Utilization of TSMO Practices in Highway Construction Work Zones: A Case Study

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TSMO and Highway Construction

• Congestion (Queuing) in highway construction work zones, and associated present risks and challenges:
  • Increased potential for secondary crashes in lengthy queues, especially if no advance warning is present.
  • User delays, both in convenience and actualized user costs.

• Safety Considerations Regarding Traffic Control Planning
  • Lane Closures – night only (Lane Closure Planning Tool)
  • Separation Methods for head-to-head traffic
  • Traffic Incident Management (TIM) Planning
  • Considerations for emergency response to incidents
  • Intelligent Work Zone (IWZ) Device Utilization
Case Study – I-35 Project, Warren County, IA

• Reconstruction of southbound lanes of I-35 in vicinity of Iowa 92 Interchange (3.6 miles).

• Reconstruct bridge over Middle River in southbound lanes.

• Portland cement concrete pavement and grading on new alignment

• 2017 construction with calendar day completion (w/I/D clause)
Case Study – I-35 Project, Warren County, IA

• Traffic maintained on northbound lanes of I-35 in head-to-head configuration (northbound lanes and interchange reconstructed in 2016).
• ADT (2015) = 22,700 vpd, 10% trucks
• Project located just south of Des Moines, with commuter traffic peaks in morning and evening rush periods
• Additional traffic increases identified on Thursday/Friday evenings in southbound direction
Previous I-35 Construction Projects in Warren County

• Companion project on I-35 in northbound lanes, constructed 2016, experienced queuing delays, and serious crashes, with injuries and a fatality

• Project at North River just north of work zone in 2016 experienced serious crash resulting in fatality

• Median pipe construction project south of work zone in 2016 experienced significant queuing delays

• Project in Cumming Interchange area in 2014 experienced major incident requiring 8 hour closure on I-35
Previous I-35 Construction Projects in Warren County

• Companion project experienced head-on collisions with serious injury and a fatality in multiple incidents
  • Utilized standard traffic control measures to separate opposing traffic (“bricks and sticks”)
  • Provided delineation of lane separation
  • Minimal positive protection in an off-tracking situation
Previous I-35 Construction Projects in Warren County

• TSMO improvements added to companion project on I-35 in northbound lanes, following serious crash incidents
  • Utilization of temporary barrier rail (TBR) between opposing lanes of traffic in the head-to-head condition
  • Queue protection and response vehicles stationed on each entry point of the project to provide advance warning of queuing situations
  • Contractor provided equipment on-call for quick response, repair and removal in the event of an incident within the work zone
  • Speed limit between multiple works zones in 10 mile section of NB direction reduced to 55 mph to prevent differential speed limits between work zones
Development (Design) Phase Considerations

• Experience from 2016 project allowed for incorporation of many of the TSMO concepts in the development phase of the project
• Providing for the TSMO components in the design and other contract documents allowed for uniform bidding and better coordination of efforts
• User safety, emergency response, and traffic management were the primary considerations when developing the TSMO components for the project
Temporary Barrier Rail with Access Gaps

• Temporary Barrier Rail (TBR) utilized on centerline between opposing traffic.

• Replaced channelizer markers and tubular markers – “bricks and sticks”.

• TBR provides positive barrier between opposing traffic flow, alleviates potential for head on collisions.
Temporary Barrier Rail with Access Gaps

• Provided four 30-foot long access gaps in barrier rail for emergency access.
  • Impact attenuators on each side of 30-foot gap.

• Gaps intended to permit emergency vehicles (law, rescue, fire, towing) to access incident from opposite side of roadway.

• Spring load tubular markers in gap deter U-turns
Speed Feedback Trailers (SP-150166)

• Speed feedback trailers placed upstream of lane closures to reduce traffic speed entering lane taper and single lane traffic condition.

• Effective in reducing speeds entering the project.

• Project plan location of installations were inside taper; additional feedback trailers added upstream.
Traffic Monitoring with Incident Response
(SP-150167)

• Modified the Standard Specification for Traffic Monitoring with Incident Response.

• Modeled the incident response vehicle after the “Highway Helper” vehicles” – providing assistance in work zone.

• Communication with Iowa DOT’s TMC added for incident response.
Traffic Queue Protection and Response (SP-150167)

• Added to contract by Special Provision.

• Two trucks with Portable Dynamic Message Boards (PDMS) mounted to vehicles.

• Trucks stationed outside of the project limits (lane closures).

• Original requirement for TL-3 truck mounted attenuator – this was eliminated for mobility.
Traffic Queue Protection and Response (SP-150167)

• As queue or other traffic incidents occur, trucks deploy upstream of queue.

