



I-70 Mountain Corridor

**Report Pursuant to HB 11-1210
Recommendations Regarding Short Term Mobility
Solutions Along the I-70 Mountain Corridor**

December 20th, 2011

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1 I-70 Mountain Corridor Overview¹

The I-70 Mountain Corridor (the Corridor) traverses the Rocky Mountains of Colorado. The portion of the Interstate 70 (I-70) highway examined in this document extends for 144 miles between Glenwood Springs on the west and the Denver metropolitan area on the east. It traverses the rugged terrain and outstanding scenery of central Colorado, including the steep grades leading up to the Continental Divide, Vail Pass and the narrow, steep -walled Clear Creek and Glenwood Canyons.

I-70 is the only east-west interstate to cross Colorado. The highway is the major corridor for access to established communities along it, as well as recreational areas that are important contributors to the quality of life and the economic base of the state. The Corridor passes through five counties (Garfield, Eagle, Summit, Clear Creek, and Jefferson) and directly serves more than 20 communities. In addition, the I-70 Mountain Corridor connects to several north-south highways (SH 82, SH 131, US 24, SH 9, US 40, SH 103, US 6, SH 119, and C-470) providing access to many outlying communities and counties. The Corridor also provides access to the White River National Forest and the Arapahoe and Roosevelt National Forests, two of the most visited National Forests in the United States. Other destinations along the Corridor include a number of major ski resorts that attract local, national, and international visitors. Recreational travel is the most predominant contributor to peak traffic in the Corridor, especially during summer and winter weekends and holidays.

In addition to serving local community and recreational trips, the I-70 highway is an important freight corridor in Colorado. Heavy vehicles—trucks, buses, and recreational vehicles—represent about 10 percent of traffic along the Corridor now, and heavy vehicles will continue to rely on the Corridor for east-west intra- and inter-state travel as few alternate routes exist. The variation in speeds between heavy vehicles and faster moving automobiles (particularly on steep grades) contributes to safety, mobility, and congestion problems in the Corridor.

Population and employment growth (with accompanying traffic growth) in the Corridor and Denver metropolitan area has impacted traffic volumes on the I-70 highway for more than 15 years. Recreational travelers currently experience substantial traffic delays on weekends and holidays on the eastern side of the Corridor. The western side of the Corridor experiences work-related trip delays during the week. Congestion periods on both sides of the Corridor are expected to expand with continued population and employment growth, resulting in weekday congestion on the eastern side of the Corridor.

Existing travel demands in this Corridor exceed the design capacity of the facility and result in severe congestion for extended periods of time. In the future, travelers will experience increasing travel delays that restrict mobility and accessibility along the Corridor. This substantial congestion has a negative impact on the local and statewide economy, decreases mobility for all vehicles, increases accidents, and compromises the ability of emergency service providers to respond to emergencies.

¹ Final Programmatic Environmental Impact Statement, I-70 Mountain Corridor, Executive Summary, March 2011

2 Summary of H.B. 11-1210

Recognizing the need for immediate improvements on the I-70 Corridor, the Colorado Legislature approved H.B. 11-1210, requiring the Colorado Department of Transportation (CDOT), on or before December 20, 2011, to make prioritized recommendations to the Transportation Committees of the House of Representatives and Senate regarding actions that can be taken on or before July 1, 2014, to improve mobility on the Corridor. Each recommendation must include a cost estimate and recommend a potential funding source for the improvements. CDOT must consider operational and safety improvement options, transit options, and traffic demand management options and shall also investigate the feasibility of nongovernmental actions that might improve mobility in the corridor.

Additionally, CDOT was required to consult with interested local governments and business entities that are located within the corridor that may be substantially impacted by action taken to improve mobility in the corridor and shall take such consultation into account when developing the recommendations.

The prioritized strategies identified in this report build on more than a decade of work to improve mobility and operations on the I-70 West Corridor. The appendix includes a comprehensive list of these current and previous efforts, many of which carry-through as strategies recommended in this report for continuation or enhancement.



3 Workshops

3.1 Twin Tunnels Visioning Workshop

The Interstate 70 Twin Tunnels, approximately one mile east of Idaho Springs, were constructed in 1961, as part of a widening of U.S. 6 & 40 through Clear Creek Canyon. The original U.S. 6 & 40 paralleled I-70, on the south side of Clear Creek, through the Twin Tunnels area. Portions of the thorough road still exist today as a frontage road.



High traffic volume on I-70, west of Denver, during the summer and winter, has led to ever-increasing periods of slow traffic, and at times, is a gridlock situation.

While this corridor experiences congestion throughout the year, the predominant period for congestion is weekend afternoons in the eastbound direction--particularly Sunday afternoons from Idaho Springs, through the Twin Tunnels, to the base of Floyd Hill.

The section of I-70 from the Twin Tunnels to Hidden Valley, the interchange just east of the Twin Tunnels (Central City Parkway exit)

has identified geometric problems and is believed by many to be the starting point for congestion and backups on eastbound I-70.

In late February 2011, the Department convened a week-long visioning workshop that included local, national and international design and construction experts to discuss a variety of short-term mobility options to aid in the alleviation of congestion in the Twin Tunnels area.

The Technically Recommended Concept that emerged balances the many critical success factors developed by the I-70 Mountain Corridor Stakeholders. This project (which is discussed on page 10 of this report) would build a third lane on eastbound I-70, beginning west of the Twin Tunnels and continues east to the base of Floyd Hill, where eastbound I-70 currently becomes three lanes.

This option includes flattening the curve on eastbound I-70, just east of the Twin Tunnels, enhancing safety and allowing for an increased design speed through this section. The project does not include improving the westbound Twin Tunnel bore or westbound I-70 between the base of Floyd Hill and Idaho Springs during the initial construction phase and the project does not violate or preclude the long-term solution for the I-70 Mountain Corridor as outlined in the I-70 Mountain Corridor Final Programmatic Environmental Impact Statement.

The Colorado Transportation Commission, on October 20, 2011, allocated \$60 million to fund this project. Further details of this project may be found in the Prioritized Recommendations section of this report.

3.2 I-70 Mountain Corridor Mobility and Operational Assessment Workshop

As result of the very successful Twin Tunnels Visioning Workshop, CDOT hosted another workshop, the I-70 Mountain Corridor Mobility and Operational Assessment Workshop. Participants included technical experts from the state, abroad, and many I-70 Mountain Corridor Stakeholders. Those represented included towns and counties along the Corridor, Colorado State Patrol, Colorado Motor Carriers Association (CMCA), Denver Regional Council of Governments (DRCOG), University of Colorado Denver, Winter Park Resort, and Federal Highway Administration (FHWA). In total, over 90 stakeholders were invited to participate and attendance ranged from 30-60 each day of the workshop.

The workshop was hosted the week of May 23rd, 2011 as a venue to explore low cost and no cost solutions and ways to maximize existing resources to improve traffic congestion along I-70. This workshop did not include evaluation of major capital improvement projects.

Throughout the week, technical experts shared current practices, new ideas, potential solutions, and lessons learned.

Many of the technical experts had a deep knowledge base of transportation issues on I-70 and throughout the mountain west. For a broader perspective, CDOT included international transportation consultants to share mobility strategies underway in the United Kingdom and in the Netherlands.



Table 1. Mobility and Operations Assessment Workshop Accomplished Objectives

Date	Accomplished objective
Monday, May 23	Presented overview of existing conditions and goals for workshop. Stakeholders shared concerns and ideas
Tuesday, May 24	Received technical presentations and initiated focus area “brainstorming” sessions
Wednesday, May 25	Continued detailed evaluation and documentation of ideas
Thursday, May 26	Continued detailed assessment of ideas and consolidated concepts
Friday, May 27	Reviewed and confirmed idea documentation and highlighted ideas with maximum benefits

Workshop participants evaluated low-cost solutions related to slow moving vehicles, truck traffic, and enforcement; maintenance and operations; active traffic management and travel demand management; and traveler information.

In all, participants developed 142 ideas to improve mobility and operations along the I-70 Mountain Corridor. All 142 ideas were grouped based on timing for potential implementation. Short-term ideas could be implemented by June, 2012. Mid-term ideas could be implemented by June 2014, and long-term ideas focused on items to be implemented beyond June, 2014.

