



COLORADO

Department of Transportation

Transportation Systems
Management & Operations

September 9, 2015

Mr. John Cater
Division Administrator
Federal Highway Administration
12300 West Dakota Avenue, Suite 180
Lakewood, Colorado 80228

RE: CDOT Work Zone Safety and Mobility Process Review

Dear Mr. Cater,

As required by FHWA's Rule on Work Zone Safety and Mobility, 23 CFR 630 Subpart J, CDOT conducted and recently completed our Work Zone Safety and Mobility (WZSM) Process Review (attached). This rule, referred to as the "Work Zone Safety and Mobility Rule", requires CDOT to conduct a process review every two years. CDOT respectfully requests formal concurrence from the FHWA for the acceptance of this report. Mr. Dahir Egal of your staff was an active member of the process review task force and concurs with the content of the report.

In May of 2014, a CDOT task force was formed to assess the effectiveness and consistency of WZSM policies and practices from all programmatic levels and make recommendations for improvement. The focus of this WZSM process review was to improve the safety and efficiency of work zones. The WZSM Process Review Task Force assessed the effectiveness of the policies and practices in place, and whether they were understood by stakeholders involved in the process and were being implemented consistently throughout CDOT.

Our review found that CDOT continues to be in compliance with 23 CFR 630 Subpart J, from policies and specifications to implementation in the field. Generally, the review revealed that the Regions recognize that while implementing WZSM procedures add construction costs to projects, the procedures add safety value to work zones and must continue to be implemented. Further, the review revealed that there are WZSM procedures that could be improved; including WZSM requirement compliance and accountability, providing additional and updated training in work zone procedures and requirements for those involved in traffic control from design to implementation, the need for procedures for collecting and sharing work zone operations data and lessons learned, and incorporating pedestrian and bicycle paths in work zones.

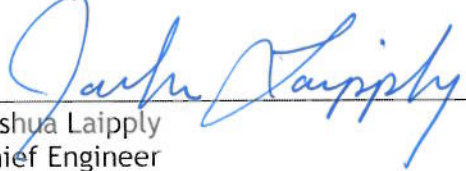
In 2013 CDOT had over 20% more construction projects active on our state's highways. That continued in 2014 and has resulted in a proportionate increase in work zone crashes. Even though the rate of crashes has not increased, the increasing number of work zones on our highways and the findings of the review emphasize the importance of CDOT using the best and safest work zone safety and mobility practices. CDOT is taking a proactive approach to



ensuring this and compliance with Subpart J. We have formed a steering committee to regularly meet, discuss, and ensure implementation of work zone improvements. The joint FHWA and CDOT Quality Improvement Council (QIC) has also identified work zones as a focus area. CDOT's Project Development and Traffic and Safety Engineering Branches will follow up on implementing the report recommendations and work closely with the steering committee, QIC, and other already established committees at CDOT to ensure the safest, most efficient, and credible work zones possible.

We look forward to your approval of this Process Review Report and our continued work together in improving work zone safety and mobility. If you have any questions, please contact me or Charles Meyer of my staff at 303-757-9879.

Sincerely,



Joshua Laipply
Chief Engineer
Colorado Department of Transportation



Ryan Rice
Director of Transportation Operations
Colorado Department of Transportation

Attached: CDOT Work Zone Safety and Mobility Process Review Report

Copy: Alicia Nolan, Deputy Division Administrator, FHWA
Charles Meyer
Work Zone Safety and Mobility Task Force





COLORADO
Department of Transportation

Work Zone Safety and Mobility Process Review



September 9, 2015

Acknowledgments

Conducted by:

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Larry Haas

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K.C. Matthews

Charles Meyer

Clint Moyer

Ken Nakao

Clark Roberts

Mark Straub

Chris Ukowich

David Vialpando

**Work Zone Safety and Mobility Process Review
CDOT**

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Executive Summary

The FHWA requires CDOT to conduct a Process Review every two years to review the Colorado Department of Transportation's (CDOT's) work zone safety and mobility (WZSM) processes and procedures. A CDOT task force was formed in May 2014 and met monthly to review the WZSM procedures, and to collect comments made by the following stakeholders involved in the Traffic Control Reviews (TCR) of their construction projects during the summer of 2014: Region design personnel, construction project engineers, and traffic operations personnel; Contractor traffic control supervisors (TCS), construction superintendents, and CDOT Maintenance. The CDOT task force reviewed the comments, and based on analysis and discussion of those comments and task force observations of work zone traffic control, found the following key findings:

