Video Analytics Usage in Transportation Agencies Nationwide Survey and Maryland Feasibility Study

Zachary Vander Laan*, Kaveh Farokhi Sadabadi, Thomas Jacobs

Center for Advanced Transportation Technology, Department of Civil and Environmental Engineering, University of Maryland

*zvanderl@umd.edu

Objective

Determine whether video analytics can be used to extract relevant traffic data from existing Maryland Department of Transportation -State Highway Administration (MDOT-SHA) closed circuit television (CCTV) cameras by:

- Conducting a nationwide survey of U.S. transportation agencies to understand other jurisdictions' experiences with video analytics.
- Developing a real-world test-bed of representative video clips from MDOT-SHA's CCTV video feeds, and performing a feasibility study to evaluate video analytic vendors' capabilities.

Nationwide Survey

- Online survey: 19 multiple choice, 5 fill-in-the-blank, and 12 free response questions focusing on camera infrastructure, video analytics solutions, experiences with vendors, and future plans.
- Distributed to members of transportation agencies from 49 states

Agency Usage

• 21 agency responses from 20 states, with 9 indicating that they are currently using video analytics

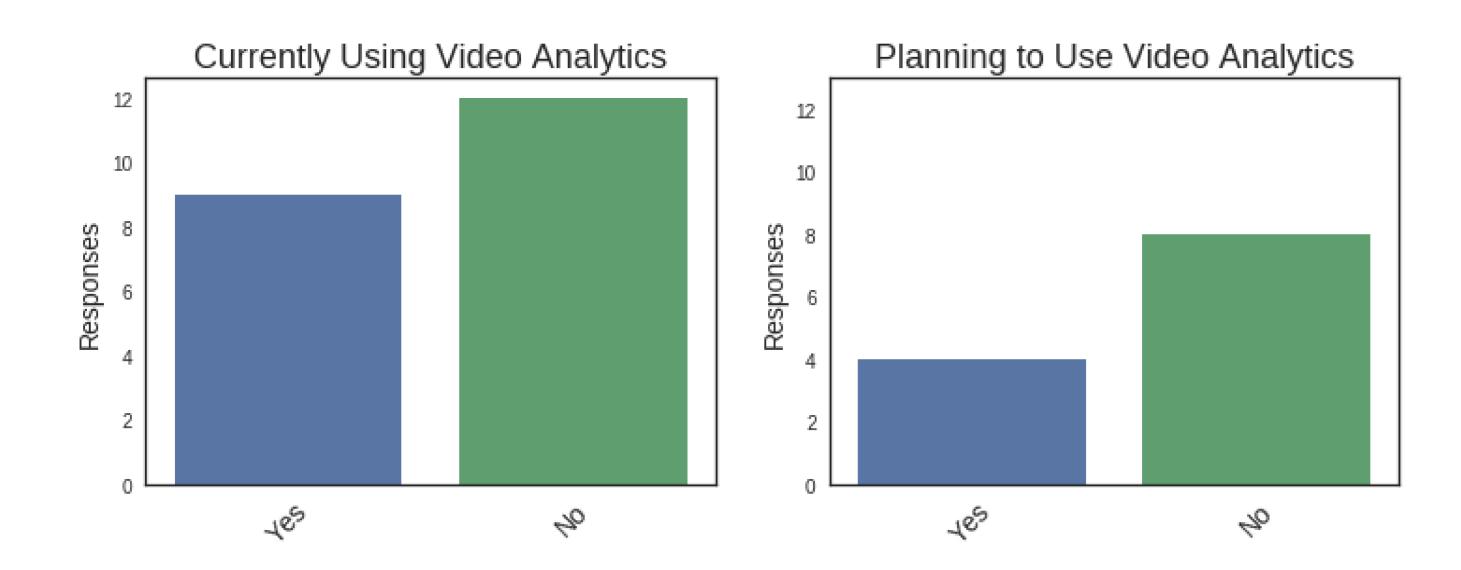


Figure 1: 9 of the 21 agencies are currently using this technology in some fashion, with an additional 4 indicating that they plan to do so in the near future.