The final report for the workshop can be found online at http://www.coloradodot.info/library/studies/I-70_Mnt-Corr_M-O_Report_FINAL_web.pdf/view. This report includes a list of current and previous mobility efforts for the I-70 Corridor, which is also included in the appendix of this report.

Further details of the recommendations that surfaced as priority recommendations for CDOT may be found in the Prioritized Recommendations section of this report.



4 Prioritized Recommendations

CDOT has considered a host of recommendations for improving the I-70 Corridor. While the list in this report is not exhaustive of the items CDOT continues to consider, they do constitute a current prioritized list of recommendations to the House and Senate Transportation Committees by the categories included in H.B. 11-1210.

Operational & Safety Improvements

1. Include Maintenance Decision Support System (MDSS) in all Trucks
2. Widen Twin Tunnels
3. Increase focus on maintenance
4. Implement speed harmonization
5. Utilize Shoulder Lanes During Peak Periods
6. Develop a Fire Suppression System for Eisenhower Johnson Memorial Tunnel
7. Install automated spray deicing system for tunnels and bridges
8. Limit single drive axle trucks
9. Limit slow moving vehicles during peak hour

Transportation Demand Management

1. Develop and expand smart phone applications and increase marketing
2. Continue and expand driver education and expanded winter driver campaign
3. Continue and expand truck driver education
4. Establish peak time tolling at Twin Tunnels
5. Establish shipper management working group and streamlining

Non-Governmental Efforts

1. Continued stakeholder interaction

Transit

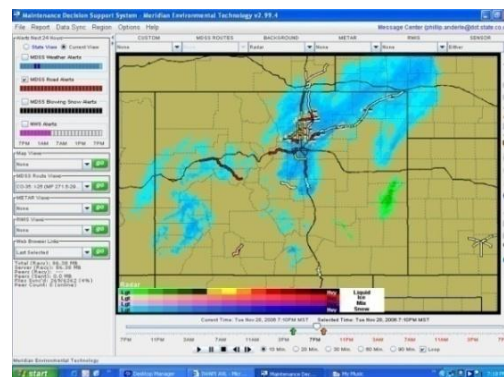
1. While no transit options were identified and prioritized that could be implemented by July 2014, this report does contain an update on transit activities on the corridor.

4.1 Operational and Safety Improvements

1. Include weather source/data (Meridian MDSS) in all maintenance trucks to improve snow removal

Description: CDOT currently utilizes a Maintenance Decision Support System (MDSS) in a portion of our maintenance trucks. This system is a web-based weather forecasting tool where operators can input real time weather information and road conditions. The system then can make application recommendations by route for the type, amount, and timing of road treatment products.

Benefits: MDSS helps each truck operator plan and schedule maintenance activities. General benefits include: (a) Manages chemicals (deicing) to reduce environmental impacts, (b) Provides recommendations to guide staff to better respond to changing weather conditions, (c) Improves CDOT management of resources and operator safety with real-time camera shots of weather and location tracking, and (d) Tracks and records location and timing of maintenance activities in both summer (chip seal, weed spraying) and winter (plowing, deicing). Supports work projections/budgeting and customer service inquiries.



Concerns: MDSS requires additional maintenance. The sensor equipment is delicate and currently maintained by only one trained mechanic. Additional training for operators and supervisors is required to use the system and address concerns with geo-tracking the trucks.

How will safety be maintained or improved? Faster maintenance and improvement of road conditions could reduce occurrence and severity of accidents.

How will mobility be improved? Optimizes staff deployment. Tuned application of deicing agents will reduce the amount of time I-70 is snow packed, which will decrease accidents and therefore maintain capacity.

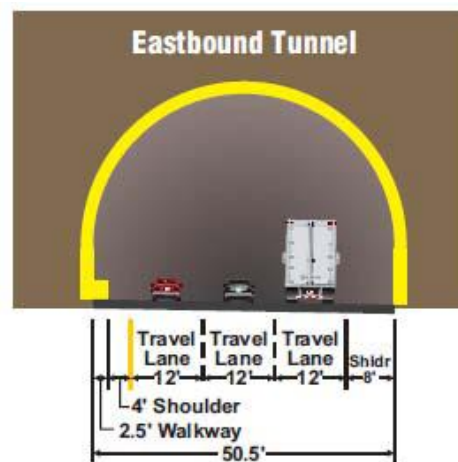
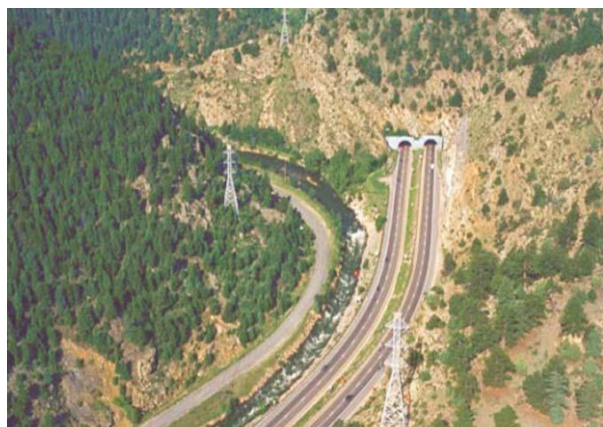


Estimated Cost: Statewide 331 of our more than 600 plows have MDSS equipment. We have over 1,250 MDSS users across these 331 plows (several users will utilize a single truck throughout the day during snow shift). CDOT's annual cost for MDSS is approximately \$230,000. Currently, each installation of MDSS hardware into a truck costs approximately \$2,000 (52 units are currently on order).

Implementation Timeline: CDOT operates 87 plows along the I-70 Mountain Corridor and 26 of those currently have MDSS technology. An additional 52 units have been ordered with the intent to have them installed and operational by October 2012. Given sufficient funding, implementation corridor-wide could be accomplished within two years. Statewide, there is no formal implementation timeline due to budget constraints. However CDOT's maintenance sections will continue to make gradual fleet and route additions.

2. Widen Twin Tunnels

Description: In September 2011, CDOT initiated a Twin Tunnels project which proposes to add a third eastbound travel lane between the Idaho Springs East Interchange (milepost 241) to the base of Floyd Hill (milepost 244), where a three-lane highway section currently exists. The project is approximately two and a half miles long and includes widening the eastbound bore of the Twin Tunnels. The Twin Tunnels Environmental Assessment (EA), which is currently being conducted, will finalize the proposed improvements, provide information on impacts to environmental and community resources, and determine appropriate mitigation to minimize any impacts.



Benefits: This project proposes to immediately address safety issues and improve traffic flow at the Twin Tunnels east of Idaho Springs, one of the most critical congestion bottlenecks on the I-70 Mountain Corridor.

Concerns: This project is on an accelerated timeline in order to deliver improvements as soon as possible, which will require close coordination with our stakeholders. During construction, traffic will need to be rerouted around the Twin Tunnels and placed on a frontage road. Significant public outreach will be required to notify the public of construction delays and to communicate the overall reason for this work and the expected improvements.

How will safety be maintained or improved? A primary goal of this project is to improve safety. This east-bound tunnel section was made a priority because it is one of the most congested areas along the corridor and has very high crash rates.

How will mobility be improved? Mobility will be improved by adding a third lane in this section and connecting it to a three-lane highway section which currently exists at the base of Floyd Hill.

Estimated Cost: \$60 million.

Implementation Timeline: The Federal Highway Administration (FHWA) is expected to issue a decision by the fall of 2012. If the project receives the federally required approvals, construction would begin in the spring of 2013, and will be open to traffic by the end of 2013. In October 2011, the Transportation Commission approved \$60 million in funding for this project.

3. Increase CDOT focus on maintenance on corridor

Description: This strategy helps address the unpredictable and dynamic winter storms common to the Corridor by combining additional resources with increased monitoring and response services. In addition to strategies discussed elsewhere in this report, such as installation of MDSS technology in the existing snowplow fleet, this strategy would provide increased presence of supervisors monitoring the storm, enhanced incident command, new methods of snow removal which may include traffic stops to proactively clear the highway before an incident, and a commitment to move resources from other regions in the state based on storm intensity. It also involves a continuation of several successful programs, including the Heavy Tow Program (designed to promptly clear large trucks from the highway), the Chain Assistance Program (allows drivers to purchase chains and chain-up service when approved vendors are present at any one of 21 chain stations), and the Courtesy Patrol Program (drivers of passenger and other smaller vehicles are provided free roadside assistance for services such as flat tires, fuel or water transfer, jump starts, short-distance towing, accident scene protection and minor mechanical assistance.)

