Transportation Systems Operations & Support

Asim Zaman

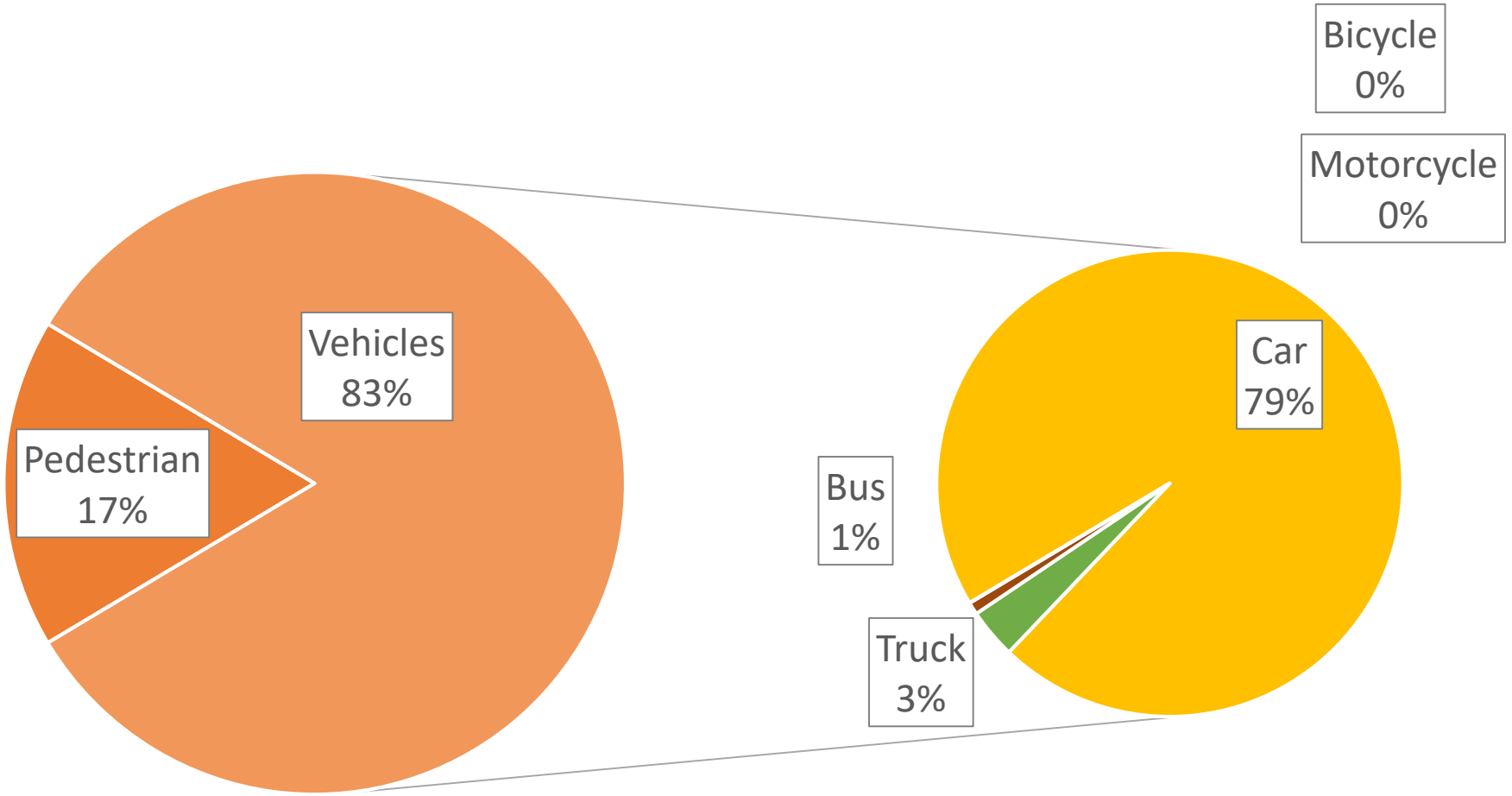
Artificial-Intelligence-Aided Automated Detection of Railroad Trespassing

