Work Zone Safety: Speeds, Distractions & Traffic Control Plans

TZD Conference – November 2017

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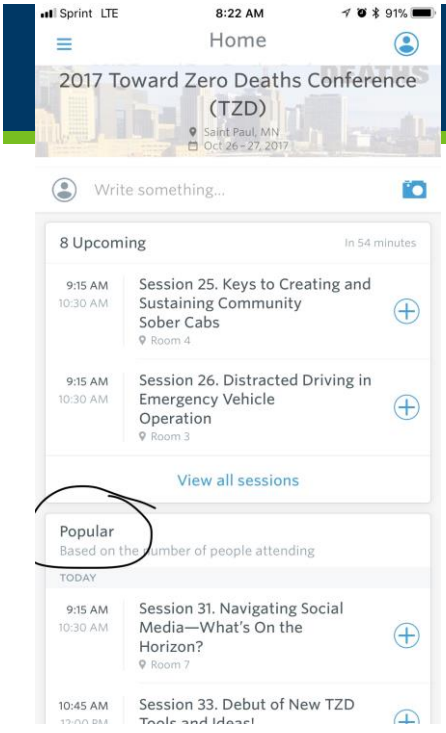
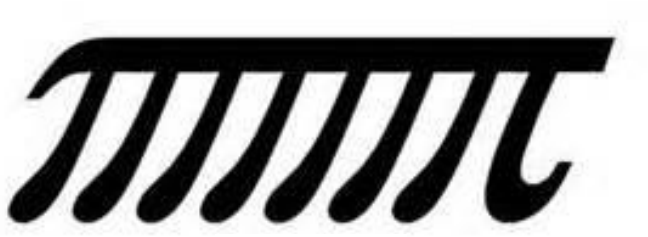
DEPARTMENT OF TRANSPORTATION

ATSSA SAFER ROADS SAVE LIVES



Like I'm in high school

Pop Quiz



What we'll cover

- Crashes in WZs
- Contributing Factors
- Possible Solutions
  - Well-engineered temporary traffic control zones
  - Enforcement
- Risk mitigation with Traffic Control Plans

General Research related to WZ Crashes

- ~22% increase in crashes when work zone is in place
  - Ktattak et al, 2002
- Factors
  - Worker & equipment presence
  - Nearby temporary barriers
  - Narrowing lanes, transition areas, reduced overall road cross-sections, lane closures

Parameters

- Three years: 2012-2014
- Work zone crashes include any crash coded with a valid work zone type.
- Severe crashes are defined as fatal (K) or incapacitating injury (A) crashes.
- Percentages were calculated as the value of interest per total number of crashes.

By the Numbers (over 3 years)

