**SUMMARY**

**What is the purpose of this report?**

This report summarizes results of a week-long workshop focused on improving traffic operations and mobility on the I-70 Mountain Corridor through potential low cost and no cost solutions.

**Who was involved in this effort?**

Hosted by the Colorado Department of Transportation (CDOT), participants in the workshop 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, 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.

**What happened in the workshop?**

The week-long workshop was held between May 23 and 27, 2011 in Golden and Lakewood, CO. Goals included developing, exploring, and documenting new and existing ideas to improve mobility and operations along the I-70 Mountain Corridor. In total, 142 ideas were generated as part of this effort and are presented starting on page 3. Ideas from this assessment were grouped based on potential implementation to improve mobility and operations in the short-, mid-, and long-term time frames.

**What are the next steps?**

The 142 ideas have not been prioritized or screened for feasibility. CDOT has not determined which, if any, ideas should be implemented and whether funding is available for implementation. Should funding become available, CDOT will work with stakeholders as appropriate within the context sensitive solutions (CSS) process to evaluate which ideas may be fully developed for implementation along the corridor.
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Background
The I-70 Mountain Corridor features mountainous terrain, increasing traffic congestion during peak travel times, and challenging weather conditions. Traffic congestion is especially high for weekend motorists as private automobiles, recreational vehicles, trucks, motorcycles, and others all share I-70 as they travel between mountain destinations and Front Range communities. Building on continued local and state collaboration, CDOT initiated a week-long workshop with technical experts and stakeholders to develop potential solutions to improve traffic operations and mobility along the I-70 Mountain Corridor.

Context Sensitive Solutions (CSS) framework
This workshop was held in a manner consistent with CDOT’s CSS framework, which is described in detail on CDOT’s CSS website (i70mtncorridorcss.com). The framework ensures collaboration based on a six-step process. The process begins with defining desired outcomes and leads to evaluating and refining alternatives and finalizing documentation. Ideas carried forward from this assessment may be fully evaluated within the six-step CSS process.
Workshop

The workshop was hosted the week of May 23rd, 2011 as a venue to explore low cost and no
cost solutions and maximize existing resources to improve traffic congestion along I-70. This
workshop did not include evaluation of major capital improvement projects. The agenda for the
week-long, fast-tracked workshop is provided in Appendix A. A summary of objectives for each
day is summarized below.

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

CDOT invited independent technical experts in planning, communications, engineering, and
related fields to participate. From the pool of applicants, 19 professionals were selected to
provide insight from their specialty areas. Attendance ranged from 32 to 61 participants over
the course of five days. Appendix D provides a detailed summary of invitees and attendees at
the workshop. Workshop participants also included representatives from towns and counties
along the Corridor, Colorado State Patrol (CSP), Colorado Motor Carriers Association (CMCA),
Denver Regional Council of Governments (DRCOG), University of Colorado Denver, Winter Park
Resort, and Federal Highway Administration (FHWA).

Focus areas

Participants divided into working groups to analyze the four areas listed below:

- Slow moving vehicles (SMVs), truck traffic, and enforcement (Enf)
- Maintenance and operations (M/O)
- Active traffic management (ATM) and travel demand management (TDM)
- Traveler information

Throughout the workshop the four groups joined together to discuss and compare ideas and
examine common issues and possible synergies.
Presentations
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. Copies of these presentations are included in Appendix B. For additional background, Appendix E includes a summary of efforts CDOT implemented in the last decade to improve mobility along the corridor. Appendix F references recent closure and congestion data and highlights CDOT’s current successes with winter programs to improve operations.

IDEAS FOR MOBILITY AND OPERATIONAL IMPROVEMENTS
Participants in the workshop developed 142 ideas to improve mobility and operations along the I-70 Mountain Corridor. The tables on the following pages summarize all of these ideas. For more detailed information, Appendix C includes the actual notes captured during the workshop.

Delivery time
All 142 ideas were grouped based on timing for potential implementation. Some groups developed similar ideas. These common threads were discussed together during a large group session to focus the ideas and incorporate different perspectives.
Additionally, each of the four focus groups highlighted ideas they felt had the greatest potential to provide mobility and operational improvements along the corridor. Summaries of these ideas are provided in pages 12 through 31 of this report.

142 ideas developed

Short-term, mid-term, and long-term ideas

Ideas supported by technical groups

CDOT is committed to implementing both short-term and long-term solutions on the I-70 Corridor. Therefore, the timing of delivery for each idea was assessed to understand when benefits can be realized on the corridor. Delivery time is defined as a function of:

- **Legislative updates** through the Colorado General Assembly or **agency policy changes**
- **Anticipated project costs** ranging from low (less than $1 million), moderate ($1 million to $5 million), and high (greater than $5 million)
- **Level of environmental documentation** to disclose potential community and environmental impacts to the public and decision makers. Documentation relates to the anticipated level of environmental impacts:
  - Categorical Exclusion (Cat Ex) – Significant impacts are not anticipated
  - Environmental Assessment (EA) – Significance of potential impacts is uncertain (generally requires 24 to 30 month process)
  - Environmental Impact Statement (EIS) – Significant impacts are expected (generally requires 3 to 5 year process)

### Delivery Time

<table>
<thead>
<tr>
<th>Short-term</th>
<th>Mid-term</th>
<th>Long-term</th>
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</thead>
<tbody>
<tr>
<td><strong>by June 2012</strong></td>
<td><strong>by June 2014</strong></td>
<td>beyond June 2014</td>
</tr>
<tr>
<td>- no or minor legislative or agency policy changes</td>
<td>- more significant legislative or agency policy changes</td>
<td>- more significant legislative or agency policy changes</td>
</tr>
<tr>
<td>- minimal capital costs</td>
<td>- minimal to moderate capital costs</td>
<td>- minimal to high capital costs</td>
</tr>
<tr>
<td>- environmental analysis: Cat Ex</td>
<td>- environmental analysis: Cat Ex or EA</td>
<td>- environmental analysis: Cat Ex, EA, or EIS</td>
</tr>
</tbody>
</table>

The following tables briefly list the ideas and implementation timeframes. **Appendix C** includes additional detail about each idea, and the icon [S] denotes that a one-page summary is available—as introduced on page 10—to highlight the idea.
Short-term implementation

The following 83 ideas could be implemented to provide relief by next summer, with implementation by June 2012. These ideas require minor or no legislative or agency policy changes, minimal capital costs, and minimal environmental documentation (a Cat Ex). The number (#) next to each idea represents the “Report ID” in Appendix C, where additional background information is available. The ideas have not been prioritized, so this number does not represent a ranking. The icon [!] denotes the idea has potential for immediate delivery by December 2011.

<table>
<thead>
<tr>
<th>Group</th>
<th>Idea</th>
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<tbody>
<tr>
<td>SMV/Enf</td>
<td>• Increase driver education for snow and mountain conditions (1) ![S]</td>
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<tr>
<td></td>
<td>• Develop public information campaign to emphasize to passenger vehicle drivers that fines exist for inadequate tires (2) ![]</td>
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<tr>
<td></td>
<td>• Increase passenger vehicle enforcement options for inadequate snow tires (4) ![S]</td>
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<tr>
<td></td>
<td>• Develop proactive education for truckers on chain law and corridor conditions (6) ![]</td>
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<td></td>
<td>• Expand methods to distribute current condition information and corridor driving tips to drivers while they are on the corridor (9)</td>
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<td></td>
<td>• Close Dumont point of entry (POE) during peak volume periods (11) ![]</td>
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<tr>
<td></td>
<td>• Increase enforcement of unsafe speeds and condition violations (14) ![S]</td>
</tr>
<tr>
<td></td>
<td>• Allow fines collected on the corridor to be utilized for increased enforcement on the corridor (15)</td>
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<td></td>
<td>• Provide CSP with electronic survey equipment designed to document an accident scene quickly in order to reopen I-70 faster (17)</td>
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<tr>
<td></td>
<td>• Disseminate high truck accident location data (20) ![]</td>
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<tr>
<td></td>
<td>• Implement shipper management working group to coordinate off-peak use of corridor (23) ![S]</td>
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<td></td>
<td>• Allow long combination vehicles to reduce overall truck volume (28)</td>
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<td></td>
<td>• Increase enforcement of minimum speeds in the left lane (30) ![]</td>
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<tr>
<td></td>
<td>• Increase SMV passing zones at specific locations (31)</td>
</tr>
<tr>
<td>M/O</td>
<td>• Increase local and State enforcement options (34) ![]</td>
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<td></td>
<td>• Increase snow and ice control maintenance level of service (36) ![S]</td>
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<td></td>
<td>• Include weather source/data (Meridian MDSS) in all maintenance trucks (37) ![S]</td>
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<tr>
<td></td>
<td>• Initiate preemptive closures in extreme weather events (39) ![]</td>
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<tr>
<td></td>
<td>• Close Dumont POE during peak travel/bad weather (40) ![]</td>
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### Short-term Ideas

<table>
<thead>
<tr>
<th>Group</th>
<th>Idea</th>
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</table>
| **M/O cont’d** | • Share equipment and personnel with I-70 from other locations as temporary and supplemental winter support (42)  
• Use accident alert for “30 minutes clear of accidents” and remove vehicles from travel lanes ASAP (43)  
• Improve on accident removal depending on status of peak period and traffic flow obstructions (44)  
• Develop automated spray systems at tunnels and bridges (45)  
• Offer employee transit and commuting opportunities from lower cost to higher cost areas (46)  
• Restrict heavy and tow vehicles to right lane during peak period year round (47)  
• Expand use of multiple plows running parallel (48)  
• Improve striping delineation (49)  
• Retain experienced employees by supporting affordable housing (50)  
• Initiate one-lane tunnel metering (51)  
• Implement short-term closures at interchanges with services when metering is in effect (53)  |
| **Traveler Information** | • Develop/expand smart phone mobile applications (62) S  
• Develop incentive program to encourage travel off-peak (63) S  
• Create CoTrip enhancements including alternate routes (65)  
• Survey and research I-70 traveler and stakeholder information needs (70)  
• Develop public information campaign to raise awareness about existing and developing I-70 info tools (72)  
• Create editorial content and syndicate a series with interesting characters conveying corridor travel information (73)  
• Expand existing social media platforms to foster a sense of community and encourage positive traveler behavior (74)  
• Expand trucker education programs and offer enhanced information stream (75) S  
• Generate revenue with public private partnership (P3) advertizing on CoTrip, mobile application (app), GovText, etc. (77)  |
| **ATM/TDM**     | • Expand use of ramp metering (81)  
• Initiate a Transportation Management Organization (TMO) to develop TDM, education, and outreach (85) S  
• Implement queue detection and warning at specific locations (86) S  
• Coordinate with resorts to encourage alternate travel times (88)  
• Utilize “predictive traveler information” (89)  
• Offer driver training program for I-70 conditions to inexperienced drivers (90)  |
<table>
<thead>
<tr>
<th>Group</th>
<th>Idea</th>
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<tbody>
<tr>
<td>• Institute emergency response uses on hard shoulders (92)</td>
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<tr>
<td>• Use variable message signs (VMS) to encourage good driving (95)</td>
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<tr>
<td>• Institute quick response and quick clearance for all incidents (96)</td>
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<tr>
<td>• Expand &quot;Casino Model&quot; for customer travel programs (97)</td>
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<td>• Provide safety information at visitor centers and rental car companies (98)</td>
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<tr>
<td>• Hire private firm to provide &quot;Icy Falcon&quot; pilot services (99)</td>
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<tr>
<td>• Apply tech tools to reduce incident clearance times (100)</td>
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<tr>
<td>• Publicize and market information on fines and statutes (101)</td>
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<tr>
<td>• Provide dedicated I-70 staff along corridor (102)</td>
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<tr>
<td>• Develop hard shoulders from US6 east for at least one mile (103)</td>
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<tr>
<td>• Provide tools/programs to address &quot;following too closely&quot; driver behavior (104)</td>
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<tr>
<td>• Enhance park and rides with bus service to major destinations (106)</td>
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<tr>
<td>• Offer vehicles at mountain destinations such as rental or shuttle cars (107)</td>
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<tr>
<td>• Manage closures/restrictions and convey traveler information more effectively (108)</td>
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<td>• Develop programs that punish bad and reward good behavior (109)</td>
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<td>• Convey to public costs and benefits of avoiding peak hour travel (111)</td>
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<tr>
<td>• Develop applications of Disney ride “fast cut” concept (112)</td>
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<tr>
<td>• Utilize rubberneck blinder, which could be funded privately (114)</td>
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<tr>
<td>• Develop partnership to create ski pass programs that limit dates or times (115)</td>
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<tr>
<td>• Partner toward community restrictions on trucking and shipping patterns (118)</td>
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<tr>
<td>• Partner toward programs to package resort visits (119)</td>
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<tr>
<td>• Enhance partnerships with rental car community (120)</td>
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<tr>
<td>• Utilize dummy cameras/perceived enforcement (122)</td>
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<tr>
<td>• Develop program to coordinate ride with guaranteed return trip (124)</td>
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<tr>
<td>• Enhance ongoing communication with communities over project goals/benefits (125)</td>
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<tr>
<td>• Develop Bus queue hop (127)</td>
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<tr>
<td>• Initiate phase 1 of speed harmonization (speed limit spaced pavement markings and other tools to reduce tail gating) (129)</td>
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<tr>
<td>• Institute Bakerville to Silver Plume Pilot Project (130)</td>
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<tr>
<td>• Establish employee flex schedules to allow midweek recreation travel (131)</td>
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<tr>
<td>• Expand TMO functions (132)</td>
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<tr>
<td>• Initiate junction control at major intersections (133)</td>
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<tr>
<td>• Initiate pre-emptive closures to conduct speed maintenance operations (134)</td>
<td></td>
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<tr>
<td>• Initiate pre-emptive closures to avoid incidents (135)</td>
<td></td>
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<tr>
<td>• Institute variable speed limits (136)</td>
<td></td>
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<tr>
<td>• Initiate voluntary car inspections (138)</td>
<td></td>
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<td>• Utilize cameras and &quot;dummy cameras&quot; to support enforcement (140)</td>
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<tr>
<td>• Manage the volume of vehicles moving onto the corridor (141)</td>
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<tr>
<td>• Add emergency refuge areas off hard shoulders (142)</td>
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</tr>
</tbody>
</table>
Mid-term implementation

The following 46 ideas could be implemented to provide relief by June 2014. These ideas require more significant legislative or agency policy changes, minimal to moderate capital costs, and a Cat Ex or EA as the highest level of environmental documentation. The number (#) next to each idea represents the “Report ID” in Appendix C, where additional background information is available. The ideas have not been prioritized, so this number does not represent a ranking.

<table>
<thead>
<tr>
<th>Mid-term</th>
<th>Group</th>
<th>Idea</th>
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<tbody>
<tr>
<td>SMV/Enf</td>
<td>• Initiate mandatory vehicle inspections for traction (3)</td>
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<td></td>
<td>• Expand collaboration with rental car companies over winter driving equipment and education (5)</td>
<td></td>
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<td></td>
<td>• Work with CSP to expand &quot;Icy Falcon&quot; pilot car program (7)</td>
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<td></td>
<td>• Initiate electronic automated speed enforcement (8)</td>
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<td></td>
<td>• Lengthen acceleration and deceleration lanes with striping on hard shoulders where possible (10)</td>
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<td></td>
<td>• Post more CSP Officers on the corridor (12)</td>
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<td></td>
<td>• Utilize TACT Program for tail gating enforcement (13)</td>
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<td></td>
<td>• Locate hazardous material (hazmat) and fatality response teams on the corridor to minimize closure times (16)</td>
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<td></td>
<td>• Implement corridor wide closure plan to enhance parking options and disseminate information to stranded motorists (18)</td>
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<td></td>
<td>• Expand state-wide campaign against distracted driving (19)</td>
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<td></td>
<td>• Provide more truck parking and improve communication regarding alternate parking options (21)</td>
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<td></td>
<td>• Restrict SMVs from corridor during adverse weather conditions (22)</td>
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<tr>
<td></td>
<td>• Seek voluntary compliance for keeping SMVs out of left lane (25)</td>
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<tr>
<td></td>
<td>• Restrict SMVs from corridor during peak hours (29) S</td>
<td></td>
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<tr>
<td></td>
<td>• Restrict single drive axle trucks (32) S</td>
<td></td>
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<td></td>
<td>• Review hazmat clean-up law as it pertains to highway closures (33)</td>
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<td></td>
<td>• Change contract with quick tow/courtesy patrol so user pays (35) S</td>
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</tr>
<tr>
<td></td>
<td>• Restrict single drive axle combination trucks during adverse weather (38)</td>
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<td></td>
<td>• Establish a one level commercial vehicle/heavy vehicle chain law (41)</td>
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<td></td>
<td>• Conduct CDOT fleet replacement (52)</td>
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<td></td>
<td>• Develop a fire suppression system in the Eisenhower Johnson Memorial Tunnel (EJMT) (55) S</td>
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<td></td>
<td>• Program repaving on a more frequent basis (56)</td>
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<td></td>
<td>• Close Loveland Pass (58)</td>
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<tr>
<td></td>
<td>• Privatize I-70 Corridor operations (60)</td>
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### Mid-term

<table>
<thead>
<tr>
<th>Group</th>
<th>Idea</th>
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</table>
| **Traveler Information** | • Make historical traffic data readily available to the general public in an easily understood format (61)  
• Offer communication Touch Point Kiosks at park and rides, resorts, rest areas, etc. (64)  
• Offer special event messaging (66)  
• Develop connected vehicle technologies (67)  
• Establish reservation system to travel during peak periods (68)  
• Establish system to allow travelers to pay for access to front of traffic queue (69)  
• Develop enhanced traveler information marketing campaign (71)  
• Improve communication of chain requirements to truckers (76)  
• Generate revenue through strategic partnerships with major brands (78)  
• Generate revenue with "title sponsorship" (79)  
• Generate revenue with government and other agency/non-profit/economic development grants (80) |
| **ATM/TDM** | • Institute speed harmonization (82)  
• Establish peak time tolling at Twin Tunnels (83)  
• Utilize frontage roads and hard shoulders to move additional traffic including "reversible frontage roads" (87)  
• Allow other uses on "express lanes" for alternative transportation modes (91)  
• Establish high occupancy toll (HOT) lanes on hardened shoulders (93)  
• Implement congestion pricing at tunnels (94)  
• Consider highly managed "UK Model" for operating on hardened shoulders (105)  
• Establish integrated I-70 ATM program with frontage roads/adjacent local roads (117)  
• Consider active lane management and additional ATM (UK Model) (121)  
• Develop truck climbing/descending lanes (126)  
• Establish speed harmonization with variable speed limit signs (128) |

### Long-term implementation

The following 13 ideas could be implemented to provide relief beyond June 2014. These ideas require more significant legislative or agency policy changes, minimal to high capital costs, and a Cat Ex, EA, or EIS. The number (#) next to each idea represents the “Report ID” in Appendix C, where additional background information is available. The ideas have not been prioritized, so this number does not represent a ranking.
## Location specific ideas

While many of the ideas developed could be implemented corridor-wide, some ideas relate to specific locations. These site-specific ideas are mapped on the next page.

