

Better Roads

For the Government/Contractor Project Team

November 2003

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Special Feature

How MnDOT Sets Speed Limits for Safety

Setting the best speed limit to increase road safety is an important part of the Minnesota DOT's safety program

by Ruth W. Stidger, Editor-in-Chief

Safety in street and highway work zones is an area of emphasis for the Minnesota Department of Transportation. Many improvements in work-zone safety are being implemented. One of these improvements is the increased use of speed limits to control vehicle speeds through street and highway work zones. Proper and uniform application of these speed limits should improve the safety of the highway worker and the traveling public.



Vehicle speeds are reduced by the placement of speed-limit signs, and the presence of active enforcement results in the best compliance to the posted limit. The work-zone speed limit should not be considered a cure-all for work-zone safety problems, but only a portion of the overall project control plan. Speed advisories should be considered prior to instituting a regulatory work-zone speed limit. Studies have shown a high level of compliance with the advisory signs and there is little difference in traffic performance between regulatory and advisory signing.

The safest work zone is one that minimizes worker and motorist accident probability and does not present roadway conditions that violate driver expectations. This safe environment is created by strict and uniform adherence to the Minnesota Manual on Uniform Traffic Control Devices, including the Field Manual. Reduced speed in a work zone is only one of the many traffic control techniques that can be used to safely guide the motorist through highway work zones.

Modification of traffic controls or working conditions may be required to expedite safe traffic movement and to promote worker safety. The engineer or their representative has the authority to control the progress of work on the project with respect to obtaining safe conditions, including the authority to modify conditions or halt work until applicable or remedial safety measures are taken. This authority is supported by the specifications and additionally by state statute. Each person whose actions affect temporary traffic control zone safety, from upper-level management personnel to field personnel, should receive training appropriate to the job decisions each is required to make. Only those who are trained in safe traffic control practices, and who have a basic understanding of the principles established by applicable standards and regulations, should supervise the selection, placement, and maintenance of traffic control devices in work zones.

Advisory speed limits

Warning signs with speed advisories should be used whenever an unexpected change in geometrics is caused by the work activity. This section addresses the use of advisory speed plates in stationary work zones. The advisory speed plate should supplement warning signs. Warning signs, with speed advisory plates, call for the reduction of speed by the driver to safely negotiate a hazard or potentially hazardous condition. Drivers will reduce their speed if they clearly perceive a hazard. Advisory speed limits should be the first consideration when establishing speed limits in any work zone.

Warning signs with speed advisories should be determined in advance. Prior work zones with similar activities should be used as a base in determining the necessary speed plates. The work-zone site should be test driven by the supervisor to confirm that the advisory speed is set at a reasonable value for the activity being performed. The most common application of advisory speed limits is on curve warning signs at crossovers for two-way bypasses. These speed limits also work well on bump signing, often used on bituminous mill and overlay projects.

Although advisory speed limits are usually used to alert motorists to hazards to themselves, there is one special advisory speed limit in which this is not the case. The advisory speed limit (worker) is used to alert motorists to workers ahead and is used in conjunction with the Worker Ahead W21-1a warning sign. Unlike other worker speed limits, the advisory speed limit (worker) is meant to be used only at spot locations. Additional signs may be used in very long work zones.

In Minnesota, a speed-limit authorization from the commissioner of transportation is not required to establish an advisory speed limit. The district engineer and/or responsible local road authority is authorized to determine the use of advisory speed plates. When this authority has been delegated down to front line supervisors, it is important that the same person always establish the speed limit. Experienced judgment is sometimes the only indicator of the reasonable speed to be posted. Traffic engineering personnel should be contacted whenever there is any doubt as to what the posted value should be.

If a work-zone advisory speed limit is located within a regulatory speed zone, it is not necessary to lower the regulatory speed to conform to the advisory speed limit. However, care should be taken not to erect an advisory speed limit so near the regulatory speed-limit sign that the motorist may become confused by two different speed values. If it is physically impossible to prevent this, then the regulatory speed sign should be covered or removed for the duration of the work-zone advisory speed limit. An advisory speed zone within a regulatory speed zone should not be posted for a value higher than the in-place posted regulatory speed zone.

Work-zone speed limits

Work-zone speed limits are regulatory speed zones generally established in short-term stationary construction or maintenance work zones. These limits are intended for use where the work area and workers are adjacent to traveled lane(s) open to vehicular traffic. This usually occurs in lane closures on multi-lane streets or highways. Work-zone speed limits are not to be used on mobile or moving operations, bypasses, or detours. Also, when flaggers are used to provide control on a lane closure on two-lane two-way streets or highways, work-zone speed limits should not be used.