Asim Frank Zaman

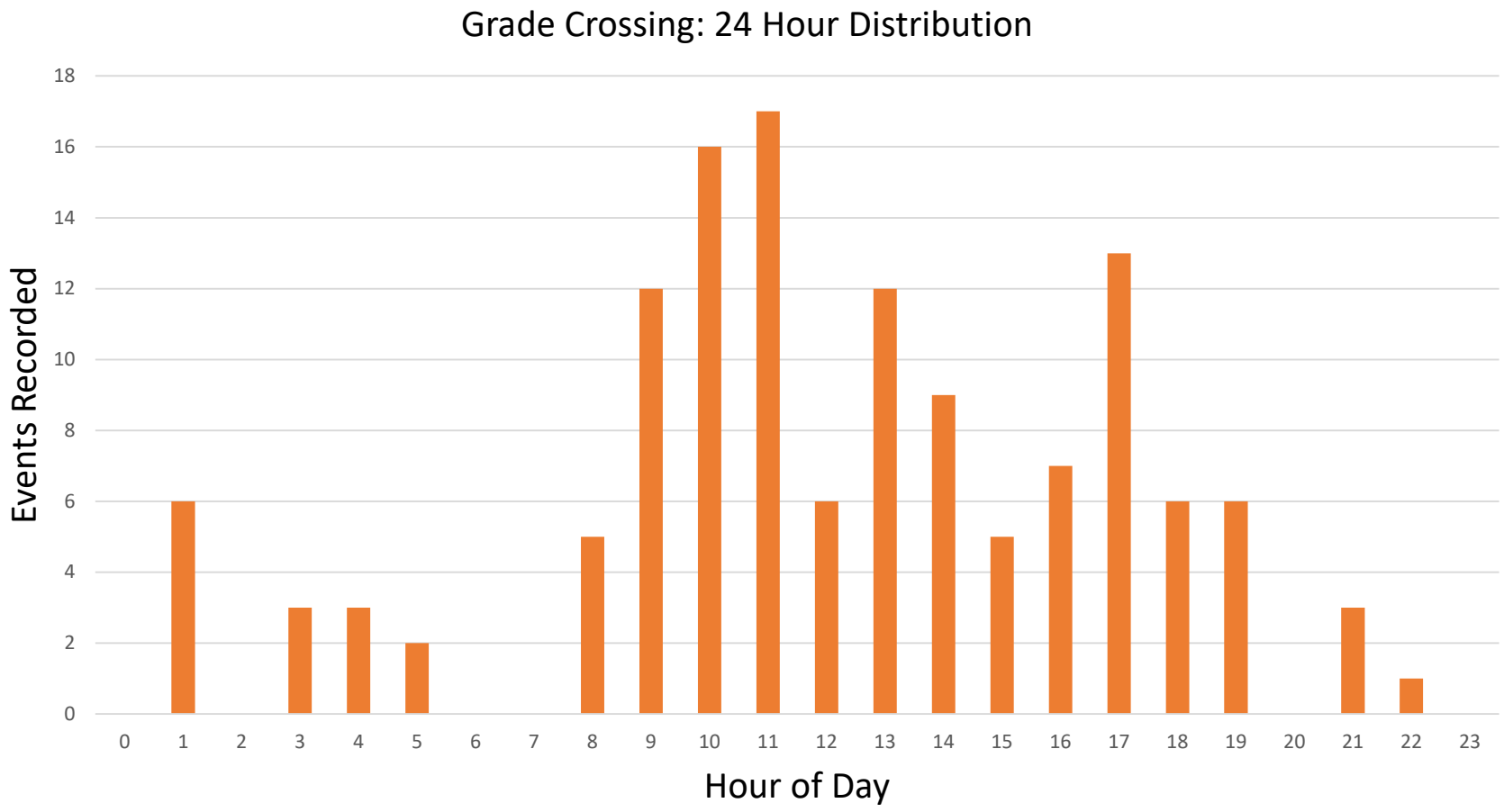
Senior Engineer, Transportation Operations Systems and Support