## Summary of ideas supported by each group

The workshop did not include any effort to prioritize these ideas. In fact, a goal of the workshop was to develop and assess as many ideas as possible without precluding or dismissing available options.

As the workshop concluded, each technical group was asked to identify four or five ideas that they believed had greatest potential to improve mobility and operations in the near future. Many of these ideas include minimal to moderate costs. The following descriptions beginning on page 12 contain summaries of these ideas that showcase important details from Appendix C. As noted, these ideas do not represent CDOT’s project priorities. Instead, the following one-page summaries present options supported most strongly by the working groups involved in the week-long effort. As described further in the last section of this document (Next Steps), CDOT will consider and evaluate all of the ideas in Appendix C.

### Long-term

<table>
<thead>
<tr>
<th>Group</th>
<th>Idea</th>
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<tbody>
<tr>
<td>SMV/Enf</td>
<td>- Allow hazmat trucks through EJMT at night (24)</td>
</tr>
<tr>
<td></td>
<td>- Restrict SMVs on I-70 over weekends (26)</td>
</tr>
<tr>
<td></td>
<td>- Allow hazmat trucks through EJMT under specific and controlled circumstances (27)</td>
</tr>
<tr>
<td>M/O</td>
<td>- Keep Loveland Pass open all the time (54)</td>
</tr>
<tr>
<td></td>
<td>- Develop a hazmat tunnel bore (57)</td>
</tr>
<tr>
<td></td>
<td>- Utilize an automated avalanche system such as GAZEX (59)</td>
</tr>
<tr>
<td>ATM/TDM</td>
<td>- Develop selected segments for hard shoulder running at peak times, including eastbound from US-40 to Twin Tunnels (84) S</td>
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<td></td>
<td>- Support P3s for the creation of destinations where travelers would be willing to wait out peak traffic (110)</td>
</tr>
<tr>
<td></td>
<td>- Convert hard shoulders to full time or peak time running lanes (113)</td>
</tr>
<tr>
<td></td>
<td>- Focus restrictions on westbound (WB) travel to maximize economic benefit (116)</td>
</tr>
<tr>
<td></td>
<td>- Change/improve the &quot;safety culture&quot; of the corridor (123)</td>
</tr>
<tr>
<td></td>
<td>- Develop a bar code that prohibits text message transmittals in automobiles (137)</td>
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<tr>
<td></td>
<td>- Support P3s to create full service truck stops at strategic locations on the corridor (139)</td>
</tr>
</tbody>
</table>
Key for location specific ideas as summarized by working group

Slow moving vehicles, truck traffic, and enforcement
1. Allow hazmat trucks through EJMT at night (24)

Maintenance and operations
1. Close Dumont POE in peak travel/bad weather (11)
2. Develop automated spray systems at tunnels and bridges (45)
3. Offer employee transit and commuting opportunities from lower cost to high cost areas (46)
4. Retain experienced employees by supporting affordable housing (50)
5. Develop a fire suppression system in the EJMT (55)

Active traffic management and travel demand management
1. Develop selected segments for hard shoulder running at peak times, including eastbound from US 40 to the Twin Tunnels (84)
2. Institute speed harmonization (82)
3. Utilize frontage roads and hard shoulders to move additional traffic including “reversible frontage roads” (87)
4. Need shoulder widening and structure modifications at exit 240 (part of [87])
5. Develop hard shoulders from US 6 east for at least one mile (103)
6. Develop truck climbing/descending lanes (126)

Traveler information
1. Offer communication Touch Point Kiosks at park and rides, resorts, rest areas, etc. (64)

The number (#) next to each idea represents the “Report ID” in Appendix C, where additional background information is available. The ideas have not been prioritized, so this number does not represent a ranking.
Increase driver education for snow and mountain conditions

Enforcement  Delay Reduction  Accident Prevention  Influencing Driver Behavior

Description
To increase the percentage of passenger vehicles with adequate tires and traction devices, a public relations campaign could be designed to emphasize the following points: (a) the importance of proper tires in our mountain environment, (b) existing regulations require adequate traction, (c) fines may be given to drivers involved in an accident who do not have adequate tires, and (d) 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. Wisconsin's Clear Roads campaign distributes scripts to radio stations for public service announcements. This campaign would emphasize the importance of traction. Consider partnerships with tire retailers to get more air time. Consider a themed campaign where the public will get to know characters over time. Appeal to Coloradoan's sense of independence and resilience: "Real Colorado: Real Snow Tires." CDOT could also consider whether to implement requirements for rental car companies to equip vehicles with snow tires.

Benefits
Reduction in accidents caused by passenger vehicles 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. Educating out-of-state drivers may be a challenge.

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

How will mobility be improved?
Reduce delays. Increase safety.
Increase passenger vehicle enforcement options for inadequate snow tires

Enforcement  Delay Reduction  Accident Prevention  Influencing Driver Behavior

**Description**
To increase the percentage of passenger vehicles with adequate tires and/or traction devices, existing regulations and enforcement of these regulations would be strengthened. Current law allows an Officer to issue a citation to a driver whose vehicle does not have adequate tread depth. Nevertheless, CSP representatives have noted that citations for inadequate tread depth frequently do not stand up in court, and the current fine amount does not serve as an effective deterrent. The required traction standards of tires would be clarified (and publicized). Officers would have the ability to issue a citation if a vehicle with sub-standard tires disrupts the traffic flow. Fines associated with this citation would be increased. This idea may require legislative action.

**Benefits**
Reduction in accidents caused by passenger vehicles will reduce delays, increase highway capacity, and increase safety.

**Concerns**
Individual citizen dissatisfaction with increased level of fines.

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

**How will mobility be improved?**
On the I-70 Corridor accidents caused by lack of traction often cause a severe disruption to traffic flow. A minor accident can back up traffic for miles; a major accident can block the highway. Prevention of these accidents can free up CSP officers for other duties on the corridor and improve safety for all.

**Delivery:** Short-term (possibly immediate)

**Cost:** Low

**Lead Team:** CSP

**Location:** Corridor-wide

**Appendix C Report IDs:**
Primary: SMV/Enf 4
Others: SMV/Enf 14
Description
Increase local and CSP enforcement of speeds and travel during inclement weather and high volume periods. Provide additional enforcement presence during peak volume periods. Allow for proactive enforcement of truck chain laws at ports of entry including ticketing for not carrying chains between September 1 and May 31.

Benefits
Accident prevention and delay reduction from better compliance with truck chain laws and speed limits. A larger law enforcement presence will allow for proactive actions toward more unsafe driving practices and quicker responses to incidents. A larger visible CSP presence will increase voluntary compliance and promote better driver behavior. Could be self funding if fines were increased and revenue from citations remained on the corridor to support CSP mountain corridor operations.

Concerns
Additional staff and equipment costs for enforcement would be necessary. Difficult to retain staff on the corridor because of harsh working conditions and high costs of living. Additional disruption to traffic flow when violators are pulled over onto the shoulder.

How will safety be maintained or improved?
Increase awareness of chain law requirements. Reduce occurrence of and/or severity of accidents on roadways, at POEs, and at truck chain-up stations.

How will mobility be improved?
Improve safety and mobility with proactive enforcement of chain laws and aggressive driving. Greater opportunity to prevent accidents.
Expand trucker education program and offer enhanced information stream

Traveler Information  Accident Prevention

Description
Expand the existing public relations campaign targeting truck drivers to 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 for truck drivers 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 unique environment for drivers, which requires special equipment and driving skills.

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/or severity of accidents caused by truck travel in challenging conditions and/or inclement weather.

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

Delivery: Short-term
Cost: Low
Lead Team: CDOT
Location: Corridor-wide

Appendix C Report IDs:
Primary: Traveler Info 75
Others: Traveler Info 76 and SMV/ Enf 1, 2, 6, 12
Include weather source/data (Meridian MDSS) in all maintenance trucks

Maintenance and Operations  Weather Forecasting Software

Description
CDOT currently utilizes a Maintenance Decision Support System (MDSS) in a portion of their 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
Main benefit is that it helps each truck operator plan and schedule maintenance activities. General benefits include: (a) Manages chemicals (deicing) to reduce environmental impacts, (b) Recommendations 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 would require additional maintenance. Sensor equipment is delicate and currently is 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?
Optimize staff deployment. Tuned application of deicing agents will reduce the amount of time I-70 is snow packed, which will decrease accidents and maintain capacity.

Delivery: Short-term (possibly immediate)
Cost: Low (under $500,000 + annual service/maintenance)
Lead Team: CDOT
Location: Corridor-wide
Appendix C Report ID: Primary: M/O 37
Implement queue detection and warning at specific locations

Active Traffic Management     Reduced Crashes     Improved Driver Expectancy

From Highway 402 Queue Warning System, Brown and Byrne, 2008

Description
Queue warning systems use detection devices to determine when average travel speeds are slowing and provide real time warnings to oncoming drivers so they can reduce their speeds. This concept requires detection devices and variable message signs placed at key locations on the corridor. Like speed harmonization, the goal is to reduce “turbulence” that causes accidents and thereby creates more congestion.

Benefits
Reduces rear-end and other crashes and lowers speeds to reduce intensity of injuries. It also provides real time road condition expectations for travelers. Lower cost than a full speed harmonization program and can provide spot benefits in areas that experience frequent bottleneck conditions. If consistent VMS and detection equipment is used, it can be integrated into speed harmonization and other traveler information programs.

Concerns
Depending on placement, the additional signage may have a negative visual impact on the corridor.

How will safety be maintained or improved?
Offers information for drivers to make better informed decisions about travel speed. Has potential to reduce occurrence and severity of accidents, which has potential to result in increased mobility.

How will mobility be improved?
Queue warning systems can improve safety and manage traffic flow by reducing turbulence and accidents. On I-70, it could be useful upstream of interchanges at US 6 and US 40, port of entry stations, and near other areas with limited sight distances or known congestion points.

Delivery: Short-term
Cost: Low ($500,000)
Lead Team: CDOT
Location: Key locations like US6, Georgetown and US40 intersections
Appendix C Report ID: Primary: ATM/TDM 86
Develop/expand smart phone mobile applications

Traveler Information     Influencing Traveler Behavior

Description
Deliver a mobile app using historical data to influence traveler behavior and encourage travel during off-peak periods. The simply designed app would utilize existing historical data to project congestion periods on I-70. For example, skiers using this app would find that traffic volumes are considerably less through the corridor before 7am on a Saturday, westbound and before or after 3:00 – 6:00pm on a Sunday, eastbound during the ski season. A longer term, multi-faceted app could also be developed on a multi-platform promotional campaign targeting travelers from a variety of formats including smart phone apps, websites, mobile web access, Facebook and Twitter, 511 and GovDelivery. The app would also be hands-free to ensure safe driving.

Benefits
Delivery time for initial app could meet corridor demands for 2011-2012 ski season. These tools would provide information to travelers to change travel behavior pre-trip to allow for reduced traffic congestion. It would deliver information to users in an enhanced manner and provide improved customer service through ongoing, real time communication. With added interaction tools on the app between corridor stakeholders, a broader conversation about influencing travel behavior could be inspired. Ultimately, CDOT could collect GPS data from smart phones, or “probes” to feedback into real time app information. This effort could potentially reduce the cost of ATM. It is scalable and could be replicated in other corridors in the state.

Concerns
The initial app with historical projections would not account for condition changes, such as weather, so it could not predict current traffic congestion. To manage expectations, clear messaging to the public about the app’s limitations would need to be explicit. A “hands-free” app would need to be developed as quickly as possible to ensure greatest safety for drivers. The app would require upgrades and maintenance. Outsourcing these tasks is recommended.

How will safety be maintained or improved?
Developing a “hands-free” app would be necessary to ensure optimal driver safety.

How will mobility be improved?
A user friendly app could provide travelers with information to make better informed decisions about how to avoid peak congestion.
Implement shipper management working group to coordinate off-peak use of corridor

Slow Moving Vehicles  Traveler Information  Managing Driver Behavior

Description
Expand coordination between CDOT, the shipping industry, and business communities regarding restricted truck deliveries and improved corridor mobility during peak congestion periods. Encourage truck companies to schedule deliveries and through-travel for off-peak periods. CDOT is a strong partner to CMCA in this effort. CDOT initiated a series of work sessions with CMCA and business communities to identify and develop strategies for reducing truck traffic impacts on I-70 while still meeting industry needs. These meetings are based on technical and engineering data provided by CDOT. Results of this collaboration will be published by CDOT. In addition, CDOT will continue to offer and expand services (VMS, CoTrip, 511, etc) to inform and educate truck drivers about institutional, legal, and operational matters. CDOT will also offer historical engineering data to CMCA for analysis to maximize schedule efficiency and motorist safety.

Benefits
If possible, avoiding the corridor during peak congestion hours could benefit commercial shippers by reducing costs and limiting stress on truck drivers. The traveling public would benefit from lower truck volumes on I-70 during peak congestion periods.

Concerns
Individual shipping companies consider a variety of options when scheduling operations. I-70 congestion is only one factor for consideration. It may be possible for some companies to implement this idea effectively, but other companies may not participate.

How will safety be maintained or improved?
This option does not directly affect safety.

How will mobility be improved?
This option may reduce congestion during peak travel periods.
Improve communication of chain requirements to truckers

Description
An unintended consequence of truck chain laws is that drivers stop immediately on shoulders to chain up when they see the chain requirement has gone into effect or if the requirement is not in effect but other truckers are chaining up on the shoulders. CSP reports frequently that trucks park to chain up on the shoulders even though space is available in an upcoming, nearby chain station. This action primarily poses safety concerns for drivers and nearby motorists. As a secondary matter, this action impedes traffic flow and reduces mobility by limiting road visibility ahead and creating obstacles for motorists. This situation could be improved with a system that monitors and reports available space in chain stations. Drivers could receive that communication in advance and make better informed decisions about where and when to apply chains to their tires.

Benefits
Highway capacity decreases when visibility and shy distance is reduced by encroachments on the shoulder. This is particularly true when the object on the shoulder is a large truck, and the driver is stepping out into the travel lane while chaining up. Both capacity and safety will be improved by reducing the current practice of chaining up on the shoulder when it is not necessary.

Concerns
The exact method/technology to implement a chain communication system has not been identified. Chain stations may be monitored by camera with communication through variable message signs.

**How will safety be maintained or improved?**
Reduce/prevent accidents along shoulders related to truck chain-up.

**How will mobility be improved?**
Increase highway capacity by reducing obstacles on shoulders.

Delivery: Mid-term

Cost: Low ($25,000-$35,000)

Lead Team: CDOT

Location: Corridor-wide

Appendix C Report ID:
Primary: Traveler Info 76
Secondary: SMF/Enf 6
Increase snow and ice control maintenance level of service

Maintenance and Operations  Snow Removal

Description
Maintain roads as “wet” longer during the storm and bring roads back to “wet” sooner after the storm. Increase use of chemical deicers to maintain roads (liquid deicers as the storm begins and granular deicers throughout the storm). As snow starts to fall, ensure resources are available to manage the storm and proactively prepare the roadway instead of reacting only after the storm has begun.

Benefits
Better road conditions (less snow pack) for the traveling public. Faster deployment and proactive maintenance will remove more snow before it is packed into ice by travelers. Fewer accidents. More consistent speeds.

Concerns
Higher costs for materials, additional storage, and snowplow upgrades to the MDSS. Potential motorist complaints and environmental impacts. May require additional plows and personnel.

How will safety be maintained or improved?
Potentially reduce severity and occurrence of accidents related to inclement road and weather conditions by improving snow and ice control maintenance.

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.
Institute speed harmonization
Active Traffic Management  Reduces collisions  Improved Throughput

Description
Speed harmonization uses frequent variable speed limit signs and enhanced enforcement to reduce speeds to manageable steady flows to reduce the “turbulence” that causes accidents and thereby creates more congestion. The program uses speed and queue detection devices to determine when to activate speed reductions. Though a full program takes more time to implement, CDOT can begin immediately installing more variable speed limit signs and speed and queue detection as part of small scale programs. This phased approach could provide some initial mobility benefits for I-70.

Benefits
Speed harmonization provides safety benefits to reduce rear-end and other collisions and reduces speed which may lead to less severe injuries when accidents do occur. It provides better travel expectations for travelers, better throughput, and reduced travel times.

Concerns
Initiation of this program will require an outreach campaign since drivers may not understand reasons/importance of reduced speed limits. 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?
Offers information for drivers to make better informed decisions about travel speed. Has potential to reduce accident occurrence and severity.

How will mobility be improved?
Speed harmonization will improve mobility on I-70 by anticipating turbulence in order to maintain speeds and reduce the number and severity of accidents.