Work Zones & Total

5,569 Crashes 226,405

58 Severe Crashes 3,963

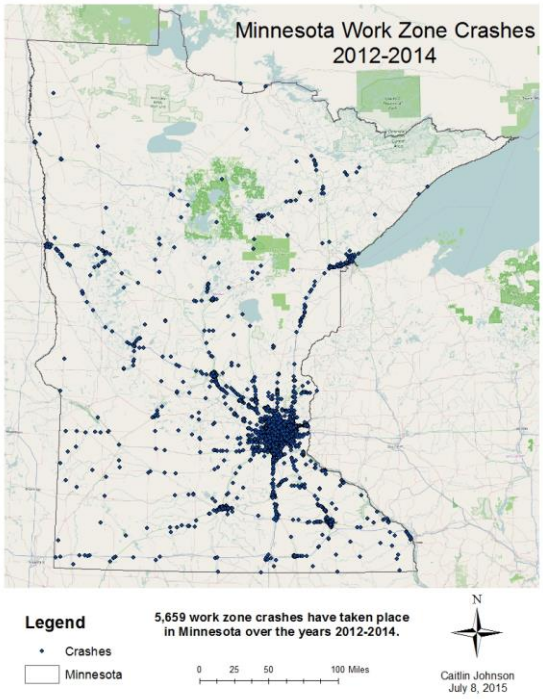
24 Fatalities 1,179

40 Incapacitating Injuries 5,753

2,270 Total Injuries 89,721

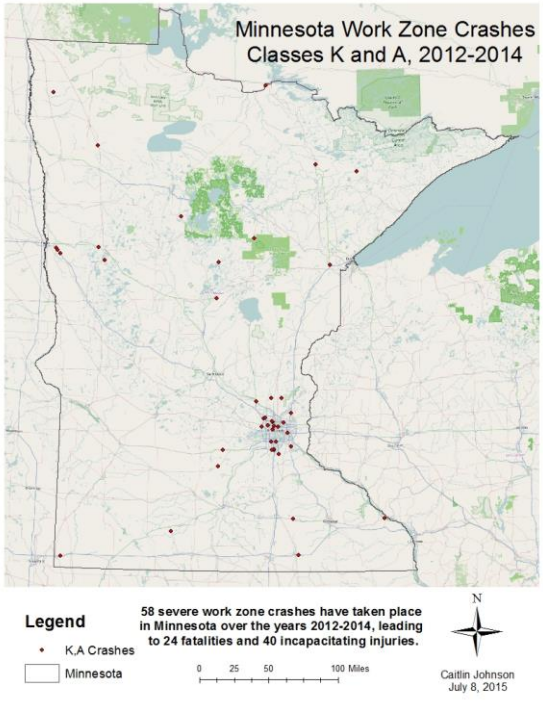
119 Vehicles (Severe) 6,212

11, 489 Vehicles (All) 410,216



Crash Map

All Work Zone Crashes

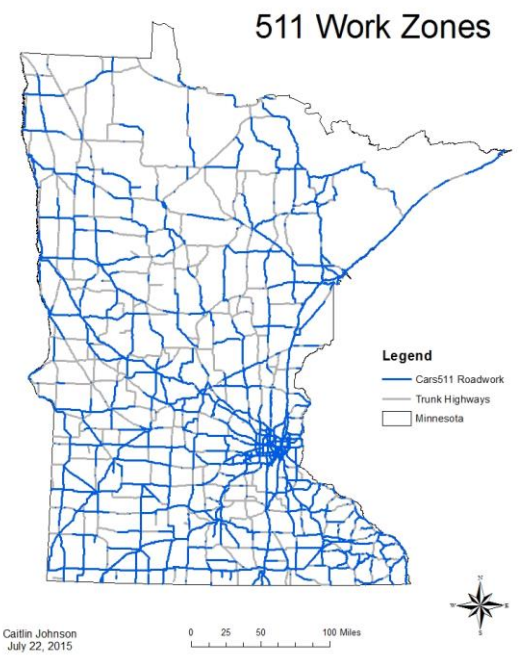


Crash Map

Severe Work Zone Crashes

Exposure

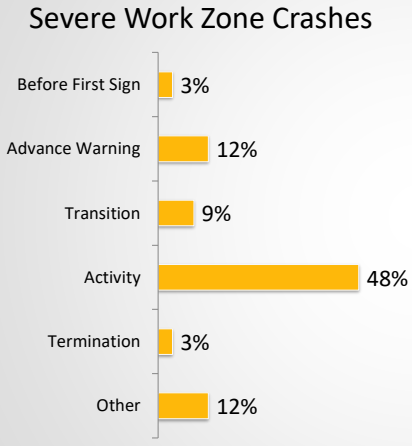
- The map to the right displays 2012-2014 data collected by 511 regarding work zone locations.
- The dataset for 2012 is incomplete, but all records are included for 2013 and 2014.
- 511 does not include any mobile work zones. The data shown here may be any stationary work zone from a one-day project to a long term work zone.



WORK ZONE STATISTICS

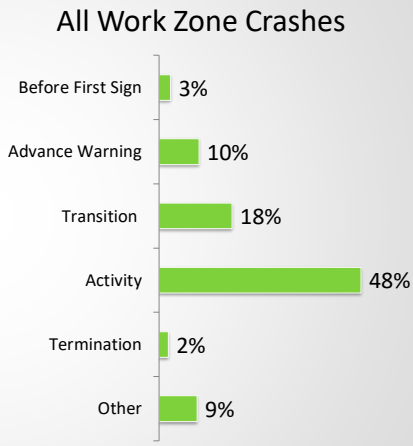
Comparing Work Zone Crashes with Other Crash Datasets

Location in Work Zone



Workers were present for 6 (10.3%) crashes.