Speed limit signs are only posted in the traffic control zone during continuous worker activity while performing construction or maintenance operations. Overuse of the work-zone speed limit will reduce the effectiveness; therefore, these must be prudently applied where the motorist can

perceive the need to reduce speeds. During periods of no activity or when the traffic controls are removed from the roadway, the speed limit signs must be covered or removed. This means installing signs at the beginning of a work shift and removing signs at the end of the shift. The speed limit is only in effect when the signs are installed and visible to traffic.

The use of the work-zone speed limit should be determined in advance. Prior work zones with similar activities should be used as a base in determining the necessary speed limits. As a general rule, posting the work-zone speed 10 miles per hour below the in-place limit is a good beginning point. On divided roads with established 70-miles per hour zones, the work-zone speed limit must be dropped 15 miles per hour to be in compliance with the 55-miles per hour maximum ceiling as specified in law. The work-zone site should be test driven by the supervisor to confirm that the speed limit is set at a reasonable value for the activity being performed.

Some hazards near the work area still require warning signs, but the regulatory speed limit should reduce drivers' speeds such that the majority of hazards can be safely negotiated. Severe hazards at spot locations may still require an additional speed advisory to slow the motorist even more.

When the work-zone speed limit calls for a reduced speed that results in a difference of 15 miles per hour from the preceding zone, then a Reduced Speed Ahead sign should be used. The sign is not required for reductions of 5 to 10 miles per hour but may be used. When this sign is posted with the temporary mounted advance warning sign series, it must be mounted at least 1 foot above the pavement.

If the advance warning series is mounted on post driven structures or attached to other fixtures, all signs should be mounted at the same height. In rural areas, this requires the bottom of the sign to be 5 feet above the pavement and 7 feet in urban areas. If the work-zone speed limit is not in effect, then the Reduced Speed Ahead sign should be covered or removed.

The work-zone speed limit signs may be mounted on temporary stands so that they can be easily removed or may be mounted on posts driven into the ground and covered when not needed. The bottom of any sign assembly should be at least 5 feet above the pavement in rural areas and at least 7 feet above the pavement in urban areas. Do not use flashers on the signs, but orange flags may be used if additional target value is desired.

The signs should be placed in the shoulder or ditch area on the side of the road open to thru traffic.

Signs should not be erected in the closed lane since equipment and channelizers may obstruct visibility of the signs. Typically, a work-zone speed limit sign is placed by the area where the workers are working.

An advance speed limit sign should be placed a minimum of 300 feet in advance of the work area to notify drivers of the necessary reduced speed. If the work activity proceeds downstream, it is important that the advance speed sign does not exceed a distance of 2,500 feet from the active work area where workers are present. If that happens, the sign should be relocated closer to the crew.

If the work activity is rather stationary, studies have shown that optimum speed reduction and compliance occurs when this advance speed sign is approximately 1,200 feet in front of the active work crew.

Temporary speed limits

Temporary speed limits in a construction zone are regulatory speed zones established in long-term construction and/or maintenance projects where there are continuous hazards to the motorist. The temporary speed limit in a construction zone is intended for a 24-hour continuous posting so, unlike the work-zone speed limit, they cannot be taken down at the end of the work shift. The speed limit goes into effect when the signs are posted.

Temporary speed limits in construction zones should be used when the roadway construction environment will continuously dictate a reduced speed and it is imperative for the motorist to reduce speed in order to safely navigate hazards that may be encountered over the length of the project.

Since the signs will be posted 24 hours a day, the primary reasons to establish the limit should also be present 24 hours a day. Conditions that would warrant temporary speed limits in construction zones are bypasses, lane drops, drop-offs, narrow lanes, no shoulders, and sight distance restrictions or poor road surface.

Some of these hazards still require warning signs, but it is intended that the regulatory speed limit will reduce drivers' speeds such that the majority of hazards can be safely negotiated. Severe hazards at spot locations may still require an additional speed advisory to slow the motorist even more.

All signs consist of black legend on reflectorized white background. Applications on higher volume and higher speed highways, such as freeways and expressways, should use larger signs to provide adequate target value and legibility.

Temporary speed limits shall be regulatory Speed Limit signs and ground mounted. A second speed limit sign should be posted within 750 feet of the first one to confirm the posted value.

These signs may be supplemented with orange flags but not flashers. The bottom of any sign assembly should be at least 5 feet above the pavement in rural areas and at least 7 feet above the pavement in urban areas.