Grade Crossing Results: Vehicle

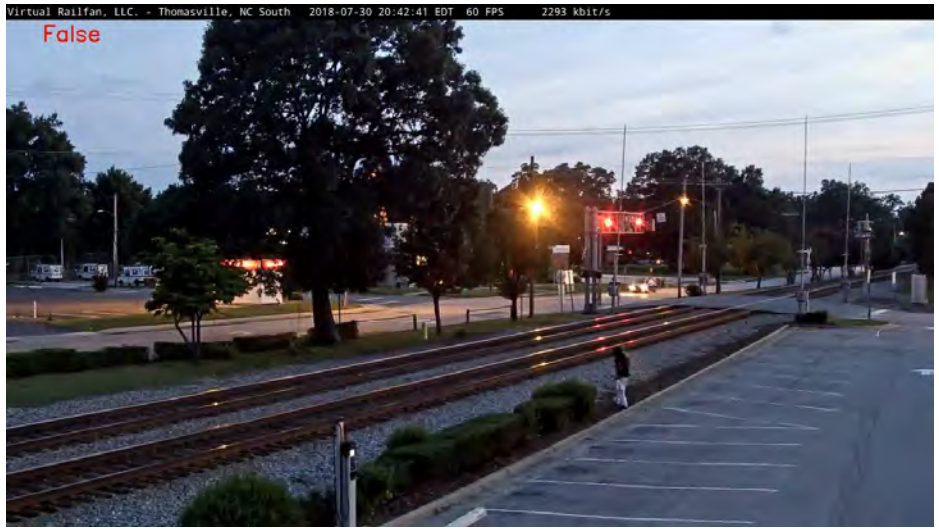
Grade Crossing Location 1 - Summary



Grade Crossing Location 1 - 24 Hour



ROW 2 Results



Task Force on Transit Safety Meeting

Pedestrian Safety and Driver Yielding Near Public Transit Stops

(Nichole Morris, Western Michigan University)

St. Paul, Minnesota – Vehicle x Pedestrian Accident Prevention

- Problem: Pedestrian x Vehicle Accidents
- Solution: Countermeasure Analysis
  - Social Media Campaigns (Minor Effectiveness)
  - Police Warnings (Minor Effectiveness)
  - Police Ticketing (More Effective)
  - MUTCD Pedestrian Bollard (Very Effective)

- NJ = Good overall accident fatality record
- NJ = Poor Pedestrian x Vehicle Accident Record