Camera Characteristics

• Camera deployment varies significantly (20-800 cameras of various types, frame rates, video encodings, and resolutions)

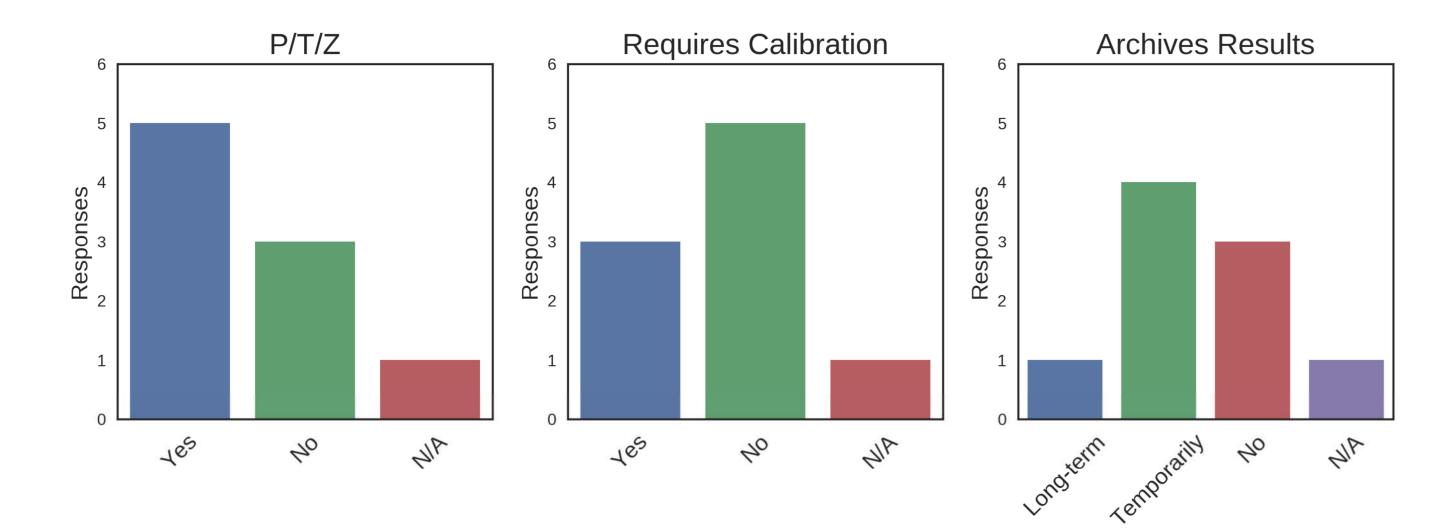


Figure 2: Of the 9 agencies that reported using video analytics in some capacity, 5 have cameras with pan/tilt/zoom functionality, and 3 require calibration to work properly.