Benefits: Faster deployment and proactive maintenance will remove more snow before it is packed into ice by travelers, providing better road conditions for the traveling public.



When combined with the Chain Assistance Program, these efforts should result in fewer accidents, including fewer “spin-outs” and “jack-knives”, which often lead to lengthy delays. Additionally, the Heavy Tow and Courtesy Patrol programs clear stranded vehicles quickly, thereby reducing congestion and delay times.

Concerns: May require additional plows and personnel, with associated cost increases. Increased presence on the Corridor could draw complaints from some motorists, though overall reaction should be favorable. Could be implications to shifting resources from other regions in the state.

How will safety be maintained or improved? Potentially reduce severity and frequency of accidents related to inclement road and weather conditions.

How will mobility be improved? Optimized staff deployment and tuned application of deicing agents will reduce I-70 snow pack, decrease accidents, and maintain capacity.

Estimated Cost: Costs would vary depending on scope of activities.

Implementation Timeline: CDOT is currently analyzing changes to personnel to provide additional focus on the Corridor. If approved and funded, implementation could happen before the 2012-2013 winter season.

4. Implement Interstate 70 Rolling Speed Harmonization

Description: Rolling speed harmonization is a means of reducing turbulence in the traffic stream by using law enforcement vehicles as “pace cars”. The main goal is to reduce crashes caused by speed differences (which exacerbate traffic congestion on I-70). Two tests have been conducted in the eastbound direction. The first test on August 13th was from the Silverthorne interchange to the Eisenhower-Johnson Memorial Tunnels (9 miles). The second test on September 25th was implemented from Silverthorne interchange to the Empire Junction (27 miles). Both test results demonstrated that this concept is operationally feasible and can be utilized to improve safety, reduce crashes and ultimately improve traffic flow on Interstate 70 during heavy traffic periods. CDOT will coordinate implementation with Colorado State Patrol (CSP) and Silverthorne Police Department as well as the



Clear Creek County Sheriff’s department. The intent is to implement rolling speed harmonization east bound on Sunday (or specific holidays) afternoons to reduce the number of incidents associated with heavy recreational traffic heading toward the front range.

Benefits: Analyses of data from the two tests showed very high compliance among drivers. Speed differentials between vehicles were reduced, even for vehicles traveling outside the paced group of vehicles.

There were no traffic accidents along the corridor during these tests. Public response to these tests has been generally positive.

Concerns: Initiation of this program requires an outreach campaign to educate drivers about the reasons/ importance of speed harmonization. Law Enforcement agencies (CSP and local) have expressed manpower concerns since up to 14 total officers will be required. The optimal version of this program would require additional enforcement and communications equipment. Additional signage may have a negative visual impact on the corridor.

How will safety be maintained or improved? Pacing operations will reduce the speed differential between lanes and reduce the approach speed of vehicles encountering a queue of slow or stopped traffic under heavily congested conditions. This will reduce the number of incidents. As a side benefit, the increased law enforcement presence will allow for quicker response and clearance of any incidents that do occur (including clearing stalled or disabled vehicles) keeping all lanes of travel open.

How will mobility be improved? Speed harmonization will reduce the number and severity of accidents, keeping travel lanes open.

Estimated Cost: \$6,000 to \$10,000 per day of operation for reimbursement to law enforcement. Costs would be covered within CDOT Region 1’s existing maintenance budget.

Implementation Timeline: CDOT began testing in August 2011. CDOT is planning on running this operation when ski traffic is at its highest, primarily on Sunday afternoons, beginning in mid-December 2011. Over the longer-term, an automated speed harmonization program using frequent variable speed limit signs and enhanced enforcement could be implemented. This program uses speed and queue detection devices to determine when to activate speed reductions. Cost is \$1-2million per mile.

5. Utilize Shoulder Lanes During Peak Periods

Description: Peak period shoulder lanes, also sometimes known as “Hard Shoulder Running”, is a concept that uses existing shoulders as temporary travel lanes, thereby adding capacity without expanding the roadway footprint. In this context, peak period shoulder lanes would provide a third eastbound lane for use during high congestion periods from US 40 to the Twin Tunnels. This idea assumes implementation of the Twin Tunnels widening project. This concept would require CDOT to add emergency access road crossing locations and emergency pullouts, restripe the highway to provide at least a 10 foot shoulder lane, and install a series of new information signs to allow traffic to use the shoulder lane at certain times.

Benefits: Adds capacity during critical travel times at key locations. Has the flexibility to be used in this or other locations as a congestion management tool, general purpose lane, truck climbing lane, or a high occupancy/transit-vehicle lane.

Concerns: Requires approval by FHWA and coordination with local municipalities. Operations at highway exits and the pier pinch point at County Road 103 in Idaho Springs will require careful attention. Coordination with local communities will also be important especially since some additional pavement will be necessary for improvements at pinch points, road crossings, and pullouts. In addition, concerns about emergency response access will need to be addressed.



How will safety be maintained or improved?

Potential to reduce congestion-related accidents, however concerns about emergency response access will need to be addressed.

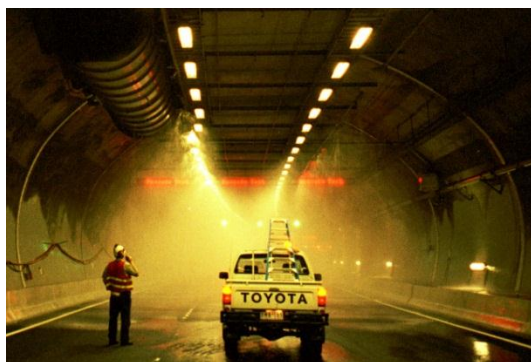
How will mobility be improved? When congestion reduces traffic speeds to below 60 miles per hour, operation of a peak period shoulder lane as a third lane allows a more steady flow of traffic volumes at controlled speeds.

Estimated Cost: \$25-30million
(preliminary estimate)

Implementation Timeline: CDOT is currently holding stakeholder discussions on the concept and seeking expert advice, including a recent informational video-conference with Great Britain and Clear Creek County on emergency response operations with peak period shoulder lanes. Assuming corridor stakeholder issues can be addressed through the Context Sensitive Solutions (CSS) process and adequate project funding, this project will be ready for implementation in fall of 2014.

6. Develop a fire suppression system for the Eisenhower and Johnson Memorial Tunnels (EJMT)

Description: Install fire suppression within EJMT. These water mist systems target zones within the tunnel complex to facilitate a rapid fire incident response and help to prevent a catastrophic structural fire regardless of the amount of congestion inside the tunnel.



Benefits: Improves emergency response, reduce employee and civilian heat exposure in fires, and extends the response time window to allow CDOT personnel additional time to safely access a fire in the tunnel structures. A fire suppression system could reduce the need for tunnel metering (which results in lengthy traveler delays) as the system would allow personnel to respond to fires regardless of congestion. A fire suppression system could also present new options for routing hazardous materials.

Concerns: Additional maintenance demands/costs. One low-risk factor is that the system may discharge by mistake. Fire Suppression Systems are not extensively used in the United States, so judging effectiveness of the system is difficult. Colorado State Patrol is responsible for routing hazardous material vehicles and would have to determine, in collaboration with CDOT and FHWA, if free flow of hazardous material carrying trucks is possible through the Tunnels, should such a system be installed.

How will safety be maintained or improved? This option allows for more expedient fire suppression in the event of an emergency. Protects motorists and emergency responders from fire hazards and extends the current eight minute window responders have to control a dangerous fire event.

How will mobility be improved? A fire suppression system could reduce the need for tunnel metering (which results in lengthy traveler delays; a 4 minute recovery is required for each minute metering is in effect) as the system would allow personnel to respond to fires regardless of congestion. Currently, when Loveland Pass is closed, regular traffic is stopped every hour to allow hazmat trucks to convoy through the EJMT alone. A fire suppression system could allow for a policy change for hazmat trucks to free flow through the tunnels thus preventing regular traffic from being stopped and throughput would be increased. The fire suppression system would help with rapid fire incident response in tunnel reducing the risk of catastrophic fire incidents. If Hazardous materials were allowed through the tunnels, CDOT could shift resources from Loveland Pass to I-70 at the EJMT for cost effectiveness and efficiency.