Delivery: Mid-term
Cost: High
Lead Team: CDOT
Location: Eisenhower to Twin Tunnels; WB approach to Floyd Hill (at lane drop)

Appendix C Report ID:
Primary: ATM/TDM 82
Secondary: ATM/TDM 128
Initiate a transportation management organization to develop TDM, education, and outreach

ATM/TDM  Enforcement  Passenger Vehicles  Education

![Banners](CommuterCASH.png)

**Examples of similar TMO programs**

**Description**
A TMO would work to coordinate transportation efforts of state agencies, local municipalities, employers, and regional destinations. The goal of the TMO is to expand the understanding and availability of alternative travel times and alternative travel modes to improve user experience on the corridor.

**Benefits**
TMOs provide a venue for stakeholders to work together to create education campaigns and safety and incentive programs. The program would help users of the I-70 corridor anticipate and avoid problems related to congestion and weather delays. It could also work directly with the trucking industry and help build consensus about future capital improvements.

**Concerns**
This organization 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.

**How will mobility be improved?**
TMO campaigns can help improve safety, reduce traffic volumes, and provide an opportunity for users to become engaged in solutions for the I-70 corridor.

![I-70 Mountain Corridor CSS](I-70MountainCorridor.png)

**Delivery:** Short-term

**Cost:** Low ($300,000)

**Lead Team:** CDOT, DRCOG, local communities, I-70 Coalition

**Location:** Corridor-wide

**Appendix C Report ID:**
*Primary:* ATM/TDM 85
*Secondary:* ATM/TDM 132
Develop enhanced traveler information marketing campaign

Raise Awareness and Education  Traveler Information

Description
Create a reciprocal arrangement with media outlets to use CDOT data in exchange for marketing time, separate from existing public service announcement services. Currently local television stations have access to limited numbers of CDOT cameras. Hardware (currently housed at ITS) was purchased and installed by television stations but is outdated and limited in its ability to transmit more than 10 of CDOT’s 400 cameras. Television channels would be able to access all cameras in real time. CDOT would upgrade the equipment and access in exchange for marketing airtime for its communication programs. CDOT would need to negotiate and amend existing agreements with television stations.

Benefits
CDOT will gain media exposure for travel behavior programs.

Concerns
Competition with private sector marketing (which is willing to pay cash) may be challenging. A formidable traveler behavior program (mobile app, incentive program) must be ready to launch upon completion of equipment upgrades.

How will safety be maintained or improved?
This option does not necessarily affect safety.

How will mobility be improved?
Increased awareness in travel behavior programs will increase participation and potentially decrease congestion during peak hours.

Delivery: Mid-term (12 months)
Cost: Low ($250,000)
Lead Team: CDOT
Location: Corridor-wide
Appendix C Report ID: Primary: Traveler Info 71
Develop incentive program to encourage travel off-peak

Incentive Program      Traveler Information     Influencing Traveler Behavior

Description
The incentive program would encourage users with tangible financial or other incentives to travel the I-70 Mountain Corridor in off-peak hours. Travelers would accrue points to qualify for specific rewards, similar to many airline frequent flyer or credit card reward programs. The program would be developed on the CoTrip.org platform and accessed via the web, mobile app, mobile website, and social media. This allows for participants to change travel behavior during pre-trip planning or during their trip. 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.)

Benefits
Reward system for changed travel behavior would improve mobility during peak hours in all seasons on all days of the week, including holidays. It offers an opportunity for CDOT to raise its national profile to create a program that influences traveler behavior using high-tech, relatively low cost solutions for congestion. GPS “probes” to collect data for CDOT are provided voluntarily and at no cost to CDOT.

Concerns
Sensitivity to local mountain stakeholders will be key to this program’s success. The outreach to communicate this program and involve as many stakeholders as possible must be extensive. The program will compete with other “offers” and potential participants may have “offer fatigue” thus making active participation difficult.

How will safety be maintained or improved?
Developing a “hands-free” app would be necessary to ensure optimal driver safety.

How will mobility be improved?
Reward system for changed travel behavior would improve mobility during peak hours in all seasons on all days of the week, including holidays.
Restrict single drive axle trucks

Description
Restrict single drive axle western doubles during inclement weather. This truck configuration has been identified by representatives of both CSP and CMCA as having unique traction problems in the I-70 Mountain Corridor environment. Reducing the numbers of these vehicles on the corridor during inclement weather, either voluntarily or through regulation, would reduce the number of accidents and associated capacity reductions. This idea may require studies and legislative action.

Benefits
Conservative estimates of the cost of blocking I-70 are $800,000 per hour. Reduction in accidents and lane blockages caused by single drive axle western doubles will reduce delays, increase highway capacity, and increase safety.

Concerns
Limited options exist for alternate truck routes when adverse weather occurs. Potential economic hardship to shipping fleets, which are based on this truck configuration. Legislation and truck industry acceptance would be necessary for complete restriction.

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.
Restrict SMVs from corridor during peak hours

Capacity Improvement     Managing Driver Behavior     Accident Prevention

Description
Restrict SMVs during known peak travel times. SMVs prominently influence mobility along the I-70 Mountain Corridor because of (a) 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. This idea may require legislative action.

Benefits
Increase in highway capacity and increase in safety.

Concerns
Shippers may have difficulty avoiding the corridor during known peak periods given the lack of reasonable route alternatives. 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. Legislation and truck industry acceptance would be necessary for complete restriction.

How will safety be maintained or improved?
Has potential to reduce rear-end 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.
Change contract with quick tow/courtesy patrol so user pays

Maintenance and Operations  Public Private Partnerships  Restore Capacity  Accident Recovery

Description
To establish a self sufficient program not reliant on tax payers, change contract with quick tow/courtesy patrol so the user pays. The current response time is approximately 20 minutes. Would provide same prompt service from dedicated wrecker, but shift costs to user by sending a bill. Drivers would not have the option to decline service or request a different service, which avoids the need to await arrival of towing services that are not located near the scene. CDOT currently funds this service during peak congestion periods to keep roads open. Funds used for this program could be re-allocated to other projects that would improve mobility.

Benefits
Continues to remove blocked lane quickly to reduce congestion but places cost on the user. Hours of service could be expanded.

Concerns
Challenge with charging for what is currently a free service. Some motorists do not have the means to pay/may not pay. The program would have to be mandatory, so drivers could not refuse service because of cost. General concerns exist over tow rotation and private wrecker contracts. If not implemented correctly could defeat quick clearance benefits.

How will safety be maintained or improved?
This option would not necessarily affect safety.

How will mobility be improved?
Potentially self-funding program providing faster return to normal highway capacity by clearing blocked lanes and roadside distractions quickly. Funds used for this program could be re-allocated to other projects that would improve mobility.
Develop a fire suppression system in the EJMT

Description
Install fire suppression within EJMT. The system can target specific fire locations. Rapid fire incident response in tunnel regardless of congestion.

Benefits
Improve emergency response and reduce employee exposure for fires, which is safer for all. Could reduce the need for metering all vehicles. A fire suppression system could also prompt other options for hazardous materials routing. CSP 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 Tunnel.

Concerns
Additional maintenance demands/costs. System may discharge by mistake, but low risk. Would need additional space for storage for water. Not extensively used in US.

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.

How will mobility be improved?
Currently, when Loveland Pass is closed, regular traffic is stopped every hour to allow hazmat trucks to convoy through the EJMT by themselves. If a fire suppression system would allow for policy change for hazmat trucks to free flow, then regular traffic would not be stopped and throughput would be increased. Rapid fire incident response in tunnel. CDOT could shift resources from Loveland Pass to I-70 at the EJMT.

Delivery: Mid-term
Cost: High
Lead Team: CDOT, CSP, FHWA
Location: EJMT
Appendix C Report ID: Primary: M/O 55
Establish peak time tolling at Twin Tunnels
ATM/TDM    Congestion Management    Better Throughput    Limited Footprint

Description
This concept would 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). 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. This location was selected because of its eligibility as a tunnel and relative equity in terms of charging all I-70 users.

Benefits
Tolling could deter discretionary trips and help 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.

Concerns
This is likely to have a very high level of political controversy and will require approval by FHWA and local communities. CDOT will need to coordinate with local municipalities to minimize or eliminate impacts on local residents. Tolls must be placed to eliminate drivers taking alternate routes though local communities to avoid tolls.

How will safety be maintained or improved?
This option would not necessarily affect safety.

How will mobility be improved?
Lower peak traffic volumes will reduce congestion and accidents. This helps maintain speeds to boost overall capacity of the corridor.
Develop selected segments for hard shoulder running at peak times

Active Traffic Management Additional Capacity Limited Footprint

Description
Without expanding the roadway footprint, provide a third eastbound lane for use during high congestion periods from US 40 through the Twin Tunnels and through to the next feasible three-lane segment of I-70. This idea assumes implementation of the Twin Tunnels widening. Ultimately, the goal is not to shift the “bottle neck” merging effect. 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 informational signs to allow traffic to use the shoulder lane at certain times.

Benefits
Add capacity for 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. It could eventually be expanded to add capacity traveling east from the merge point at US 6.

Concerns
Requires approval by FHWA and coordination with local municipalities. Operations at highway exits and the pier pinch point at MM 103 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. NCHRP Report 369 provides guidance for hard shoulder running applications.

How will safety be maintained or improved?
This option would not necessarily affect safety.

How will mobility be improved?
When congestion reduces traffic speeds to below 60 miles per hour, operation of a hard shoulder as a third lane allows a more steady flow of traffic volumes at controlled speeds. This idea is likely to be most effective if CDOT is also able to actively control the speed limit in the corridor with variable speed limit signs and speed harmonization.
The following table summarizes ideas presented in the one-page summaries. As noted, these ideas do not necessarily represent CDOT’s project priorities. The number (#) next to each idea represents the “Report ID” in Appendix C, where additional information is available.

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<th>Timeframe</th>
<th>Cost</th>
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<td>Communication</td>
</tr>
<tr>
<td>Improve communication of chain requirements to truckers (76)</td>
<td>Mid-term</td>
<td>Low</td>
<td>Communication</td>
</tr>
<tr>
<td>Increase snow and ice control maintenance level of service (36)</td>
<td>Short-term/immediate</td>
<td>Moderate</td>
<td>Maintenance improvement</td>
</tr>
<tr>
<td>Institute speed harmonization (82)</td>
<td>Mid-term</td>
<td>High</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Initiate a transportation management organization to develop TDM, education, and outreach (85)</td>
<td>Short-term</td>
<td>Low</td>
<td>Communication</td>
</tr>
<tr>
<td>Develop enhanced traveler information marketing campaign (71)</td>
<td>Mid-term</td>
<td>Low</td>
<td>Communication</td>
</tr>
<tr>
<td>Develop incentive program to encourage travel off-peak (63)</td>
<td>Short-term</td>
<td>Low</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Restrict single drive axle trucks (32)</td>
<td>Mid-term</td>
<td>Low</td>
<td>Restriction</td>
</tr>
<tr>
<td>Restrict SMVs from corridor during peak hours (29)</td>
<td>Mid-term</td>
<td>Low</td>
<td>Restriction</td>
</tr>
<tr>
<td>Change contract with quick tow/courtesy patrol so user pays (35)</td>
<td>Mid-term</td>
<td>Neutral</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Develop a fire suppression system in the EJMT (55)</td>
<td>Mid-term</td>
<td>High</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Establish peak time tolling at Twin Tunnels (83)</td>
<td>Mid-term</td>
<td>Moderate</td>
<td>Traffic management</td>
</tr>
<tr>
<td>Develop selected segments for hard shoulder running at peak times (84)</td>
<td>Long-term</td>
<td>High</td>
<td>Traffic management</td>
</tr>
</tbody>
</table>
This assessment identifies short-term, mid-term, and long-term ideas to improve mobility and operations on the I-70 Mountain Corridor. CDOT is actively seeking partnerships and funding to implement mobility solutions. As funding becomes available, CDOT will work with stakeholders within the CSS process to evaluate which ideas may be fully developed for implementation on the corridor.

Ideas may be developed in a phased approach. Some ideas that can be implemented within the next six months may be the first step of a larger program. For example, effective communication to influence traveler behavior is a good example of taking initial steps within a larger program. Other ideas may be dependent on timing of other improvements, such as projects near the Twin Tunnels.

Additionally, many ideas share the common themes of public relations and education and sustainable funding.

**Public Education** – Successful implementation of many of the ideas developed would also require public education campaigns to inform corridor users of new technologies, practices, or regulations. This campaign could be part of an integrated and dedicated approach to enhance
public education services to I-70 Mountain Corridor users. Existing ATM/TDM and intelligent transportation system (ITS) tools may be included and expanded (such as vehicle chain laws, 511, CoTrip.org) to distribute the messages through new technologies including mobile apps and social media. Additionally, a long-term forward-looking approach should be integrated into the campaign as part of a multi-stepped effort to generate a robust public education vision for the I-70 Mountain Corridor. Public education campaigns assume voluntary compliance and could be strengthened with enforcement.

Sustainable Funding – Funding is constrained for many aspects of the I-70 Mountain Corridor including maintenance, operations, enforcement, public education campaigns, ITS tools, and planned improvements. Ideas that identify reductions in costs, increased revenues, or self-funding, could benefit the corridor as a whole by freeing up funds to support new or under-funded programs.

Self-funding/sustainable funding is an innovative business model mechanism using P3s to create sustainable low cost/no cost solutions. The partnership allows CDOT to leverage its assets in a synergistic manner with partners to realize sustainability of a project.

One idea includes developing and leveraging an integrated CDOT communication platform (integrates use of an app, 511, GovDelivery, Facebook, Twitter, CoTrip and other social media). Funding is provided by external sources to offset program costs while CDOT provides access to data and leverages its assets to its partners. Sources of funding include advertising, sponsorships, reciprocal partnerships, and grants. P3s can be structured in a variety of ways. Opportunities for self funding are also identified with ideas related to enforcement, employee housing, towing, and tolling.

**Next Steps**

*I-70 Mountain Corridor Mobility and Operational Assessment* has been posted on [http://i70mtncorridorcss.com/](http://i70mtncorridorcss.com/) to share with stakeholders.

As funding becomes available, ideas will be developed though the 6-step CSS process.
APPENDIX A – AGENDA

Monday, May 23

Location: CDOT Region 1 - Golden Residency - 425C Corporate Circle, Golden

Welcome – Stacey Stegman and Tony DeVito

Overview of Project - Jim Bemelen

Introductions

Workshop Schedule and Roles – Mary Keith Floyd

Overview of Existing Operation and Mobility Conditions

- Slow Moving Vehicles and Truck Traffic – Bernie Guevara
- Enforcement – Captain Ron Prater
- Maintenance and Operations – Mike DeLong / Mike Salamon
- Active Traffic Management / Travel Demand Management – Clark Roberts
- Traveler Information – Ken DePinto / Stacey Stegman

Stakeholder Discussion

Wrap Up

Tuesday, May 24

Location: Michael Baker, 165 South Union Boulevard, Suite 200, Lakewood

Large Group – Traffic Data Presentation – Bryan Allery

Large Group – Netherland’s Congestion Management Pilot Projects – Dirk Grevink

Large Group – Idea Documentation – Mary Keith Floyd

Breakout into Small Group - Data and Current Practices

- Slow Moving Vehicles and Truck Traffic
- Enforcement
- Maintenance and Operations
- ATM /Travel Demand Management
- Traveler Information
Tuesday, May 24 (cont.)

Large Group Presentations:

- Shoulder Lanes – Best Practices from other States – Craig Siracusa
- Speed density related to accidents - Jake Kononov

Large Group – Wrap Up

Wednesday, May 25

Location: Michael Baker

Large Group Discussion – Corridor wide and location specific ideas

Breakout into Small Groups - continue to brainstorm and document ideas

Large Group - report out ideas

Thursday, May 26

Location: Michael Baker

Large Group – Consolidate ideas and shift groups

Breakout into Small Groups – brainstorm ideas

Large Group – Review and update corridor wide and location specific ideas

Wrap Up

Friday, May 27

Location: Michael Baker

Large Group – Review all ideas and confirm idea documentation

Slow Moving Vehicles and Enforcement Groups - Restrictions

Large Group – Identify packages of Ideas which complement each other

Wrap Up / Next Steps
Slow Moving Vehicles and Truck Traffic

Bernie Guevara

May 23, 2011

Current Conditions & Challenges: Steep Grades, weather conditions, sharp curves, capacity, traffic mix

Eastbound I-70, Sunday Afternoon, Georgetown to Twin Tunnels
- Congestion occurs 2:30 p.m. – 7 p.m.
- Traffic is very directional both AM and PM in opposite directions.
- Represents worst traffic delays of weekend.

Current Conditions & Challenges: Directional Split
I-70 Crash Data Trends

Travel Times

Number of Occurrences

2007-08 Number of Occurrences

Typical Sunday travel time (Georgetown – Evergreen) = 79 mins
Diversions to frontage roads
Tunnel metering
Emergency Services delayed

Time to recover takes several hours
Highway Closure cost = $800,000 per hour
2007 Legislation to ease I70 Congestion

Violations

*The fine for not carrying chains between mileposts 163 and 259 on the I-70 corridor during the specified season is $50 plus a surcharge.*

*Statewide, the fine for not chaining up when the chain law is in effect is $500 plus a surcharge.*

*The fine for not chaining up and subsequently blocking the highway is $1,000 plus a surcharge, and will result in a Class B traffic infraction.*

Traffic Operations Strategies

Legislative Strategy #2: Senate 10-173: Left Lane Restriction
I-70 Reversible Lane Feasibility Analysis

I-70 Closures

<table>
<thead>
<tr>
<th>Weather</th>
<th>Both</th>
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<th>WB</th>
<th>Total</th>
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</tr>
<tr>
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<tr>
<td></td>
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Current Performance

Due to accidents

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<td>Year</td>
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Due to weather

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<td></td>
<td>Year</td>
<td>5</td>
<td>5</td>
<td>7</td>
<td>17</td>
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</table>
Quick Lane Clearance - Heavy Tow Program

<table>
<thead>
<tr>
<th>Winter Season</th>
<th># of CV cleared</th>
<th># of lanes cleared</th>
<th>Clearance Time*</th>
<th>Cost Savings (million)</th>
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<tbody>
<tr>
<td>2007-2008</td>
<td>184</td>
<td>217</td>
<td>28 min 51 sec</td>
<td>$21.37</td>
</tr>
<tr>
<td>2008-2009</td>
<td>212</td>
<td>245</td>
<td>26 min 6 sec</td>
<td>$23.68</td>
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<td>2009-2010</td>
<td>199</td>
<td>232</td>
<td>17 min 44 sec</td>
<td>$27.97</td>
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<tr>
<td>Average</td>
<td>198</td>
<td>231</td>
<td>24 min 14 sec</td>
<td>$24.34</td>
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Recurring Problems

Chain Law compliance
Unfamiliar to driving conditions
Speed, speed, speed
Not paying attention
Hazmat Processing @ EJMT
CSP staffing

ENFORCEMENT………..