Video Analytics Solutions

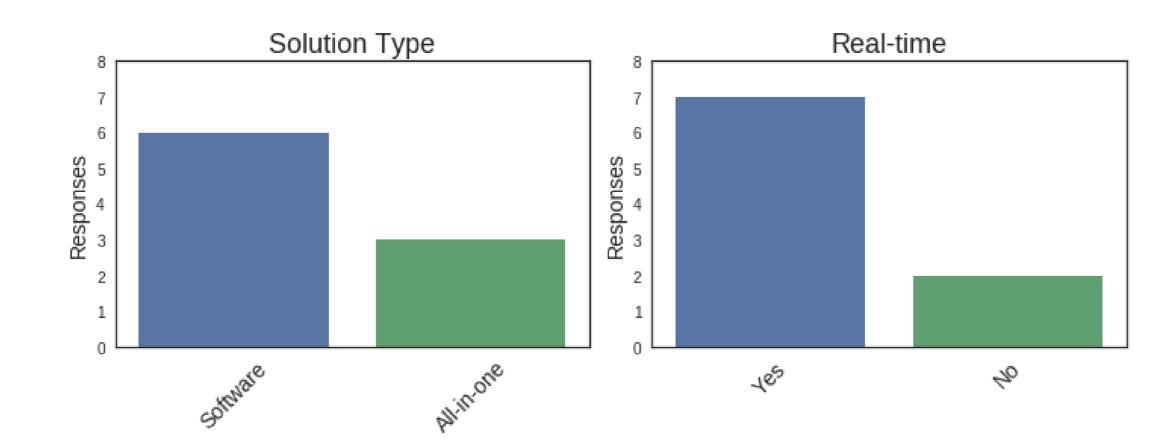


Figure 3: 6 of the 9 systems are software-only solutions (i.e., no hardware purchase necessary), and all but 2 systems deliver the data in real-time.

Data Outputs

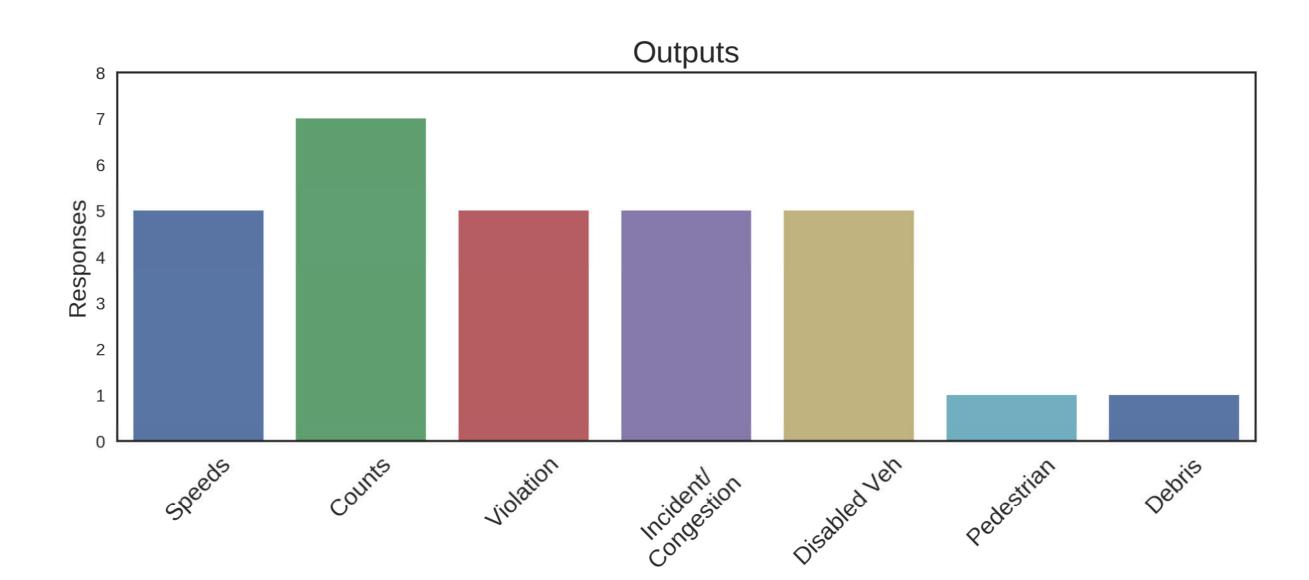


Figure 4: Despite different implementations, the following data outputs are common to at least 5 agencies: speeds, counts, incidents, violations, and disabled vehicles.