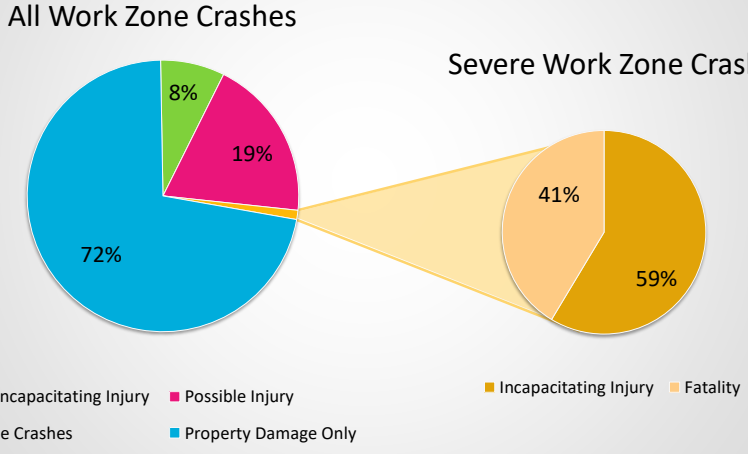
Total Crashes: 58



Workers were present for 1,703 (30.1%) crashes.

Total Crashes: 5,659

Severity

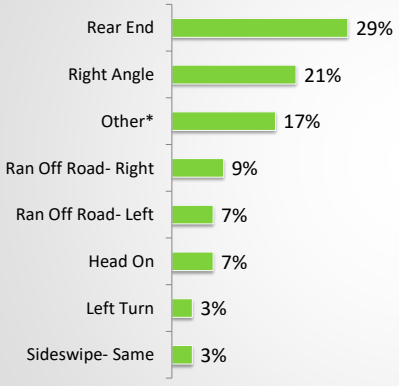


Total Crashes: 5,659

Total Crashes: 58

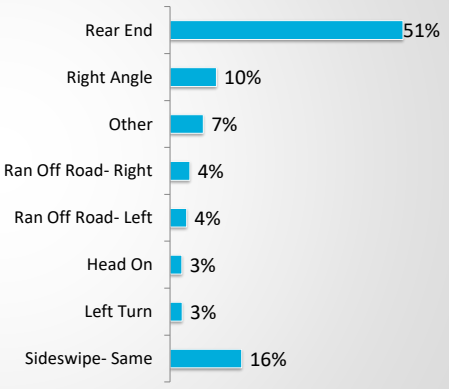
Crash Diagram

Severe Work Zone Crashes



Total Crashes: 58

All Work Zone Crashes



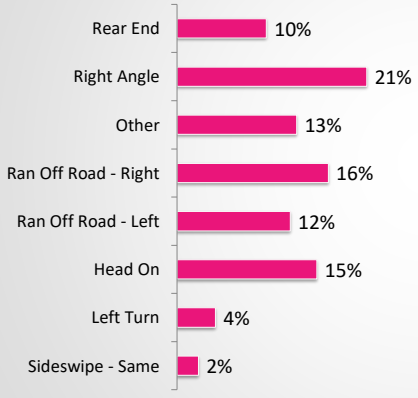
Total Crashes: 5,659

* "Other" collisions included: 1 pile-up, 2 pedestrian, 1 construction equipment, 4 motorcycle (hit drums, median, milled pavement), 1 non-collision

Note: Sideswipe- Opposing and Right Turn crashes were omitted from the "All Work Zone Crashes" graph, for purposes of comparison, because no fatal or serious crashes were of these types of collisions.