Chain Law Enforcement in Progress……..
I-70 Crash Data Trends

I-70 Closures

VAIL PASS CHAIN LAW ENFORCEMENT

<table>
<thead>
<tr>
<th>MONTH</th>
<th>OUT OF STATE</th>
<th>COLORADO</th>
<th>MOST COMMON</th>
<th>FINE AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oct-10</td>
<td>18</td>
<td>4</td>
<td>185</td>
<td>$ 135.50</td>
</tr>
<tr>
<td>Nov-10</td>
<td>17</td>
<td>3</td>
<td>182</td>
<td>$ 581.50</td>
</tr>
<tr>
<td>Dec-10</td>
<td>22</td>
<td>6</td>
<td>184</td>
<td>$ 1,159.50</td>
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<td>12</td>
<td>4</td>
<td>187</td>
<td>$1,159.50</td>
</tr>
<tr>
<td>Feb-11</td>
<td>27</td>
<td>3</td>
<td>182</td>
<td>$ 23</td>
</tr>
<tr>
<td>Mar-11</td>
<td>16</td>
<td>7</td>
<td>185</td>
<td>$ 18</td>
</tr>
<tr>
<td>TOTALS</td>
<td>110</td>
<td>27</td>
<td>189</td>
<td>$ 34</td>
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</table>

I-70 Visioning Collaboration Overview

Mike Salamon

May 23, 2011
Does CDOT Maintenance impact mobility or does mobility impact CDOT Maintenance?

CDOT Maintenance Impacting Mobility
- Retention of Employees
- Location/Functional Facilities
- Avalanche Control
- Age of Fleet
- Work Process

Mobility Impacting CDOT Maintenance
- Road Closures
- Traffic Volumes
- Loveland Pass Closure
I-70 Mountain Corridor Mobility

Mike Salamon

May 23, 2011

• Mountain Corridor Mobility and Operational Assessment
  May 2011

• Mike Salamon,
  EJMT Superintendent (CDOT)
I-70 Mountain Corridor Mobility

- Eisenhower/Johnson Memorial Tunnels
  - Eisenhower Opening March 1973
  - Edwin Johnson Opening December 1979

- Hazardous Material Program
  - When Loveland Pass Closes Only.
  - Tunnel Allows Haz-Mat on the Hour.
  - Public Traffic Held.

<table>
<thead>
<tr>
<th>Year</th>
<th>HazMat Used the Tunnel</th>
<th>Loveland Pass Closure Time</th>
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<tbody>
<tr>
<td>2008</td>
<td>3050</td>
<td>10 days 11 hours</td>
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<tr>
<td>2009</td>
<td>2717</td>
<td>10 days 7 hours</td>
</tr>
<tr>
<td>2010</td>
<td>3172</td>
<td>16 days 17 hours</td>
</tr>
<tr>
<td>2011</td>
<td>3471</td>
<td>10 days 13 hours</td>
</tr>
</tbody>
</table>

- Tunnel Metering Data (continued)
  - Summit Daily Article 01/22/11

Metering usually happens on eastbound lanes on peak travel days, particularly Sunday afternoons and holidays in both the summer and the winter when skiers or tourists are heading back to Denver. Traffic is generally held up to 20 minutes as needed until the tunnel clears out.
CDOT officials begin metering the tunnel when volumes increase to between 2,800 and 3,100 vehicles through the tunnel per hour, depending on how the traffic is flowing. Issues such as accidents or bad weather can also cause backups bad enough to require metering.

CDOT holds traffic by activating a stop light just outside the tunnel, which causes already slow-moving traffic to stop. Bob Wilson said metering, a process that has been in place for 20 years, does not usually cause drivers additional delays because traffic is moving so slowly on the other side of the tunnel as well. On busy Sunday afternoons CDOT stops traffic an average of three to six different times.

<table>
<thead>
<tr>
<th>Year</th>
<th>number of meterings</th>
<th>total time for each year</th>
</tr>
</thead>
<tbody>
<tr>
<td>08/09</td>
<td>50 times</td>
<td>10.9 hours</td>
</tr>
<tr>
<td>09/10</td>
<td>40 times</td>
<td>10.5 hours</td>
</tr>
<tr>
<td>10/11</td>
<td>84 times</td>
<td>17.7 hours</td>
</tr>
</tbody>
</table>

- 1973 projected average daily traffic by year 2000: 14,000 vehicles
- 2000 actual average daily traffic: 28,123 vehicles
- 2010 Average Daily Traffic: 31,210
- Current total actual traffic count as of April 30, 2011: 291,308,594
• **I 70 Incident Management Program**

  Tunnel Control is the Region 1 Dispatch Center with Particular Responsibility for the I 70 Corridor Incident Management Program

• **Traffic & Security Management Practices**

• **Tunnel Staffing**
  - 50 Full Time Employees
  - 1 Superintendent
  - 2 LTC Ops I
  - 3 TM IIs
  - Tunnel Mechanics
  - Electronics
  - Wastewater/Water
  - A&E Mechanics
  - Utility
  - Store Room
  - Administration Staff

• **E/JMT Avalanche Reduction Program**
  - 4 Employees in Program
  - 440 rounds deployed FY 10/11
Thanks for your time.

Active Traffic Management

Clark Roberts

May 23, 2011
Active Traffic Management

What exactly is Active Traffic Management or ATM?

- It is the ability to dynamically manage recurrent and non-recurrent congestion based on prevailing traffic conditions.
- It is the ability to increase throughput and safety using integrated systems and new technology, to dynamically deploy traffic management strategies.
- It is the ability to optimize the efficiency of the existing highway facility by focusing on trip reliability.

Causes of congestion in the United States

From FHWA International Programs website

Active Traffic Management

ATM Strategies include:

- **Lane Use Management**
  - Managed lanes, a component of congestion management, are defined as highway facilities or a set of lanes in which operational strategies are implemented and managed (in real time) in response to changing conditions to preserve unimpeded flow.
  - Examples include:
    - HOV Lanes
    - HOT Lanes
    - Reversible Lanes
    - Bus Lanes
    - Truck Lanes

- **Hard shoulder Running**
  - This strategy provides additional capacity during times of congestion and reduced travel speeds on a facility. The shoulder lanes are generally limited to peak hour use and controlled by electronic signing and video camera detection. Additionally, “active management” systems monitor the lanes and shut them down in the event of emergency, weather, or accident situations.

- **Speed Management/Speed Harmonization**
  - This strategy consists of dynamically adjusting speed limits on a freeway corridor based on the level of congestion, the running speeds of downstream traffic, or other traffic flow criteria. This reduces the risk of accidents (both primary and secondary in nature), the severity of accidents, and generally optimizes the flow of vehicles through the corridor.
Active Traffic Management

ATM Strategies include:

- **Queue Detection/Queue Warning**
  This strategy consists of identifying slow moving or potentially stopped traffic on an existing facility and displaying information to traffic upstream. This informs motorists of traffic conditions ahead, preparing them to slow down/stop, or potentially to select alternate routes or lanes and reduce queue buildup.

Active Traffic Management

ATM Strategies include:

- **Ramp Metering**
  This strategy consists of maintaining smooth freeway mainline flow by breaking up platoons of entering vehicles and/or limiting vehicle entry at entrance ramps.

Active Travel Demand Management

ATDM is the intervention to modify travel decisions making alternative modes of transportation appealing and reducing the number of single occupancy car travel during congested periods on an existing facility.

ATDM Strategies include:

- Enhanced travel alternatives in actively managed corridors
- Incentives to reduce traffic volumes on congested facilities
- Promotion of TDM at major trip generators in corridors
- Multimodal traveler information to encourage mode shift
Challenges to consider

The Section of Interstate 70 Mountain corridor is a rural corridor and while ATM solutions are used largely in urban areas, any ATM applications deemed beneficial for the I-70 Mountain Corridor will need to consider the environment in which they are to be applied.

Strategies that have already been applied include:
- Ramp Metering
- Queue Detection/Queue Warning

Benefits of ATM and ATDM

ATM and ATDM Strategies can be used individually, or in combination to address congestion on existing highway facilities.

ATM strategies respond to prevailing Road, Traffic and Weather conditions in real time, in order to improve safety, operational capacity and trip consistency in the I-70 Mountain Corridor.

ATM Strategies can be deployed on the I-70 Mountain Corridor quickly, with less funding, and with less construction impacts.

ATDM Strategies can encourage travelers in the I-70 Mountain Corridor to select alternative modes of transportation.

ATDM Strategies reduce the number of single occupant vehicles during the peak travel hours on the I-70 Mountain Corridor.

I-70 Mobility and Operational Assessment
“Traveler Information”

Presented by the CDOT Intelligent Transportation Systems (ITS) Branch

Ken DePinto and Stacey Stegman

May 23, 2011
**Background Information**

- Cotrip.org Web site
- CTMS Operations Package
- 511 HIVR Automated Phone System
- Browser-based Mobile Application for COTRIP
- Gov Delivery (text alerts)
- Media, Video, Travel Time, Other
- Public Private Partnerships
- Oracle Database Management
- Variable Message Boards – Travel Times
- Twitter / Social Media
- Traditional Media

**Cotrip.org Web site**

Cotrip.org is the official CDOT web site dedicated to:

- Statewide traveler information
- Features include as a minimum:
  - Google map base
  - CCTV camera streaming video and still shots
  - Road and weather information
  - Construction reports
  - Variable message real time data
  - Travel time
  - Other

There is a strong demand for the information as evidenced by the table that shows an exponential increase in web requests from 2007 to 2010.

<table>
<thead>
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<th>Year</th>
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<td>7615012</td>
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<td>604748480</td>
</tr>
</tbody>
</table>

**CTMS Operations Package**

The Colorado Transportation Management System (CTMS) is the core operating system for the Colorado Transportation Management Center’s (CTMC) statewide ITS infrastructure and the CoTrip web site, and also provides an interface with the 511 HIVR automated phone system (ie: I-70 Trip Travel Time).
511 HIVR Automated Phone System

Features:

• Updated messages regarding Closures, Chain Laws, Special Messages, Event messaging
• Real-time travel times on selected corridors
• Voice recognition prompts
• Ability to transfer to RTD’s and other transportation provider’s traveler information systems

In 2010 the 511 system received 2.3 million calls. Due to the enhancements that were made, CDOT routinely uses the VMS to direct travelers on the roadway to the 511 system to provide more detailed traveler information.

Browser-based Mobile Application for COTRIP

In 2002 CDOT developed a basic browser based mobile application for cellular phones prior to the advent of the smart phones (eg. DROID, I phone, Blackberry)

Gov Delivery (text alerts)

8000 plus Subscribers to date are signed up. Online self subscriptions are available with customized alert options:

• 82% of subscribers use GovDelivery for Highway Corridor Traffic and Travel
• 80% of subscribers feel like they are getting the right amount of information through GovDelivery
• Nearly 30% of subscribers use GovDelivery to commute to work
• 21% use it for mountain destination commute
• 32.4% use it for a both commuting and mountain travel; for work such as emergency responders or to keep customers informed.
Media, Video, Travel Time, Other

In 2002 CDOT entered into an agreement with Denver local media to allow installation of media equipment in the CTMC to provide media the ability to select and switch CCTV camera images.

In addition CDOT now shares its data and images with over 60 partners through a data feed at no cost to the users.

Public Private Partnerships

- In 1996 the Colorado Legislature enacted a law allowing CDOT to enter into PPPI provided that certain provisions, terms and conditions were satisfied.
- The Department first used the PPPI in 1998 with Adesta, which provided Adesta access to selected highway rights-of-way to install fiber optic cable in exchange for fiber optic cable.
- More recently, CDOT entered into a twenty-year agreement with Comcast to lease two strands of fiber on I-70 in exchange for annual cash compensation and in-kind engineering and maintenance services.
- Currently, CDOT is in the process of executing a twenty-year agreement with Crown Castle to allow access to SH 119/US 6 to install fiber optic cable and a cellular communication’s system in exchange for fiber optic cable, cash, other infrastructure, electrical power and annual in-kind maintenance services.

Oracle Data Base Management

- All data reported to CTMS and posted on COTRIP with the exception of camera images are saved in an Oracle data base for about the last 5 years.
- The data can be queried to provide reports regarding messages posted on sign, travel times, speeds, volumes, weather station road conditions such as wind speed/temperature/other, etc.

Variable Message Boards-Travel Times

- CDOT provides traveler information in many formats such as the web (COTRIP), Variable Message Signs (VMS), media/others via data feeds and 511 (I-70 only to date).
- The travel time program has expanded in the past 5 years and is now visible on I-70 from Golden to Denver, I-25 from South Denver to Colorado Springs, SH6 from Golden to I-25 and is slowly migrating into the metro area.
- While most travel times are posted on the web in the metro area the next phase which consists of utilizing the overhead VMS will be implemented over the next year.
Twitter/Social Media

• Twitter site launched in January of 2009 and we currently have about 7000 followers.
• This site is used primarily to provide information on road conditions/chain laws and other incidents although some other CDOT information is distributed via Twitter as well.
• CDOT has been exploring the use of Facebook and expects to launch a new site this year but will focus on other CDOT issues rather than traveler information via this forum.

Traditional Media

• CDOT also uses traditional media to get information out via GovDelivery and other distribution channels.

Questions?

I-70 Mountain Corridor Mobility and Operational Assessment

Mary Keith Floyd

May 23, 2011
Overview of Project

Goals for the I-70 Mountain Corridor Mobility and Operational Assessment:

To develop, explore, and document both new and existing ideas to improve mobility and operations within the CSS framework.

Idea Documentation

Document how well an idea meets our goals and objectives. We will identify:

- Benefits
- Drawbacks
- Timeframe to deliver
- Cost
- Lead agencies
- Successful applications and best practices

...and document each idea for potential to move forward within the CSS process.
How this fits into the CSS Process

- Step 1: Define Desired Outcomes and Review
- Step 2: Define the Process
- Step 3: Establish Criteria
- Step 4: Develop Alternatives and Options
- Step 5: Evaluate, Select, and Refine Alternatives and Options
- Step 6: Finalize Documentation and Evaluation Process

Develop and document ideas to be utilized within this process.

Introductions

Bringing together ideas from across the state and globe

Schedule Overview

- Monday – Review current conditions and share issues and concerns.
- Tuesday – Review detailed operational data.
- Wednesday – Brainstorming ideas in small groups.
- Thursday – Continued to develop and document ideas.
- Friday – Review idea documentation and identify packages.

Roles

- Stakeholders – sharing ideas and concerns
  - Presenters – share data, current practices, and examples
  - Technical Experts – identify ideas and applications
  - Facilitators – document ideas
Small Technical Groups

- Slow Moving Vehicles and Truck Traffic
- Enforcement
- Maintenance and Operations
- Active Traffic Management and Travel Demand Management
- Traveler Information

Existing Conditions

Slow Moving Vehicles and Truck Traffic

Bernie Guevara

Existing Conditions

Enforcement

Captain Ron Prater

Existing Conditions

Maintenance and Operations

Mike DeLong

and

Mike Salamon
Existing Conditions

Active Travel Management and Travel Demand Management

Clark Roberts

Existing Conditions

Traveler Information

Ken DePinto and Stacey Stegman

Stakeholder Discussion

- Slow Moving Vehicles and Truck Traffic
- Enforcement
- Maintenance and Operations
- Active Traffic Management and Travel Demand Management
- Traveler Information

Stakeholder Discussions – Wrap Up

Now the Technical Team will ...

- Take the issues and concerns we have discussed and form ideas for analysis
- Evaluate the pros and cons of all ideas
- Develop a report to document all ideas to share with Stakeholders
- As funding becomes available, ideas may then move forward within the CSS process
Thank You
I-70 Maintenance and Operations Assessment Workshop: Silverthorne to Morrison

Bryan Allery

May 24, 2011

I-70 Crash Data Trends

Vail to Denver
MP 181 to MP 259

I-70 Crash Data Trends

Vail to Denver
MP 181 to MP 259

I-70 Crash Data Trends

Vail to Denver
MP 181 to MP 259
Safety Performance Functions (SPF)

The SPF reflects the complex relationship between traffic exposure measured in Average Annual Daily Traffic (AADT), and accident count for a unit of road section measured in Accidents Per Mile Per Year (APMPY).

The SPF models provide an estimate of the normal or expected accident frequency for a range of AADT among similar facilities. The SPF allows us to assess the magnitude of the safety problem from a frequency standpoint.