- Proactive Accountability for WZSM Requirements
 - Efforts of this review need to be carried on proactively; therefore, the review team recommends that a continuously meeting task force be formed to carry out the recommendations of this review, as well as other identified WZ safety and mobility improvements.
 - CDOT saw a 20% increase in active construction projects on our highways in 2013 from past years and continues to anticipate more projects than in the past. As a result, a proportionate increase in crashes was also observed. While the rate of crashes per work zone has not significantly increased, CDOT still needs to strive toward making construction zones as safe, efficient, and credible as possible to the travelling public to reduce these crashes where workers and travelers are more vulnerable.
 - Implementing the CDOT WZSM procedures continues to add costs to the projects, but provided safe traffic maneuvering through work zones.

- WZSM Training and Awareness
 - A new, formal WZSM training program is needed to ensure all Region design, construction and Section maintenance personnel have a uniform, working knowledge of WZSM.
 - Additional training requirements for traffic control personnel, including flaggers, are needed to ensure safe traffic control in work zones.
 - Speed reduction training is needed for the CDOT Maintenance personnel to ensure proper speed reductions in maintenance project work zones.
 - Updated guidance on speed reduction is needed for all work zones.
 - Concerns with flagger performance were noted. Ways to improve flagger performance should be explored.
 - The WZSM Procedures document needs to be rewritten to inform the Regions that this document shall be followed on all projects.
 - There is a need to communicate to the Regions that all projects, including CDOT Maintenance projects, should follow the CDOT WZSM Procedures document. Publicize the document during statewide RE visits, PE II and III, and Traffic Engineer meetings, as well as during the Maintenance Academy, so the Regions and Maintenance Sections are informed.

- The Regions continue to implement their respective lane closure strategies successfully.
- Several projects reviewed did not have a Transportation Management Plan (TMP).
- WZ Public Information
 - There were examples of well-coordinated public outreach and relations efforts on projects reviewed.
 - Variable message signs continue to be used in the cases of extended delays and to notify the traveling public of upcoming construction.
- Complying with WZSM and Resource Needs
 - Additional uniformed traffic control (UTC) is needed to enforce the posted work zone speed limit and 'Fines Double' regulations, which would lead to safer traffic control in work zones.
 - There continues to be a need to improve the implementation of pedestrian and bicycle paths, crosswalks, and/or stop bars into the Method of Handling Traffic (MHT) for projects.
 - There continues to be a need for collecting, analyzing and sharing WZ operations data.
- Next Process Review
 - Definitions of key terms should be included in the next Process Review.

Background

In September 2004, the Federal Highway Administration (FHWA) published updates to the work zone regulations at 23 CFR 630 Subpart J, referred to as *Work Zone Safety and Mobility Rule*. In December 2007, FHWA added new regulations at 23 CFR 630 Subpart K referred to as *Temporary Traffic Control Devices Rule*. Both are applicable to all Federal-Aid Highway Projects with the intent to improve work zone management and decrease the likelihood of fatalities and injuries to road users and workers exposed to motorized traffic. The Safety and Mobility Rule was effective on October 12, 2007 and the Subpart K was effective on December 4, 2008.

The Colorado Department of Transportation's (CDOT) WZSM policy directive (805.0) became effective October 2008, with accompanying procedures that were completed January 2009. The first Process Review was conducted during the summer of 2010, covering six (6) projects. CDOT has since implemented the recommendations from that review.

For this Process Review, 31 projects were reviewed (See Appendix B for more details). This Process Review focused on programs and policies related to elements of the Rule that could assist or be added to the procedures or the next Process Review.

The results of the review are intended to lead to improvements in work zone processes and procedures, data and information resources, and training programs so as to enhance efforts to address safety and mobility on current and future projects. According to the Rule, the review may include the evaluation of work zone data at the State level, and/or review of randomly selected projects throughout their jurisdictions.

Purpose Statement

The purpose of this review is to assess the effectiveness and consistency of WZSM policies and practices for design, construction, maintenance and operations. The WZSM Process Review Team assessed the effectiveness and work towards consistent implementation and better understanding of current policies and practices throughout CDOT. The focus of this WZSM Process Review is to improve the safety and efficiency of work zones. This includes, but is not limited to:

- Speed reduction practices.
- Full closure procedures.
- Lane closures adjacent to, or vicinity to, CDOT projects.
- Use of positive protection devices.
- Transportation Management Plan (TMP) implementation.
- Monitoring daily WZSM performance.
- Knowledge-sharing of work zone safety operations and best practices among the five (5) Regions of CDOT
- Variable Message Sign (VMS) board messaging.
- Researching the performance and certification of the TCS' and flaggers.