Use Cases

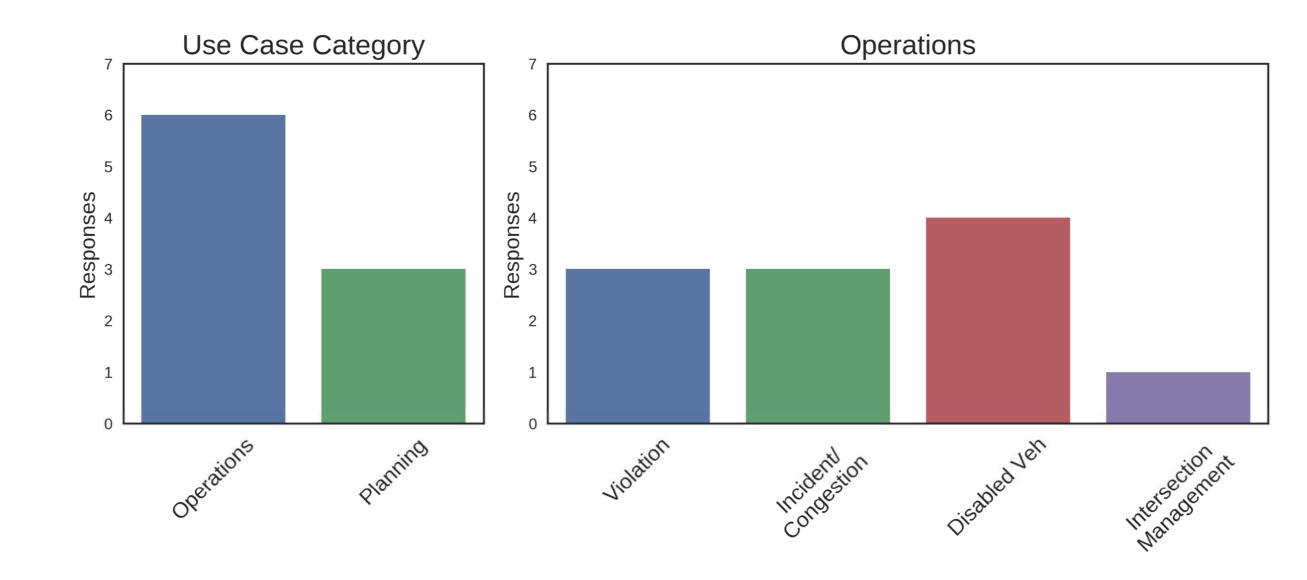


Figure 5: Each of the 9 video analytics users described different use cases, which can be broadly categorized as focused on operations or planning.

Data Validity

Reliability unknown or low in poor visibility conditions

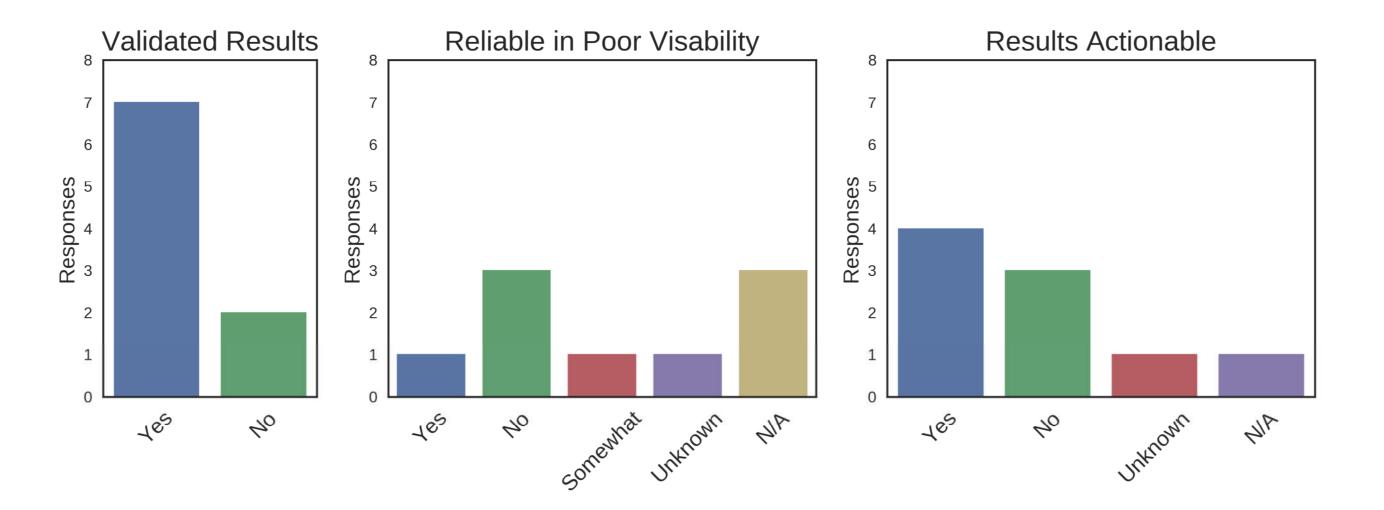


Figure 6: Questionable reliability in poor visibility, and about half the respondents are willing to act on the results, while the rest are somewhat apprehensive.