Develop Safety Performance Segments

Roadway is Divided up into Segments from Interchange to Interchange:
Winter Slow Moving Vehicle Crashes Only by Direction

Overall Winter Volumes and Vehicle Crashes by Direction

Overall Summer Volumes and Vehicle Crashes by Direction

EB Winter All Days Crashes/Volume by Time of Day

EB Summer All Days Crashes/Volume by Time of Day
I-70 Crash Data Trends
EB Summer Weekend Volumes and Vehicle Crashes by Direction

EB Summer Weekend Crashes/Volume by Time of Day

Questions/Comments?
I-70 Travel Times

Sunday Winter Travel Times by Direction – (From Modeling)

Percentages by Vehicle Classification

Questions/Comments?
BNV Mobility: Avoiding rush hours

Dirk Grevink

May 24, 2011
A. FOUNDING SHAREHOLDERS

- 40 years of experience in highways PPPs and operations
- +1600 km in operation today
- Leading expertise in Intelligent Transport Systems
- 5 years of specialization in Dutch infrastructures
- Highly regarded Dutch Governments PPP advisor
- Expertise in financial operations and maintenance models

50% - 50%

BNV Mobility
Brisa - NedMobiel Venture

B. CORPORATE AND GOVERNANCE STRUCTURE

- Dutch (Breda) based company
- Access to staff and references parents
- Board of Directors
  - Dirk Grevink, Chairman and Business Development
  - Pedro Mourisca, CFO and O&M Services
  - Alinda Kooistra, Mobility Services
  - Pedro Baptista, Business Development

B. CORPORATE AND GOVERNANCE STRUCTURE

- Metropolitan Congestion Management
- Road charging
- Avoiding rush hours
- Annaways: Mobility budgets

O&M Services
- Consultancy
- O&M Service provision

C. SCOPE BNV MOBILITY

- 16 million people

10 mile

BlnV
(Breda)
Road Pricing in The Netherlands

- Road pricing has been the centre of political debate for many years;
- Six successive ministers have proposed road pricing schemes. So far, without much success.
- Never been so close: ‘Anders Betalen for Mobiliteit’ (=‘Paying Differently for Mobility’) based on stakeholder participation.
- But 2010: end of Road Pricing

ABvM: ‘Paying differently’

Congestion problems: the effective measures are not feasible, the feasible ones are not effective

ABvM: budget neutral for all passenger cars. Price per kilometer, differentiated for time, place and environmental features.

Public support is crucial to get road pricing started. This support depends heavily on two questions:
- Is the instrument fair?
- Is the instrument effective?
Mobility Projects: getting started

Mobility projects are introduced in 5 heavily congested areas:
1. To relieve congestion;
2. To prove the instrument of pricing is effective and stimulates rush hour avoidance;
3. To make people aware of the alternatives for their daily commute;

BNV Mobility Projects: 2 projects

- BNV Mobility is managing two Projects in The Netherlands
  - In Rotterdam, SpitsScoren project
    - From October 2009 to July 2012
    - So far, the most successful mobility project in The Netherlands
  - In Utrecht, Spitsvrij project (just awarded)
    - From July 2011 to March 2013
  - Projects managed by a Consortium, in which BNV is the operational partner

ToC

1. Mobility Projects in Dutch Road Pricing
2. SpitsScoren: Mobility Project in Rotterdam
3. The SpitsScoren concept
4. The recruitment and retention of participants
5. Learning experiences

OUR BRAND:

OUR PARTNERS:
Outline of the problem

- **Client:**
  - “De Verkeersonderneming”
  - Collaborating public bodies (local, regional, national + Port of Rotterdam)

- **Anchoring:**
  - Road pricing
  - Task force mobility management
  - Regional agreement to reduce 5% traffic during rush hours

- **Budget:** 10M Euro
  - At risk

---

**The question**

Of the > 10.000 drivers

...takes Y% part in SpitsScoren
...to avoid the rush hour in 2% of the cases

...in which a minimum of 530 participants is necessary to make the effect on the traffic noticeable.

---

**ToC**

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**Recruitment participants**

1. During 8 weeks pictures of license plates are taken (ANPR). Bases on best 4-week during this period a weekly reference is defined
2. Licenses plates seen > 3 days/week: request for name and address owner national data base
3. Sending invitation to participate by offering 4 weeks budget based on weekly reference,
4. Budget defined on € 5,- multiple weekly reference multiple 4 weeks (so maximum of € 100,- / 4 weeks)
The SpitsScoren Rewarding Structure

Statement: To reward the driver for avoiding the rush hour, he or she will get € 5,-

and I’ll also get such a nice phone!

How it works

1. Participant receives a smartphone with GPS and SpitsScoren app
2. The participant has to prove that he/she avoids driving during rush hours.
3. To do so he/she daily has to give its intention if he/she will avoid rush hours by using an app which is linked to our back office (see example next slide)
4. During rush hours the smartphone has to be switch on so we can trace the GPS track.
5. ANPR controls if participant is really not driving on A15.
6. In case participant can not prove that he/she did avoid driving during rush hours the budget is reduced with € 5,-

The Smartphone functions as the medium for services

Value Added Services

The OBU: T-Mobile G2 Touch

Intention and control Spitsmijden

Supervision Spitsmijdingen

Traffic Information

SpitsScoren ‘community’

SpitsScoren G2 applicatie

The Smartphone functions as the medium for services
alternatives to travelling

How can participants avoid the rush hour?
- Telework and travel to the office later;
- Car-share with a colleague;
- Car-share via “Pooll”, digital search system (social network);
- Working in the Dialogue Port;
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- Public Transport:
  - (Train);
  - (Metro);
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Principle of participant recruitment

Participants are recruited through their employer, their lease company and through a broad commercial marketing campaign, aimed at local commuters.
SpitsScoren begins here!

SpitsScoren ‘community’

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# Participants
**Result: # Spitsmijdingen**

Number of daily avoidences

**Reduction of traffic**

**Daily pattern**

- People are willing to alter their travel behaviour when there is an incentive.
- People have more alternatives than appears on first notice.
- Behavioural change is not a gradual, but rather a ‘step-by-step’ phenomenon. By this, I mean that people only reconsider their daily routine when it’s triggered by some external factor. Projects can be successful when they aim at this ‘trigger’, not the long term factor.
Shoulder Lanes

Craig Siracusa

May 24, 2011
SHOULDER LANES

PRESENTATION OUTLINE
1. Presenters Background
2. What Are Shoulder Lanes?
3. Experience Elsewhere
4. Issues and Opportunities

SHOULDER LANES

WHAT ARE SHOULDER LANES?
- Use of shoulders as travel lanes
- Hours of Operation – fixed or dynamic
- Use Restrictions – autos, buses, trucks
- Operational Requirements
- Trade-offs

SHOULDER LANES

Presenters Background
- Transportation Experience
- NYSDOT Commissioner White’s Challenge
- Long Island Expressway Shoulder Lane
- CDOT
SHOULDER LANES

EXPERIENCE ELSEWHERE

- Massachusetts
- Virginia
- Minnesota
- New York

Massachusetts
- Hyundai of Shoulder Lanes
- Fixed Hours – 5 hrs in AM, 4 hrs in PM
- I-93, I-95, SR 3
- Limited upgrades to shoulders
- Ground Mounted Signing
- No trucks
- Ramps scary

Massachusetts
- Cadillac of Shoulder Lanes
- I-66 – 6.5 mi. dual HOV/Shoulder Lane
- Fixed Hours – 5.5 hr. in AM, 6 hr. in PM
- 11 ft. wide upgraded shoulder
- No trucks
- Overhead signing
**SHOULDER LANES**

**Virginia**

- 8’ - 11’
- 12’
- 12’
- 11’ Shoulder

**Minnesota – Buses on Shoulder (BOS)**

- 290 mi. of Freeways & Arterials
- Bus speed limited to 15 mph above
- Buses yield to entering/exiting vehicles
- Buses merge into ML when shldr is obstructed
SHOULDER LANES

New York
- I-495 Long Island Expw – eastbound 5 mi.
- Shoulder Upgraded and widened
- Fixed hours – 4-7 pm
- No Trucks, buses or trailers
- Entrance/Exit Ramp modifications
- Ground mounted signing
- Taken out of service when HOV Lanes added

SHOULDER LANES

New York

Issues and Opportunities
- Conflicts at ramps
- Disabled vehicles – loss of shoulder
- Speed differential
- Debris on shoulder
- Shoulder pavement structure
- Shoulder width/cross slope
- Fixed Hours – Dynamic Hours

Issues and Opportunities Continued
- Emergency Response
- Bridge Clearances
- Signing – overhead?
- Vehicle Restrictions?
- Where to Begin/End
- Accident Profile – before/after implementation
- Environmental Considerations –
  - Air Quality
  - Noise
  - Roadside Disturbance
Information Sources

- FHWA-HOP-10-023 Efficient Use of Highway Capacity, May 2010  TTI for FHWA

Contact Info – email craigsiracusa@gmail.com

BNV Mobility: Mobility projects in the Dutch Road Pricing Scheme

Dirk Grevnik

May 24, 2011
INTRODUCTION

BNV: Founding Shareholders

- 40 years of experience in highways, PPPs, and operations
- +1600 km in operation today
- Leading expertise in Intelligent Transport Systems

Corporate structure

- Dutch (Breda) based company
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BNV Mobility: office

16 million people
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AVOIDING RUSH HOURS

1. Mobility Projects in Dutch Road Pricing
2. SpitsScoren: Mobility Project in Rotterdam
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OUR BRAND:

OUR PARTNERS:
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  - Regional agreement to reduce 5% traffic during rush hours

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...in which a minimum of 530 participants is necessary to make the effect on the traffic noticeable.

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Intention and control Spitsmijden

Spitsmijden

Traffic Information

Supervision Spitsmijdingen

SpitsScoren 'community'

SpitsScoren G2 applicatie

Value Added Services
alternatives to travelling

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5. Learning experiences

# Participants

0 200 400 600 800 1000 1200 1400 1600 1800 2000

0 200 400 600 800 1000 1200 1400 1600 1800

SpitsScoren ‘community’
Result: # Spitsmijdingen

Number daily avoidences

Reduction of traffic

Last 5-10% has most impact on traffic

Daily pattern

Learning experiences so far:

- People are willing to alter their travel behaviour when there is an incentive
- People have more alternatives than appears on first notice;
- Behavioural change is not a gradual, but rather a ‘step-by-step’ phenomenon. By this, I mean that people only reconsider their daily routine when it’s triggered by some external factor. Projects can be successful when they aim at this ‘trigger’, not the long term factor.
Dirk Grevink (47)