Scope

The scope for this review team was to review CDOT's processes and procedures as they relate to WZSM at both the program and project levels. A multidisciplinary review team included representation from Headquarters, Regions, construction, traffic, maintenance, and FHWA evaluated what was working well, what was not working well and needed adjustments, and determined how to improve the safety and efficiency of CDOT work zones. To conduct these reviews, the review team used a process similar to that used to conduct quality assurance reviews. The review team included:

Review Team Members	Title, Office	Member Roles
Kevin Brown	Region 1 Resident Engineer, CDOT	Team Member
Dahir Egal	Safety/Traffic Engineer, FHWA	Team Member
Larry Haas	Region 4 Traffic Operations Engineer, CDOT	Team Member
Doug Lollar	Region 2 Program Engineer, CDOT	Team Member
K.C. Matthews	Safety/Traffic Engineer, CDOT	Team Member
Charles Meyer	Safety/Traffic Engineer, CDOT	Team Leader
Clint Moyer	Region 3 Resident Engineer, CDOT	Team Member
Ken Nakao	Safety/Traffic Engineer, CDOT	Team Leader
Clark Roberts	Region 1 Traffic Engineer	Team Member
Mark Straub	Area Engineer, CDOT	Team Member
Chris Ukowich	Region 4 Safety Officer	Team Member
David Vialpando	Region 5 Maintenance, CDOT	Team Member

The review team selected projects from around the state to assess effectiveness of work zone policies and procedures, understanding and application of those policies and procedures, and overall implementation of WZ safety and operation principles. Projects were selected statewide from the projects identified by Project Development for the annual Traffic Control Reviews (TCR), and one project in each of the five (5) CDOT Regions received both a TCR field and office visit. In addition, two (2) CDOT maintenance projects per Region (except only one maintenance project was performed in Region 5) were given a TCR field review, and the maintenance staff completed the Process Review survey.

Safety Analysis

The review team also conducted a review of safety performance of work zones in Colorado highways over the past five (5) years to determine whether concerning trends were emerging. The crashes occurring within work zones during a five-year (2009-2013) period are shown in the table below.

Year	Statewide Construction Zone Crashes						
	PDO	Injury Crashes	Injuries	Fatal Crashes	Fatalities	TOTAL Crashes	Active Projects
2009	933	81	104	10	11	1024	1417
2010	825	80	100	8	11	913	1651
2011	825	90	122	6	11	921	1536
2012	877	90	117	6	8	973	1583
2013	1212	103	133	8	10	1323	1921

Since VMT has remained relatively constant over the past several years, the increase in total crashes from previous years to 2103 was of concern to the team. Further investigation revealed that the vast majority of the increase in crashes occurred in two counties: Larimer and El Paso, which experienced devastating flooding and fires in late 2013. As a result, there was a large increase in the number of work zones in those counties, and other locations around the state. Further, CDOT has increased delivery of its overall construction program, leading to more work zone exposure to the travelling public. We have included the active projects information in the above table for comparison.

The team found that while any fatality and crash is concerning, and especially those in work zones that endanger our vulnerable employees and construction workers, increasing injury and total crashes trends are emerging with increased construction work zones as shown from the above table. That said, the rate or proportion of work zone crashes has not increased. However, all safety stakeholders need to continue their efforts to reduce all crashes, including those in construction and maintenance work zones. Several of the findings and recommendations in this report will improve work zone safety.

The review plan was to survey the five project designers, project engineers (construction), Region Traffic Operations Engineers, Traffic Control Supervisors, and construction superintendent involved in the traffic control of the projects at the CDOT Offices; and survey the nine CDOT Maintenance personnel involved in traffic control of their projects, using a questionnaire format (Appendix A). The questionnaires contained a series of questions specific to design, construction, traffic operations, TCS', and construction superintendents. Upon completion and review by the review team, best practices and recommendations were documented. Results of both the TCR program (Appendix B) and the Process Review were presented to each CDOT residency and to maintenance. Any follow up actions as a result of the Process Review will be documented and assigned to the appropriate CDOT branch for resolution.