Estimated Cost: The fire suppression system has a preliminary cost of approximately \$20 million to install as well as the purchase of one additional fire fighting vehicle to be stationed on the west side of the tunnel complex. CDOT is pursuing Homeland Security funding at this time, as no funds have been identified to pay for these improvements at this time.

Implementation Timeline: In November, CDOT traveled to Washington DC to meet with the Colorado Congressional Delegation and several Congressional Committees seeking funding opportunities for this project. Until funding is identified, there is no timeline for implementation of this improvement.

7. Install automated spray deicing systems at tunnels and bridges

Description: Automated deicing spray systems have been used throughout Colorado with varying degrees of success. The systems require tanks of liquid deicer to be placed at key locations. Strategy requires significant mechanical delivery systems along with a “pump house” and a Road Weather Information System (RWIS) weather station. The RWIS sensors measure temperature, moisture, form of moisture (snow/ice), and amount of de-icing chemical present. These sensors determine when the system activates to apply the liquid deicers.



The systems have been used in Dowd Canyon on I-70; Wolf Creek Pass (tunnel), Glenwood Canyon (near portals of Hanging Lake Tunnels) and other areas.

Benefits: Automated deicing spray systems benefit safety by applying deicer at a specific “trigger point” during times when icing of the roadway is imminent. This technology takes some of the human decision making out of the equation and relies on actual data to determine when to apply liquid deicer. Areas that would most benefit from automated systems are located in isolated areas where the climate produces icing problems at site-specific locations (bridges) and where there is a long response time for conventional methods of applying deicer.

Concerns: Several concerns exist relating to system costs (upfront costs and maintenance costs of many “moving parts”), system reliability, and environmental concerns. Several projects in the mountain areas (SH 9 in Breckenridge and “Loveland” bridges on I-70 as well as the EJMT tunnel approaches) have looked into the technology and found too many concerns to warrant automated systems. These areas already have significant deicing infrastructure in place (i.e., plows/sanders/deicing tankers) which is easily deployed by conventional methods. There is a safety concern if automated systems break down and no conventional methods can be deployed in a timely manner. Environmental concerns relate to mechanical breakdowns/tank failures near sensitive environments.

How will safety be maintained or improved? Especially in remote/isolated areas where “spot” icing is a continual problem, these systems will provide much quicker response times to treat the roadway with deicer.

How will mobility be improved? Mobility will be improved in these remote/isolated areas by decreasing roadway closures resulting from significant accidents.

Estimated Cost: Costs vary widely (depending on location and whether RWIS can be established using intelligent transportation systems (ITS) already in place).

Implementation Timeline: These systems can be implemented on new projects or retrofitted into existing areas. Environmental clearances can become difficult and may add to an extended implementation timeline.

8. Limit single drive axle trucks

Description: Restrict or limit single-drive axle western double trucks from traveling the corridor during inclement weather. This particular truck configuration has been identified by CSP as having unique traction problems in the I-70 Mountain Corridor environment. Reducing the number of these vehicles on the corridor during inclement weather, either voluntarily or through regulation, may reduce the number of accidents or associated capacity reductions. This idea may require studies and state and federal actions. CMCA has already engaged major operators on the I-70 Mountain Corridor in an effort to achieve a higher level of efficiency on the corridor during inclement weather.

Benefits: Conservative estimates suggest the cost of an I-70 shutdown during peak ski weekends to be \$800,000 per hour. Reduction in accidents and lane blockages caused by single drive axle western doubles will reduce economic impact due to road closures and traffic delays, and would increase highway capacity and safety.

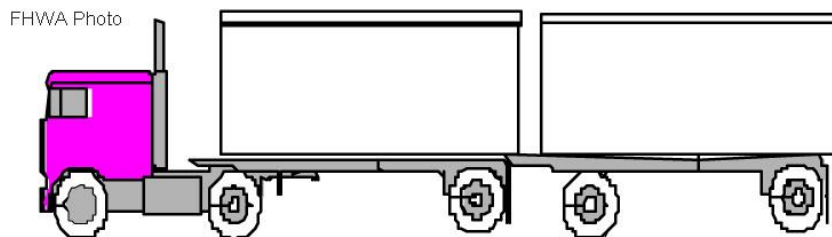
Concerns: Limited options exist for alternate truck routes when adverse weather occurs. Could pose economic hardship to shipping fleets, which are based on this truck configuration. Significant analysis, outreach and truck industry acceptance would be necessary for complete restriction. Would require increased enforcement. CMCA may oppose full restrictions of this configuration.

How will safety be maintained or improved? Has potential to reduce accident occurrence and severity related to truck travel in inclement weather.

How will mobility be improved? Reduction in accidents caused by this truck configuration will reduce delays, increase highway capacity, and increase safety.

Estimated Cost: CDOT has not conducted an analysis of the costs of this strategy.

Implementation Timeline: The FHWA has established a clear process through 23 C.F.R. § 658.11 for seeking restrictions such as these. This process requires the state to analyze a number of issues and prepare a proposal to FHWA.



9. Limit Slow Moving Vehicles from corridor during peak hours

Description: Restrict or limit Slow Moving Vehicles (SMVs) during known peak travel times. SMVs prominently influence mobility along the I-70 Mountain Corridor because of (a) the extended steep grades along the Corridor, (b) the influence that steep grades have as SMVs pass other SMVs and thereby slow traffic in all travel lanes, and (c) the lack of reasonable alternatives for trucks making deliveries along the Corridor. In addition, accident rates increase as speed differentials increase. Current regulations prohibit SMVs from the left lane in certain areas, however enforcement is difficult. Regulations prohibiting SMVs from the corridor during specified time periods would alleviate these problems during these periods. The shipper/trucking working group also has identified “Voluntary Realignment of Operations to Outside Peak Periods” as an operational strategy.

Benefits: Increase in highway capacity and an increase in safety.

Concerns: Shippers may have difficulty avoiding the corridor during known peak periods given the lack of reasonable route alternatives. There also is inadequate SMV or truck parking along I-70 west. Recreational vehicle operators are drawn into the corridor during peak periods. All SMVs may not be readily identified until they are on the corridor blocking traffic. (Currently oversize and overweight commercial vehicles are already prohibited during peak periods.) Restricting SMVs during peak hours may increase problems during other time periods and would require additional enforcement. Truck industry acceptance would be necessary for complete restriction. Full restriction could negatively affect shipments on critical time schedules.

How will safety be maintained or improved? Has potential to reduce collisions and overall accident occurrence and severity.

How will mobility be improved? Restricting SMVs during known peak volume periods will increase in highway capacity and increase in safety during those periods.

Estimated Cost: CDOT has not conducted an analysis of the costs of this strategy.

Implementation Timeline: The FHWA has established a clear process through 23 C.F.R. § 658.11 for seeking restrictions such as these. This process requires the state to analyze a number of issues and prepare a proposal to FHWA.

4.2 Transportation Demand Management Options

1. Develop/expand smart phone applications and increase marketing of current traveler information

Description: This strategy combines delivery of a new smart phone application (app) with increased marketing of our current information platforms, including Cotrip.org and 5-1-1 phone system.

Smart Phone App: Deliver a mobile application (app) that provides real-time traveler information including historical travel time data and time-sensitive incentives to influence traveler behavior and encourage travel during off-peak periods. The information will be provided to travelers in a “personalized” manner based on their geo-referenced location and projected direction of travel. For example, skiers using this app would find that travel times and traffic volumes are considerably less on westbound I-70 before 7:00 am on a Saturday and on eastbound I-70 before or after 3:00pm – 6:00pm on a Sunday. The app also would be hands-free to ensure safe driving, and would be expanded to cover the entire state.

In addition, time-sensitive incentives could be provided to induce travelers to take advantage of special discounts and/or rewards that are only offered during certain periods. These incentives could be designed as a point/reward system, similar to many airline frequent flyer or credit card reward programs. Once becoming members of the program, participants would register at the beginning of their trip using their smart phone (with GPS capability). Location and time would be recorded throughout the trip to verify travel during off-peak hours. A similar process would occur for their return trip. The program would need to work in conjunction with and support of mountain corridor businesses (restaurants, hotels, resorts, ski areas, gas stations, etc.)

