TEMPORARY SHOULDER USE

Description

Temporary shoulder use, also known as hard shoulder running, is a dynamic measure designed to adapt roadway capacity to high traffic volumes on a temporary basis. By allowing vehicles (either all vehicles or only transit vehicles) on the shoulder using reduced speed limits, it is possible to serve a higher number of people and vehicles and avoid congestion, either totally or partially, during peak periods. The decision to implement shoulder use on a segment is taken by the operator in the traffic management center based on operating policies and volume considerations after a check for obstacles.

Two approaches to temporary shoulder use are:

- *Shoulder use for all vehicles* – allows all vehicles on the roadway to utilize the designated shoulder when open. Traffic control devices over or adjacent to the shoulder instruct drivers when driving on the shoulder is permitted.
- *Transit-only shoulder use*, also known as a bus bypass shoulder (BBS) or bus on shoulder (BOS) – allows only transit vehicles to utilize the designated shoulder in specific conditions and driving regulations. The bus drivers are instructed to use the shoulder under specific circumstance to ensure the safety of the operation and all the freeway users.

Target Market

- Freeways or roads experiencing frequent congestion.
- Freeways servicing multiple high ridership bus routes that experience significant travel time reliability problems.

Virginia DOT

Cost:	●●○○○
Time:	**Moderate**
Impact:	**Corridor**
Who:	**State**
Hurdles:	**Right-of-Way, Public Support, Design, Operations**

How Will This Help?

Temporary shoulder use can help postpone the onset of congestion. By increasing capacity and encouraging more uniform speeds, traffic flows more smoothly and efficiently, which can improve trip travel time reliability.

Increased vehicle volume can be another benefit of temporary shoulder use by temporarily increasing capacity.

Transit service can become more reliable as buses are allowed to bypass congestion on primary route corridors.

Implementation Examples

The Netherlands implemented temporary right shoulder use in 2003 as part of a larger program to improve use of the existing infrastructure. The strategy is utilized on more than 620 road miles across The Netherlands[1] and only operates during time periods of congestion or when

incidents occur along instrumented roadways. Since 1996, Germany has deployed temporary shoulder use to provide additional capacity during congested operations. Operated on more than 120 miles of roadways across the country, it is only deployed in conjunction with variable speed limits when maximum allowable speeds are 60 mph and if dynamic message signs are used for lane control.[1] Temporary shoulder use in Great Britain is deployed as part of an overall operational Active Traffic Management (ATM) scheme, and is only deployed in conjunction with variable speed limits and when speeds are reduced (initially to 50 mph).

Temporary shoulder use varies in the U.S. On Massachusetts SR 3, IH 93, and IH 95 in the Boston area, all vehicles are permitted on shoulders in the peak periods only. Similarly, in Virginia on IH 66, the shoulder carries general purpose traffic from 5:30 a.m. to 11:00 a.m. (eastbound) and 2:00 p.m. to 8:00 p.m. (westbound); however, during this time, the interior general purpose lane is open to HOV traffic only. IH 66 uses extensive traffic signals and signage in order to communicate the active times of service. In the Seattle area, the right shoulder on the US 2 trestle near Everett is open to all traffic in the eastbound direction during the afternoon peak period. A similar operation is provided on H1 in Honolulu in the morning peak on the right shoulder. A unique combination of strategies is active on IH 35W in Minneapolis where a segment has the left shoulder open during the peak periods. Known as priced dynamic shoulder lanes (PDSL), transit buses and carpools use the shoulder for free and MnPASS (automated toll payment program) customers can use the shoulder for a fee.

Bus on shoulder programs operate on over 290 miles of freeways and major streets in the Minneapolis-St. Paul metropolitan area, and also operate in California, Delaware, Florida, Georgia, Illinois, Maryland, New Jersey, Virginia, and Washington. This operational strategy is generally low-cost and can be quickly implemented without expansion of right-of-way.

Application Techniques and Principles

For temporary shoulder use for all vehicles, facilities should have the following:

- Considerable rush hour congestion.
- A segment of significant length (about three miles or more).
- No regular bottleneck at the downstream end of the shoulder use segment.
- The need to move buses past a regular bottleneck.
- Low volumes entering and exiting the facility, especially if going through interchanges.
- Available right of way for emergency refuge areas and acceleration/ deceleration tapers.
- Sufficient pavement strength on the shoulder to bear the traffic.

Additionally, temporary shoulder use can also benefit from active incident management programs, connection to a traffic monitoring center serving as the focal point for the system, existing sensors and intelligent transportation systems, and the presence of variable speed limits on the facility.

For transit-only shoulder use, a facility should have:

- Predictable congestion delays during the peak period.
- A minimum 10-ft shoulder width available.
- Sufficient pavement strength to sustain bus load.
- A significant number of high ridership buses per hour.