List of Projects Reviewed (in field and office)

Region	Date Reviewed	Project Number	Roadway	Project Location
1	FY 15	CC R600-438	---	Chatfield State Park – Road Improvements Phase 7
2	FY 15	STR 0505-048	SH 50	La Junta
3	FY 15	STA 133A-039	SH 133	Carbondale
4	FY 15	STA 0142-058	SH 14	West Sterling
5	FY 15	NH 0502-068	SH 50/285	Poncha Springs

List of Maintenance Projects Reviewed

Region	Date Reviewed	Roadway	Project Location
1	FY 15	I-25 and E 470 SH 8	Lone Tree Bear Creek
2	FY 15	SH 12 SH 50	MP 68 Hasty
3	FY 15	SH 125 SH 6	MP 12 Near Willow Creek Reservoir MP 227 near Loveland Pass
4	FY 15	US 34/US 85 SH 138	Greeley Sterling
5	FY 15	SH 50	Salida

Successful Practices

Successful Activity 1: Projects continue to implement their lane closure strategies successfully.

Responsible Party: Region's Traffic Engineers, and CDOT Traffic and Safety Engineering Branch.

Successful Activity 2: Of the projects reviewed, there are examples of well-coordinated public outreach and relations efforts.

Responsible Party: Regions' Resident Engineers, Project Managers and Project Engineers; Public Relations, Traffic Operation Center, and Contractors.

Successful Activity 3: Variable message signs continue to be used in the cases of extended delays and to notify the traveling public of upcoming construction.

Responsible Party: Regions' Resident Engineers, Project Managers and Project Engineers; Public Relations, Traffic Operation Center, and Contractor.

Observations/Recommendations

Observation 1: A new, formal Work Zone Safety and Mobility (WZSM) training program is needed to ensure all Region design and construction personnel have a uniform, working knowledge of the WZSM.

Recommendation 1: The CDOT Traffic and Safety Engineering Branch and the 2017 CDOT Process Review should develop a WZSM training program for Region design, construction, and Section maintenance personnel to ensure everyone has uniform knowledge of the WZSM.

Responsible Party: CDOT Traffic and Safety Engineering Branch, and 2017 Process Review Team.

Observation 2: Additional training requirements for traffic control personnel, including flaggers, are needed to ensure safe traffic control in work zones.

Recommendation 2: Develop a standardized list of training requirements for all traffic control personnel, including flaggers, to provide consistent traffic control performance in work zones.

Responsible Party: CDOT Contracts and Market Analysis Branch and Traffic and Safety Engineering Branch.

Observation 3: CDOT WZSM procedures were not consistent with the current specifications for overall temporary traffic control. In particular, TMP components did not consistently meet standard expectations on significant projects.

Recommendation 3: The WZSM Procedures document needs be updated to be consistent with the current specifications, and the Regions/Sections need to be informed about the WZSM Procedures document. Reminding Regions during annual RE visits, and adding a hyperlink to the CDOT Design and Construction Bulletins would help keep the Regions aware of the document.

Responsible Party: CDOT Contracts and Market Analysis Branch, and CDOT Traffic and Safety Engineering Branch.

Observation 4: There was a lack of pedestrian and bicycle paths, crosswalks and/or stop bars in the Method of Handling Traffic (MHT) on projects.

Recommendation 4: Training is needed for all design and construction personnel on MHTs to ensure consistency in MHTs on all projects.

Responsible Party: CDOT Contracts and Market Analysis Branch, CDOT Region Traffic Engineers, CDOT and Consultant Project Engineers, CDOT Maintenance, and CDOT Traffic and Safety Engineering Branch.

Observation 5: There is a lack of follow-up action procedures to address the recommendations listed in process review reports in a timely manner.

Recommendation 5: Form a separate task force to make sure the recommendations listed in this report is addressed before the 2015 Traffic Control Review (TCR) begins.

Responsible Party: CDOT Traffic and Safety Engineering Branch, and CDOT Contracts and Market Analysis Branch.

Follow-up Actions

The following table summarizes the observations and recommendations from the Process Review. These follow up actions relate directly to the development of the WZSM guidelines in which FHWA will continue to work directly with CDOT.

