Traffic Management Systems Managing the Use of Variable Speed Limits During Adverse Weather Conditions

Traffic management systems (TMSs) face challenges with managing and controlling traffic during adverse weather conditions. Changing weather and roadway conditions may influence which operational strategies a TMS may use and what information may be shared with motorists along a particular roadway. The use of variable speed limits (VSLs) is one example of an operational strategy agencies may use to improve the safety and reliability of travel when weather adversely affects roadway conditions. Several agencies have successfully used VSLs as part of their TMSs to reduce travel speeds, provide information for travelers, and reduce the numbers of crashes and road closures associated with adverse weather.

KEY CONSIDERATION

VSL benefits may vary from site to site due to multiple uncontrolled factors such as driver comprehension of reasons for speed limit changes, speed limit compliance, driver behavior, and road geometry.

DESIRED OUTCOMES

- Actively manage traffic based on changing conditions and circumstances.
- Reduce speed limits and variation in vehicle speeds to improve safety and travel time reliability within travel corridors susceptible to sudden changes in weather conditions.
- Improve driver awareness of changing conditions by providing information such as lane or roadway closures in advance of the use of VSLs to reduce the probability of crashes.

KEY ISSUES TO CONSIDER

- TMSs need the capabilities and resources to actively manage and operate VSLs.
- TMSs need to collect data, share information, monitor conditions, and have staff who understand how weather affects traffic.
- VSL operational requirements are similar to those of other TMS operational strategies.
- Agencies may establish formal internal operating procedures for VSLs.

CURRENT PRACTICES

Ohio Department of Transportation (DOT)[1]

https://ohioitsarch.transportation.ohio.gov/html/inv/el117.html[2]

- In 2018, on a section of Interstate 90 (I–90), Ohio DOT implemented digital VSL signs, road weather stations, control management systems (CMSs), closed-circuit televisions (CCTVs), software in TMSs to manage VSLs, and processes to manually determine and implement recommended speed limits.[1]
- Based on a 2024 report, Ohio DOT found that the use of VSLs along a section of I–90 reduced crashes by 35 percent from 2017 to 2023 compared with data from 2005 to 2015.[3] In addition to the reduction in overall number of crashes, fatal crashes decreased from 20 to 9 per year.
- VSLs are managed from the statewide TMS, enabling operators to post messages to CMSs and VSL signs.
- A new software platform was developed to receive road weather information system (RWIS) data, recommend speed limits, and control traffic signs due to limitations with legacy TMC software.[1]
- Data inputs to software platform include National Weather Service alerts, local agency observations on conditions, observations from CCTVs, and traffic speed data.[1]

Oregon DOT[4]

https://www.oregon.gov/odot/dmv/pages/online_manual/study-section_2.aspx#:~:text=Variable%20Speed%20Signs,reason%20for%20a%20reduced%20speed[5]

- Oregon DOT implemented enforceable VSLs via CMSs on US 97, I–5, and I–84 (figure 1).
- Data from RWISs installed on each corridor are used for determining appropriate speed limits.
- The minimum allowable speed limit is 30 mph and is reserved for severe weather conditions in combination with low visibility.
- A website enables law enforcement to see speed data and speed limit history, which improves coordination.

FIGURE 1. Illustration. VSL and DMS message in Oregon.
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Washington State DOT (WSDOT)[6]

https://tsmowa.org/category/intelligent-transportation-systems/variable-speed-limits[7]

- In 1997, WSDOT implemented VSLs along a 25-mi section of I–90 over the Snoqualmie Pass that is now operated by the Northwest Region's TMS (figure 2).
- Data from radar detectors and RWIS stations installed on I–90 are used for enabling the TMS to manually set speed limits.
- VSLs and CMSs are integrated into the regional TMS to control the content of signs and manage the use of VSLs.
- Speed limits are changed in 10-mph increments and are tied closely to tire chain requirements; that is, as chain requirements get added, speed limits get reduced.

FIGURE 2. Illustration. VSL and dynamic message sign (DMS) message on I–90 in Washington State.
© 2023 Washington State DOT.

Utah DOT (UDOT)[8]

https://www.udot.utah.gov/connect/about-us/technology-innovation/research-innovation-division/[9]

- UDOT operates a VSL corridor on a 13-mi section of I–80 in Parleys Canyon.
- The system automatically lowers speed limits based on prevailing traveling speeds and data from a series of radar detectors, weather stations, and VSL signs along the corridor.
- TMS operators check current vehicle speeds and coordinate with UDOT's road weather maintenance group to determine speed limits and update speeds on VSL signs.