Survey Summary

- Strong interest in video analytics amongst US transportation agencies (24% of states have agencies using or planning to use)
- General concern about reliability of results, particularly during lowlight, poor weather, and high-glare conditions
- Suitability of existing solutions depends on application (i.e., detecting abnormalities vs. highly-accurate speed/count data)

Maryland Feasibility Study

- Developed representative testbed from 10 MDOT-SHA CCTV feeds
- Invited vendors to demonstrate their capabilities on the test clips

Testbed

• Includes a variety of scenarios (camera locations/angles, time of day, weather, incidents, traffic, road geometry, camera movement)

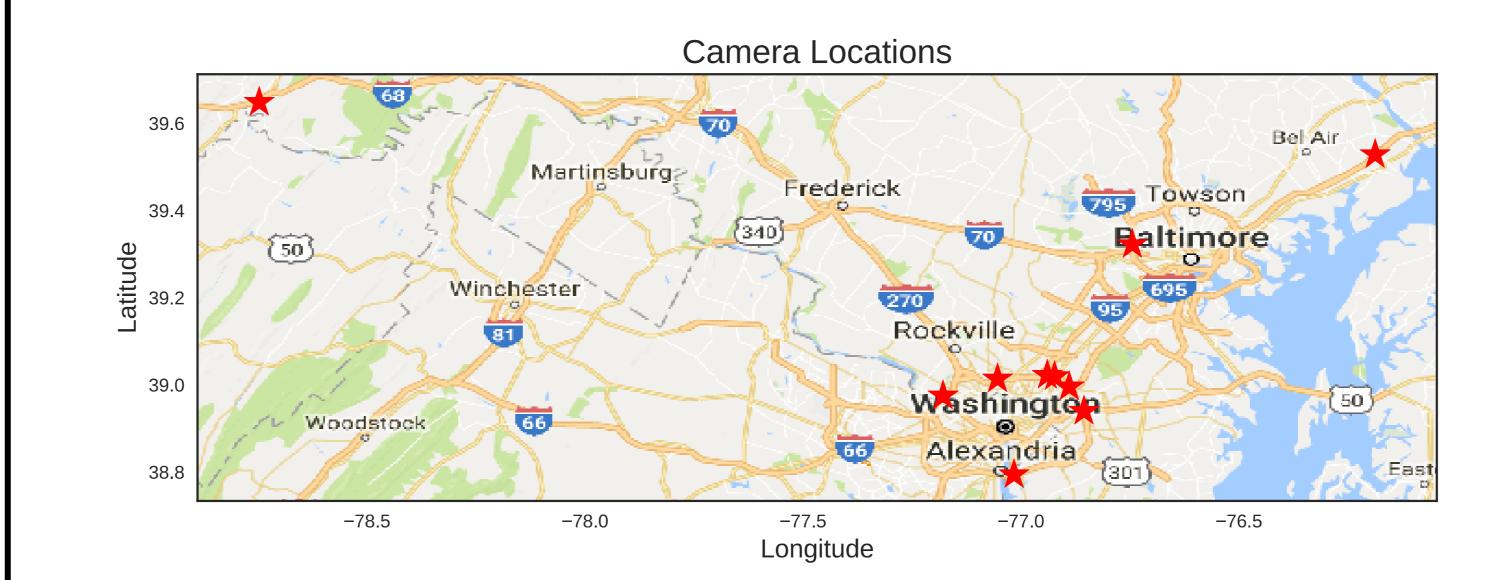


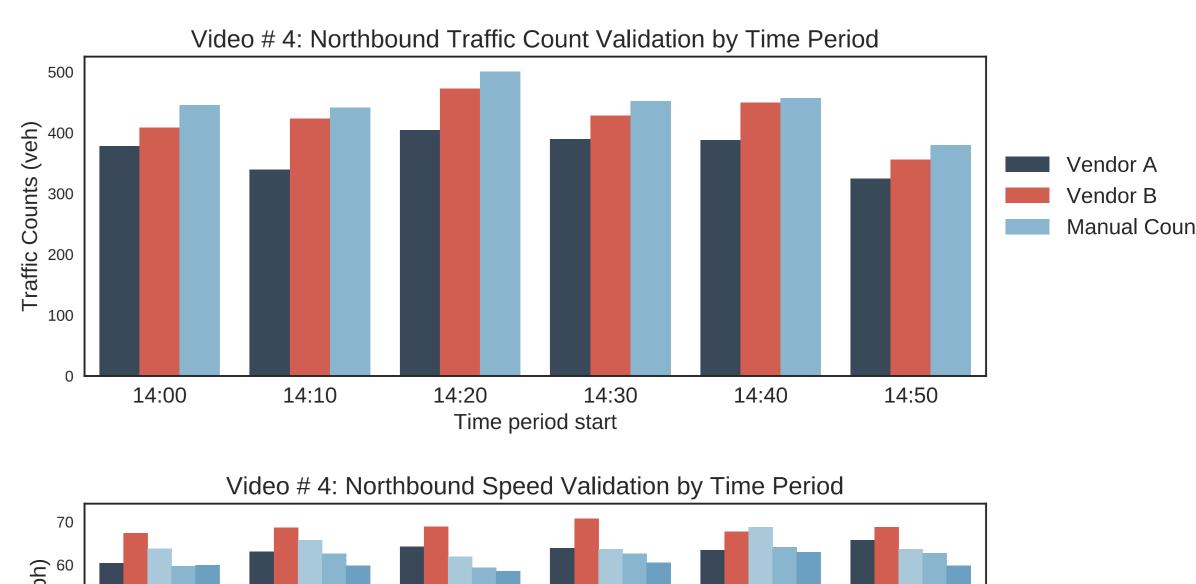
Figure 7: Locations of MDOT-SHA CCTV cameras used in testbed.

Vendor Evaluation