Activity/ Observation	Summary	Follow-up Action	Responsible Party	Target Date
Observation 1	New formal WZSM training program is needed to ensure all Region design and construction personnel have a uniform, working knowledge of the WZSM.	The CDOT Traffic and Safety Engineering Branch and the 2017 CDOT Process Review should develop a WZSM training program for Region design, construction, and Section maintenance personnel to ensure everyone has uniform knowledge of the WZSM.	CDOT Traffic and Safety Engineering Branch and 2017 CDOT Process Review Team	
Observation 2	Additional training requirements for traffic control personnel, including flaggers, are needed to ensure safe traffic control in work zones.	Develop a standardized list of training requirements for all traffic control personnel, including flaggers, to provide consistent traffic control performance in work zones.	CDOT Contracts and Market Analysis Branch and Traffic and Safety Engineering Branch	
Observation 3	The WZSM Procedures document needs be updated to be consistent with the current specifications, and the Regions/Sections need to be informed about the WZSM Procedures document.	The WZSM Procedures document needs be updated to be consistent with the current specifications, and the Regions/Sections need to be informed about the WZSM Procedures document. Reminding Regions during annual RE visits, and adding a hyperlink to the CDOT Design and Construction Bulletins would help keep the Regions aware of the document.	CDOT Contracts and Market Analysis Branch, and CDOT Traffic and Safety Engineering Branch.	
Observation 4	There was a lack of pedestrian and bicycle paths, crosswalks and/or stop bars into the Method of Handling Traffic (MHT) on projects.	Training is needed for all design and construction personnel on Methods of Handling Traffic (MHTs) to ensure consistency in MHTs on all projects.	CDOT Contracts and Market Analysis Branch, CDOT Region Traffic Engineers, CDOT Maintenance, CDOT Traffic and Safety Engineering Branch, and CDOT and Consultant Project Engineers.	
Observation 5	There is a lack of follow-up action procedures to address the recommendations listed in process review reports in a timely manner.	Form a separate task force to make sure the recommendations listed in this report is addressed before the 2015 Traffic Control Review (TCR) begins.	CDOT Traffic and Safety Engineering Branch, and CDOT Contracts and Market Analysis Branch.	

Conclusions

This review looked at one project in each CDOT Region with the goal of understanding how today's work zone practices can help shape future efforts to make Colorado's work zones operate effectively and be as safe as possible. We appreciated the cooperation and open communication that was very evident with both the Region and Headquarter office staff that participated in this review.

CDOT continued to take pride and was doing a commendable job in the execution of work zones, and the continued evaluation of work zones throughout the life of a project.

As with all processes and procedures, this review confirmed that there are opportunities for better coordination and management of work zones. This report identified several good practices but also identified a number of items that were being implemented differently. As CDOT continues to develop their safety and mobility implementation guidelines, these findings can act as a guide to improve these processes and procedures.

2014 Work Zone Process Review Results Summary for CDOT's Work Zone Safety and Mobility Survey

The following are questions that were given to project personnel in Design, Construction, and Traffic Operations. General assumptions and recommendations were reviewed by the Work Zone Process Review Task Force.

Design Personnel Questions

1. Did the designers for this project take the WZSM training provided by CDOT within the last three (3) years? If no, why not?

3 of 5 answered "No".

- Haven't heard of the training program.

Recommendation:

- Rephrase this question to encourage responders who answered no to give a reason why.
- Perhaps more training to improve knowledge of the WZSM procedures is needed.
- Publicize the training better; only the Region traffic units knew about the training.
- Improve communications between HQ and the Regions
- Offer training two times, annually.

2. What traffic control plan (TCP) and WZSM procedure required strategies were commonly utilized on this project

http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/lane-close-work-zone-safety/work-zone-safety-mobility/WZSM_Procedures.pdf/view?

Answers include:

- Manual, called "Common Sense Approach to Traffic Control in the State Parks."
- M & S Standard Plans.
- Public Information.

Recommendation:

- None – Continue to measure.

3. Have the WZSM procedures affected project delivery and costs?
4 of 5 answered “No”.

Recommendation:

- In the next Process Review, further define this question to enable participants to answer “positively” or “negatively”. Perhaps rephrase the question to, “If the WZSM procedures negatively affected your project delivery and cost, how?”
- Add in this question that “if the answer is ‘negatively’, why?”

4. Please explain specific concerns you have with the WZSM Procedures.

Answers include:

- None.

Recommendation:

- Rephrase this question; make it more specific.

5. Are there any WZSM procedures that are difficult to comply with?
5 of 5 answered “No”.

Recommendation:

- Maybe this question should be deleted from future questionnaires because if the responders are not sure of the procedures, the easy answer is “No”.

6. Are there any conflicting requirements that are difficult to comply with? If yes, specifically how?
5 of 5 answered “No”.

Recommendation:

- This question should be deleted from future questionnaires.