- Once study published, NJDOT could take action based on the formal results

Transportation Systems Operations & Support

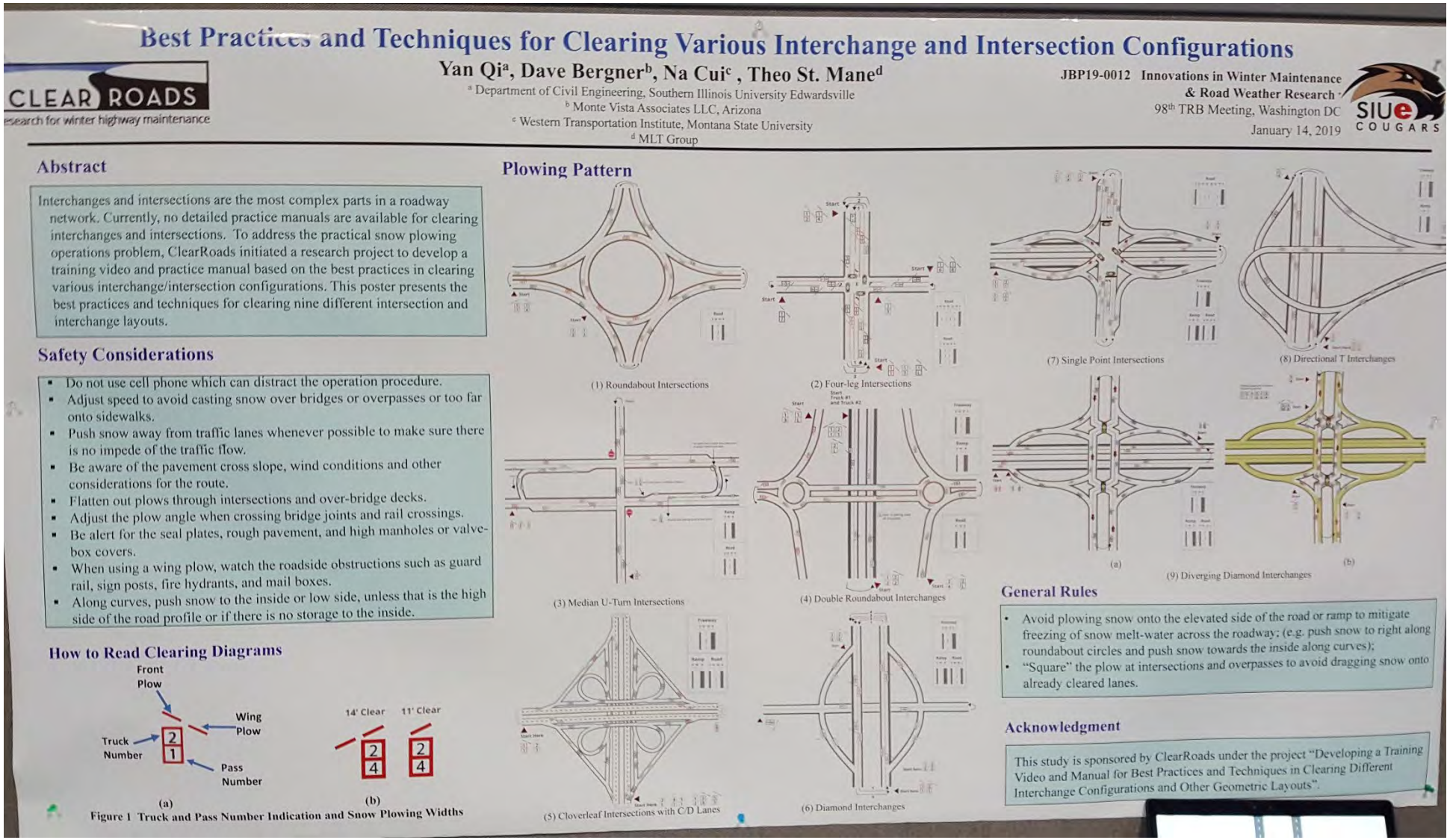
Parth Oza

Overview of Discussion Topics

Parth Oza, Assistant Division Director, Operations, North Region

- Best Practices and Techniques for Clearing Various Interchange and Intersection Configurations
- Clear Roads Winter Maintenance Pooled Fund
- Impact of Utilizing CEI Consultants on Highway Construction Project Cost and Schedule Performance
- Other ideas

Best Practices and Techniques for Clearing Various Interchange and Intersection Configurations



Best Practices and Techniques for Clearing Various Interchange and Intersection Configurations

Yan Qi[a], Dave Bergner[b], Na Cui[c] , Theo St. Mane[d]

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[d] MLT Group

JBP19-0012 Innovations in Winter Maintenance & Road Weather Research
98th TRB Meeting, Washington DC
January 14, 2019

CLEAR ROADS
research for winter highway maintenance

SIUe COUGARS

Abstract

Interchanges and intersections are the most complex parts in a roadway network. Currently, no detailed practice manuals are available for clearing interchanges and intersections. To address the practical snow plowing operations problem, ClearRoads initiated a research project to develop a training video and practice manual based on the best practices in clearing various interchange/intersection configurations. This poster presents the best practices and techniques for clearing nine different intersection and interchange layouts.