- Shared testbed with 6 interested vendors
- 2 agreed to participate, 2 declined (testbed did not meet requirements), and 2 stopped communicating upon seeing sample clips
- Vendors A and B provided short annotated videos visually demonstrating their ability to count vehicles and identify incidents/congestion, and also agreed to extract raw data from one of the testbed videos

Quantitative Results

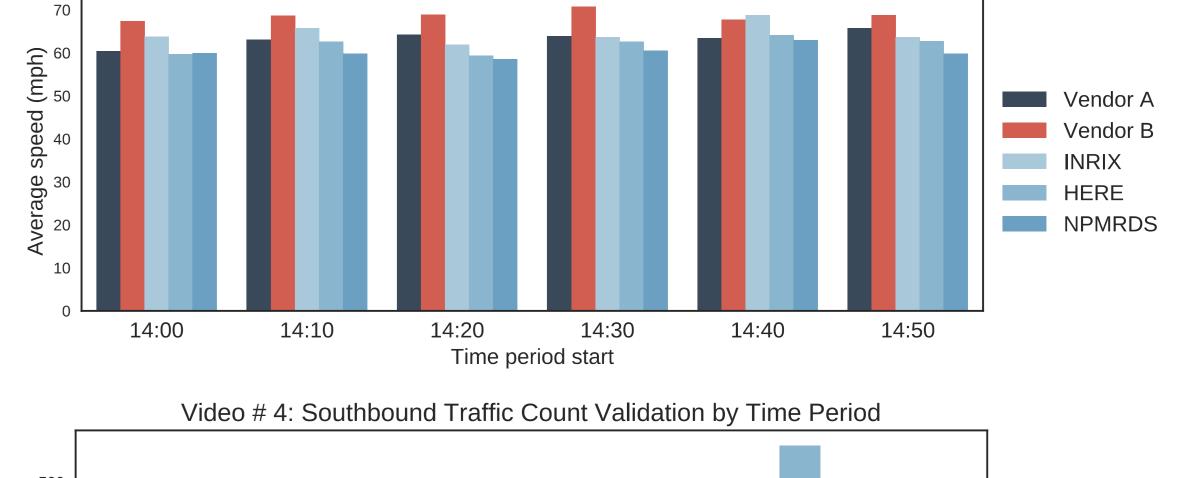
- Test clip: 1 hour long, contains snowfall and poor visibility
- Validation: manual counts and probe speed data
- Vendor A: within 15% of manual counts and 4% of probe speeds in the primary direction, and did not extract results for secondary direction
- Vendor B: within 5% of manual counts and 7% of probe speeds in the primary direction, and 25% of manual counts and 20% of probe speeds in the secondary direction