7. During project scoping, was the minimization of road users impacts considered?
4 of 5 answered “Yes”.

Recommendation:

- Add to the question with, “If Yes, how?”

8. Has the implementation of the WZSM procedures caused you to consider additional or different strategies than what has been used in the past?
4 of 5 answered “No”.

Recommendation:

- Add to this question with, “If yes, how?”

9. Was a modeling software used to analyze work zone traffic impacts for this project, other than for lane closure policy?
5 of 6 answered “No”

Recommendation

- Add to the question with, “Why or why not?”, or ask “Do you think a modeling software would have benefitted this project?”
- Address this with Operations Assessment and Operations Clearance criteria.

10. Was consideration given to potential work zone impacts, including delays, and does that influence the evaluation and selection of a build alternative?
3 of 5 answered “No”.

Recommendation

- Add to this question with, “If no, why?”

11. If this project was on the interstate within a Transportation Management Area (TMA), was an exception request submitted to FHWA?
5 of 5 answered “No”.

Recommendation

- Further awareness and training is needed regarding the Transportation Management Area and FHWA regulations.
- Add to this question two (2) parts, as follows: “Was this project in a Transportation Management Area (TMA)?”, and “If yes, was an exception granted?”
- Add a “N/A” radial button as part of this question.
- Delete this question - Many designers don’t know if their project is in a TMA or not.

12. Was a draft traffic control or phasing plan prepared prior to the FIR?
3 of 5 answered “No”.

Recommendation:

- Delete this question because in Project Development manual, the TCP or phasing of a project is not established prior to FIR; it is established prior to FOR.

13. If your project was a design bid/build project, was phasing put in the plans?
4 of 5 answered “Yes”.

Recommendation:

- Question needs to be rewritten.
- Add a “N/A” radial button as part of this question.
- Add to this question with, “Was your project required to be bid or could the Contractor propose a different plan?”

14. If required by the WZSM Procedures document, was a Transportation Operation Plan (TOP) developed and considered prior to the FIR?

3 of 5 answered "No".

Recommendation:

- Delete this question – The TOP is not established prior to FIR; it is developed for the FOR.

15. Was the funding for the Transportation Operation Strategies (TOS) included in the initial design estimate for the project?

4 of 5 answered "No".

- Funding is still an issue for TOS in initial design estimates of projects.

Recommendation:

- Delete this question – Funding for strategies is not in the project budget or scope.
- Add to this question with, "If no, why?"
- Add a N/A radial button as part of this question.

16. What transportation operation strategies was being used?

http://www.dot.state.co.us/Traffic_Manuals_Guidelines/Work_Zones/WZSM/WZSM_Procedures.pdf

Answers include:

- Emergency road repair force account; designed to handle issues during non-working hours.
- Temporary traffic signal.
- Lane closure.
- Construction phasing.

Recommendation:

- None – Continue to measure.
- Delete this question - This is similar to Question 2, "What traffic control plan (TCP) and WZSM procedure required strategies were commonly utilized on this project?"
- Rephrase this question to, "What Transportation Operation Strategies (TOS) were being used?"
- Add a "N/A" radial button as part of this question.

17. Was there communication between traffic designers and the Region Traffic Operations Engineer?

4 of 5 answered "Yes".

Recommendation:

- None – Continue to measure.
- Add a "N/A" radial button as part of this question.
- Add to this question with, "If no, why?"

Construction Project Engineer Questions

1. What Traffic Control Plan (TCP) and WZSM Procedure required strategies were commonly utilized on this project?

Answers include:

- Basic traffic control methods because project was 'Non-Significant'.
- Construction phasing.
- Lane closures and lane shifts.
- Public information.

Recommendation:

- Rephrase this question to: "Which of the following strategies were used on your project: Public Information, Construction Phasing, Full roadway closure, Lane Closure, Lane Shifts, Reduced shoulder widths, etc.

2. Have the WZSM procedures affected project delivery and costs? If yes, specifically how?

4 of 5 answered "No".

- Due to the large number of pedestrian and cyclists in the work zone area, implement a safe and adequate pedestrian access plans. These features were not anticipated in the project traffic control quantities, resulting in increased costs.

Recommendation:

- In the next Process Review, further define this question to enable participants to answer "positively" or "negatively".
- Add in this question that "if no, why?"

3. Please explain specific concerns you have with the WZSM procedures.

Answers include:

- CDOT Standard specifications indicate that the Contractor is responsible for implementing an adequate pedestrian access plan. In reality, these plans are being done at the project-level by CDOT and consultants, which seems to overrun the project traffic control pay item quantities.