When the temporary speed limit calls for a reduced speed that results in a difference of 15 miles per hour or greater from the preceding zone, then a Reduced Speed Ahead sign should be used. The sign may be used for a difference of 10 miles per hour when deemed necessary by engineering judgment. When this sign is posted with the advance warning sign series, it must be mounted at least 1 foot above the pavement. When ground mounted or attached to some other permanent fixture on the roadway, it must be mounted a minimum of 5 feet (rural) or 7 feet (urban) above the roadway elevation.

The concluding sign should be a regulatory Speed Limit sign with the in-place speed limit for the roadway ahead. This is to inform the drivers that the temporary construction zone speed limit has ended.

Work Zone Speed-Limit Guidelines			
Method	Description	Examples	Authority
Advisory speed limits (road)	For driver safety, warning signs with speed advisory speed plates, call for the reduction of speed by	Bump, low shoulders, drop-offs, bypass indicating the curve,	Established by the district or local road

conditions)	the driver to safely negotiate a potentially hazardous condition caused by the work activity. Advisory speed limits should be the first consideration.	narrow lanes, no shoulders, sight distance restrictions, or poor road surface.	authority.
Advisory speed limits (worker)	For worker safety at spot locations and under temporary conditions. Warning signs alert motorists that there are workers ahead.	Maintenance or construction operations at spot locations.	Established by the district or local road authority.
Work-zone speed limits	For worker safety, work-zone speed limits are established in short-term projects during continuous worker activity when the workers are present and are adjacent to moving traffic.	Pavement repair, bridge repair, loop detector installation and turn lanes, mill and overlay projects, concrete joint repair, and crack sealing with multiple operations.	Established by the district or local road authority.
Temporary speed limits in a construction zone	Temporary speed limits in construction zones are regulatory speed zones intended for a 24-hour continuous posting established in long-term projects where it is imperative for the motorist to reduce speeds in order to safely navigate through hazards over the length of the project.	Bypasses, shoulder drop-offs, narrow lanes, grade separations, and pavement repair.	Established by the commissioner as recommended by the district traffic engineer.

Speed limits on detours

Construction projects may involve detouring onto a local road or onto roads designated as temporary trunk highways.

The increased traffic and varying designs of the affected detour roads may require the establishment of different speed limits. These detours are typically not under construction, therefore work-zone speed limits are not appropriate. It is also not appropriate to double fines on speeding citations in these areas since there are no workers or construction involved.

Authorization of a normal regulatory speed limit, for a temporary time frame, should be used in these instances.

Extra enforcement

Speed-limit signs alone do not always reduce vehicle speeds in the work zone. In many cases, special efforts must be taken to enforce speed limits and reduce the risk of traffic accidents within the work zone. Law enforcement officials provide the means for enforcing work-zone speed limits. Mn/DOT employs the Minnesota State Patrol for extra enforcement on federally funded construction projects.

Mn/DOT has procedures for obtaining funding of extra enforcement on state projects. Federal

funding for these enforcement services is available if approved in advance by the state construction engineer. These requests are considered on a project-by-project basis.

The Minnesota Department of Transportation and the Federal Highway Administration employ extra enforcement and surveillance efforts when it is reasonably expected to increase the safety of the traveling public or construction personnel.

Local road authorities are also encouraged to use extra enforcement to increase work-zone safety. The need for extra enforcement should be identified early in the project development process.

Truck inspections may also be included in the extra enforcement effort. Minnesota State Patrol personnel, either troopers or law compliance representatives, can provide truck inspection support on a contract basis. Obtaining funding and support follows basically the same procedure as that used for extra enforcement. A major difference is that truck inspection requires more flexibility in its planning and operation.

Planned use for extra enforcement and truck inspection ensures enough time for processing and provides better coordination between Mn/DOT and the MSP. Prior planning provides efficient use of safety and enforcement resources. A planned request is always preferable to an immediate request.

Immediate requests are requests that take less than one week to process before enforcement is desired. Procedures for immediate requests are the same as those for planned requests.

It is important that requests, and their approval, precede contracting for extra enforcement and truck inspection services. This is a major stipulation in receiving federal funding for these types of activities. Also important is that a Mn/DOT representative be readily available to sign the Minnesota State Patrol weekly reports, and to check that the report identifies the correct S.P. It is a good practice to provide the MSP trooper with a cell phone or pager to call at the conclusion of the service.

This article is courtesy of the Minnesota Department of Transportation.

Can Late Merge Strategy Increase Safety?

You can protect drivers by positioning merge signs late.

You're driving down the highway and move into the next lane when you see a merge sign. Traffic ahead of you slows and then stops. Beside you, in the lane closed ahead, other drivers speed by clogging what was intended to be a gradual and orderly merge before a work zone.

What's the solution?

Late merges provide a good option on some types of roads, says Gerald Ullman, a research engineer with the Texas Transportation Institute in College Station.

