is part of unit: <ul style="list-style-type: none"> <li>o Auto height adjustment</li> <li>o Ability to mow thick wood stacks, tree saplings or shrubs</li> </ul> </li> </ul>

Image 1: Draft of testing Criteria

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