- Civil Engineer and Urban Designer. Graduated in 1987
- 12 year career as a public officer at the local, regional and national level
- 6 years working as a Project Leader, Manager of Operations (start up phase) and Deputy Managing Director resp. for business development) of Westerschelde tunnel, a 6,6km tunnel in the Province of Zeeland
- Co-founder of NedMobiel in 2006
- CEO of NedMobiel (2006 - )
- Co-founder of Movenience in 2007
- Co-founder of BNV Mobility in 2010
- Chairman Board of Directors of BNV Mobility, very much focused on business development
- Dirk lives in Eindhoven (Netherlands)
- Married and 2 sons
<table>
<thead>
<tr>
<th>Workshop idea title</th>
<th>Benefits</th>
<th>Drawbacks</th>
<th>Time to deliver</th>
<th>Costs</th>
<th>Lead agencies</th>
<th>Applied best practices</th>
<th>Notes and synergies with other ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase driver education for snow and mountain conditions. PR campaign (DVD, brochure or news media campaign targeting all drivers of all ages including trucks and other slow moving vehicles of the potential challenges they may face navigating I-70 west.</td>
<td>Increase driver education for snow and mountain conditions. Traffic Safety, Reduced Congestion</td>
<td>Time and effort to create and deliver the message and in what format.</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CDOT PR office, CSP, private partners</td>
<td>Various applications: CMCA currently has a DVD for truckers. This can be updated. Other PR campaigns on winter driving</td>
<td></td>
</tr>
<tr>
<td>Develop public information campaign to emphasize to passenger vehicle drivers that tires exist for inadequate tires. Education given to drivers before they start their journey to obtain compliant driver behavior. May include media campaigns, leaflets, radio etc.</td>
<td>PR campaign to emphasize to passenger vehicle drivers that there are fines for inadequate tires. Increase these fines.</td>
<td>Compliant driver behavior leading to reduced congestion and safer roads</td>
<td>Time and cost to identify what information is required and where the information should be distributed to reach all customers.</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CSP, Legislature</td>
<td>UK and other States Need to link with Traveler information and ATM. This can be a component of Idea 7.</td>
</tr>
<tr>
<td>Collate mandatory vehicle inspections for winter Goal to get all drivers to have Proper Traction</td>
<td>Mandatory vehicle inspections - including passenger cars tires - similar to Donner Pass</td>
<td>Reduced accidents caused by cars, reduce delays, increase capacity</td>
<td>Queuing traffic to inspect, cost to public physical location to conduct,</td>
<td>Mid-term</td>
<td>Low</td>
<td>CSP</td>
<td>Donner Pass Donner Pass is reported to have lower traffic volumes than I-70 in Colorado. Applies only to trucks, also to front and rear wheel drive vehicles. Promote purchasing chains (e.g., offer coupons) for folks who can't necessarily afford new tires -- carry chains Need adequate place for chain-up Current law states &quot;adequate snow tires;&quot; in court tread depth would be considered and applied Review/update regulations to provide clearer direction Examples of corridor locations: Straight Creek (Tunnel to Silverthorne), Vail Pass, Tunnel grades, Georgetown Hill Consider utilizing fines collected for I-70 fund instead of General Fund.</td>
</tr>
<tr>
<td>Increase passenger vehicle enforcement options for inadequate snow tires 1) Enforcement occurs when stalled vehicle creates problem and/or needs to be towed and is therefore given a ticket. 2) Better education about adequate vehicle preparation and more experience with driving in winter conditions.</td>
<td>Enforcement of passenger car chain laws/traction devices. (Although front wheel and all wheel drive is better than rear-wheel drive, adequate tire tread is necessary. Stopping is the same for all drive wheel configurations and depends on adequate tread and driver actions.)</td>
<td>Improved safety and reduced congestion</td>
<td>Cost of adequate, comprehensive education program. Manpower for enforcement</td>
<td>Short-term (Immediate) 1-6 months for coordination of enforcement protocols and education program</td>
<td>Low – potential exists for self-funding with increased ticket revenue</td>
<td>CDOT, CSP, local law enforcement</td>
<td>CalTrans/Donner Pass? WashDOT/Stevens Pass? Truck-relate chain up education</td>
</tr>
<tr>
<td>Expand collaboration with rental car companies over winter driving equipment and education. Rental car companies need to better educate customers about winter driving conditions and vehicle options (possible ideas - website info when making reservation and email message to follow-up once reservation is made. Work with companies to make sure vehicles going to mountains are properly equipped (tires, sand, shovel, etc.).</td>
<td>Idea not carried forward: Is the rental fleet supplying snow tires (Rental cars probably have adequate all season tires because cars are low mileage?) Chains (probably not available but 4-wheel drive is for a &quot;handsome fee&quot;) Will they (This probably won't change until fine for obstruction by inadequate vehicle goes to car owner, not driver)?</td>
<td>Improved safety and reduced congestion</td>
<td>Cost of snow tires would be high (only required for Colorado mountains). Tires need to be changed for summer. Rental companies would successfully lobby against enforcement.</td>
<td>Mid-term</td>
<td>Low</td>
<td>CSP</td>
<td>CalTrans/Donner Pass? WashDOT/Stevens Pass? Don't necessarily need a separate campaign -- if CDOT mandates, they may have to follow</td>
</tr>
<tr>
<td>Report ID</td>
<td>Report idea title</td>
<td>Workshop idea title</td>
<td>Benefits</td>
<td>Drawbacks</td>
<td>Time to deliver</td>
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<td>Lead agencies</td>
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<td>1</td>
<td>Increase driver education for snow and mountain conditions</td>
<td>Driver education for snow and mountain conditions</td>
<td>Traffic Safety, Reduced Congestion Time and effort to create and deliver the message and in what format.</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CDOT PR office, CMCA</td>
<td>Various application (CMCA DVD)</td>
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<td></td>
<td>PR campaign (DVD, brochure or news media campaign targeting all drivers of all ages including trucks and other slow moving vehicles of the potential challenges they may face navigating I-70 west.</td>
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<td>6</td>
<td>Develop proactive education for truckers on the chain law levels - Ensure that the trucks chain up by level and not at once</td>
<td>Proactive education for truckers on the chain law levels - Assure that the trucks chain up by level and not at once</td>
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<td>Traffic Safety, Reduced Congestion Time and effort to create and deliver the message and in what format.</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CDOT PR office, CMCA</td>
<td>Various applications - Existing CMCA DVD</td>
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<td>PR campaign (DVD, brochure or news media campaign targeting all drivers of all ages including trucks and other slow moving vehicles of the potential challenges they may face navigating I-70 west.</td>
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<td>7</td>
<td>Work with CSP to expand “Icy Falcon” pilot cars program</td>
<td>CSP to expand “Icy Falcon” pilot cars program</td>
<td>Traffic moves at a uniform and safe speed. Delays related to accidents and closures are prevented.</td>
<td>Mid-term</td>
<td>Med</td>
<td>CSP/CDOT</td>
<td>Recommend a separate funding source for I-70 CSP staffing like gaming does.</td>
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<td></td>
<td>A marked car is used to escort traffic at a lower, safer and consistent speed eliminating accidents.</td>
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<td>8</td>
<td>Initiate electronic automated speed enforcement</td>
<td>Electronic (automated) enforcement of speed limits in targeted areas and at targeted times</td>
<td>Cost to implement and may face stakeholder issues against provision of speed cameras</td>
<td>Med-term</td>
<td>Med</td>
<td>UK and other States</td>
<td>Need to link with Traveler information and ATM. We cannot consider this resource in lieu of CSP officers. Still need people power (e.g., Amber alerts, catching felons with routine traffic stops)</td>
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<td>The automatic enforcement of speed limits displayed will ensure that drivers comply and would mean that enforcement is not solely reliant on patrol cars.</td>
<td>Consider average speed enforcement (AVS) Variable speed limits – incorporate other notes (work zones are separate issue)</td>
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<td>9</td>
<td>Expand methods to distribute current condition information and corridor driving tips to drivers while they are on the corridor</td>
<td>Methods to relay tips to drivers while they are on the road</td>
<td>Compliant driver behavior leading to reduced congestion and safer roads</td>
<td>Short-term</td>
<td>Low</td>
<td>CDOT</td>
<td>UK and other States</td>
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<td>Goal: consider measures (i.e. the provision of information) that can be implemented to encourage drivers to comply with the speed limits and other instructions. This may include consideration of the type of messages displayed, lane markings on road, GPS, etc.</td>
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<td>10</td>
<td>Lengthen acceleration and deceleration lanes, with striping or hard shoulders where possible.</td>
<td>Improve accel/decel lanes with striping (when possible)</td>
<td>By improving the merging/diverging operation by trucks would reduce queuing.</td>
<td>Ramp closure required during construction.</td>
<td>Mid-term</td>
<td>Low</td>
<td>CDOT, POE</td>
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<tr>
<td>11</td>
<td>Close Dumont point of entry (POE) during peak volume periods.</td>
<td>Closure of Dumont POE during peak periods</td>
<td>Better traffic operations on I-70 as performance in right lane improves</td>
<td>Potential enforcement concerns; potential loss of safety check (e.g., chains); possible operational impact</td>
<td>Short-term (immediate)</td>
<td>None</td>
<td>CSP and CDOR</td>
</tr>
<tr>
<td>12</td>
<td>Post more CSP Officers on the corridor</td>
<td>More CSP Officers on the corridor. Incentives to keep the experienced ones</td>
<td>Shortened crash investigation times, more effective patrolling strategies, community partnerships, problem solving activities</td>
<td>Difficulty determining an effective incentive. No sustainable funding source exists - state budget deficits, political climate</td>
<td>Mid-term: Need time to research the specifics of the incentive. Implementation by FY 2012/2013</td>
<td>High</td>
<td>CSP</td>
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<td>13</td>
<td>Utilize TACT Program for tail gaiting enforcement</td>
<td>Tail gaiting enforcement - especially at high speeds in the left lane (Look at TACT Program)</td>
<td>Education combined with targeted enforcement results in changes in driving behavior and awareness</td>
<td>Dependent on federal grant funding and budget. Media campaign is manpower and time intensive.</td>
<td>Mid-term: Scheduled: March through August 2012</td>
<td>$920,000 cost and 4,000 citations</td>
<td>CSP/FMCSA CSU assessing success of program</td>
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<tr>
<td>14</td>
<td>Increase enforcement of unsafe speeds and condition violations.</td>
<td>More enforcement to targeted to unsafe speed for conditions violations and incident response.</td>
<td>Slower, safer speeds in inclement driving conditions reduces accidents thereby increasing traffic volumes</td>
<td>Not sustainable - very costly a time of significant state budget deficits and revenue short falls including Tabor issues</td>
<td>Short-term if funded</td>
<td>High</td>
<td>CSP</td>
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<tr>
<td>15</td>
<td>Allow fines collected on the corridor to be utilized for increased enforcement on the corridor.</td>
<td>Improve operations by providing increased resources to respond to I-70 incidents. Permit revenue from tickets issued for new chain laws and automated speed enforcement to remain in the I-70.</td>
<td>Provide source of funding for increased enforcement and incident response – create funding mechanism</td>
<td></td>
<td>Short-term</td>
<td>Low</td>
<td>CDOT, communities along corridor, Legislature</td>
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<td>15</td>
<td>Slow-Moving Vehicles and Enforcement</td>
<td>Provide source of funding for increased enforcement and incident response -- create funding mechanism</td>
<td></td>
<td></td>
<td>Short-term</td>
<td></td>
<td>CDOT, communities along corridor</td>
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<td>16</td>
<td>Locate hazardous material (hazmat) and fatality response teams on the corridor to minimize closure times.</td>
<td>TaskMat CSP technician and fatality response team - Relocate existing resource teams onto the corridor or add additional team on corridor to improve response time and minimize lane closures.</td>
<td>Reduce closure times and corresponding economic losses.</td>
<td>Requires an investment in expert personnel in the inter-mountain areas of the corridor. Current personnel would not consent to reassignment.</td>
<td>Mid-term: Two to three years to recruit and train staff.</td>
<td>High</td>
<td>CSP</td>
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<td>17</td>
<td>Provide CSP with electronic survey equipment designed to document an accident scene quickly in order to reopen I-70 faster</td>
<td>Technology to document accident scenes faster so highway can be reopened sooner.</td>
<td></td>
<td></td>
<td>Short-term</td>
<td>Medium</td>
<td>CSP</td>
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<tr>
<td>18</td>
<td>Implement corridor wide closure plan to enhance parking options and disseminate information to stranded motorists</td>
<td>Improve corridor wide traffic management when Interstate closes.</td>
<td>Public acceptance and public making better choices</td>
<td>None</td>
<td>Mid-term: 1 - 2 years</td>
<td>Low</td>
<td>CDOT, CSP, locals</td>
</tr>
<tr>
<td>19</td>
<td>Implement state-wide campaign against distracted driving</td>
<td>Campaign against distracted driving</td>
<td>Reduction in accidents</td>
<td>Difficulty developing the information. Potential privacy and intrusion issues. May need legislation expanding anti-texting laws.</td>
<td>Mid-term</td>
<td></td>
<td>CSP and CDOT</td>
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<td>20</td>
<td>Disseminate high truck accident location data</td>
<td>Identify high accident locations for trucks and recommend strategies.</td>
<td>Best Value for Safety/Congestion Strategy</td>
<td>None</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CDOT HQ - Traffic &amp; Safety</td>
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<tr>
<td>21</td>
<td>Provide more truck parking and improve communication regarding alternate parking options</td>
<td>Same as workshop id 12</td>
<td></td>
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<tr>
<td>21</td>
<td>Provide more truck parking and improve communication regarding alternate parking options</td>
<td>More truck parking and better communication of alternate parking locations</td>
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<td>22</td>
<td>Restrict SMVs from corridor during adverse weather conditions</td>
<td>Truck Restrictions (from Corridor) with weather related triggers (winter)</td>
<td>Reduce congestion and accidents involving vehicles &gt; 26,000 lbs, towns and communities may run out of groceries and other supplies. May be in violation of Federal Interstate laws. May need a special legislation to implement.</td>
<td></td>
<td>Mid-term</td>
<td>Medium to high depending on location and quantity</td>
<td>CDOT (and US Forest Service?)</td>
</tr>
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<td>23</td>
<td>Implement shipper management working group to coordinate off peak use of corridor</td>
<td>Shippers/Transporter management -- working group to optimize delivery periods</td>
<td>Reduced truck traffic during peak periods</td>
<td>Could affect delivery schedules and costs could be increased to businesses and consumers. Much of the traffic though does not have discretion to change schedules.</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>CMCA and CDOT</td>
</tr>
<tr>
<td>24</td>
<td>Allow hazmat trucks through EJMT at night</td>
<td>Route HazMat trucks through EJMT at night.</td>
<td>Reduce delays, reduce truck traffic during peak periods, increase truck safety, accident causing closure of tunnel could affect I-70 for long period of time.</td>
<td></td>
<td>Long-term: Legal authority now to implement 1 year for low end solution. Probably up to 5 years to obtain funding and implement fire suppression system</td>
<td>Low Cost - If for Limited access for Hazmat truck traffic under controlled conditions and limited periods of time. High approx. $12 M to add fire suppression system which might allow for free flow of Hazmat trucks on a 24-7 basis.</td>
<td>CDOT and CSP</td>
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<td>25</td>
<td>Seek voluntary compliance for keeping SMVs out of left lane</td>
<td>Keep SMVs out of left lane in good weather (voluntary compliance)</td>
<td>Improve public sentiment Reduce travel time Reduce driver aggression/Frustration May be practical in some locations</td>
<td>Concept may not be implemented by truckers (ineffective)</td>
<td>Mid-term</td>
<td>Low</td>
<td>CDOT, CSP, Legislature</td>
</tr>
<tr>
<td>26</td>
<td>Restrict SMVs on I-70 over weekends</td>
<td>Complete closure to SMVs on weekends</td>
<td></td>
<td></td>
<td>Long-term</td>
<td></td>
<td></td>
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<td>27</td>
<td>Allow hazmat trucks through EJMT under very specific and controlled circumstances</td>
<td>Allow HazMat through tunnel under very specific (controlled) circumstances. Get trucks off of Loveland Pass Reallocation of maintenance</td>
<td>Magnitude of potential accidents Magnitude of risk is undefined Cost of risk mitigation Economic development impacts LOS issues, parking issues, hours of operation/delivery issues; Magnitude of risk needs to be assessed.</td>
<td>Long-term</td>
<td></td>
<td></td>
<td>Fire suppression? Targeted materials (levels of hazmat severity) – can standards be adjusted on what is considered hazardous and can be carried through w/o suppression? Downhill portion (subject segment is Tunnel entrance to Silverthorne) would require enhancements. Other capital costs are necessary: ramp, more explicit signs (gears/speed) (see previous study); fire suppression system (MO) Time of day and day of week restrictions? Permit/certification for authorized/premiere specified companies? Previous study resulted in negative conclusion</td>
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<td>28</td>
<td>Allow long combination vehicles to reduce overall truck volume</td>
<td>Permit long combination vehicles.</td>
<td>Efficiency Reduces number of trucks Emission reduction Restrictions by permit travel during peak periods and inclement weather</td>
<td>Requires regulatory/statutory changes</td>
<td>Short-term</td>
<td>Low</td>
<td>Enforcement at POE At present, oversized and overweight vehicles cannot travel during peak periods</td>
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<td>29</td>
<td>Restrict SMVs from corridor during peak hours</td>
<td>Restrict slow moving vehicles based on volume triggers. More uniform traffic flow Greater throughput</td>
<td>Requires regulatory/statutory/legislative changes Enforcement (may need to relate to TDM) Communication of current travel conditions</td>
<td>Mid-term</td>
<td>Med</td>
<td></td>
<td>Consider implementing incentives, congestion pricing Encourage SMV travel during low congestion times. Education necessary</td>
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<td>30</td>
<td>Increase enforcement of minimum speeds in the left lane</td>
<td>Increase enforcement of minimum speeds in left lane.</td>
<td>Greater throughput Resources (man power) Communication of current travel conditions</td>
<td>Time based vs. location based restrictions?</td>
<td>Short-term (Immediate)</td>
<td>High</td>
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<td>30</td>
<td>Increase enforcement of minimum speeds in the left lane</td>
<td>Link to 106 above: Enforce SMVs passing other SMVs.</td>
<td>Greater throughput Higher travel speeds Resources (man power) Presently not effective</td>
<td>Time based vs. location based restrictions?</td>
<td>Short-term (Immediate)</td>
<td>High</td>
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<td>30</td>
<td>Increase enforcement of minimum speeds in the left lane.</td>
<td>Link to SMV passing</td>
<td>Link to id 30 above: Manage individual trucks with capabilities to travel at different speeds on steep grades.</td>
<td>SMVs merging back into traffic flow (on two lanes) -- safety and operational issues. Magnitude of vehicle breakdowns on shoulder (poses conflicts)</td>
<td>Short-term (Immediate)</td>
<td>Low</td>
<td>Med</td>
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<td>31</td>
<td>Increase SMV passing zones at specific locations</td>
<td>Increase SMV passing zones (climbing lanes or hard shoulder running).</td>
<td>Greater travel speeds in corridor Less rear-end accidents</td>
<td></td>
<td>Short-term</td>
<td>Med</td>
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<td>29</td>
<td>Restrict SMVs from corridor during peak hours.</td>
<td>Restrict SMVs during peak hours.</td>
<td>Increase throughput during historically congested periods Improved travel time reliability for all vehicles Reduced emissions from lack of idling along corridor Reduces time necessary for maintenance at chain station areas Less speed differential (may improve safety)</td>
<td>Interstate Commerce Clause Insufficient SMV parking Driver hours of service Economic development Delivery schedules Increased noise and emissions near parking areas Insufficient facilities Large influx of SMVs onto corridor following lift of restriction</td>
<td>Mid-term</td>
<td>Low</td>
<td>Based on historical volume conditions Consider accident potential</td>
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<td>32</td>
<td>Restrict single drive axle trucks</td>
<td>Restrict single drive axle western doubles during adverse weather conditions</td>
<td>Less traction-related problems Fewer closures Improved safety Frees CSP and COOT resources Simplifies chain law</td>
<td>Implementation issues Some existing fleet are still on single drive axles</td>
<td>Mid-term</td>
<td>Low</td>
<td>CSP, Legislature Further investigation is necessary. Keep restrictions high level -- develop process to solve the problem Single drive axle creates problems (from lack of traction) during adverse weather Fleet changes from single drive axle may be resolved over time with fleet turnover</td>
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<td>33</td>
<td>Review hazmat clean-up law as it pertains to highway closures</td>
<td>Review Details of “Haz Waste Remove &amp; Law”</td>
<td></td>
<td></td>
<td>Mid-term</td>
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<td>34</td>
<td>Increase local and State enforcement options</td>
<td>- Ensure staffing available to write ticket for truck non-compliance during accident (did not have on chains) and proactive enforcement of not carrying chains (September 1 through May 31). Options include: - Additional local and CSP enforcement at peak travel - target weekends to increase perception of heavy enforcement. - CSP DOT inspectors check for chains at POE and write tickets - CSP Hazmat units - when not responding to incidents, enforce chain law - Increase fees for non-compliance</td>
<td>Increased local and State enforcement options</td>
<td>Additional revenue from enforcement - Reducing accidents/spinouts and associated traffic delay - Increase of enforcement resources dedicated to the corridor</td>
<td>Short-term (Immediate)</td>
<td>Could be self funding with increased ticket fees, especially if revenues remained in corridor</td>
<td>CSP and local law enforcement</td>
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<td>35</td>
<td>Change contract with quick tow/courtesy patrol so user pays</td>
<td>CDOT currently funds this service to keep road open - response in approx. 20 minutes. Would provide same prompt service from dedicated wrecker, but shift costs to user by sending a bill. Drivers would not have the option to decline service or request a different service.</td>
<td>Change contract with quick tow/courtesy patrol so user pays</td>
<td>Continues to removes blocked lane and reduces congestion but places cost on the user.</td>
<td>Mid-term</td>
<td>cost neutral</td>
<td>CDOT</td>
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<td>36</td>
<td>Increase snow and ice control maintenance level of service</td>
<td>Maintain roads in a wet condition longer during storm and bring roads back to a wet condition after the storm - sooner. Use more chemical deicers, both liquids at start of storm and granular deicers throughout storm. Can also be proactive to prepare roadway for an incoming storm rather than reacting after the storm has hit.</td>
<td>Improve snow and ice control maintenance LOS</td>
<td>Better road conditions (less snow pack) for the traveling public. More proactive maintenance of snowfall to avoid traffic driving on snow and packing it to ice. Fewer accidents and more consistent speeds.</td>
<td>Short-term (Immediate)</td>
<td>Moderate</td>
<td>CDOT</td>
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<td>37</td>
<td>Include weather source/data (Meridian MDSS) in all maintenance trucks. Maintenance Decision Support System - weather forecasting tool. Operator places in real time information. Makes recommendations by route on type, level of resources to use (deicers, etc.). Helps reduce environmental impacts by not over using products. Started using in some trucks 2003. CSP also uses to schedule troopers to</td>
<td>Weather source/data - Maintenance Decisions Support System (MDSS) in all maintenance trucks</td>