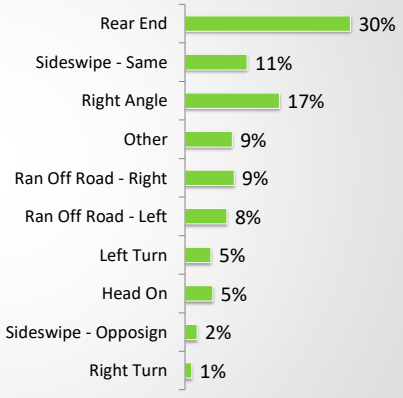
Crash Diagram

All Severe Crashes



Total Crashes: 3,963

All Crashes

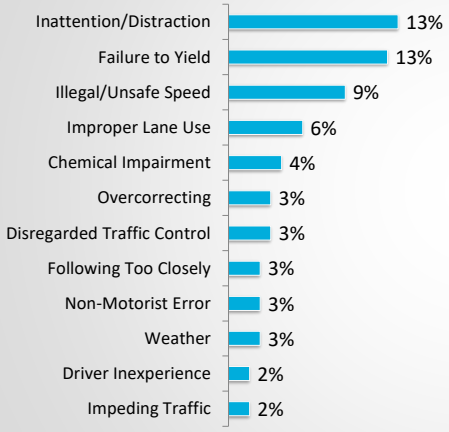


Total Crashes: 226,405

Note: Sideswipe- Opposing and Right Turn crashes were omitted from the "All Severe Crashes" graph, for purposes of comparison, because none of the severe work zone crashes were of these types of collisions.

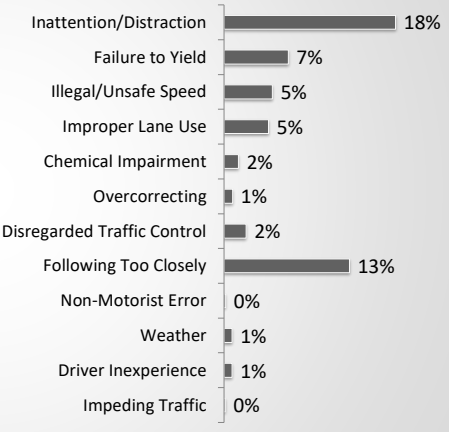
Contributing Factors

Severe Work Zone Crashes



Total Vehicles: 119

All Work Zone Crashes

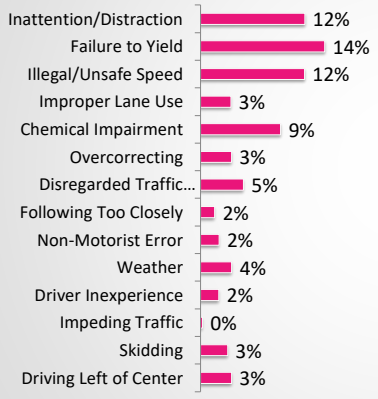


Total Vehicles: 11,489

Notes: 1) Percentages were determined as the number of crashes due to each factor per total number of vehicles involved in crashes. 2) For purposes of comparison, contributing factors that didn't lead to serious crashes were omitted from the "All Work Zone Crashes" graph. Omitted from both graphs were skidding, improper passing, and driving left of center, which each contributed to one serious crash but had negligible (<1%) percentages. "Other" contributing factors were also omitted.

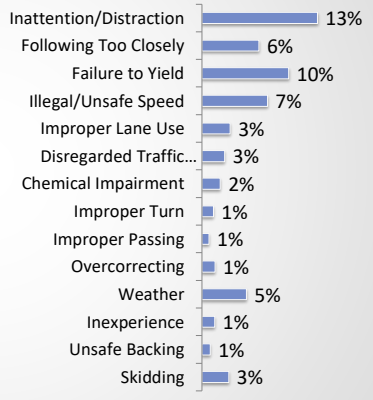
Contributing Factors

All Severe Crashes



Total Vehicles: 6,212

All Crashes

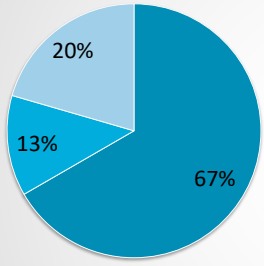


Total Vehicles: 410,216

Notes: 1) Percentages were determined as the number of crashes due to each factor per total number of vehicles involved in crashes. 2) Some factors were omitted from the "All Severe Crashes" graph, for purposes of comparison, because none of the severe work zone crashes were of these types of collisions. Improper passing was also omitted, which contributed to one severe work zone crash but had a negligible (<1%) percentage. "Other" contributing factors were also omitted from both graphs.