The Institute's researchers studied late-merge on a six-lane freeway project in Dallas.

Signs of the impending work were placed 7,920 feet before the actual lane closure.

The first sign on the three-lane, one-way segment, with the left lane to eventually close, read Use

All Lanes to Merge Point.

Some improvements in traffic flow were noted.

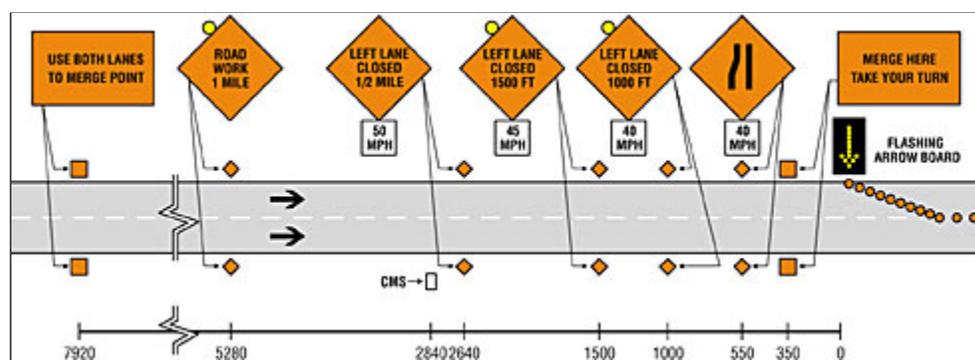
A more striking result came from a University of Nebraska late-merge test on a four-lane rural interstate highway, Ullman says.

There, late-merge sent road capacity up 18% compared to conventional merging.

There were 75% fewer merging conflicts and lane straddling was reduced by 30% in the test.

In another test, on I-35E and I-35W, the Texas Transportation Institute looked at late-merge effects on a heavily traveled rural interstate area near Hillsboro, Texas.

Use of late-merge allowed a throughput of 2,400 vehicles per hour compared to about 1,700 vehicles per hour with a conventional lane closure.



Ullman recommends the use of various portable message systems when using late-merge. A portable changeable message sign reading Merge Here, Take Your Turn was one suggestion for signage at the actual merge point.

System Alerts Motorists to Hydroplaning Conditions

A smart work-zone management system helped alleviate a potentially dangerous hydroplane situation that occurred as a result of a bridge replacement work zone on I-85 near Charlotte, North Carolina.

The bridge project resulted in eight lanes — four in each direction — of temporary pavement being put down to detour traffic around the work zone. After the temporary lanes opened, and prior to the deployment of the IntelliZone System, over 50 incidents had been reported, many of which were attributed to water on the roadway during heavy rains that caused vehicles to hydroplane.

Since the deployment of the IntelliZone System in March of this year, no incidents have been reported due to hydroplane conditions. The system was supplied by [Quixote Transportation Safety](#) and its Highway Information Systems subsidiary.



The first attempt to correct the problem was to lay down a second surface with permeable asphalt that would allow water to be absorbed and run off between the two surfaces. While this provided some measure of improvement, it did not completely solve the problem. Construction contractor Rea Construction requested that



the North Carolina Department of Transportation consider reducing the speed limit. After reviewing the situation further, NCDOT opted for an automated hydroplane detection/alert system, and the IntelliZone System was selected.

The system now allows traffic to flow at normal speed during dry conditions, but alerts motorists to slow down when the system detects water on the roadway. QTS distributor Wilson-Finley Company has played a vital role in providing the variable message signs and ongoing support to the project.

The North Carolina IntelliZone System includes two FP2000 pavement sensors that measure water depth, and two precipitation sensors, all of which are manufactured by the QTS subsidiary Surface Systems, in St. Louis, Missouri. Each direction of travel has one of each sensor type. The rest of the system includes two variable message signs (one for each direction), a wireless communication system, and a computer for configuring and monitoring the system.

Each variable message sign is placed approximately one-half mile in advance of its respective sensor location. The roadside computer collects data from the precipitation sensor and pavement sensor, makes a decision about which message to display, and then automatically updates the VMS.

If the pavement is dry, the variable message sign has a blank display. If the pavement is wet and the water level is below 6 mm, the VMS message is Wet Pavement Ahead; Observe Speed Limit. When the water depth reaches 6 mm, the VMS displays Standing Water Ahead; Reduce Your Speed. The IntelliZone System runs autonomously and is monitored remotely via a Cellular Digital Packet Data link to the Internet. Highway Information Systems personnel in Durham, North Carolina monitor the system and collect and analyze the data.

*Reprinted from Better Roads Magazine
November 2003*

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