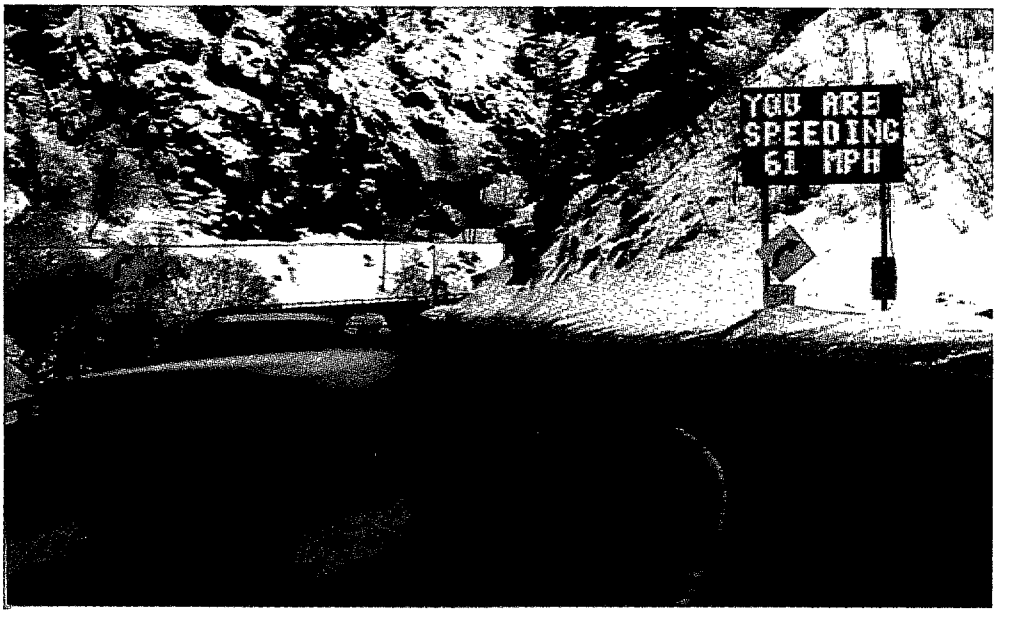
United States Department of Transportation
Federal Highway Administration
Federal Transit Administration

Technology in Rural Transportation "Simple Solution" #13

E N T ERPRISE

Speed Warning Systems



Introduction: This application was identified as a promising rural Intelligent Transportation Systems (ITS) solution under a project sponsored by the Federal Highway Administration (FHWA) and the ENTERPRISE program. This summary describes the solution as well as opportunities for expansion into the broader context of rural ITS.

Technology Overview: Vehicles traveling too fast for conditions, particularly on curves or long downslopes increase their risk and hence their likelihood of being involved in an accident. This simple solution is a method for warning these vehicles in real-time to the impending dangers with the expectation that the vehicles will slow down.

Real-world Example - **Truck Speed Warning System**

Overall goal: To improve safety by lowering the speed of trucks on a narrow curve with a history of severe truck accidents.

Technical approach: A radar gun was installed to determine the speed of trucks approaching the curve. If a speeding truck is detected, a variable message sign is activated which reads "YOU ARE SPEEDING AT [xx] M.P.H. 45 M.P.H. CURVE AHEAD."

Current status: The system has been in place and operational since September, 1996.

Location / geographic scope: The curve, which is on a down gradient and which tightens from seven to five degrees midway, is on I-70 in Glenwood Canyon, Colorado.

Agencies involved: Colorado Department of Transportation

Cost information: The cost of the system is estimated at between $25,000 and $30,000.

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Have goals been achieved? The maximum design speed for the curve was 43 mi/h due to limited sight distance. Speed tests were performed before and after the installation of the sign. Prior to installation the 85th percentile of truck speed was 66 mi/h. Following installation this reduced to 48 mi/h.

Solution timeline: CDOT plans to leave the system permanently installed. At present there are no plans to implement the system in additional locations.

Further Description of Application

Additional technologies may ***include:*** This particular application is of note as it is not infrastructure intensive, that is, it requires minimal permanent equipment installations. Variable speed limiting has a wide range of applications and can be triggered by a number of characteristics, such as geometry, road condition, traffic, weather condition, etc. Thus a number of different sensor systems could be installed as appropriate at a site depending on local characteristics, messages being relayed to drivers by the same message signs.

It is conceivable that in the future, if roadside instrumentation and vehicle-to-roadside communications were widely deployed, then vehicle specific warnings could be provided to a driver using sensors triggered by a vehicle approaching a dangerous curve or down-grade. Warnings could be provided to drivers via in-vehicle graphical display units, speech synthesis or head-up displays. However, the costs associated with such a system would make it viable only if it was incorporated into a system providing wider functionality such as a traveler information or automated highway system.

More general advice on the location of dangerous down-grades or curves could be provided to the drivers of vehicles via wireless data broadcast, using AM, FM, or HAR subcarriers. Messages could either be provided to travelers using roadside signs or in-vehicle devices, including regular radios.