BENEFITS

- VSLs can reduce travel speeds, crashes, and crash-related road closures and increase driver awareness during adverse weather.
- Many agencies are conducting before and after studies to quantitatively measure the effectiveness of VSLs:
  - » An Ohio DOT study found that the agency's VSLs reduced crashes during snow events by 35 percent and reduced fatal and injury crashes from 20 to 9 per year.[3]
  - » A University of Washington study showed WSDOT's VSL system reduced the average vehicle speed by 13 percent.[6]
  - » UDOT noticed improved speed limit compliance and a significant reduction in crashes after deploying a new VSL system.[8]

LESSONS LEARNED

- Integrating VSLs into an agency's TMS enables operators to access and view relevant information in a single location, post messages to CMSs, and adjust speeds on VSL signs.
- Implementation of VSLs does not always require new positions or additional staff training, because the operational requirements for VSLs are similar to other TMS strategies.
- Agencies noted the importance of coordinating closely with winter maintenance crews and law enforcement to obtain firsthand knowledge of the road conditions.
- VSLs are most effective when used in conjunction with CMSs to provide motorists credible information about changes in speed limits.

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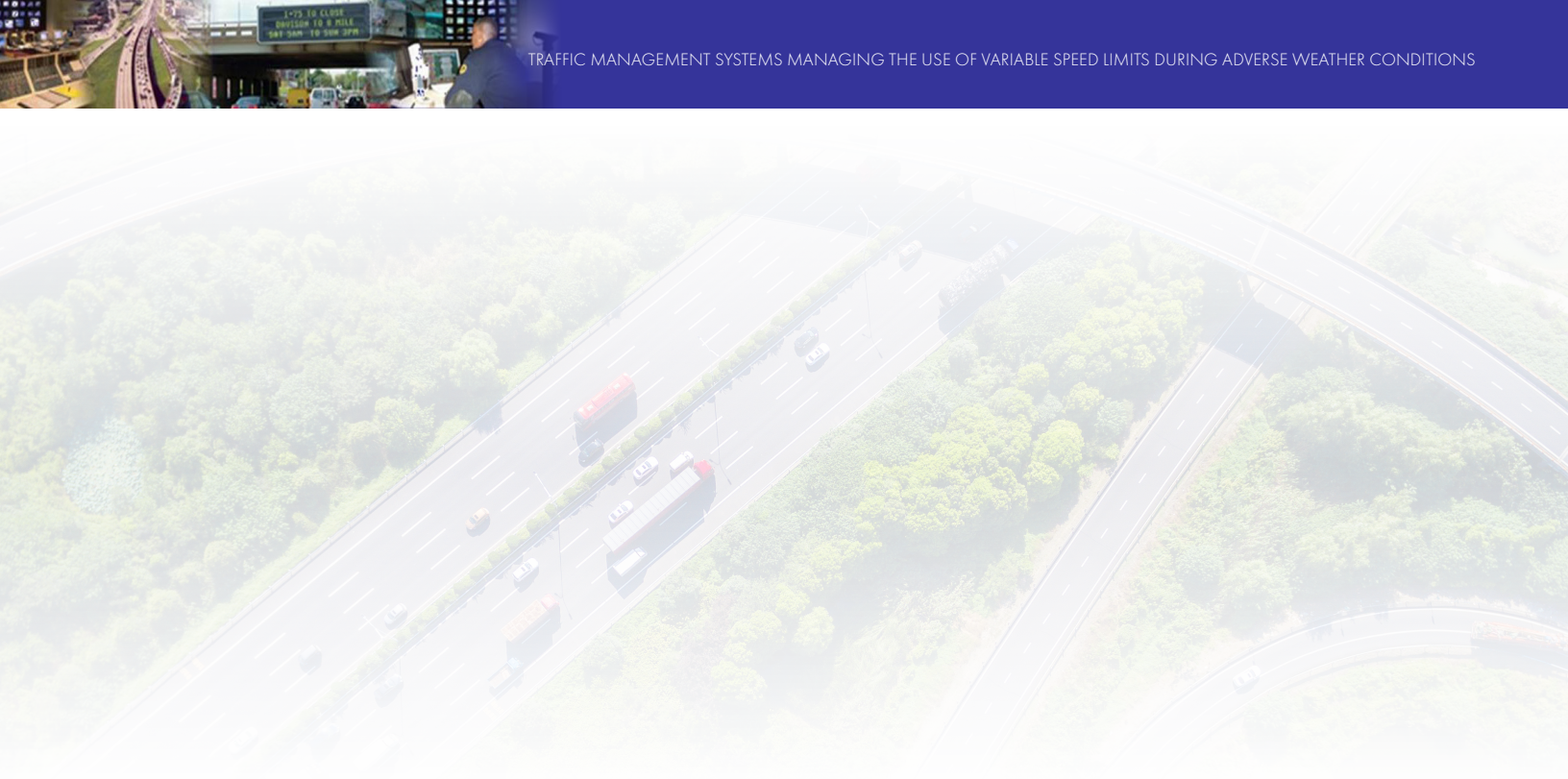

FOR MORE INFORMATION on other practices or the TMC Pooled-Fund Study:

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