Vehicle Type

Severe Work Zone Crashes

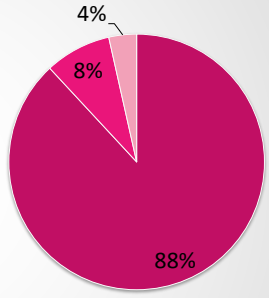


"Other" Includes:

- **7 Pedestrians**
- 2 Bicycles
- 12 Motorcycles
- 1 Motorhome/RV
- 1 ATV
- 1 Construction

Total Vehicles: 119

All Work Zone Crashes



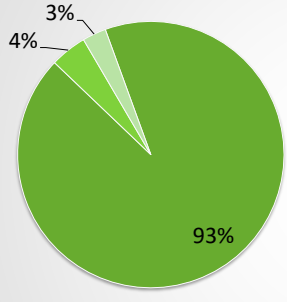
"Other" Includes:

- **51 Pedestrians**
- 33 Bicycles
- 125 Motorcycles
- 10 Mopeds/Scooters
- 11 Farm
- 13 Motorhome/RVs
- 2 ATVs

Total Vehicles: 11,489

Typical Commercial Vehicle Data

All Crashes



"Other" Includes:

- **2,582 Pedestrians**
- 2,612 Bicycles
- 3,936 Motorcycles
- 197 Motorhome/RV
- 223 Snowmobile/ATV
- 371 Scooters/Mopeds
- 426 Farm
- 37 Skaters

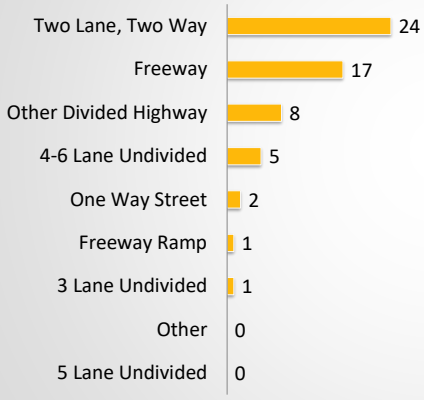
Total Vehicles: 410,216

Percentage of Traffic

- Only have trunk highway data for 2013.
- Typical volumes – may be different when work zones are present.
- Heavy vehicles made up 8.25% of the total vehicle miles traveled.

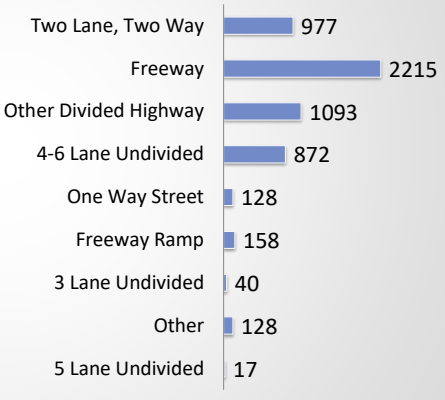
Road Type

Severe Work Zone Crashes



Total Crashes: 58

All Work Zone Crashes

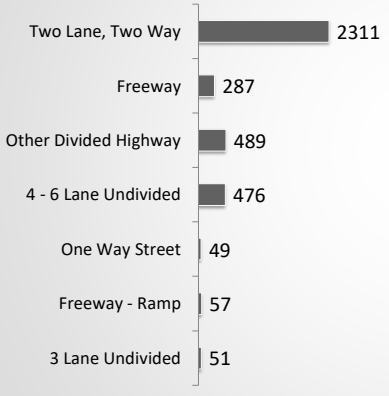


Total Crashes: 5,659

Note: Many of the "All Work Zone Crashes" reports coded "other" for road type were found to be 4-6 lane divided roads not commonly considered highways (sections of University Ave, for example).