Increased Marketing: CDOT provides statewide traveler information via the Cotrip.org web site and the 5-1-1 automated traveler information phone system. Cotrip.org is recognized as one of the premier DOT traveler information web sites in the nation. This is further substantiated by a strong demand from users, which has grown exponentially in the last few years. Likewise, the 5-1-1 automated traveler information phone system call volume has increased from one million calls in 2006 to 2.3 million calls in 2010. However, although web usage and call volumes are significant, there has been no paid advertising to increase awareness of the sites by CDOT, and surveys and anecdotal information suggest that only a relatively small portion of the traveling public is aware of the sites. An effective marketing campaign would increase awareness that this traveler information is available.

Benefits: Reduce travel congestion by providing pre-trip information to travelers to change their travel behavior thereby reducing congestion and “smoothing out” the peak. Could bring new customers to businesses along the corridor through discount program. Over the longer term, new interaction tools could help initiate a broader conversation between corridor stakeholders about influencing travel behavior. CDOT could collect GPS data from smart phones, or “probes” to enrich the quality and granularity of data and to expand the coverage of the app statewide. This effort could reduce future costs of Active Traffic Management programs.

Concerns: App development relies on companies with specialized skill sets and capabilities on smart phone app development (including management and maintenance of the App) and marketing and advertising (securing and managing advertising and business incentive clients). These developers could conclude that the initial upfront outlay cost is too risky and deem the project cost prohibitive.

How will safety be maintained or improved? Could reduce congestion and congestion-related accidents.

How will mobility be improved? Increased use of traveler information will result in overall operational improvements to the state highway system as more travelers use the information to modify their travel plans. For example if only five percent of travelers changed their travel plans, it is estimated that a measurable reduction in congestion levels during peak periods would occur. CDOT believes this is very attainable.

Estimated Cost: Funds to contribute to this project are not currently available and estimated development costs are unknown. However, it is expected that more than sufficient revenue could be generated by allowing advertising on Cotrip.org web site and possibly the 5-1-1 automated traveler information phone system. In addition, app development revenue will increase over time as greater numbers of travelers access the Cotrip.org web site and use the app. Revenue sharing will help offset the cost of collecting, processing, managing and disseminating statewide traveler information. Lastly, expenditures, although significant, will decrease over time after the app is developed.

Implementation Timeline: CDOT published an RFP in October requesting proposals regarding development of the app including marketing, advertising and incorporating business incentives. CDOT intends to select the best and most advantageous proposal in January 2012 and a signed contract with a consultant the following month. Initially, the app will be designed to cover the I-70 Corridor generally from Denver to Vail.

A longer term app also could be developed with a multi-platform promotional campaign targeting travelers from a variety of formats including smart phone apps, websites, mobile web access, Facebook and Twitter, 5-1-1 and GovDelivery.

2. Driver education and expanded winter driving campaign

Description: To encourage drivers to better equip their vehicles with adequate tires and traction devices as well as tips and tools for mountain and winter driving, CDOT will continue and expand its public education campaign and include the following points: (a) the importance of proper tires in our mountain environment, (b) existing regulations requiring adequate traction, chains, etc. (c) that fines may be given to drivers involved in an accident who do not have adequate tires, and (d) that braking ability on snow and ice depends on tread design and depth and is not improved by 4-wheel drive capabilities. Many states, including Colorado, have launched winter driving safety campaigns based on the "Ice and Snow, Take it Slow" theme. In addition to encouraging better traction, the campaign will also inform and educate the public (including tourists and truckers) and the media about the importance of safe winter driving with items such as safe winter driving tips, winter vehicle preparation and chain law information.



This campaign will utilize traditional earned media, social media and a number of other communication tools such as text and email alerts, posters, website, mailings, public service announcements, electronic signage and videos.

Benefits: Reduction in accidents will reduce delays, increase highway capacity, and increase safety.

Concerns: Possible increased cost to individual passenger vehicle owners to improve their equipment. Additional

enforcement would be necessary. Currently CDOT does not spend state dollars for paid advertising so the reach of earned and social media as well as public outreach is limited.

How will safety be maintained or improved? Increase awareness of winter driving and traction relative to safe travel. Reduce occurrence and severity of traction-related accidents.

How will mobility be improved? Reduce delays by increasing safety and reducing accidents on the Corridor.

Cost: Minor costs to develop new creative materials.

Implementation Timeline: Will continue all winter 2011/2012.

3. Truck driver education

Description: Better inform truck drivers and increase awareness of I-70 Mountain Corridor travel challenges. Existing efforts and programs include: CMCA's I-70 Mountain Corridor DVD; select web-based and classroom trainings; and brochures, web-resources, and/or articles about winter mountain conditions, chain law requirements, and truck parking options. With additional funding, these resources could be expanded to include updated and expanded information and additional media outlets, such as radio, television, and smart phone applications. An additional recommendation for expanding the truck driver education program includes "branding" the I-70 Mountain Corridor as a challenging route for drivers, which requires special equipment and driving skills.

Currently, several strategies are in progress to inform, educate and train truck drivers. They include:

- **Communications and Awareness Campaign** - National, regional, and local communications outreach program to trucking companies and drivers, focused on better preparing carriers and drivers for driving the I-70 Corridor, greater compliance with the chain law, making carriers and drivers aware of peak periods so that they can avoid them if possible. This includes print media, web, social media, and radio targeted at trucking industry.
- **Best Practices for Trucking Companies and Drivers for Traveling on I-70** – Many companies have adopted special techniques and concepts relating to their type of equipment, loading procedures, driver training, internal policies, communication, and technologies that allow them to safely navigate I-70. CMCA is compiling a set of the best practices from these different companies that we will distribute and then work with individual companies to get them to adopt these practices.
- **Focused Training on I-70** – Seeking to better train and prepare truck drivers for driving the I-70 Corridor. This includes updating and distributing our DVD on "Driving I-70 through the Rockies", a how-to chain-up video, demonstrations at truck stops for chaining, and distribution of winter driving tips and specific training targeted for drivers traveling the I-70 Corridor.
- **Freight Travel Demand Working Group** – The trucking industry has been working with major shippers and carriers to have shipments conducted outside of the peak travel periods.
- **Incident/Issue Response and Information Group** – Development of Key Contact List with names, cell phones, and e-mails for individuals with major carriers traveling I-70. This would allow CDOT or CSP to directly address any problems with a carrier on the corridor regarding compliance with the chain law, traction problems, unsafe driving practices etc. This allows CDOT to quickly distribute information and to contact particular companies when needed.
- **Outreach to Truck Stops and Other Trucking Facilities** – CMCA is working with our truck stops to provide streaming video from I-70 CDOT cameras in truck stops and truck terminals so that drivers can be made aware of conditions. Also working with in-cab technology companies to send weather and road condition messages to drivers.



Benefits: Better driver preparation will improve safety, decrease accidents, and subsequently decrease congestion.

Concerns: Campaign may not be as effective for cross country drivers entering the corridor for the first time.

How will safety be maintained or improved? Greater potential to reduce occurrence and severity of accidents caused by truck travel in challenging conditions and/or inclement weather.

How will mobility be improved? Reduce congestion. Decrease accident rate.

Cost: Minimal implementation cost to CDOT.

Implementation Timeline: In progress. Some strategies expected to be in place this winter travel season.

4. Establish peak time tolling at Twin Tunnels

Description: Tolls could be implemented at the twin tunnels through several different approaches. One option is to manage congestion by implementing variable rate toll charges at the Twin Tunnels to encourage people to use alternate modes or travel outside of peak times (7-11 am weekend mornings and 2-7pm on Sundays). Another option would be to install a single tolled express lane, which would give travelers the option of a congestion-free ride through the tunnels. Rates would be highest in the middle of peak, with lower rates during the edge hours, and no tolls in the off peak. Tolls would be collected via monthly mailed invoices from license plate photos and toll tags.



Benefits: Tolling could help deter discretionary trips and maintain a certain operating speed to improve safety. Providing predictable times that the tolls would be charged would allow people to plan their trips and to avoid paying a toll. Alternatively, the single tolled lane option gives consumers the option of paying for an uncongested ride through that portion of their I-70 trip.

Concerns: This action requires approval by FHWA. CDOT will need to coordinate with local municipalities to minimize impacts on local residents. Tolls must be placed to eliminate drivers taking alternate routes through local communities to avoid tolls.



How will safety be maintained or improved? This option could improve safety by reducing congestion.