<td>Helps operator to plan and schedule equipment. Most effective in trucks so real-time weather can be put into model. Tool to help train/guide inexperienced staff to respond to different weather conditions. Reduces chlorides on environment - and overall use of product. Weather forecasts are better than NOAA/TV. Truck is tracked, location, activity (plow up or down, deicing, etc.) so this can track productivity and best practices. If a complaint that a road was not covered, CDOT can respond when, where, and what. Can be used in summer for spraying, chip seal, any maintenance activity. Real time camera shots of what truck driver is seeing.</td>
<td>High maintenance to keep system running - delicate system. Things fall off truck and sensitive to moisture and corrosion. Loss cell coverage - need better tower coverage. Training of operators and mechanics (currently only one mechanic can work on system). Easy to use, but operators feel like they are being tracked. Additional education/training and supervisor support. Low drawbacks</td>
<td>Short-term (Immediate)</td>
<td>$3,500 per trucks * 11 trucks $33 for monthly cell service additional maintenance/keep costs change in yearly fee/training? Estimated under $500,000 implementation + annual maintenance/service</td>
<td>CDOT</td>
</tr>
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<td>38</td>
<td>Restrict single drive axle combination trucks during adverse weather. Additional restriction limiting single axle combo trucks from driving on corridor during weather events (even with chains).</td>
<td>single axle combination trucks - weather restrictions</td>
<td>less tie ups with traffic spin out removing trucks less suited to bad weather conditions during weather/congestion high benefits</td>
<td>Additional truck parking and removing trucks less suited to bad weather conditions Pushback from trucking industry. Delayed product to consumers (deliveries). Would need legislative change. More enforcement required. High drawbacks</td>
<td>Mid-term</td>
<td>Medium to CDOT, truck parking mixed out, need more property or FS easement. Cost for additional signs/notification Medium to CSP High to truckers</td>
<td>CDOT to initiate implementation and implement restriction FS and communities for parking locations CSP to enforce CMCA - shift in policy</td>
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<td>39</td>
<td>Initiate preemptive closures in extreme weather events. Preemptive closures due to weather. Allows travelers to get off at safe and convenient locations. Put into effect sooner than what CDOT is doing now. How often is storm severity very close to the forecasts?</td>
<td>Preemptive closures in extreme weather events. Close sooner in advance of oncoming storm.</td>
<td>Gets traffic out of way for maintenance vehicles - easier clean up after storm passed Currently in incident management plan (but not used widely). Safety for CDOT and traffic High benefit</td>
<td>Not widely used - who makes the call? Inconvenience/anger traveling public/communities Loss of revenue High drawbacks; may be difficult to forecast/predict storm weather; fall easy to predict; spring difficult Extremely difficult to do for the person making the call</td>
<td>Short-term (Immediate)</td>
<td>Loss of revenue when road closed.</td>
<td>CDOT</td>
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<td>40</td>
<td>Close Dumont POE in peak travel/bad weather</td>
<td>Close Dumont POE in peak travel/bad weather</td>
<td>keep speeds up and reducing weaving Able to do currently high benefit Can be done easily</td>
<td>Cannot preemptively enforce chain Overweight trucks on road low drawbacks</td>
<td>Short-term (Immediate)</td>
<td>no cost</td>
<td>CDOT in conjunct with Dept of revenue</td>
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<td>Costs</td>
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<td>41</td>
<td>Establish a one level commercial vehicle/heavy vehicle chain law. CDOT to enact code 18.</td>
<td>One level commercial vehicle/heavy vehicle chain law</td>
<td>Easier to understand and enforce</td>
<td>Pushback from trucking industry, wear and tear on surface, More chain stations</td>
<td>Mid-term legislation/rule-making or CDOT policy (code 18),</td>
<td>Low/moderate cost</td>
<td>CDOT</td>
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<td>42</td>
<td>Share equipment and personnel with I-70 from other locations as temporary and supplemental winter support. Bring in trucks and equipment from other areas to provide increased coverage during peak travel times. Week shifts or could bring in day support from R6 (OT).</td>
<td>More CDOT maintenance equipment and personnel from other locations for temporary winter support</td>
<td>Adding dependable trucks to patrol. Opportunity for existing fleet preventative maintenance. Allows employees assigned to that patrol a break/relief. Improves employee safety. Reduces down time of equipment</td>
<td>Cost - staff, equipment, and travel (hotel) inefficient use of materials and personnel. Putting people unfamiliar with corridor on that road. Could lower LOS in other parts of state. Stress on traveling employee.</td>
<td>Short-term (Immediate)</td>
<td>OT for equipment and staff, per diem, fuel, assume 55 OT and 20 trucks to provide round the clock coverage (Nov - April). Less than $400,000 a season</td>
<td>CDOT</td>
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<td>43</td>
<td>Use accident alert for &quot;30 minutes clear of accidents&quot; and remove vehicles from travel lanes ASAP. Open road to traffic as soon as possible. Implement accident alert and remove from accident scene and file a cold report. Implement a 30 minute clear of accidents increase communication with emergency service providers. Limit lane blocks of EMS. Explore options instead of actual investigation of scene (ART from Golden) mobilize, set up and investigate - use other technologies (3D camera)</td>
<td>Use Accident Alert on I-70 Mtn. Corridor for 30 minute clear of accidents</td>
<td>Opens corridor to traffic faster after accidents</td>
<td>Change in CSP protocol Troopers on road would need additional equipment/training. Low drawbacks.</td>
<td>Short-term</td>
<td>Cost neutral</td>
<td>CDOT and CSP</td>
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<td>44</td>
<td>Improve on accident removal depending on status of peak period and traffic flow obstructions. If not obstructing hwy, no reason to remove when traffic levels are high</td>
<td>Education on accident removal. If not obstructing traffic, during peak hours, wait to remove vehicle in off-peak.</td>
<td>Less traffic obstruction Safer for tower.</td>
<td>Delay for vehicle owner Additional training for CDOT/CSP</td>
<td>Short-term (Immediate)</td>
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<td>45</td>
<td>Develop automated spray systems at tunnels and bridges</td>
<td>Automated spray systems (tunnels and bridges)</td>
<td>To ensure bridges and tunnel approaches are in as good of condition as the rest of the roadway. Reduce accidents and congestion.</td>
<td>Additional maintenance requirements - someone does have to maintain Perception they do not work</td>
<td>Short-term</td>
<td>Per site: $250,000 to install (but less for smaller areas like Loveland Bridge). OM - additional cost low/moderate cost</td>
<td>CDOT</td>
</tr>
<tr>
<td>46</td>
<td>Offer employee transit and commuting opportunities from lower cost to higher cost areas</td>
<td>Employee transit - commuting opportunities from lower cost areas to high cost</td>
<td>Employee benefit for retention and reducing stress Reduces traffic volumes and environmental impacts Access to affordable housing in front range. Voluntary - full participation when previously available at EJMT. Reduce parking demand at work Moderate/high benefit</td>
<td>More difficult to manage shifts/staffing in differing conditions Public/agency perception of frivolous benefit Response time Possible loss of extreme hard to fill pay less flexibility to address family emergencies low drawbacks</td>
<td>Short-term (Immediate)</td>
<td>Cost of van and gas Would have to pay overtime to commute - unless AG ruled otherwise (potential 8 hrs a week overtime) Can avoid overtime with opportunities to obtain/use DRCOG van low cost</td>
<td>CDOT</td>
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<tr>
<td>47</td>
<td>Restrict heavy and tow vehicles to right lane during peak period year round</td>
<td>Right lane restriction for all heavy vehicles and tow vehicles during peak period year round.</td>
<td>Keeps potential slower traffic in right lane. Potentially higher capacity on left</td>
<td>Pushback from industry and rec. users harder on pavement in right lane Signing/change in CDOT policy Enforcement</td>
<td>Short-term</td>
<td>low</td>
<td>CDOT</td>
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<tr>
<td>48</td>
<td>Expand use of multiple plows running parallel clearing lanes at same times. Plow equal to icy falcon</td>
<td>Multiple plows running parallel</td>
<td>Reduced accidents due to slower speeds clear entire road at once - more effectively Speed harmonization low/moderate benefit</td>
<td>Congested traffic behind Can trap other operators - lack of service Can impact downsides perception of traveler to CDOT impede traffic moderate/high drawbacks</td>
<td>Short-term (Immediate)</td>
<td>similar</td>
<td>CDOT</td>
</tr>
<tr>
<td>49</td>
<td>Improve striping delineation</td>
<td>Improve striping delineation</td>
<td>more visible improves safety more durable</td>
<td>doesn't last, freeze. Sand gets into grooves cost congestion</td>
<td>Short-term (Immediate)</td>
<td>low</td>
<td>CDOT</td>
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<td>50</td>
<td>Retain experienced employees by supporting affordable housing</td>
<td>CDOT has property in middle of Frisco for employees trailers. Almost a block. Opportunities to work with Town of Frisco and other agencies to sell/swap/develop affordable housing by redeveloping or selling this parcel. Need improved affordable housing due to high cost of living. Need employees close to duty station so can respond in a timely manner. If decent place to rent/live, would improve employee retention. More mobile to respond and in area affected by the weather they are responding to.</td>
<td>Options to maximize/improve affordable housing for joint use by agencies.</td>
<td>Decent/convenient housing is an important employee benefit in all economic climates. Faster response time for employees. Opportunities for joint agency partnerships - CSP, FS, etc. Consistent with local and employer goals to provide affordable housing in the region. Proactively addressing Town of Frisco zoning with old trailers time may be limited. High benefits</td>
<td>CDOT prefer not to be landlords. Several options have been pursued - need a champion. Low drawbacks</td>
<td>Short-term CDOT ROW would meet with Town to initiate. Land swap sell. At least a year.</td>
<td>Cost of upkeep of property if CDOT remains land owner. Continued subsidy cost. Funds from sale/swap of Frisco property could be a revenue source to develop</td>
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<td>51</td>
<td>Initiate one-lane tunnel metering</td>
<td>Allow one lane of traffic through tunnel during metering, rather than shutting down both lanes</td>
<td>One-lane tunnel metering</td>
<td>Allows some traffic flow through tunnel and meets objective of metering traffic, but doesn’t shut off the flow completely. Still allows emergency access even if that single lane backed up through the tunnel. Option with speed harmonization</td>
<td>Very negative public complaints that EJMT is deliberately slowing traffic -- i.e., complaints of unnecessary closure during peak times. Does not improve overall mobility. Backups will go further to neck down for one lane. Single lane will still stop/slow when it reaches traffic ahead.</td>
<td>Short-term (Immediate)</td>
<td>Low. Setting up cones for lane closure</td>
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<tr>
<td>52</td>
<td>Conduct CDOT fleet replacement</td>
<td>Due to aging fleet and mechanical failure 61 trucks + other equipment</td>
<td>Fleet replacement</td>
<td>Newer technology - Dependable fleet - reduces downtime of equipment</td>
<td>Cost</td>
<td>Mid-term</td>
<td>Replace 61 trucks at least $15 million to replace vs. increasing cost of continued maintenance</td>
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<td>53</td>
<td>Implement short-term closures at interchanges with services when metering is in effect</td>
<td>Proactive diversion/removal from highway. Staged closures at point that can handle the traffic and traveler services. More of a process like staged closures. Would need to be included in incident management updates. Need to determine how to meter/limit most effectively.</td>
<td>Short term closure at interchanges with services when metering is in effect</td>
<td>Can provide an alternate route Can access services Don’t have traffic stalled straight creek hill - safety, frustration, spin outs limit stranding</td>
<td>plug up Silverthorne and Frisco. Need new/more parking. 2800 vehicles per hour dumped into town affect local EMS and community access inadequate signage - limited VMS Enforcement at ramps to close</td>
<td>Short-term 6 - 12 mo</td>
<td>Lead - CDOT support from local communities</td>
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<td>54</td>
<td>Keep Loveland Pass open all the time</td>
<td>Heavy weather makes keeping open a challenge esp. with avalanches. Would require snow sheds (sisters and other areas), more technology on CDOT maintenance vehicles, and much more maintenance</td>
<td>Keep Loveland Pass open all the time</td>
<td>Would not have to meter hazmat traffic at tunnel. If up on Straight Creek - alternative route to Denver. Medium/high benefits</td>
<td>Intense cost and maintenance requirements. Safety factors - avalanches, visibility, no guardrail, visibility of hitchhikers/snowboarders Wind/Visibility Environmental - lots more deicing products May add queue at tunnel, because of access at pass High drawbacks Cost effectiveness</td>
<td>Long-term environmental/public process to approve.</td>
<td>Environmental process cost - Construction costs - snow sheds, barrier, widen road OM costs - Very high cost</td>
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<tr>
<td>55</td>
<td>Develop a fire suppression system in the Eisenhower Johnson Memorial Tunnel</td>
<td>Install fire suppression within EJMT tunnel. System can target specific fire locations. This may potentially allow hazmat trucks can potentially go through in a free flow condition.</td>
<td>Fire suppression in EJMT</td>
<td>Potential for free flow hazmat trucks based on legislative changes. Improve emergency response and reduce employee exposure for fires - safer for all. Could reduce the need for metering for all vehicles - can potentially go through in a free flow condition. Reduction in responsibilities for TM1s (no longer have to stage hazmat trucks) High benefits</td>
<td>Misting system - can freeze tunnel. Will have to heat trace. Other suppression options like foam/dry system but not as likely. Additional maintenance demands/costs. System may discharge by mistake - low risk To allow free flow hazmat would require legislative/policy change. Would still need to restrict hazmat trucks during extreme weather to hold so not stalled on steep slopes. Need additional space for storage for water (possible) Not extensively used in US. Environmental concerns with hazmat spills and extensive tunnel closure. Medium/high drawbacks and controversial</td>
<td>Mid-term Feasibility study completed; Confirm options and test - one year; Design/installation - at least a year.</td>
<td>$10m design and installation $10,000 annually for maintenance/testing</td>
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<td>56</td>
<td>Program repaving on a more frequent basis</td>
<td>Asphalt requires every three years repaving. Potholes to be repaired - but limited resources during winter due to snow removal. Limited options with extreme weather conditions - Rutting, chains, freeze thaw.</td>
<td>Program repaving on a more frequent basis</td>
<td>Smoother road/drivability safer. Rutts reduced so less snowpack/hydroplane potential. Reduces lane use (out of service in extreme deterioration) low benefits</td>
<td>Additional cost and man hours. Additional construction - disruption of traffic, Very small window to do major overlay during peak summer travel times Higher speed traffic Moderate drawbacks</td>
<td>Mid-term Need to get on STIP - two years one construction season</td>
<td>$1million a mile</td>
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<td>57</td>
<td>Develop a hazmat tunnel bore</td>
<td>additional tunnel for hazmat</td>
<td>Hazmat tunnel bore</td>
<td>Dedicated full time safe route</td>
<td>CDOT and environmental impacts. Additional CDOT maintenance (or would need to be privatized)</td>
<td>Long-term</td>
<td>$3-48</td>
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<td>58</td>
<td>Close Loveland Pass</td>
<td>Close Loveland Pass</td>
<td>Can pull manpower and costs to support I-70 (Nov - May) reduce winter long avalanche maintenance Eliminates queue down from tunnel Saves maintenance time and dollars - removes cost to shoot slides and keep open Low/medium benefits</td>
<td>Out of direction travel to access A Basin from east. Loss of alternate route. Limiting access to backcountry recreation. Need additional chain up space at Silverthorne because have to chain up at 205 now (Loveland has 3 chain up on west side). Closer chain up station to tunnel (need something closer to tunnel at Herman’s gulch for hazmat/fuel) Current under capacity for all chain up anyway. Would add additional traffic on I-70 at a different location (Silverthorne to US 6) Cost to open in the spring Without fire suppression - would have to shut down tunnel to meter for hazmat. Increased hazmat spill risk to I-70 Medium/High drawbacks</td>
<td>Long-term environmental process and legislative 3 to 5 years implement (gate) - week</td>
<td>Cost to implement - low $5m secondary impact costs cost to operate - some savings Cost: Moderate</td>
<td>CDOT but heavy local buy in</td>
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<td>59</td>
<td>Utilize an automated avalanche system such as GAZEX</td>
<td>Automated avalanche systems (GAZEX)</td>
<td>automated safety</td>
<td>very expensive cost significant environmental impact - pipes/propane in every avalanche starting zone. Huge visual impact helicopter to fill tanks backcountry skiers Forest Service special use permit process</td>
<td>Long-term EIS required - years</td>
<td>very high</td>
<td>CDOT / FS</td>
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<tr>
<td>60</td>
<td>Privatize I-70 Corridor operations</td>
<td>Privatization of I-70 Corridor Operations</td>
<td>Save money Generate revenue - capture true costs Higher level of service and enforcement Synergize all ideas - incentive based Can toll - self funding and added capacity</td>
<td>Contract has to be long enough to recoup investment Overcoming community concerns, political will and significant cultural change. Can toll - controversial insurance for avalanche and other operations Risk to CDOT</td>
<td>Mid-term</td>
<td>Public process for CSS process to implement $5-10 million Depends on contract model. Revenue neutral and or current I-70 funds freed up for other portions of the state. Moderate/High cost</td>
<td>CDOT and CSP</td>
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<td>61</td>
<td>Make historical traffic data readily available in the corridor</td>
<td>Provide historical travel time modeling/data via cotrip.org</td>
<td>Change behavior pre-drive</td>
<td>Change behavior pre-drive</td>
<td>Based on historical data, doesn't account for change in conditions/</td>
<td>Mid-term</td>
<td>No incremental cost. Included in 2012 budget</td>
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<td>62</td>
<td>Develop/app KoP to influence travel behavior at Touch Points</td>
<td>App</td>
<td>Using the app while driving; requires purchase &amp; maintenance - would require outsourcing. Ski areas have limited flexibility on hours of operation due to day light</td>
<td>Low</td>
<td>Short-term (possibly immediate)</td>
<td>7S Branch and Public Relations. Need Senior Management Support</td>
<td>Berkeley, Beat the Traffic, Fuel Finder</td>
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<td>63</td>
<td>Develop incentive program to encourage Travel-Off-Peak</td>
<td>Incentive program</td>
<td>Reward behavior changes and improve mobility. Have CDOT's national leadership in innovation; create GPS based probes to collect data and deliver incentives.</td>
<td>No matter what/who we promote, other mountain entities will be offended. Perceived bitching and politics that may ensue (although all will be given an equal chance to participate). And will it be hard to get adoption due to &quot;offer fatigue&quot;, i.e. so many groupon like sites already exist?</td>
<td>Short-term 6 months to implement after research/campaign</td>
<td>Development, Self-funded.</td>
<td>ITS Branch and Public Relations. Need Senior Management Support</td>
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<td>64</td>
<td>Offer coordination Touch Points at key rest areas, locations, key points, etc.</td>
<td>Communication at Touch Points</td>
<td>Influence travel behavior at those points.</td>
<td>Idea would be to install in multiple locations. Capital costs could be required by CDOT or end user (ski area). Requires maintenance</td>
<td>Mid-term</td>
<td>CDOT would have to provide data electronically. End user would have capital cost.</td>
<td>ITS Branch and Public Relations. Need Senior Management Support</td>
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<td>65</td>
<td>Create CoTrip enhancements including Alternative Routes</td>
<td>Alternative Routes</td>
<td>Reduce traffic congestion during peak hours</td>
<td>Alternative routes unreliable; limited value access to monitor routes; Extensive out-of-direction travel subject to same weather/road conditions; Increased maintenance/limited budget</td>
<td>Short-term -- could be implemented immediately</td>
<td>Minimal</td>
<td>ATM ITS Branch.</td>
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<td>66</td>
<td>Use special event messaging</td>
<td>Events</td>
<td>Access to audience likely to use corridor during peak congestion hours</td>
<td>May have minimal impact</td>
<td>Mid-term 9 months to collect data into a PR package and distribute</td>
<td>ITS &amp; PR Staff time + PR package costs</td>
<td>ITS Branch and Public Relation</td>
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<td>67</td>
<td>Develop connected vehicle technologies: Vehicle computers receiving data. Can provide speed, time travel. Also includes vehicle-to-vehicle information and vehicle-to-roadside information. Trucking companies have computers in trunks which is an opportunity for specific information distribution.</td>
<td>Connected Vehicle Technologies</td>
<td>Will change how CDOT collects data, analyzes, manages data; App may be a precursor to collect data in a similar manner</td>
<td>Not low cost</td>
<td>Mid-term, 18 months +</td>
<td>MOVE TO ATM?</td>
<td>ITS &amp; ITS Branch and Public Relation.</td>
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<td>68</td>
<td>Establish reservation system to travel during peak periods.</td>
<td>Reservations</td>
<td>Reduction in vehicles during peak congestion hours</td>
<td>Unenforceable</td>
<td>Mid-term</td>
<td>ITS &amp; PR Staff time</td>
<td>ITS Branch and Public Relation.</td>
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<td>69</td>
<td>Establish system to allow travelers to pay for access to front of traffic queues. Use app to pay to get in front of traffic and know when congestion is.</td>
<td>Disney app</td>
<td>Encourages behavior change to reduce congestion during peak traffic hours</td>
<td>Unenforceable. If already in traffic, no way to get to front of the line</td>
<td>Mid-term</td>
<td>Outsource task to consultant: $50,000</td>
<td>ITS Branch and Public Relation.</td>
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<td>70</td>
<td>Survey and research I-70 traveler and stakeholder information needs. Study to understand I-70 market and stakeholders and key needs. Also, make it accessible.</td>
<td>Research/Survey Traveler &amp; I-70 stakeholders (resources)</td>
<td>To inform forward product and communication developments + informs multiple products in information umbrella + and identify target audience</td>
<td>Cost - outsource.</td>
<td>Short-term -- could be implemented immediately</td>
<td>$50,000</td>
<td>ITS Branch and Public Relations</td>
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<td>71</td>
<td>Develop enhanced traveler information marketing campaigns.</td>
<td>Enhanced traveler info marketing</td>
<td>To gain media exposure for travel behavior programs. Allows channels to stream cameras on to their websites; This swap camera feeds to news station in exchange for advertising of awareness programs. Has the best potential for marketing at low cost.</td>
<td>How do you change behavior of media? Will become political. Can’t compete with private sector</td>
<td>Mid-term</td>
<td>CDOT offer to upgrade equipment in exchange for marketing. Approx $150,000 in capital cost. No agreement. Nominal maintenance.</td>
<td>ITS Branch and Public Relations</td>
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<td>72</td>
<td>Develop public information campaign to drive awareness about existing and developing I-70 travel</td>
<td>Public Relations</td>
<td>Generate awareness to increase the public use of tools. Address unique needs of I-70 corridor.</td>
<td>Possible additional cost. Building unattainable expectations</td>
<td>Short-term with Management Support</td>
<td>Win-house. No cost</td>
<td>ITS Branch and Public Relations</td>
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<td>73</td>
<td>Create additional content and produce a series with interesting characters, computer generated travel information.</td>
<td>Editorial Content and Syndication</td>
<td>Attracts more travelers to CDOT media access points. Can be used by other media (traveler stakeholders - visitors bureau)</td>
<td>Creation and distribution of it, but can be maintained at a minimal cost</td>
<td>Mid-term -- could be implemented immediately</td>
<td>Could be done in-house; Externally $10 - $20k</td>
<td>Collaborate with tourism industry</td>
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<td>Costs</td>
<td>Lead agencies</td>
<td>Applied best practices</td>
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<td>74</td>
<td>Generate revenue through strategic Social Media</td>
<td>gets buy in from the user</td>
<td>Requires real-time management</td>
<td>Short-term -- could be implemented immediately</td>
<td>Low</td>
<td>ITS and Public Relation; Managed by PR</td>
<td>White House; Oregon Tourism</td>
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<td>65</td>
<td>Create CoTrip enhancements including CoTrip enhancements</td>
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## ATM/TDM