Safety Considerations

- Do not use cell phone which can distract the operation procedure.
- Adjust speed to avoid casting snow over bridges or overpasses or too far onto sidewalks.
- Push snow away from traffic lanes whenever possible to make sure there is no impede of the traffic flow.
- Be aware of the pavement cross slope, wind conditions and other considerations for the route.
- Flatten out plows through intersections and over-bridge decks.
- Adjust the plow angle when crossing bridge joints and rail crossings.
- Be alert for the seal plates, rough pavement, and high manholes or valve-box covers.
- When using a wing plow, watch the roadside obstructions such as guard rail, sign posts, fire hydrants, and mail boxes.
- Along curves, push snow to the inside or low side, unless that is the high side of the road profile or if there is no storage to the inside.

How to Read Clearing Diagrams

Figure 1 Truck and Pass Number Indication and Snow Plowing Widths

Plowing Pattern

General Rules

- Avoid plowing snow onto the elevated side of the road or ramp to mitigate freezing of snow melt-water across the roadway; (e.g. push snow to right along roundabout circles and push snow towards the inside along curves);
- "Square" the plow at intersections and overpasses to avoid dragging snow onto already cleared lanes.

Acknowledgment

This study is sponsored by ClearRoads under the project "Developing a Training Video and Manual for Best Practices and Techniques in Clearing Different Interchange Configurations and Other Geometric Layouts".

Clear Roads Winter Maintenance Pooled Fund

PRACTICAL, READY-TO-IMPLEMENT RESEARCH

Plug-and-Play Initiative

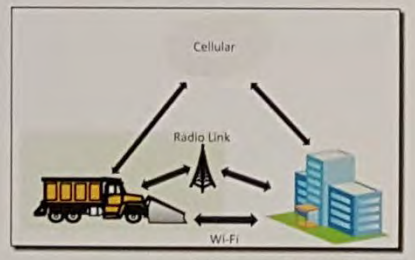
Project 13-05 (in progress) and others

For several years, Clear Roads has led a collaborative effort to develop a universal communications protocol for in-cab electronics, allowing "plug and play" functionality regardless of the manufacturer or service provider.

This protocol will benefit both Clear Roads member states and their vendors by standardizing how critical operational data are shared on modern snow and ice vehicles, namely between compatible Automatic Vehicle Location (AVL) devices and anti-icing/deicing joystick and spreader controller systems.

"We are watching closely the next steps in this effort as ODOT moves forward with automatic data collection and using spreader controllers to collect and send truck activity information."

—Patti Caswell, Oregon DOT



Graphic courtesy of SRF Consulting Group

Snowplow Supervisor and Operator Training

Project 12-04, completed April 2017

This project created a 22-module training program that states can customize to fit their needs. The modules cover equipment and materials, principles of weather and ice, safety, environmental concerns, and winter maintenance management.

Photo by David Gonzalez, Minnesota DOT

"Success! One county has proven less material use with just one training session for all drivers prior to last winter."

—Allan Johnson, Wisconsin DOT

75% of member states have implemented this project.

Far-Reaching Benefits

Clear Roads has received **nearly 100 requests** for its Snowplow Operator and Supervisor Training materials from non-member agencies.

"We've implemented the modules into our new snowplow operator training. Benefits include time savings to trainers and educated staff."

