Minnesota DOT Access Restriction

Since 1996 several Minnesota Department of Transportation (DOT) maintenance districts have worked with the Minnesota State Patrol and county sheriffs to direct traffic off of freeways and to restrict freeway access at ramps when winter storms create unsafe travel conditions. After maintenance vehicles have cleared snow and ice, freeways are reopened to traffic.

System Components: Two types of gates are used to restrict freeway access. One maintenance district has installed gate arms that are positioned on the side of the road and swing into place when needed. These arms have amber lights. Other districts deployed upright gate arms, with red lights, that are lowered into position. Static fold-down warning signs are located in advance of gates to notify motorists of freeway closures.

System Operations: Traffic and maintenance managers consider several variables to identify threats to highway operations. Weather parameters include winter storm duration and severity (i.e., snowfall rate), and visibility. Pavement condition, time of day, day of the week, seasonal travel patterns, and the capacity of towns to accommodate diverted motorists are transportation system factors. Threat information is used to determine closure locations and times.

When a threat is identified traffic and emergency management personnel execute a systematic, coordinated plan to divert traffic off of freeways with mainline gates and prohibit freeway access using ramp gates. DOT personnel travel to gate locations to open warning signs and activate gate arm lights. Gate arms are then positioned in travel lanes to alert drivers that the freeway is closed. During closure and reopening activities, uniformed law enforcement personnel staff gate locations with patrol vehicles to prevent motorists from interfering with clearing operations.

Gate Arms and Warning Sign

Transportation Outcome(s): During a severe snowstorm on November 11, 1998 a 50-mile (80.4-kilometer) section of Interstate 90 was closed, while 59 miles (94.9 kilometers) of US Highway 75 remained open. Plows made four passes on Interstate 90 and ten passes on Highway 75 to clear the pavement of snow and ice. The freeways were reopened when the pavement was 95 percent clear. Because Highway 75 was open to traffic, significant snow compaction occurred on this roadway. Delay on Interstate 90 was minimized, as it was cleared four hours before Highway 75. As shown in the table below, over 24 dollars per lane mile were expended on Highway 75, while it cost less than 20 dollars per lane mile to clear Interstate 90.

Minnesota DOT Access Restriction and Maintenance Costs

	US Highway 75 (Open to Traffic)	Interstate 90 (Access Restricted)	Percent Difference
Number of Plow Passes	10	4	60%
Total Miles Plowed	590	200	66%
Labor Hours per lane mile	0.41	0.38	7%
Labor Costs per lane mile	$9.98	$9.08	9%
Material Costs per lane mile	$4.59	$4.50	2%
Equipment Costs per lane mile	$9.54	$6.14	36%
Total Costs per lane mile	**$24.11**	**$19.72**	**18%**

The DOT conducted a study of Interstate 90 closures in 1999. Analysis revealed that roughly 80 crashes per year were related to poor road conditions on the freeway. Study results also confirmed that access restriction operations enhanced mobility by reducing closure time and associated vehicle delay. Examination of this control strategy during a single storm event and over a six-month period indicated that productivity, mobility, and safety were improved.

Implementation Issues: The DOT contracted with a consulting firm to analyze the costs and benefits of deploying gate arms for access restriction. The consultant used historical operations and accident data to calculate benefits associated with reductions in travel time delay and crash frequency. After deciding to implement gate arms based upon the benefit/cost analysis, the DOT consulted agencies in North and South Dakota. An assessment of gates used in the Dakotas found that snowdrifts could block swinging gates necessitating shoveling before they could be positioned in the road. The upright gates also had disadvantages. In some cases, the pulley mechanism failed causing the gate arm to slam down unexpectedly. Individual maintenance districts selected the type of arm most appropriate for their operations. Ice and high winds occasionally interfered with the opening of warning signs.

The DOT plans to test remote operation of gates and Closed Circuit Television surveillance at one interchange. Remote monitoring and control via a secure web site will be tested during the 2002/2003 winter season.

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