

## HIVE-II: Updated Culvert Inspection Vehicle

### PROJECT TITLE

HIVE-II: Updated Culvert Inspection Vehicle

### STUDY TIMELINE

October 2019 – September 2020

### INVESTIGATORS

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### VTRANS CONTACTS

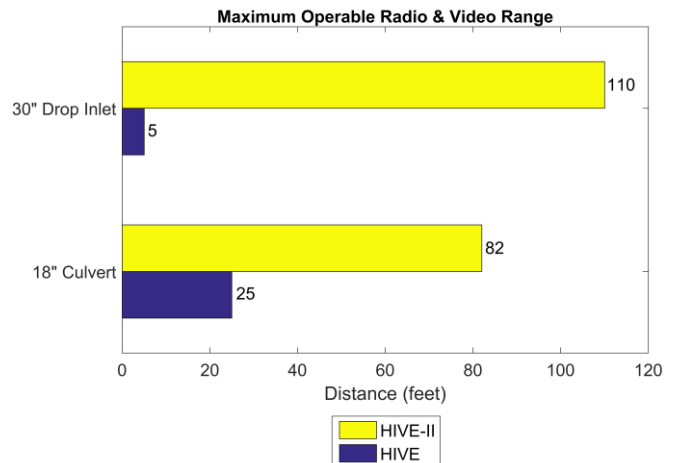
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### Introduction or Problem Statement

The Vermont Agency of Transportation must inspect approximately 9,600 small culverts annually. During inspection, a small remotely controlled vehicle drives through a culvert and streams video of the culvert interior back to the operator. However, of the two inspection vehicles currently available to VTrans, the “Crawler” is too costly for widespread deployment, and the Hydraulic Inspection Vehicle Explorer (“HIVE”) is unable to transmit video from deep within long culverts. In this project, a next-generation culvert inspection vehicle, the “HIVE-II”, is designed to meet VTrans requirements for efficient and effective low-cost culvert inspection.



HIVE-II



Performance of HIVE-II versus original HIVE  
(Longer bars are better)

### Methodology or Action Taken

A Heng Long 1/16-scale remote control toy tank was chosen for the HIVE-II chassis due to its compact size, low cost, and continuous tracks. Continuous tracks allow it to meet VTrans requirements to span a 6-inch (152 mm) separation gap and remain stationary on a 20-degree slope. Optimal equipment for radio control and video transmission through small culverts is understood through theoretical analysis and a series of field tests. Total materials cost of the HIVE-II is less than \$1500.

### Conclusions or Next Steps

Compared to the original HIVE, the HIVE-II offers much greater operating range, improved capability to traverse obstacles and gaps, and precise distance encoding from a tether spool with a digital revolution counter. The figure above shows that the HIVE-II equipped with a 5.8 GHz video transmitter provides 100+ feet (30.5+ m) of additional range when operating in a 30-inch (752 mm) drop inlet, and 50+ feet (15.2+ m) of additional range when operating in an 18-inch (457 mm) culvert.

### Potential Impacts and VTrans Benefits

Proper inspection of small culverts can prevent roadway failures, traffic disturbances, and costly unexpected repairs.

More information about the VTrans Research Program, including additional Fact Sheets, can be found at:  
<http://vtrans.vermont.gov/planning/research>