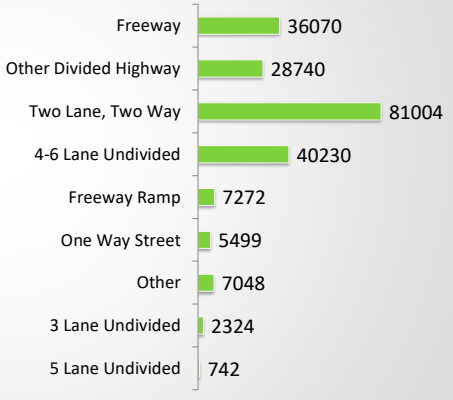
Road Type

All Severe Crashes



Total Crashes: 3,963

All Crashes



Total Crashes: 226,405

Note: For purposes of comparison, Alley/Driveways, Privately Owned Roads, 5 Lane Divided, and Other were excluded, because no work zone accidents occurred on this type of road.

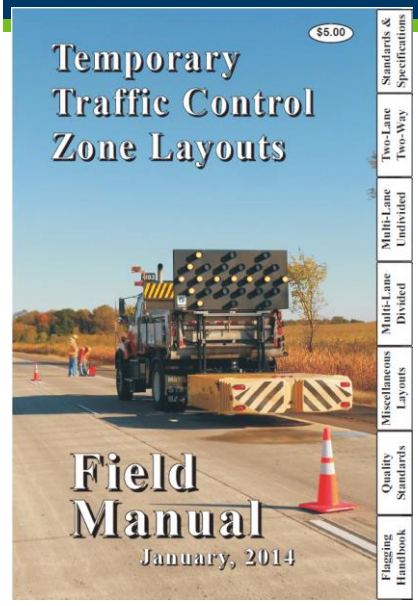
DEPARTMENT OF TRANSPORTATION

WZ Crashes - Possible Solutions

Mn MUTCD Chapter 6B

- Seven fundamental principles of TTC
  1. General plans or guidelines should be developed
  2. Road user movement should be inhibited as little as practical
  3. Motorists, bicyclists, and pedestrians should be guided in a clear and positive manner
  4. Routine day and night inspections of TTC elements should be performed
  5. Attention should be given to the maintenance of roadside safety
  6. Training appropriate to the job
  7. Maintain good public relations

1. Plan should be developed



A TTC plan should be prepared and understood by all responsible parties before the site is occupied.

Any changes should be reviewed and approved by agency

Consistency - reduces user confusion

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2. Road user movement inhibited as little as possible

- Avoid frequent and/or abrupt geometric changes
- Schedule work to minimize closures and get open to traffic
- Reduce traffic volumes – consider alternate routes or closures
- Accommodate pedestrians and bikes
- Schedule off-peak, if possible. Consider night work.
- Early coordination with locals and EMS
- Speed

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Reduce traffic volumes – consider alternate routes or closures

Detours and road closures:
- Often reduces length of work
- Improves overall safety

Considerations
- Capacity of roadway
- Traffic volumes
  - ADT (Average Daily Traffic)
  - Vehicles per hour

Speed Limits in Work Zones

- Why do workers want speed limits?
- How effective are speed limits in work zones?
- What are the speed limits that can be used in a Work Zone?


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MINNICH MFG.

Speed Limit Sign (only)

Table 1. Potential Voluntary Speed Reductions for Various Work Zone Conditions.

Work Zone Condition	Potential Voluntary Speed Reduction*
Work Zone Reduced Speed Limit Sign	0 to 3 mph
Barrier Near Inside Travel Lane	0 to 3 mph
Lane Encroachment	1 to 5 mph
Lane Closure	1 to 7 mph
Construction Vehicle Access/Egress Location	5 to 6 mph
Temporary Crossover	4 to 9 mph
Two-Lane, Two-Way Barrier Separated Traffic	7 to 9 mph

** The speed reductions listed are based on a study conducted in Texas. Operating speeds upstream of the work zones ranged from 60 mph to 77 mph.*

Drivers disregard static signs that don't reflect current driving speeds

Source: *Guidelines on Managing Speeds in WZ* – Roadway Safety Consortium, published by FHWA, available on www.workzonesafety.org

Speed Limit Sign Effectiveness – with other enhancements

Table 2. Potential Speed Reductions for Various Speed Management Techniques.