—Melissa Longworth, Michigan DOT

Annual Survey of State Winter Maintenance Data

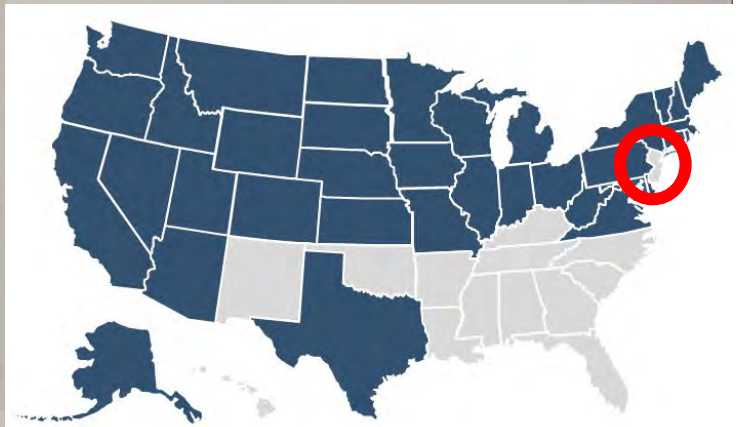
Project 15-S1 (ongoing)

Each year, Clear Roads compiles a range of winter operations data from state DOTs across the country. These metrics are displayed on an interactive map that lets states see how they compare to others in salt use, per-ton salt costs, number of plows, and more.

75% of member states have implemented this project.

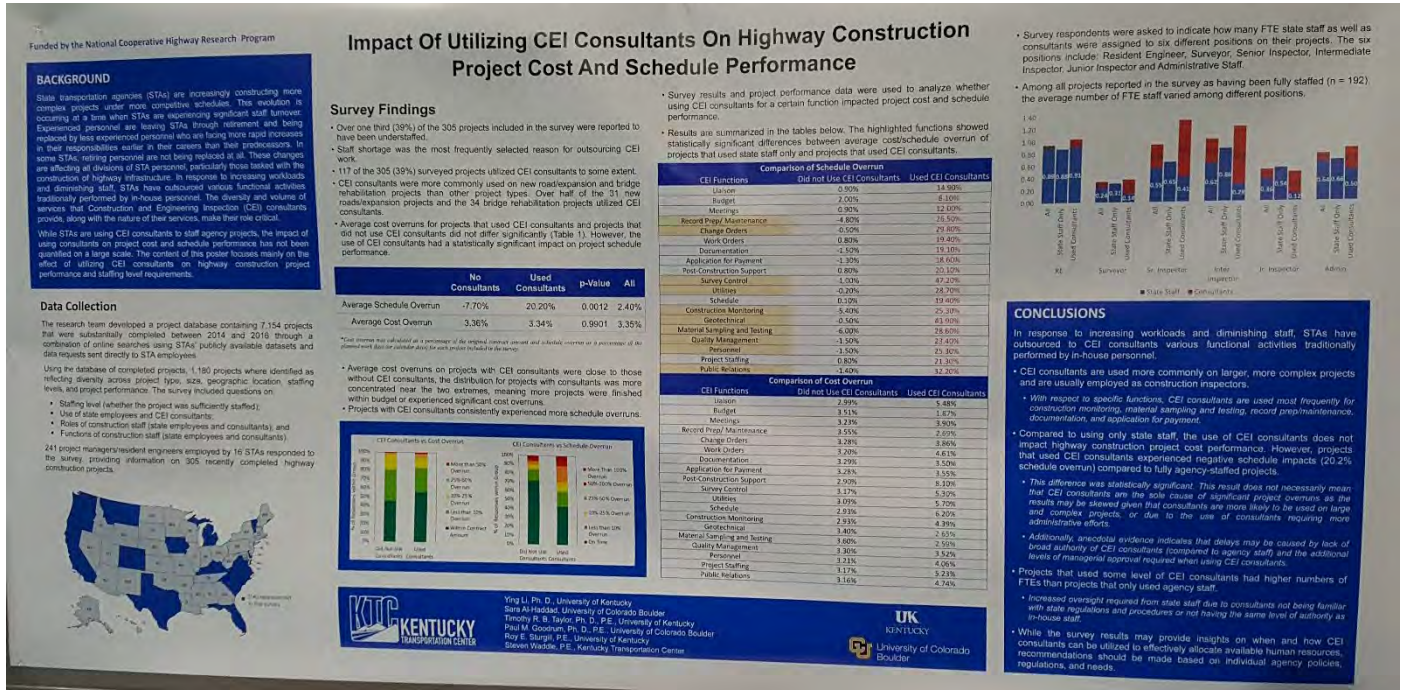
"This project has saved us a significant amount of time. We use it routinely for internal and external communication, routine comparison for salt costs with other states as well as equipment type and quantity comparisons."