How will mobility be improved? Lower peak traffic volumes will reduce congestion and accidents. Helps maintain speeds to boost overall capacity of the corridor.

Estimated Cost: Twin Tunnels expansion is expected to cost approximately \$60 million. Tolling the new capacity (the tunnel and corresponding lane widening) would cost approximately \$250,000 more. Toll revenue could be utilized to offset the cost of maintenance of the tolled lane.

Implementation Timeline: As part of the Environmental Assessment (EA) being conducted for the east-bound tunnel widening project, CDOT is evaluating the feasibility of multiple tolling scenarios for this section (east-bound only). The team is also considering the design issues associated with installing gantries and other features necessary for a tolled facility. This EA will be completed by fall 2012.

5. Shipper/trucking management working group and streamlining

Description: While many roads in Colorado present significant challenges for motor carriers due to the climate, steep grades and mountain passes, these challenges are magnified on the I-70 Corridor by the addition of periods of high traffic volume and congestion. This strategy would expand coordination between CDOT, the shipping and trucking industry and business communities regarding streamlining of freight deliveries in the high country to improve corridor mobility during peak congestion periods. Encourage truck companies and their corresponding receivers to schedule deliveries and through-travel



during off-peak periods. CDOT and CMCA are partners in this effort. In addition, CDOT will continue to offer and expand services (VMS, CoTrip, 5-1-1, etc.) to inform and educate truck drivers about institutional, legal, and operational requirements. CDOT will also offer historical engineering data to CMCA for analysis to maximize delivery schedule efficiency and overall motorist safety.

Benefits: Lower truck volumes on I-70 during peak congestion periods will benefit travelers and reduce costs to commercial shippers along with limiting stress on truck drivers.

Continued cooperation with industry could

result in beneficial voluntary efforts to improve mobility on the corridor, which are preferable to legislatively mandated solutions.

Concerns: I-70 congestion is only one factor to consider when individual shipping companies schedule their operations. It may be possible for some companies to implement this idea effectively, but other companies may not participate since trucking companies do not control their schedules, rather it is their shippers and customers that dictate delivery time frames. In addition, some deliveries (e.g. fresh produce, mail, etc.) are not as flexible and must be delivered at certain times of the day.

How will safety be maintained or improved? Has potential to reduce collisions and overall accident occurrence and severity by reducing the number of trucks traveling during peak congestion period. The I-70 PEIS indicated truck weekend volume at 4% to 8% of average daily traffic (8%-14% on weekdays). During the 2010/2011 season, through the heavy tow program, there were 201 commercial vehicles relocated and 214 lanes cleared (weekends only). There were 39 accidents involving semis, causing 109 hours of road closure.

How will mobility be improved? This option may reduce congestion during peak travel periods.

Estimated Cost: No direct cost to CDOT but may have indirect cost to commerce in the high country.

Implementation Timeline: The workshops to discuss streamlining of I-70 freight deliveries have been in progress since March 2011. The 5th and final workshop will be held by January of next year. It is anticipated that the first streamlining effort could be implemented during the winter of 2012.

4.3 Non-governmental Actions

1. Continue Stakeholder Interaction on Corridor

Description: Given the needs and complexities of the I-70 Corridor, successful stakeholder coordination is a key component of any strategy to improve mobility. The I-70 Coalition was formed in 2004 to address transportation issues along the I-70 Mountain Corridor. The mission of the coalition, which includes dozens of political jurisdictions and private companies along the corridor, is to enhance public accessibility and mobility through the implementation of joint public & private transportation management efforts.

A Transportation Management Organization (TMO) is another model used elsewhere in Colorado to coordinate transportation efforts of state agencies, local municipalities, employers, and regional destinations. The goal of a TMO is to expand the understanding and availability of alternative travel times and alternative travel modes to improve user experience on the corridor.

Benefits: The I-70 Coalition provides a venue for stakeholders to work together to create education campaigns and to discuss key issues impacting the corridor. Establishment of a TMO could be one way to further these efforts. Regardless of the format, continued and enhanced stakeholder involvement will help build consensus about future capital improvements and could provide another way to interface with the trucking industry.

Concerns: A TMO would be advisory only and would be governed by a board of representative stakeholders from the corridor. This organization would need to fundraise from those representatives and government organizations. However, it would not be under the direct control of any one agency or stakeholder.

How will safety be maintained or improved? Offers information for drivers to make better informed decisions about trips relative to safe travel. Helps create widespread support for and input to corridor projects and operational improvements.

How will mobility be improved? Outreach campaigns can reduce traffic volumes and provide an opportunity for users to become engaged in solutions for the I-70 Corridor.

Estimated Cost: Costs vary depending on staff and organization needs.

Implementation Timeline: Given the already established I-70 Coalition, creation of a TMO could be a relatively straightforward process.

4.4 Transit Options

Advanced Guideway System (AGS) Feasibility Study and Interregional Connectivity Study (ICS)

The Advanced Guideway System (AGS) study, together with the Interregional Connectivity Study (ICS) will provide an analysis for implementation of an AGS system on the I-70 Mountain Corridor providing transit connectivity to a larger regional transit system beyond the study area.

AGS Study: CDOT has issued a Request for Proposal (RFP) seeking a Program Support Consultant (PSC) to provide technical and financial advisement services that will assist CDOT's Division of Transit and Rail (DTR) and CDOT Region 1 in determining if there is viable innovative, cost-efficient, and appropriate technological solution for the corridor. The PSC will analyze, evaluate and document industry developed materials. Capital, operations and maintenance cost considerations will be evaluated in determining the viability of a system.

These analyses will serve as a basis for determining which alternatives provide a cost-effective, safe, high-speed transit system that meet the criteria outlined in the Interstate 70 Mountain Corridor Final Programmatic Environmental Impact Statement (FPEIS) and Record of Decision (ROD); and as defined in collaboration with the manufacturing, engineering, project implementation, and financing industries (collectively, the "Industry") and with Project Leadership Team (PLT) stakeholders.

ICS Study: CDOT's Division of Transit and Rail Interregional Connectivity Study (ICS) will run concurrently and interface directly with the AGS Feasibility Study. The primary purpose of the ICS is to recommend optimal locations for High Speed Intercity Passenger Rail (HSIPR) alignments, technologies and station locations in the Denver Metropolitan Region with connections to the Regional Transportation District FasTracks transit program.

In 2009 the Federal Railroad Authority (FRA) gave CDOT a grant to study north-south and east-west high-speed rail corridors in the state. The study will focus on maximizing ridership and minimizing competition between proposed HSIPR corridors and present or future RTD FasTracks services. The study will recommend the best locations for a north-south high-speed rail alignment from Fort Collins to Pueblo, and an east-west high-speed rail alignment from Denver International Airport to Eagle County Regional Airport.

CDOT will use both the ICS and AGS Feasibility Study as a point of departure for examining an AGS system on the I-70 Mountain Corridor, which would provide transit connectivity beyond the study area to a larger regional transit and passenger rail system.

5 Public Involvement

In preparing this report, as with all efforts on the I-70 Mountain Corridor, CDOT solicited input from a variety of stakeholders. As one example, CDOT participated in a meeting of the I-70 Coalition on September 30, 2011 where a number of the ideas in this report were discussed. A few of the topics included:

- Restricting truck traffic on the corridor
- Better enforcement of chain law
- Proactive snow removal where CDOT could close the highway to let group plows go through and clear the road before an incident. Currently, plow trucks get stuck in traffic and can't effectively plow the road or respond to accidents.
- Hiring an operations manager for the corridor to provide higher priority attention on the corridor.
- Forming a TMO and the many activities a TMO could do to help provide incentives for getting vehicles off the road.
- Mobile App for traveler information

CDOT also met frequently in 2011 with local officials along the corridor, has formed Project Leadership Teams for a number of the studies on the corridor, led a tour of the I-70 Mountain Corridor with the Denver Metro Chamber on July 28, 2011 and meets regularly with the Colorado Motor Carriers Association on I-70 issues and ideas. These efforts will continue in 2012.

5.1 Workshops

Twin Tunnels and Corridor Mobility and Operational Assessment Workshops: As already described in this report, CDOT held two major workshops on I-70 in 2011. Participants in these workshops included technical experts from the state and abroad and many I-70 Mountain Corridor Stakeholders. Representatives included towns and counties along the Corridor, Colorado State Patrol, CMCA, Denver Regional Council of Governments (DRCOG), University of Colorado Denver, Winter Park Resort, and Federal Highway Administration (FHWA). In total, over 90 stakeholders were invited to participate in these workshops.