Recommendation:

- Increase pedestrian access training for designers so this problem does not occur during construction phase of projects.

4. Are there any WZSM procedures that are difficult to comply with?

4 of 5 answered "No"

- Designing and implementing an ADA compliant work zone.

Recommendation:

- Provide additional training in this area for CDOT/Consultant designers and construction personnel to help make more work zones ADA-compliant.

5. Are there any conflicting requirements that are difficult to comply with?
5 of 5 answered “No”.

Recommendation:

- Delete this question - This question is similar to Question #5.

6. Were Transportation Management Plan's (TMP's) implemented, as designed?
4 of 5 answered “No”

- TMP was not included in the project, and the engineer did not require it.
- All three parts of the TMP (TCP, TO component, and PI) were not included in the project.

Recommendation:

- Add to this question with, “If no, why?”, and “What documentation did you follow to revise the TMP?”
- Training
- Inform the Regions that page 2 of the WZSM Procedures document states that a TMP is required on all projects.

Questions 7 - 9 pertain to adjustments to the TCP:

- 7a. Were field adjustments made to the TCP required review by the Traffic Engineer? If yes, what were they?
4 of 5 answered “No”

Recommendation:

- None – Continue to measure.
- Rephrase this question – Question appears open-ended.

- 7b. Were the project managers or designers notified of any adjustments?
3 of 5 answered “Yes”.

Recommendation:

- Add to this question with, “If no, why?”
- Rephrase this question – Question appears open-ended.

8. Were change orders written for changes to the TCP? If yes, please mail or e-mail the change orders to Ken Nakao at HQ (Justification Letter and Form 90).
4 of 5 answered “No”

Recommendation:

- Rephrase this question – Question appears open-ended.
- Add to this question with, “What caused the need to have a change order?”
- Add “N/A” radial button as part of this question.

9. If adjustments were made to the speed limits during the course of the project, what criterion was used?

Answers include:

- Lane width adjustments.
- Engineering judgment and ultimate approval of the Form 568.
- Common sense.

Recommendation:

- Include in the question “, and was a Form 568 completed?” and, “If not, why?”
- Add “N/A” radial button as part of this question.

10. Was a detour required for this project?

3 of 5 answered “Yes”

- No traffic impacts on detoured routes were analyzed.

Recommendation:

- Rephrase this question – Question appears open-ended.
- Add “N/A” radial button as part of this question.

- 11a. Was the project being completed in phase construction?

3 of 5 answered “Yes”

Recommendation:

- Rephrase this question – Question appears open-ended.
- Add “N/A” radial button as part of this question.

- 11b. Did the contractor build the project as per project phasing plans?

3 of 5 answered “Yes”.

Recommendation:

- Rephrase this question – Question appears open-ended.
- Add to this question, “If no, why not?”

12. Did you receive copies of the official crash reports from law enforcement?

4 of 5 answered “No”

Recommendation:

- Add to this question, “If no, why not?”
- Rephrase this question to ask if copies of the crash reports were received from CDOT.
- Add “N/A” radial button.

13. Were reduced speed limits in place during non-working hours if no hazards were present to the traveling public?

3 of 5 answered “No”

- Speed limits were not reduced.

Recommendation:

- Add “N/A” radial button.
- Add to this question, “If yes, why?”

14. How were traffic queues and delays measured, and where were they documented?

Answers include:

- Traffic queues were randomly monitored, and they were documented in project diaries.
- Delays were measured in time, and they were documented in the Project Engineer’s daily diary.

Recommendation:

- None – Continue to measure.

15. Were there mitigation efforts in place when traffic queues were greater than the Region Lane Closure Strategy (LCS) threshold?

5 of 5 answered “No”.

- No delays exceeded the 10-minute threshold allowed by the contract.

Recommendation:

- None – Continue to measure.
- Delete question – Not many know the threshold and it may not be listed in the Region LCS.

16. If the project deviated from the LCS, did you follow the variance process?

4 of 6 answered “No”

Recommendation:

- Rephrase the question
- Add to this question, “If no, why?”
- Add “N/A” radial button.

17. On a scale of 1 (worst) to 10 (best), how would you rate the TCS, and why?

1 was rated a “3”, two (2) were rated a “4”, and two (2) were rated a “5”.

Reasons include:

- Average performance.
- TCS was replaced multiple times on our project until the last one was good.

Recommendation:

- None –Continue to measure.