—James Morin, Washington State DOT



Impact of Utilizing CEI Consultants on Highway Construction Project Cost and Schedule Performance

- Staff shortage was reason for outsourcing CEI (Construction Engineering Inspection) work
- Use of consultants → no significant impacts on cost overruns
- Use of consultants → resulted in longer project schedules
- Develop ideal staffing profiles based on project complexity



Funded by the National Cooperative Highway Research Program

BACKGROUND

State transportation agencies (STAs) are increasingly constructing more complex projects under more competitive schedules. This evolution is occurring at a time when STAs are experiencing significant staff turnover. Experienced personnel are leaving STAs through retirement and being replaced by less experienced personnel who are facing more rapid increases in their responsibilities earlier in their careers than their predecessors. In some STAs, retiring personnel are not being replaced at all. These changes are affecting all divisions of STA personnel, particularly those tasked with the construction of highway infrastructure. In response to increasing workloads and diminishing staff, STAs have outsourced various functional activities traditionally performed by in-house personnel. The diversity and volume of services that Construction and Engineering Inspection (CEI) consultants provide, along with the nature of their services, make their role critical.

While STAs are using CEI consultants to staff agency projects, the impact of using consultants on project cost and schedule performance has not been quantified on a large scale. The content of this poster focuses mainly on the effect of utilizing CEI consultants on highway construction project performance and staffing level requirements.

Data Collection

The research team developed a project database containing 7,154 projects that were substantially completed between 2014 and 2016 through a combination of online searches using STAs' publicly available datasets and data requests sent directly to STA employees.

Using the database of completed projects, 1,180 projects where identified as reflecting diversity across project type, size, geographic location, staffing levels, and project performance. The survey included questions on:

- Staffing level (whether the project was sufficiently staffed);
- Use of state employees and CEI consultants;
- Roles of construction staff (state employees and consultants); and
- Functions of construction staff (state employees and consultants).

241 project managers/resident engineers employed by 16 STAs responded to the survey, providing information on 305 recently completed highway construction projects.

Impact Of Utilizing CEI Consultants On Highway Construction Project Cost And Schedule Performance

Survey Findings

- Over one third (39%) of the 305 projects included in the survey were reported to have been understaffed.
- Staff shortage was the most frequently selected reason for outsourcing CEI work.
- 117 of the 305 (39%) surveyed projects utilized CEI consultants to some extent.
- CEI consultants were more commonly used on new road/expansion and bridge rehabilitation projects than other project types. Over half of the 31 new roads/expansion projects and the 34 bridge rehabilitation projects utilized CEI consultants.
- Average cost overruns for projects that used CEI consultants and projects that did not use CEI consultants did not differ significantly (Table 1). However, the use of CEI consultants had a statistically significant impact on project schedule performance.

	No Consultants	Used Consultants	p-Value	All
Average Schedule Overrun	-7.70%	20.20%	0.0012	2.40%
Average Cost Overrun	3.36%	3.34%	0.9901	3.35%

- Average cost overruns on projects with CEI consultants were close to those without CEI consultants, the distribution for projects with consultants was more concentrated near the two extremes, meaning more projects were finished within budget or experienced significant cost overruns.
- Projects with CEI consultants consistently experienced more schedule overruns.

- Survey results and project performance data were used to analyze whether using CEI consultants for a certain function impacted project cost and schedule performance.
- Results are summarized in the tables below. The highlighted functions showed statistically significant differences between average cost/schedule overrun of projects that used state staff only and projects that used CEI consultants.