CDOT-CMCA TDM Workshops: This series of five (5) workshops were proposed by the CMCA and sponsored by the I-70 Mountain Corridor TDM Committee. The Committee acts as the Project Leadership Team (PLT) for the effort. The workshops follow the Context Sensitive Solutions (CSS) process. The overall goal is to reduce the impact and "foot-print" of slow moving vehicles on the corridor. The group has identified many action items under the following categories of initiatives:

- Operational changes, such as delivery schedules, voluntary or regulatory restrictions, hazardous material transportation, etc.
- Specific training focused on the I-70 Corridor and chain procedures
- Traction issues

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- Trucking industry changes, such as single axle truck operations
 - Education and information
 - Develop support for Legislation for more productive vehicles

The 5th and final workshop is anticipated to be held before January of next 2012.

5.2 Transportation Commission I-70 Mountain Corridor Road Trip

The Transportation Commission and CDOT senior staff, along with a number of state and local elected officials, took a road trip along the I-70 Mountain Corridor on Wednesday, October 19, 2011. Tony Devito, Region 1 Transportation Director, led the trip, pointing out challenges, future plans and key features along the entire route. Participants stopped and received a full briefing on plans for the twin tunnels and discussed options for operational improvements along the corridor. CDOT Transit and Rail Director Mark Imhoff briefed the group on next steps for transit on the corridor. The group received a tour of the Eisenhower-Johnson Memorial Tunnels and discussed tunnel traffic counts, truck traffic, metering at the tunnel, and the hope for a future fire suppression system at the tunnels.

Following the tour, the Commission met with county commissioners from Eagle, Summit and Clear Creek counties, local officials from towns along the corridor, and the State Legislators who represent the area. The meeting provided a useful exchange of information for all who attended.

On Thursday, October 20, 2011 the Transportation Commission held its Regular Meeting in Breckenridge and formally approved \$60 million to fund the widening of the Twin Tunnels. On the return trip, the Transportation Commission met in Winter Park with local officials and commissioners from Grand County.

5.3 Corridor Coordination Meetings

Below is a brief description of the different committees, forums and organizations with whom CDOT works to address issues on the I-70 Mountain Corridor and adjacent highways. The overall purpose of these efforts is to build consensus and identify and address issues related to operation and management of the Corridor. Many of projects and initiatives described in this report have been vetted through these processes, ensuring effective and efficient delivery of our programs and projects. These groups will continue to play a key role as we move forward to implement the strategies in this report.

Monthly Operations and Coordination Meetings: Initiated in 2007, this well-attended working group represents CDOT Regions I and III; CDOT Public Relations; FHWA; local governments; CSP and other law enforcement agencies and emergency response organizations along the corridor; State OIT; Ports of Entry; ski areas and organizations such as the CMCA.

This working group discusses issues related to the operations and maintenance of the corridor. These meetings have provided a forum to improve interagency coordination, create consensus and build trust among all parties involved. All issues of interest are discussed and addressed openly. Below are examples of projects or issues that have been initiated or vetted, and supported by the group.

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- Implementation and improvements to operational programs such as Heavy Tow and Courtesy Patrol programs and rolling speed harmonization
 - Chain stations and truck parking improvements
 - Project identification and support
 - Automated chain station management and queue detection systems
 - Expanded ITS infrastructure
 - Enhanced signing to address safety and operational issues
 - Construction projects in different phases are discussed
 - Improvements to incident management plans, resulting in streamlined and more effective procedures
 - Debriefs on major accidents or weather-related events
 - Establishment of unified incident command at the EJMT, with full communication capability
 - I-70 Talk-Group, a radio communication channel dedicated exclusively to CDOT and agencies involved in managing the I-70 Mountain Corridor. This eliminates barriers to radio communication amongst agencies.
 - Improvements related to slow moving vehicle operations
 - Improved communication among traffic operation centers and dispatchers

I-70 Coalition Transportation Demand Management (TDM) Committee: The purpose of the group is to identify and pursue initiatives aimed at better managing traffic demand on the I-70 Mountain Corridor. This is accomplished by implementing strategies that reduce the number of vehicles on the road, or shift the demand from current peak periods to other times of the day or the week. The committee has adopted an annual work plan, which identifies action items under six categories of initiatives (truck management, enforcement, and parking, use of technology, transit, and coordination with local businesses).

CDOT-CMCA Monthly Coordination Meetings: These monthly meetings are attended by CDOT Region I and HQ staff, CSP, CMCA staff and trucking and shipping industry representatives. The goal is to identify issues of interest to different organizations and reach consensus on ways to make improvements. This also is a forum to exchange information about CDOT's projects and programs, as well as trucking industry initiatives or changes, ensuring perspectives of different organizations are considered.

Clear Creek County Public Safety Committee: This is a monthly meeting. Members include county and local government representatives, emergency responders, law enforcement, and CDOT traffic and maintenance staff. This committee provides another forum for CDOT to interact with stakeholders. Current and upcoming projects are discussed, and feedback is received. Issues related to the operation and maintenance of the I-70 Mountain Corridor and adjacent highways are discussed, and areas for collaboration and improvement are identified. This group has a high interest in incident management and CDOT and CSP's approach to road closures, especially during adverse weather.

Clear Creek and Summit County Quarterly Coordination Meetings: CDOT Region I conducts these quarterly meetings with the boards of County Commissioners in Clear Creek and Summit Counties. Other local officials and law enforcement also attend these meetings. The meetings are attended by the Region I Transportation Director and the Region Management Team. Projects in planning, design and construction phases, as well as issues related to maintenance and operation of the I-70 Mountain Corridor and adjacent highways are discussed.

6 Conclusion and Next Steps

The priorities highlighted in this document represent just a selection of strategies that CDOT is considering to improve safety and mobility for the traveling public on the I-70 Mountain Corridor. While HB 11-1210 mandated that CDOT provide a list of prioritized options that may be implemented by July 2014, CDOT has already begun implementation on a wide variety of options to improve the corridor, from high tech options such as smart phone mobile applications and Maintenance Decision Support Systems (MDSS) to targeted “hard construction” activities including widening the eastbound Twin Tunnels.

CDOT will continue to pursue these and other options to improve our Mountain Corridor, and will continue to keep the Colorado Legislature informed on its progress.



Appendix

Previous and Current Mobility Efforts

The following strategies were included in the final report for the May 2011 I-70 Mountain Corridor Mobility and Operational Assessment Workshop. This list summarizes initiatives and programs CDOT has undertaken in the last decade to improve mobility and operations on the I-70 West Corridor (Denver to Vail).

Slow Moving Vehicles/Truck Traffic and Enforcement

1) **Chain stations** – Spent \$10 million to add and improve chain stations, including the addition of 7 new chain stations. Includes an additional 137 truck parking spaces (52 eastbound/85 westbound) to the existing 185 spaces, providing a safer environment for chain installation or removal. Also added lighting to stations, which provides needed visibility when the chain law is in effect at night or during other low visibility periods.

2) **CB Wizard** – Initiated the use of CB Wizard which is a radio broadcast device that transmits pre-recorded or on-site messages to inform truck drivers of available truck parking at chain stations and other pertinent truck related issues within two miles of their location. More devices will be deployed pending feedback from truck drivers.

3) **Truck/shipper delivery management** – Collaborating with Colorado Motor Carriers Association (CMCA) and businesses to streamline truck deliveries within mountain communities.

4) **Hot brakes** – Monitoring research on infrared technology to detect defective truck brakes. At this time, technology cannot handle higher speeds travelled on I-70.

5) **Chain assistance program** – Developed public-private partnership to provide chain assistance. Along the corridor, chains are sold and installed for a fee when needed. This winter service benefits truck drivers unfamiliar with mountain driving and overall I-70 mobility. This service is provided between Dotsero and Denver West Boulevard and is performed at no cost to CDOT as truck drivers pay for the service. During one winter season, this program sold a total of 252 chains and installed chains on 445 trucks.

6) **Autosock™** – Reviewed, evaluated, and recommended approval of fabric traction device that slips over a vehicle's outer driving wheels. It provides extra traction on snowy and icy roads. In 2008, Autosock was approved for use in Colorado. This option is easier and faster to install than steel chains (with an installation time of 30 minutes). Truck drivers are permitted to carry Autosock instead of chains during the I-70 winter chain law period between Dotsero and C-470.