Furthermore, temporary shoulder use for transit vehicles also benefits when travel time variability is higher than one minute per two

miles; when few conflict points exist at interchanges; and when the facility segment under consideration services multiple high ridership bus routes.

The following are key factors to consider that can help facilitate successful deployment:

- Temporary shoulder use is typically implemented in conjunction with variable speed limits.
- When implemented with variable speed limits, speed limit signs and lane control signals need to be visible to all vehicles; therefore, the signs should be placed on gantries over every lane of traffic. During normal operation (when the use of the shoulder is prohibited) all the signs—including the sign over the shoulder—are blank.
- Either the left or the right shoulder can be used for the application, depending on the facility conditions. It is not recommended to apply shoulder use on both left and right shoulders of a facility at the same time.
- Video cameras should be regularly spaced to allow operators to check for obstacles before opening the shoulder to traffic and to monitor operations while shoulder use is permitted. Emergency refuge areas (ERA) should be located at regular intervals along the shoulder with proper signing to avoid having stranded vehicles on an open shoulder. ERA provides refuge on the side of the freeway. The figures below show an example from England where the ERAs are located approximately every half-mile. Operators detect vehicles in the refuge areas using video cameras and/or vehicle detection technology. Each ERA contains an emergency telephone linked directly to a regional control center.
- Overhead guide signs should reflect the current use of the roadway. In other words, when the shoulder is open to traffic, guide signs should provide information to the shoulder lane as if it was a permanent travel lane. This can be accomplished with dynamic message signs.

England: Example of emergency refuge area[2]

Issues

While successful in Europe for many years, temporary shoulder use in the U.S. has been limited and varies considerably. In the Boston area, all vehicles are permitted on shoulders in the peak periods only, that is also the case in Virginia in the Washington, D.C., area. In the Seattle area, the right shoulder on the US 2 trestle near Everett is opened to all traffic in the eastbound direction during the afternoon peak period. A unique combination of strategies is operational on IH 35W in Minneapolis where a segment has the left shoulder open during the peak periods. Known as priced dynamic shoulder lanes (PDSL), transit buses and carpools use the shoulder for free and MnPASS (their automated toll payment program) customers can use the shoulder for a fee.

England: Example of emergency refuge area sign[2]

For more information, please refer to: http://mobility.tamu.edu/mip/strategies.php.

Who Is Responsible?

The local TxDOT office bears the responsibility of developing and maintaining variable speed limits. This agency should determine the viability of and need for the strategy along with the availability of right-of-way required for sign installation at regular intervals for adequate visibility. It should also provide the adequate infrastructure for the TMC and deployment support for other devices.

Sufficient incident management is also important during activation since the shoulder will no longer be available for first responder vehicle use.

Project Timeframe

The length of temporary shoulder use projects differ based on the available infrastructure and planning in place at the time this technique starts. The systems should have adequate connections to the local traffic center, and other supporting infrastructure and policies should be in place. Furthermore, since some additional signage may be required, a typical temporary shoulder use deployment may take between 6 to 12 months to initiate for a simple deployment or between one and two years to initiate a more comprehensive and technology-intensive deployment.

Cost

The cost of implementing temporary shoulder use within a corridor varies considerably depending on the existing infrastructure and whether variable speed limits will be deployed in conjunction with the shoulder use. As one example, a scanning/feasibility study on active traffic management conducted for Washington State Department of Transportation (WSDOT) showed that shoulder use is an effective way to increase capacity and reduce congestion in a small amount of time. The cost of preparing a freeway for shoulder use was estimated at $2.7 million per mile.[3]

Data Needs

Temporary shoulder use deployments require standard traffic information to evaluate the need and to deploy the strategy. Data regarding traffic volumes, travel speeds, shoulder availability, and incident presence and location are essential to determine the need for deployment.

Temporary Shoulder Use Best Practice

- Type of Location: Freeways, arterials.
- Agency Practices: Strong program support from administrators and policy makers.
- Frequency of Reanalysis: Annual or when substantial changes in traffic demand or in capacity due to nearby construction.
- Supporting Policies or Actions Needed: Changes to state law.
- Complementary Strategies: Variable speed limit, queue warning.

For More Information

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References

1. Kuhn, B. *Efficient Use of Highway Capacity Summary.* Report No. FHWA-HOP-10-023. College Station, TX: Texas Transportation Institute, The Texas A&M University System. 2010.

2. Brown, M. "Managed Motorways: Design Standards and Technology," Presentation to FGD Scan Team, June 10, 2010.

3. Active Traffic Management Feasibility Study. Report to Washington State Department of Transportation, Urban Corridors Office. Seattle, WA: PB Americas, Carter + Burgess, EarthTech, Inc., and Telvent Farradyne, 2007.