Comparison of Schedule Overrun

CEI Functions	Did not Use CEI Consultants	Used CEI Consultants
Liaison	0.90%	14.90%
Budget	2.00%	-8.10%
Meetings	0.90%	12.00%
Record Prep/ Maintenance	-4.80%	26.50%
Change Orders	-0.50%	29.80%
Work Orders	0.80%	19.40%
Documentation	-1.50%	19.10%
Application for Payment	-1.30%	18.60%
Post-Construction Support	0.80%	20.10%
Survey Control	-1.00%	47.20%
Utilities	-0.20%	28.70%
Schedule	0.10%	19.40%
Construction Monitoring	-5.40%	25.30%
Geotechnical	-0.50%	63.90%
Material Sampling and Testing	-6.00%	28.60%
Quality Management	-1.50%	27.40%
Personnel	-1.50%	25.30%
Project Staffing	0.80%	23.30%
Public Relations	-1.40%	32.20%

Comparison of Cost Overrun

CEI Functions	Did not Use CEI Consultants	Used CEI Consultants
Liaison	2.99%	5.48%
Budget	3.51%	1.87%
Meetings	3.23%	3.90%
Record Prep/ Maintenance	3.55%	2.69%
Change Orders	3.28%	3.86%
Work Orders	3.20%	4.61%
Documentation	3.29%	3.50%
Application for Payment	3.28%	3.55%
Post-Construction Support	2.90%	8.10%
Survey Control	3.17%	5.30%
Utilities	3.09%	5.70%
Schedule	2.93%	6.20%
Construction Monitoring	2.93%	4.39%
Geotechnical	3.40%	2.65%
Material Sampling and Testing	3.60%	2.50%
Quality Management	3.30%	3.52%
Personnel	3.21%	4.06%
Project Staffing	3.17%	5.23%
Public Relations	3.16%	4.74%

- Survey respondents were asked to indicate how many FTE state staff as well as consultants were assigned to six different positions on their projects. The six positions include: Resident Engineer, Surveyor, Senior Inspector, Intermediate Inspector, Junior Inspector and Administrative Staff.
- Among all projects reported in the survey as having been fully staffed (n = 192) the average number of FTE staff varied among different positions.

CONCLUSIONS

In response to increasing workloads and diminishing staff, STAs have outsourced to CEI consultants various functional activities traditionally performed by in-house personnel.

- CEI consultants are used more commonly on larger, more complex projects and are usually employed as construction inspectors.
  - *With respect to specific functions, CEI consultants are used most frequently for construction monitoring, material sampling and testing, record prep/maintenance, documentation, and application for payment.*
- Compared to using only state staff, the use of CEI consultants does not impact highway construction project cost performance. However, projects that used CEI consultants experienced negative schedule impacts (20.2% schedule overrun) compared to fully agency-staffed projects.
  - *This difference was statistically significant. This result does not necessarily mean that CEI consultants are the sole cause of significant project overruns as the results may be skewed given that consultants are more likely to be used on large and complex projects, or due to the use of consultants requiring more administrative efforts.*
  - *Additionally, anecdotal evidence indicates that delays may be caused by lack of broad authority of CEI consultants (compared to agency staff) and the additional levels of managerial approval required when using CEI consultants.*
- Projects that used some level of CEI consultants had higher numbers of FTEs than projects that only used agency staff.
  - *Increased oversight required from state staff due to consultants not being familiar with state regulations and procedures or not having the same level of authority as in-house staff.*
- While the survey results may provide insights on when and how CEI consultants can be utilized to effectively allocate available human resources, recommendations should be made based on individual agency policies, regulations, and needs.

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	No Consultant	Used Consultants
Avg. Schedule Overrun	-7.70%	20.20%
Avg. Cost Overrun	3.36%	3.34%

Other Ideas

- Uber has travel time trends through Uber Movement – free data for research and analysts
- Innovation – No Boundaries Pooled Fund
  - Sign Refurbishing – 10% savings of annual operating budget for sign shop
  - MNDOT
    - Idea → Submit → Award → Evaluation → Final Assessment → **Implementation**
- Six Minute Pitch – Shark Tank