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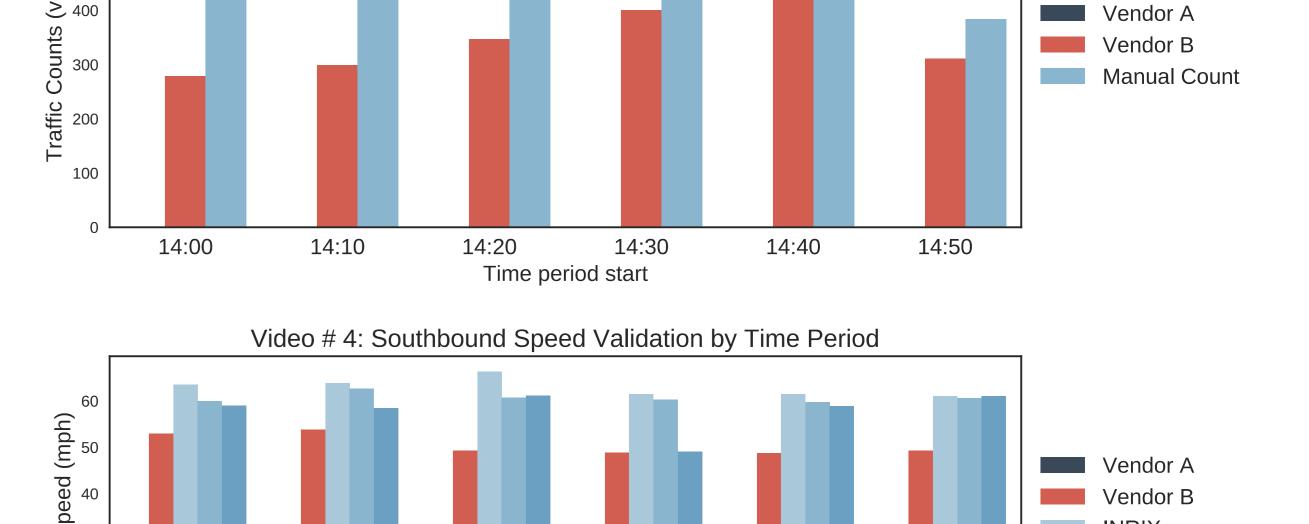


Figure 8: Validation results indicate that count and speed estimates are far more accurate in the primary (Northbound) direction.

Feasibility Study Summary

- Count/speed accuracy is highly dependent on camera positioning and video quality (from vendor comments and quantitative results)
- Even without proper calibration or ideal conditions, video analytics systems may be useful for detecting anomalies

Conclusions

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ADMINISTRATION

- General optimism about the future of video analytics, but current solutions have challenges (positioning, visibility requirements)
- Based on existing MDOT-SHA camera infrastructure, video analytics solutions currently most suitable for:
- Anomaly detection (e.g., incidents, congestion)
- Short-term data collection under ideal conditions

Acknowledgments

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