7) **Truck parking lots** – Constructed the Dotsero truck parking lot, which accommodates up to 60 semi-trucks. The Department is also working with Bennett Truck Stop to provide holding areas for truck drivers awaiting improved weather conditions. By allowing truckers to await road re-opening in a lot

instead of along the shoulder, CDOT can plow the highway more safely and effectively and reopen it more quickly. The Dotsero Truck Parking Lot has alleviated congestion along Vail Pass during snow storms.

8) **Truck parking management** – Improved commercial truck parking management and communications during inclement weather at four locations along I-70. Includes installing various truck parking management components such as electronic signs, closed-circuit cameras, and power and communications systems. The additional components will help direct commercial drivers to the nearest chain station, which ultimately provides a safer environment for those chaining up or chaining down and for the rest of the traveling public.

9) **Truck maps** – Created and distributed more 10,000 copies of Colorado Truck Parking maps. These maps highlight specific parking locations, which is critical information for route planning.

10) **Left lane restriction for trucks** – Implemented on all uphill grades greater than 6 percent per recent legislation (SB 10-173). The Region installed signs along the corridor restricting trucks over 26,000 pounds from being on the left lane when ascending grades over 6 percent.

11) **CMCA coordination** – Holds meetings with CMCA and other I-70 stakeholders to collaborate over mobility and operational matters. These meetings were expanded from monthly meetings during the winter season to monthly meetings year-round. The goal of CDOT's collaboration with CMCA is to disseminate important information and updates about the I-70 corridor and to coordinate over concerns and suggestions from both the trucking industry, CDOT, and other corridor stakeholders.

12) **Heavy tow program** – Implemented a successful quick lane clearance program designed to assist truck drivers with traction problems that cause lane blockages. To date, strategy has reduced historical lane closures by approximately 50 percent. Prior to the program, tow assist and eventual lane clearance would take 52 minutes because tow units had to originate from their shops. With the quick clearance program, 3 heavy tow units are strategically located at frequent incident occurrence sites. The wreckers can be quickly dispatched to move commercial vehicles from traffic lanes to a safe location during weekends, holidays and other adverse weather days. The operations protocol has been refined over the last 4 years and has reduced lane clearance time down to 24 minutes. CDOT's program cost is \$500,000, but the total savings equates to over \$15 million per season.

13) **Reversible lane** – SB 10-184 mandated CDOT to examine feasibility of implementing reversible lane on I-70. Following this investigation, which included a cost/benefit analysis, CDOT decided not to pursue reversible lanes on I-70.

14) **Accident photogrammetry and enforcement** – Exploring the use current technology to speed up accident investigation for the purpose of accelerating highway openings after an accident.

15) **Expanded use of local enforcement** – Overtime contracts opened and offered to local police and sheriff departments to assist CSP during winter enforcements.

Maintenance and Operations

1) **Icy Falcon** – Implementing snow plowing operations performed intermittently to prepare the highway ahead of traffic by stopping traffic for a short period of time. Further enhancement of this operation (manual speed harmonization) is currently under development for implementation.

2) **Incident Command Center** – Created at the Eisenhower Johnson Memorial Tunnel (EJMT) to coordinate all major incidents with all stakeholders.

3) **Incident management plan** – Worked with local agencies to develop an incident management plan for improved response, clearance, and communications in Eagle, Summit, Clear Creek, and Jefferson Counties. All agencies are now working at an unprecedented level of service in responding to incidents on the I-70 Mountain Corridor, which has resulted in reduced closure frequencies and durations and improved safety. Implementation of these plans include:

a) Annual Incident Exercise performed by Clear Creek, Summit, and Eagle Counties.

b) Monthly I-70 Coordination meetings with all stakeholders (CDOT, counties, enforcement agencies, emergency response entities, CMCA, etc.) to discuss pertinent I-70 operations and maintenance issues.

4) **Resource sharing** – Developed partnerships between CDOT patrols and/or Regions to share maintenance resources (manpower and equipment) with I-70 West Corridor.

5) **Tunnel lighting** – Completed the installation of new tunnel lighting in 2000 and 2005 at the EJMT. These projects greatly improved tunnel luminance and helped mitigate the “black hole” effect, which causes motorists to be apprehensive and slow down as they approach a tunnel.

6) **Variable message sign (VMS) boards** – Installed new VMS boards in 2005 and 2008 that are much narrower than the original boards. These new signs prompted rule changes that raise height clearances for commercial vehicles and have prevented hundreds of over-height vehicle stoppages each year.

7) **Improved parking** – Constructed a new and improved Hogback Parking Facility at I-70 and Morrison Road, which tripled parking capacity for commuters and recreational users that utilize the lots for car pooling and transit access. The Woolly Mammoth lot includes 918 new parking spaces. The Hogback Parking Facility now has 1181 parking spaces, which includes 15 spots designated for Jefferson County Open Space users.

Active Traffic Management & Travel Demand Management

1) **Smart phone (app) discount program** – Currently working with University of Arizona to develop a discount program whereby motorists can gain “rewards” for not being on I-70 West during peak travel times.

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- 2) **Ski bus** – Explored offering a Ski Bus to Copper Mountain during 2006. This option lost popularity because of perceived high bus fare costs and because of rider interest in creating “party bus” atmosphere.
 - 3) **Active traffic management (ATM)** – Introduced the concept of ATM for I-70 in 2006. The Department installed the first variable speed limit signs in 2009 as part of its chain law enforcement program. For both fiscal years 2012 and 2013, \$5 million dollars are budgeted (from FASTER funds) for expanding implementation of ATM on I-70 West. These projects may be delayed because of stakeholder concerns from the CSS process.
 - 4) **Queue detection systems** – Installed a warning system last year on Georgetown Hill (eastbound) to detect and warn approaching traffic of any developing congestion from Georgetown westward.
 - 5) **Hard shoulder running** – Introduced by the Region for use on I-70 West in early 2010 as temporary congestion relief. The concept is currently being implemented in many States and countries to open shoulders for traffic use during congestion.
 - 6) **Courtesy Patrol** – Provides drivers of passenger and other smaller vehicles free roadside assistance for services such as flat tires, fuel or water transfer, jump starts, short-distance towing, accident scene protection and minor mechanical assistance. Three trucks patrol I-70 between the top of Floyd Hill and Silverthorne looking for disabled vehicles. This program is offered primarily on weekends and holidays during the winter and summer months. The annual cost to CDOT is approximately \$300,000. Over 1100 cars were assisted last season.

Traveler Information

- 1) **Fiber optics and intelligent transportation system (ITS) devices** – Invested approximately \$11 million toward installing 90 miles of fiber optics along I-70 West between Officer’s Gulch and the Town of Vail. This resource has enabled CDOT to quickly deploy traffic messages, obtain visual access via closed circuit television, and conduct critical communications. Compared with cell phone technology (which was used previously), fiber optics offer instantaneous communication with needed devices. To reduce CDOT's construction cost and further leverage the project, CDOT partnered with:
 - (a) Xcel Energy, who installed electric power lines from Officer's Gulch to Vail Pass to upgrade and provide reliable service in the area.
 - (b) Town of Vail, who installed fiber optic cable from Vail Pass to Town to provide interconnectivity to the ITS network.
- 2) **VMSs, cameras, speed radars, and remote weather information systems** – Continually installing these electronic devices and systems to provide flexible traffic messaging, visual detection, and traffic and weather data on I-70.

- 3) **511** – Manages phone-based public information system through the CTMC. 511 has been expanded for capacity and is a reliable and current source of feedback for travelers who call into the service.
- 4) **CoTrip.Org** – Manages internet website that provides updated traveler information.
- 5) **Travel time** – Implemented real-time trip-travel times displayed on overhead VMSs to provide travel time information along the corridor. Provides the public reasonable accuracy in predicting total travel time from point A to B. This system has been in operation for 5 years and is continually being enhanced by the CTMC.
- 6) **VPN** – Provides direct internet link to various government agencies (police, CSP, emergency management services, etc.) and business establishments (resort hotels, ski kiosks, restaurants, etc.) with streaming data from Cotrip.org to inform viewers of travel times, weather conditions, traffic congestion, etc.