Enhancing State DOT Work Zone Safety by Integrating Internal Traffic Control Plan

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Introduction

- In 2023, a total of 898 people were killed, and 40,170 were injured in work zone crashes in the United States.
- Work zone crashes are further estimated to result in more than $38.9 billion per year in damages and losses.
- By analyzing worker fatalities at road construction sites from 2011 to 2022, it is found that 12% of the workers are killed by contact with objects or equipment, 47% are killed by being struck by vehicles (2 in 10 workers are killed by dump trucks), and 28% by other transportation incidents, including driving to and from the site.
- Internal Traffic Control Plans (ITCPs) are designed to manage these internal movements and reduce conflicts between workers and equipment.
- This study evaluates the feasibility and potential benefits of integrating ITCPs into state-level work zone safety practices.
- Through a combination of literature review and expert interviews with state agencies, researchers, contractors, and industry leaders, the study investigates current practices, implementation challenges, emerging technologies, performance metrics, and cost-benefit analysis that can enhance internal traffic control.
- The findings contribute to establishing the recommendations associated with this study.

Table 1: Comparison of ITCP, TCP, and TMP

Plan	Area	Focus	Movement	Includes
Internal Traffic Control Plan (ITCP)	Work areas not open to public traffic	Internal movements	Workers, equipment, passengers	Movements in work areas
Traffic Control Plan (TCP)	Areas outside and adjacent to ITCP	Public traffic and pedestrians	Entry and exit through work zone	Safe traveler movement; not internal work patterns
Traffic Management Plan (TMP)	Regional / area level	Impact of TCP	Travelers through or around project	Detours, alternatives, community outreach

Research Methodology

- Three primary components: literature review, expert interviews, and thematic analysis of responses.
- Existing literature related to work zone safety, TCPs, TMPs, and ITCPs, including guidance documents from federal agencies, industry standards, academic research publications, and state DOT manuals was reviewed to understand current work zone safety practices and identify gaps related to internal traffic control planning.
- Structured interviews were conducted with representatives from state DOTs, academic institutions, technology providers, and national safety organizations that can be divided into three sections: interview questionnaire design, reaching out to interviewees, and the interview process.
- The collected data were then analyzed using a qualitative thematic analysis approach, identifying common patterns, best practices, and implementation challenges, and these findings were used to develop recommendations for improving ITCP integration within existing work zone safety frameworks.

State of the Art Practices

- ITCP implementation is not uniformly mandated across states, and enforcement often depends on contractor practices or internal company safety policies.
- Only one state DOT (Michigan DOT) requires ITCP in their work zone safety and mobility manual, indicating that the responsibility of developing ITCP is transferred to the contractor.
- Another state DOT only mentions ITCP as their best practices but has no requirements (Colorado DOT).
- Ajax Paving is one of the contractors that promote and develop ITCP documentation outlining how workspaces are organized to manage the movement of construction vehicles, equipment, and workers safely within a job site.
- Benefits of ITCP can be summarized from the literature: reduction of worker–vehicle conflicts (50 or 60 fatalities every year due to internal work zone crashes), enhanced communication and training (including direct communication between spotters and workers), improving traffic flow (designating safe routes).