Potential additional uses for this technology may include: The signs in place for the speed warning system could also be used to communicate additional types of information to drivers. Additional communications links and / or sensor systems would need to be installed to enhance current systems in place. If multi-purpose variable message signs, and other sensor technologies, were utilized, information provided could include:

- Warnings to drivers about construction or maintenance occurring ahead.
- Temporary speed advisories / warnings due to construction activities or severe weather conditions.
- Advice to put on or remove snow chains.
- Advice on the status of mountain passes in winter weather conditions.
- Traveler information, including diversion advice.
- Warnings of hazardous roadway or weather conditions.
- Vehicle width, height or weight restrictions ahead.

Interconnection of signs to a regional traffic management or traveler information center may provide maximum flexibility in the messages which could be displayed. Should additional types of information be displayed on the speed warning signs, rules would need to be established for determining how and when a speed warning message should override a more general informational message.

Benefits of Application

	Benefits to travelers / the community	Benefits to business / industry	Benefits to the public sector
Direct benefits	increased safety at dangerous curves down-grades	Increased safety at dangerous curves down-grades	Less costs incurred in malting repairs to crash locations
Indirect benefits	Less costs incurred in repairs or insurance through avoiding accidents	Less costs incurred in repairs, insurance, and loss of shipments through avoiding accidents	Favorable public perceptions of safety improvement schemes

Probable Implementation Process

Step One: Presuming that agencies may wish to implement the speed warning system as a stand-alone system and not as part of a wider traffic management or traveler information tool, agencies should first investigate general locations within their jurisdiction that will most benefit from the system. These locations are likely to include accident "black spots" where excessive speed has been identified as a major factor in causing accidents. If the agency is interested in utilizing the signing system for a variety of messages then additional considerations will need to be taken into account when determining where to locate the signs.

Step Two: For the speed warning system, consideration then needs to be given as to the optimum location for the radar gun installation and specific siting of the sign itself. The speeds at which vehicles currently approach the dangerous section of roadway will need to be assessed. Based on these speeds, the distance required for the vehicles to slow down to the recommended safe speed prior to the dangerous section of roadway can be calculated. Based on these findings, the signs can be placed at the most appropriate points which will allow drivers sufficient time to react to the warning messages.

Step Three: Depending on what conditions the sign will provide warnings for, the message wording to be displayed should be determined.

Step Four: The appropriate combinations of radar systems and warning signs should be specified and procured.

Step Five: Warning systems must be installed and evaluated to verify that all components are functioning properly prior to being fully commissioned. If the systems perform satisfactorily, full operation can then commence. Periodic speed testing should be performed to gauge the effectiveness of the signs in encouraging drivers to reduce speeds. Depending on the location of the sign, it may be found that frequent travelers along that route pay less attention to the warnings over time. If this is the case, the agency should consider altering the message wording or visual characteristics of the warning in order to regain frequent drivers' attention.

Potential Implementation Issues: Care should be taken to ensure that speed readings displayed on the warning signs are consistently accurate, as readings that differ from the speedometer readings in vehicles will negatively impact the credibility of the system.

As was described in Step Five above, periodic testing should be undertaken to ensure that drivers are continuing to alter their speeds in response to the warnings.

Solution's Contribution to Broader Rural ITS Developments: This simple solution is a prime example of a site-specific, stand-alone application of technology that could serve as part of a much larger integrated system. The potential contributions of this solution to rural ITS deployments are described below:

Rural Traveler Information - If enhanced with additional information types, this solution could serve as part of a regional traveler information system, providing real-time information to travelers at spot locations.

Rural Traffic Control - Since the messages displayed to travelers are intended to inform them of dangerous situations and advise speed adjustment to prevent accidents, they could serve as traffic control systems.

The Technology in Rural Transportation. "Simple Solutions" Project: This project was performed within the ENTERPRISE pooled-fund study program, and aimed to identify and describe proven, cost-effective, "low-tech" solutions for rural transportation-related problems or needs. "Simple solutions" studied within the project focussed on practical applications of technologies, which could serve as precursors to future applications of more advanced systems, or intelligent transportation systems (ITS).

More than fifty solutions were initially identified and documented. Of these, fourteen solutions were documented and analyzed in detail. The transportation technology applications were also categorized according to the seven Critical Program Areas (CPAs) defined within the U.S. Department of Transportation's Advanced Rural Transportation Systems Program. It is hoped to utilize the information gathered within this study to perform outreach to local level transportation professionals to introduce them to ITS and its potential benefits.

For More Information: A full report on this study is available from the FHWA R&T Report Center, telephone no. 30 l-577-08 **18. Title:** Technology in Rural Transportation: "Simple Solutions." **Publication** No.: FHWA-RD-97-108. This research was conducted by Castle Rock Consultants, Eagan, Minnesota. For more information, contact Paul Pisano of FHWA, HSR-30, 703-285-2498. For more information about ENTERPRISE, contact Bill Legg, Washington State DOT, 206-543-3332.

Publication No. FHWA-RD-97- 122