### 81
**Report item title**
Report idea title

**Workshop idea title**
Institute speed harmonization

**Benefits**

**Drawbacks**

**Time to deliver**
Short-term

**Costs**

**Lead agencies**

**Applied best practices**

**Notes and synopses with other ideas**

- Use of traffic signals on I-70 to manage the rate of automobiles entering the freeway
- Traffic signal timing

### 82
**Report item title**
Speed harmonization via Variable Speed Limit Signage from Eisenhower Tunnel to Twin Tunnels

**Workshop idea title**
Institute speed harmonization

**Benefits**

**Drawbacks**

**Time to deliver**
Short-term

**Costs**

**Lead agencies**

**Applied best practices**

**Notes and synopses with other ideas**

- Use of traffic signals on I-70 to manage the rate of automobiles entering the freeway
- Traffic signal timing

### 83
**Report item title**
Speed harmonization via Variable Speed Limit Signage from Eisenhower Tunnel to Twin Tunnels

**Workshop idea title**
Institute speed harmonization

**Benefits**

**Drawbacks**

**Time to deliver**
Short-term

**Costs**

**Lead agencies**

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**Notes and synopses with other ideas**

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<td>87</td>
<td>Utilize frontage roads and hard shoulders to move additional traffic including &quot;reversible frontage roads&quot;</td>
<td>Begin the shoulder lane from Eisenhower to Floyd Hill - Shortest implementation phase - 1 from Eisenhower to Twin Tunnels</td>
<td>Additional capacity during peak periods</td>
<td>Shoulder widening and structure modifications (105/exit 248)</td>
<td>Mid-term Planning - 1 yr, final design - 1 yr and time implementation to open with tunnel widening</td>
<td>Medium cost $3M</td>
<td>40</td>
<td>Virginia Model (Kasol examples)</td>
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<tr>
<td>88</td>
<td>Provide alternate means to encourage alternate travel times</td>
<td>Resort coordination to encourage alternative travel times</td>
<td>Alleviate congestion regarding alternate travel options</td>
<td></td>
<td>Short-term</td>
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<tr>
<td>89</td>
<td>Utilize &quot;predictive traveler information&quot;</td>
<td>High local traffic does not allow much route choice</td>
<td>Providing expanded information to facilitate route choice</td>
<td></td>
<td>Short-term (Immediate)</td>
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<td>90</td>
<td>Offer driver training program for I-70 conditions in Shoulder lanes</td>
<td>Driver training regarding I-70 conditions for inexperienced drivers</td>
<td>New but helpful - Brand CDOT and flexible to deliver information about different programs</td>
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<td>Short-term</td>
<td>Not too expensive.</td>
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<td>91</td>
<td>Allow other uses on &quot;express lanes&quot; for alternative transportation modes</td>
<td>Other uses on &quot;express lanes&quot; to encourage alternative modes</td>
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<td>Mid-term</td>
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<td>92</td>
<td>Institute emergency response uses on hard shoulders</td>
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<td>Short-term</td>
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<td>Utilize frontage roads and hard shoulders to move additional traffic including &quot;reversible frontage roads&quot;</td>
<td>Reversible lane on hard shoulder lane</td>
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<td>Mid-term</td>
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<td>94</td>
<td>Implement congestion pricing at tunnels</td>
<td>Congestion pricing at tunnels</td>
<td>Directly influences travel time choices. Available technology, there is available</td>
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<td>Mid-term</td>
<td>Ongoing O&amp;M and administration costs.</td>
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<td>95</td>
<td>Use variable message signs (VMS) to encourage good driving</td>
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<td>Short-term (Immediate)</td>
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<td>96</td>
<td>Institute quick response and quick clearance for all incidents</td>
<td>Quick response/quick clearance for all incidents</td>
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<td>Short-term</td>
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<td>97</td>
<td>Expand &quot;Casino Model&quot; for customer travel programs</td>
<td>Identified programs could be implemented by a TMO</td>
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<td>98</td>
<td>Provide safety information at visitor centers and rental car companies</td>
<td>Information provided at Welcome Centers, and coordinate with local visitor centers</td>
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<td>Short-term</td>
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**Notes:**
- ATM/TDM aspects are limited and reactive based on the needs of the maintenance and operations programs.
- Both rental car community and visitors are targeted.
- Requires coordination with federal agencies to consider tolling on tunnels and bridges.
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<td>Hire private firm to provide &quot;Icy Falcon&quot; pilot services</td>
<td>Private firm escorts for &quot;Icy Falcon&quot;</td>
<td>Regular drivers of the corridor can get incentives operating as a pace car (who get incentivized to travel within reasonable speeds on the corridor. Could be coupled with a PR campaign.</td>
<td>Short-term (Immediate)</td>
<td>60K per vehicle</td>
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<td>Apply tech tools to reduce incident clearance time</td>
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<td>Short-term</td>
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<td>Publicize and market information on fines and statutes</td>
<td>Market statutes + fines to improve compliance</td>
<td>Identified programs could be implemented by a TMD</td>
<td>Short-term (Immediate)</td>
<td></td>
<td></td>
<td>Coordinate with enforcement</td>
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<td>102</td>
<td>Provide dedicated I-70 staff during incidents</td>
<td>Dedicated I-70 staff</td>
<td>The amount of fiber and equipment in the corridor require additional IT, maintenance support. Jim is the lead.</td>
<td>Short-term</td>
<td></td>
<td>Public private sector partnership</td>
<td>Boston Big Dig coordination</td>
<td>Potential for an integrated system with CIP, IT, Maintenance people</td>
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<td>Develop hard shoulders from the east for at least two miles</td>
<td>Hard shoulders from the east for at least a mile or two</td>
<td>Only if enforcement and infrastructure concerns are thoroughly vetted and addressed with money and resources targeted.</td>
<td>Short-term</td>
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<td>104</td>
<td>Provide tools/programs to address &quot;following too closely&quot; driver behavior</td>
<td>Tools to address following &quot;too close&quot; issue</td>
<td>Could be automated to alert drivers with photo radar.</td>
<td>Short-term (Immediate)</td>
<td></td>
<td>CDOT / DMV inform action book</td>
<td>UK chevron application, Federal Trucking &quot;no zone&quot; campaign, TAP program, rollout of HCM decade of safety</td>
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<td>Consider highly managed &quot;UK Model&quot; for operating on hardened shoulders</td>
<td>Loss of the applications of ATM - hard shoulder</td>
<td>Running for general purpose</td>
<td>Medium-term</td>
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<td>106</td>
<td>Enhance park and rides with bus service to major destinations</td>
<td>Park and ride enhancements with bus service to major destination</td>
<td>A private company could use the piggyback list - at their cost then the private sector would provide the service</td>
<td>Short-term</td>
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<td>TMO</td>
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<td>107</td>
<td>Offer vehicles at mountain destinations such as rental or shuttle cars</td>
<td>Vehicles available at ski destinations - rental or shuttle cars</td>
<td>Limited audience</td>
<td>Short-term</td>
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<td>108</td>
<td>Manage closures/restrictions and conveying traveler information more effectively</td>
<td>Information management of what people should do when CDOT has closures / restrictions</td>
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<td>Short-term</td>
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<td>Develop programs that punish bad and reward good behavior</td>
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<td>Identified programs could be implemented by a TMD</td>
<td>Short-term</td>
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<td>Support PI for the creation of destinations where travelers would be willing to wait out peak traffic (service providers would provide parking)</td>
<td>Is there a place for PPP destinations for travelers to wait out traffic?</td>
<td>Inside if coordinated with CDOT facilities - maintenance facilities? Chain stations? Scenic overlooks?</td>
<td>Long-term</td>
<td></td>
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<td>The market has not provided this already - why isn’t it done already?</td>
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<td>Convey to public costs and benefits of avoiding peak hour travel</td>
<td>Reduces air quality; allows for better transportation management</td>
<td>Additional costs for signage and technology</td>
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<td>Develop applications of dynamic ride “fast cut” strategy</td>
<td>Applications of Enviro ride fast cut concept; focus on reducing congestion</td>
<td>Requires significant investment in technology</td>
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<td>Coordination with ski resorts</td>
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<td>Convert hard shoulders to full time or peak time travel</td>
<td>Options to convert hard shoulders to full time general purpose lane</td>
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<td>Use rubberband blinder, which could be funded through tolling</td>
<td>Rubberband blinder - which could be privately funded</td>
<td>Limited benefit, and challenging implementability</td>
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<td>Develop program to package resort visits with guaranteed return trip</td>
<td>Programs to package resort visits and guarantee a return trip for ski “slug”</td>
<td>Potential for increased convenience and reduced costs</td>
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<td>Implement congestion pricing at tunnels</td>
<td>Potential to increase revenue and manage congestion</td>
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<td>I-95 example to deter detour traffic</td>
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<td>Change/improve the “safety culture” of the corridor</td>
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<td>Partner toward community restrictions on trucking and shipping patterns</td>
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<td>Even if not all of them are functional, there will be better compliance through perceived enforcement</td>
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<td>Enhance ongoing communication with communities</td>
<td>Need to make sure project benefits are communicated back to the communities</td>
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<td>Develop Truck Stopping/Rebounding lanes</td>
<td>Need to identify a length that is long enough for trucks to merge back into traffic. Minimum of 1 mile requirement.</td>
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<td>Need to make sure there is enough benefit of this project to make sure it is seen as successful</td>
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<td>Barcode that prohibits texting</td>
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<td>Similar to fire department child seat safety inspection. With potential to sell related items (e.g., car seats).</td>
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## I-70 Mountain Corridor Mobility and Operational Assessment

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**Totals** | 61 | 49 | 37 | 32 | 46
APPENDIX E – PREVIOUS AND CURRENT CDOT INITIATIVES TO IMPROVE I-70 MOBILITY

The following lists summarize 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. 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 investigation, CDOT recommended the benefit/cost ratio of this alternative is not acceptable.

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 Wooly 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.

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.
APPENDIX F - SUCCESSFUL SEASON FOR I-70 WEST PROGRAMS

Successful Season for I-70 West Winter Programs

June 8, 2011 - Heavy Tow Quick Clearance, Chain Assistance and Courtesy Patrol aided Travelers - DENVER – The Colorado Department of Transportation’s (CDOT) wintertime programs continued to reduce traffic congestion and delays along the Interstate 70 West corridor last winter.

Quick Clearance is a program that provides standby heavy wreckers at strategic locations along I-70, between Floyd Hill and Vail Pass, allowing stalled and spun-out commercial vehicles to be moved quickly from traffic lanes to a safe location. CDOT contracted with USAC/Drive America to provide the service.

The 2010-2011 program began Thanksgiving weekend and ended in late April. It included all weekends and holidays and two other separate occasions – one severe storm and when I-70 was closed during the day for rock removal at Georgetown Hill in early April. Overall:

- 193 commercial vehicles relocated
- 214 lanes cleared
- Average clearance time – reduced to 22 minutes

“We’re very pleased that the clearance times for Heavy Tow continue to go down each year,” says CDOT Regional Transportation Director Tony DeVito. “It’s been a major success at reducing lane closures and the delay times on I-70 which, in turn, enhances highway safety for all users.”

The average clearance time before implementation of the Quick Clearance program was approximately 50 minutes. It averaged 27 minutes during the program’s first season, in late 2008; 23 minutes during the 2009/2010 season.

CDOT also put its Chain Assistance program into service for a third straight year. By law, commercial vehicles are required to carry chains for travel on I-70 between Dotsero and the Morrison exit from September 1 through May 31. To help truckers comply when the chain law is in effect, drivers can purchase chains and chain-up service from approved vendors when they are present at any one of the 21 chain stations along I-70.

During the 2010/2011 winter season, three companies sold 252 sets of chains and installed 445.

“When we look at the number of closures we experienced for Heavy Tow continue to go down each year,” said CDOT Regional Transportation Director Tony DeVito. “It’s been a major success at reducing lane closures and the delay times on I-70 which, in turn, enhances highway safety for all users.”

The average clearance time before implementation of the Quick Clearance program was approximately 50 minutes. It averaged 27 minutes during the program’s first season, in late 2008; 23 minutes during the 2009/2010 season.

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During the 2010/2011 winter season, three companies sold 252 sets of chains and installed 445.

“When we look at the number of closures we experienced on the corridor, it’s gone down significantly from 2007-2008 – the season before we put Heavy Tow and Chain Assistance into operation,” said DeVito. “These programs have directly addressed those non-accident problems, such as having no chains and vehicle break downs.”

The Courtesy Patrol provided drivers of passenger and other smaller vehicles with 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 patrolled I-70 between the top of Floyd Hill and Silverthorne on weekends and holidays, from Thanksgiving to the end of March. During the 2010-2011 winter season, the Courtesy Patrol assisted 766 vehicles.
“All of these programs have been effective at reducing congestion and delay times on the I-70 Corridor,” said DeVito. “I-70 can lose about 50% of its capacity when just one lane is closed, and 65% when two lanes are blocked, which can cost thousands of dollars in lost revenue and hours of travel delays. Providing these services allows us to get traffic moving again in a timely manner, providing benefits for trade, tourism and recreation that far outweigh the cost, which is just over $695,000 a year.”

Studies have shown that for every hour the I-70 West Corridor is closed to traffic, it can have an economic impact of up to $800,000, with a majority of those revenues affecting surrounding communities.

*Summary of I-70 Events between Vail Pass and Morrison Road Interchange*

**September 1, 2007 to April 30, 2008 (to East Vail)**

- Implemented Chain Law: 316
- Total Accidents: 297 (Commercial Vehicles 156/Non-Commercial Vehicles 141)

(including both single & multi-vehicle crashes or property damage only)

- Closures due to adverse weather: 20 (93 hours, 32 minutes)
- Other Closures: 317 (No chains, breakdowns, out of fuel, etc.)

**September 1, 2008 to April 30, 2009 (to East Vail)**

- Implemented Chain Law: 284
- Total Accidents: 133 (Commercial Vehicles 47/Non-Commercial Vehicles 86)
- Closures due to adverse weather: 25 (69 hours, 17 minutes)
- Other Closures: 134 (No chains, breakdowns, out of fuel, etc.)

**September 1, 2009 to April 30, 2010**

- Implemented Chain Law: 217
- Total Accidents: 63 (Commercial Vehicles 48/Non-Commercial Vehicles 15)
- Closures due to adverse weather: 12 (34 hours, 47 minutes)
- Other Closures: 104 (No chains, breakdowns, out of fuel, etc.)

**September 1, 2010 to April 30, 2011**

- Implemented Chain Law: 220
- Total Accidents: 159 (Commercial Vehicles 39/Non-Commercial Vehicles 120)
- Closures due to adverse weather: 31 (84 hours, 4 minutes)
- Other Closures: 4 (Sun glare; medical emergency, grass fire, rock mitigation)