Speed Management Technique	Potential Speed Reduction*
CB Radio Information Systems	0 to 2 mph
Narrow Lanes With Channelizing Devices	0 to 5 mph
Transverse Pavement Markings	0 to 5 mph
Portable Changeable Message Sign With Radar	0 to 6 mph
Drone Radar	2 to 3 mph
Transverse Rumble Strips	2 to 5 mph
Speed Display Trailers	2 to 10 mph

** The speed reductions listed are based on a number of studies, and the results vary considerably.*

15 mph reduction in some situations
5-10 mph reduction more common

Advisory Speeds

- Application
  - For driver safety – let driver know a safe speed to travel to negotiate a potential hazard
    - Bumps, low shoulders, bypass indicating the curve, narrow lanes, lane shift, poor road surface, etc
  - **For worker safety at spot locations – let driver know that there are workers ahead**

- Authority
  - Warning sign needed
  - Established by the District per the MN MUTCD Part 6H-2

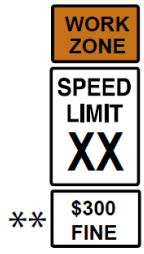
Can be as effective as regulatory speed limit

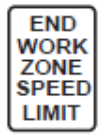
Workers Present Speed Limit

- Regulatory speed limit
  - Engineering study not needed
  - Required 45 mph under certain conditions
  - Or agency determined
    - At MnDOT - District Traffic Engineer or designee
  - Workers have to be present
- What can the speed limit be?
  - Required 45 mph under certain conditions
  - No more than 20 mph reduction – existing 55 mph or greater
  - No more than 15 mph reduction - existing 50 mph or less

Workers Present Speed Limit

- Application
  - For worker safety, established in short-term projects during continuous worker activity **when workers are present** and are adjacent to moving traffic.
- Examples:
  - Pavement repair, loop detector installation, M&O, concrete joint repair & crack sealing.





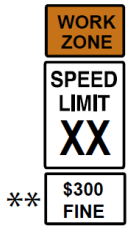
24/7 Construction Speed Limit

- Authority
  - Regulatory speed limit allowed by MN Statute 169.14 Subd 4, same statute as permanent regulatory speed limits
  - Established by Commissioner as recommended by District Traffic Engineer (requires "engineering and traffic investigation")
- Engineering and traffic investigation
  - Traffic Control Plan, idea of staging, location of geometric issues, narrative with reasons why.
- Speed limit should be monitored and verified that it is appropriate for activities
  - Investigation is done prior to the actual set-up

24/7 Construction Speed Limit

- Application
  - Regulatory speed limit intended for **24 hour** posting where motorists must reduce speeds **to safely navigate** the work zone. Primarily for driver safety.
  - Typical 10 mph reduction – research shows that compliance to 10 mph reduction much more likely than greater speed limit reductions
- Examples
  - Bypasses, shoulder drop-offs, narrow lanes, grade separations, and pavement repair.

W3-5



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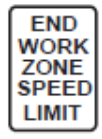

Dynamic Speed Display Sign

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Incidence response

- Plan for incident response in the Transportation Management Plan
- Tow trucks clearing crashes

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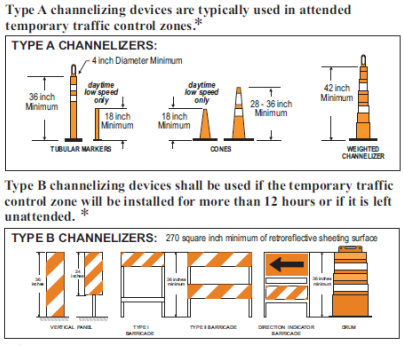
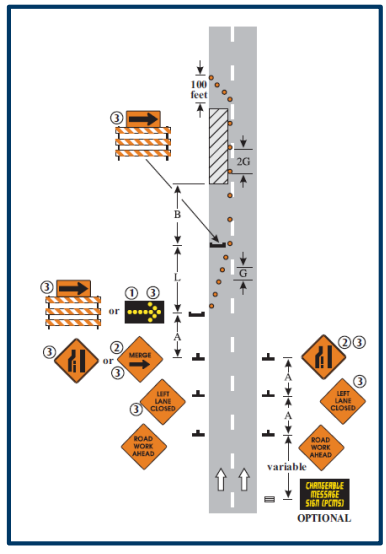
3. Guided in a clear and positive manner