• TMC provides messaging for PDMS.

• Queue response vehicles display warning messaging to incoming traffic.

• Stationed on shoulder, can move upstream if queue increases.
Intelligent Work Zone (IWZ) Tools

• Intelligent Work Zone (IWZ) tools used throughout work zone.
• Part of Iowa DOT’s Traffic Critical Project (TCP) Program.
• Coordinated with TMC, Traffic Operations (Central and District), Iowa State University (InTrans).
• Real time information provided to 511 system and other traffic management portals.
• Identified equipment prior to project start up and additional equipment additions/modifications as traffic is evaluated in work zone.
Intelligent Work Zone (IWZ) Tools

- Traffic cameras (including streaming video)
- Queue detection sensors
- Portable dynamic message boards (PDMS’s)
- INRIX data
Extra Enforcement Efforts

• Iowa DOT Extra Enforcement Program utilizes law enforcement to use extra patrols in traffic critical projects.

• Identified projects each year, funding pays for overtime for law enforcement to perform extra patrols.

• Iowa DOT Motor Vehicle Enforcement, Iowa State Patrol, Local Law Enforcement.
Traffic Incident Management (TIM) Plan

• Traffic Incident Management (TIM) Plan developed for I-35 in Warren County in years prior to this project.

• Identifies designated detour routes in the event of traffic incidents on I-35.

• Plan is very detailed, including messaging for PDMS’s, specific detour routes based on location of incident.
Traffic Incident Management (TIM) Plan

• Plans developed with input of all shareholders: Iowa DOT, Local Government, Law Enforcement, Rescue Services, Towing Services, and others as necessary.

• Plans periodically updated.

• Clears roadway – reduces chances of queues/secondary crashes.
Traffic Management Center (TMC)

• Located in Iowa DOT’s Ankeny Complex.
• Operates 24-7-365.
• Operation Center monitors transportation systems.
• Responds to incidents.
• Coordinates assistance and traffic control activities.
• Can operate all message boards remotely.
Traffic Management Center (TMC)

• For project, telephone communication between project staff and TMC coordinates operations during incidents.

• PDMS messaging, 511 entries, TIM route recommendations, deployment of local Maintenance staff, notification to DOT key staff for collaboration, notification to local responders.
Pre-Construction “Pre-Action” Meeting

• Pre-Action Meeting held in advance of primary traffic switch.

• All shareholders invited – Iowa DOT (Central/District), Law Enforcement (State/Local), Responders/Rescuers, Contractors, Towing Services.

• Discussion Items:
  • Project Staging and Schedule
  • TSMO Concepts and Responsibilities
  • Communications – with TMC, Contractor, DOT Staff, Law Enforcement, Others
  • TIM Plan – preferred detours based on other construction in area
  • Utilization of gaps
After Action Reviews

• After Action Reviews (AAR’s) held following significant incidents.
• All Shareholders invited to participate.
• Review of incident and traffic management.
• What went well?
• What could be improved?
• Results have included modified traffic control setups or TIM detour selection.
• Great tool to initiate dialogue.
Review and Adjust Traffic Control

• Incidents in area approaching “chute” – added TBR on outside to north
• Additional speed feedback trailers - placed further upstream of lane tapers.
• Weekly meetings allowed for discussion and review of traffic safety and traffic control setup as project progresses.
• Analysis of traffic data on TCP website (ISU/IDOT) – heat map, queuing incidents, etc.
TCP Traffic Data

Includes “Heat Map” data from Work Zones to identify queuing events
TSMO Efforts
Results to Date
Positive Results of TSMO Efforts on Project

- No head on crashes have occurred in the work zone despite the head-to-head configuration. TBR contacts observed.
- No serious injuries to date from crashes on project site.
- No secondary crashes to date identified.
- Reduction in queuing events in project site compared to 2016 project.
- Queuing situations reduced or eliminated in traffic incident situations with assistance of TIM plan utilization, enforcement efforts, and advance queue notification messaging.
- Better communication channels between partners in construction, traffic operations, law enforcement, towing services, and better incident management has resulted.
Areas for Improvement and Review

• Design and Location of Access Gaps in the TBR:
  • Turning radius issues with 30’ gap for larger tow units and trucks.
  • Potential for snagging impact issue at impact attenuators.
  • Best location determination for gaps with respect to emergency response.

• Queue Protection and Response Vehicles:
  • Appropriate size and configuration of units.
  • Utilization and number of units (stationary or moving).

• Reporting of Activities – Traffic Monitoring and Queue Protection
  • Documentation of response and assistance activities needs standardization.
Thank You!