Analysis and Results

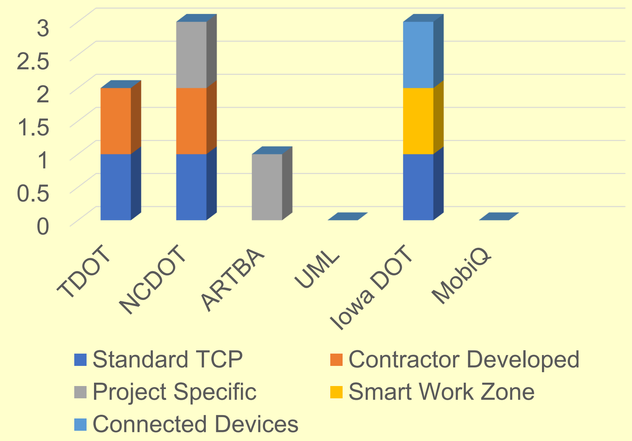


Figure 1: ITCP/TCP models used by agencies

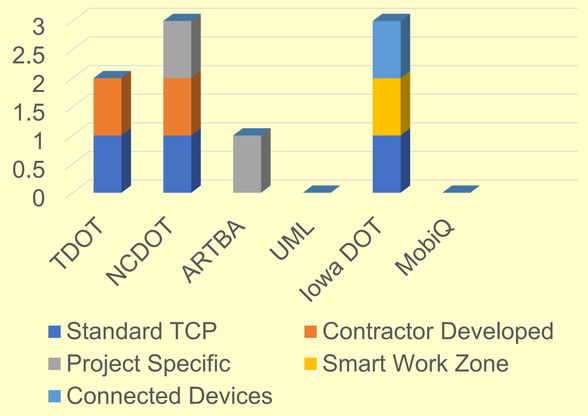


Figure 2: ITCP/ TCP model types implemented by agencies

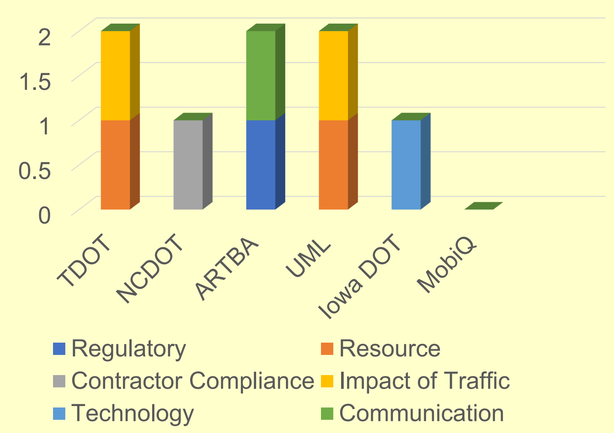


Figure 3: ITCP/ TCP implementation challenges by agencies

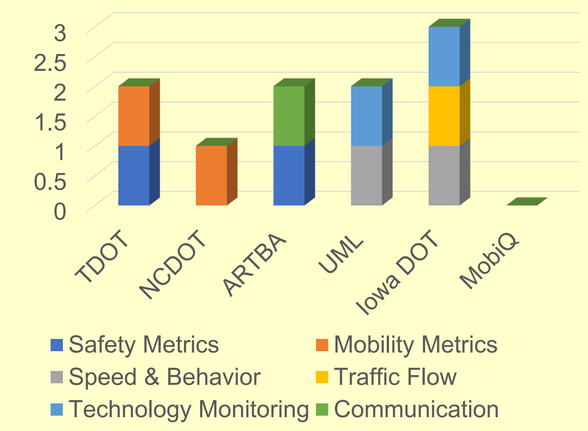


Figure 4: Type of performance metrics used by agencies

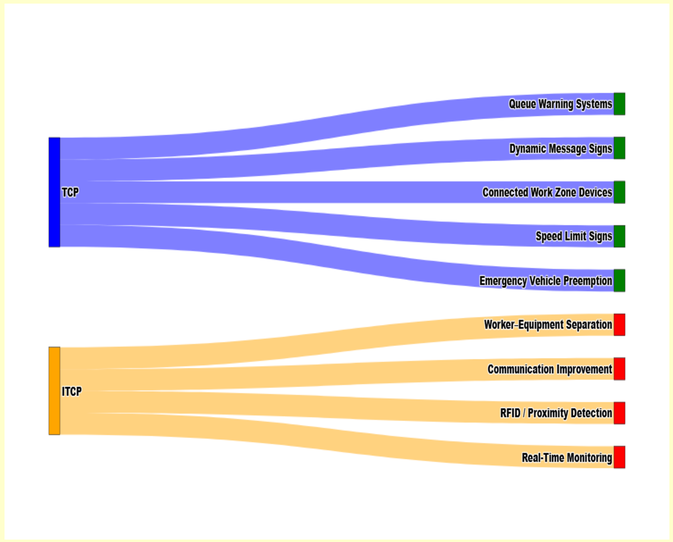


Figure 5: Sankey Diagram of best practices and technologies differentiated for TCP and ITCP

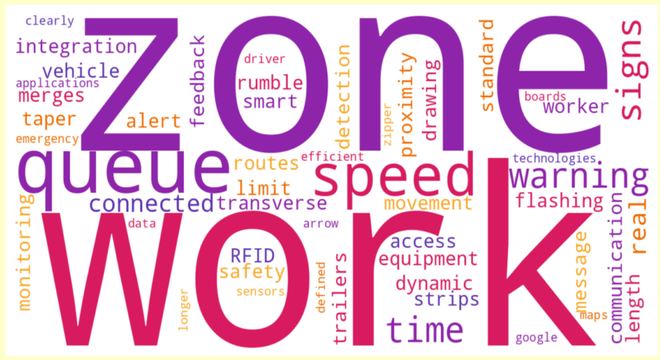


Figure 6: Word Cloud of best practices and technologies of TCP and ITCP

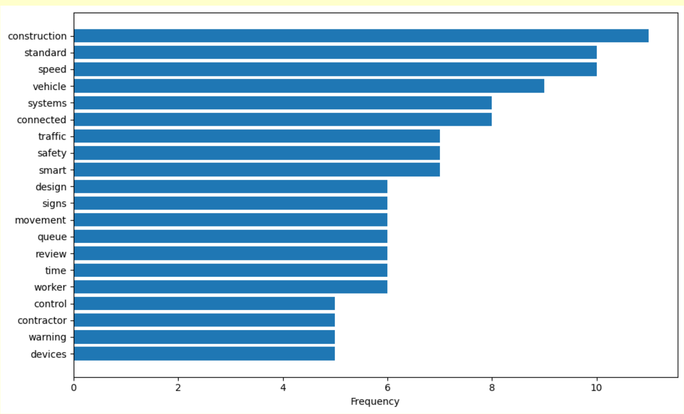


Figure 7: Top content words in responses (technology-enabled traffic control is recurring theme)

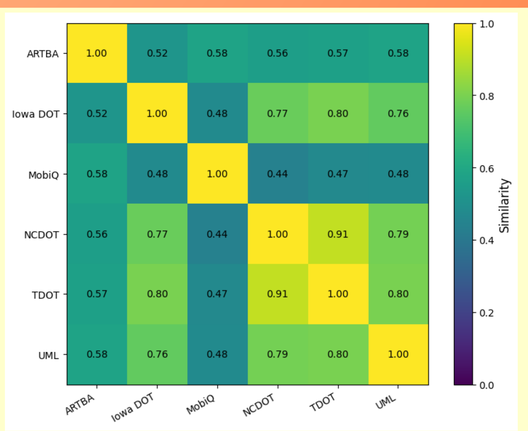


Figure 8: Cosine similarity between responses in different agencies

Discussion

Recommendations

- Establish policy for ITCP
- Follow FHWA 8-step guidance
- Implement worker detection technologies
- Establish a clear communication protocol

Acknowledgement

- This study is supported by New Jersey Department of Transportation (NJDOT).