- Use devices to highlight travel path. Remove inconsistent devices for long-term. Don't confuse the road user.
- Long-term – change pavement markings



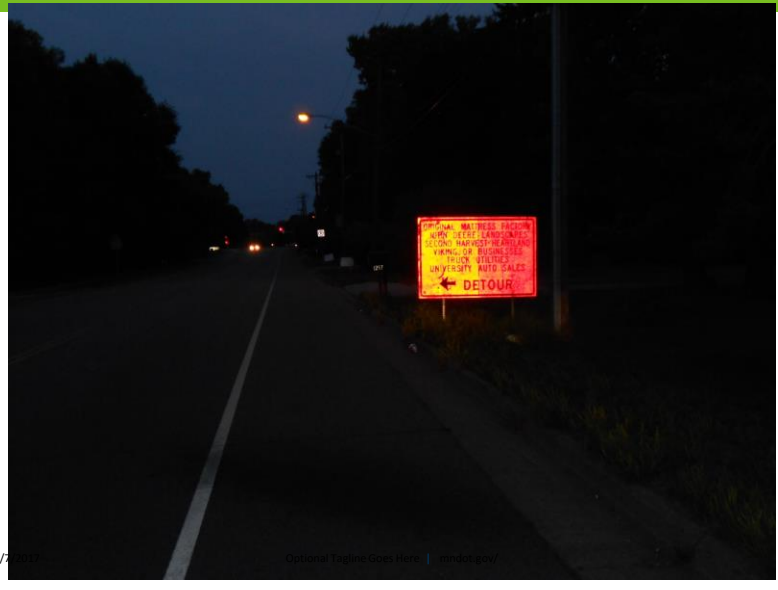


Thoughts about devices

- More devices are often warranted
  - Taper area (night or high volume)
  - Open areas subject to wind
  - Particularly hazardous situation
    - Closed roads
    - Workers close to traffic
    - Large drop-off that is not obvious

- When is less desired? (Rare occasions)
  - Signing can get too cluttered
    - Information Overload
  - Construction signing can block other critical signing

Positive guidance?



4. Inspections

- Routine day and night inspections.
- Knowledgeable individuals responsible. Check that devices are consistent with TTC plan and are effective.
- Modify TTC controls to provide mobility, positive guidance, and safety. Staff responsible for TTC should be able to halt work.
- Monitor TTC zone under various conditions and check devices.
- Monitor crashes.

SAMPLE
PROJECT INSPECTION CHECKLIST

PROJECT - _____

ITEM	YES	NO	HOW MANY?
1. Are any devices missing?	☐	☐	_____
Do any devices need repair?	☐	☐	_____
Were all replaced or repaired?	☐	☐	_____
2. Are any lights (flashers, etc.) not functioning	☐	☐	_____
Were they all replaced or repaired?	☐	☐	
3. Are any devices improperly placed?	☐	☐	_____
Were all positions corrected?	☐	☐	
4. Do any devices need cleaning?	☐	☐	_____
Were all devices cleaned?	☐	☐	
ADDITIONAL COMMENTS ON THE BACK OF THIS FORM	☐	☐	

The above check was completed by _____
(name / title)

on _____ at _____ ☐ a.m. ☐ p.m.
(date) (time)

5. Roadside safety

- Clear zones provided when practical.
- Channelization effective and crashworthy.
- Equipment, vehicles, materials, and debris stored to reduce run-off-the-road crashes.

Temporary barriers

Trailer/Truck Mounted Attenuators

6. Training

- Appropriate to your job.
- Only those trained in TTC practices should supervise the selection, placement, and maintenance of TTC devices.

7. Good public relations

- Advance notice for all appropriate road users.
- News releases.
- Assess needs and accommodate (as practical) property owners, residents, and businesses.
- Coordinate and accommodate with EMS providers.
- Assess needs and coordinate with railroads and transit.
- Assess needs and coordinate with commercial vehicles.
  - Alternate route may be better.

Questions?

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