18. On a scale of 1 (worst) to 10 (best), how would you rate the flaggers, and why?
One (1) was rated a “3”, two (2) were rated a “4”, and two (2) were rated a “5”.

Reasons include:

- Very little training for most of the flaggers.
- Majority of the flaggers were inexperienced.
- Flaggers vary in ability and desire to work.

Recommendation:

- None – Continue to measure.

- 19a. Does CDOT need to increase the training requirements of traffic control personnel?

3 of 5 answered “Yes”.

Recommendation:

- Add to this question, “If yes, in what areas?”

- b. Should CDOT do something to increase the quality of traffic control supervisors?

3 of 5 answered “Yes”.

Recommendation:

- Rephrase this question to generate recommendations.

- c. Should CDOT do something to increase the quality of flaggers?

5 of 5 answered “Yes”.

If yes, what do you suggest?

Answers include:

- Increase pay for flaggers to attract better workers.
- Set up an apprenticeship program for entry-level flaggers.

Recommendation:

- More training requirements is needed.
- Maybe require more flagger experience on larger, more complicated projects; including on interstates.
- More mandatory drug testing prior to being allowed to work on projects.

20a. Was there a time extension, allowed by the Form 105, that was outside the working hours recommended by the LCS?
5 of 5 answered “No”.

Recommendation:

- Rephrase this question to find out what procedure was in place, and to find out why there was a time extension.

b. If yes, what process was used to obtain approval to change the allowable work hours?

N/A

Recommendation:

- Rephrase this question.

c. Were any penalties assessed?

5 of 5 answered “No”.

Recommendation:

- None – Continue to measure.

General Recommendation:

- Add the following four-part question:
 - a. If you had crashes in your construction project, did you receive copies of the crash reports?
 - b. If you had crashes, what crash types [i.e. rear-end, sideswipe (same direction), sideswipe (opposite direction)] occurred during construction and off-construction hours?
 - c. What caused the crash, in your opinion; and did the traffic control or phasing contribute to the crashes?
 - d. What adjustments did you make to mitigate crashes in the work zone?

Traffic Operations Personnel Questions

1. What percentage of-Region projects have implemented the WZSM procedures? What were the duration of these projects? If you answered “None”, please explain.

One (1) was 0%, one (1) was 10%, one (1) was 80%, and two (2) were 100%.

- Some of the WZSM procedures were applied to all projects.
- There are few work zone locations in Region 3 which experiences traffic congestion to utilize all WZSM procedures.

Recommendation:

- None – Continue to measure.

2. Did the Region Traffic Designers create the Traffic Control Plans (TCP) for the project?

3 of 5 answered “No”

Recommendation:

- Rephrase the question to read, “Who created the Traffic Control Plans (TCP)?”

3. What Public Information (PI) strategy was used?

Answers include:

- Coordination with the Region PI officer, schools, emergency services, traffic radio and VMS.
- Create brochures/mailers to distribute to the public.
- Public open house meetings, and direct contact with local businesses.
- Press releases produced by CDOT public relations.
- 24/7 phone hotline.
- Information web site.
- Contracted PI services.
- CDOT PI specifications.

Recommendation:

- None – Continue to measure.

4. What policy, procedure or guidance was used to determine speed reductions in work zones?

Answers include:

- CDOT Chief Engineer memos for Temporary Traffic Control.
- Region Lane Closure Policy.
- CDOT Form 568.
- Work Zone Safety memo.

Recommendation:

- None – Continue to measure.

5a. When are work zone posted speed limits reduced?

Answers include:

- When it is warranted by the Form 568.
- When work is performed within the traveled way.
- 24 hours per day.
- When normal traffic operation is directly impacted, or a hazard exists in the clear zone to do construction.

Recommendation:

- None – Continue to measure.

b. How are you choosing your work zone speed limit?

Answers include:

- Form 568.
- Chief Engineer memos.
- Design criteria for horizontal curves.
- Based upon proposed work.
- Region Lane Closure Policy.
- Traffic impacts.

Recommendation:

- Delete this question – This is similar to Question #4.

6. Who makes the final decision on work zone speed limits?

Answers include:

- Region Traffic Engineer or designee.
- Region Traffic Operations Engineer

Recommendation:

- None – Continue to measure.

7. What policy, procedure or guidance is used to determine lane closures?

Answers include:

- Region Lane Closure Policy
- Traffic queue length calculations and roadway impacts.

Recommendation:

- None – Continue to measure.

8. When are lane closures permitted?

Answers include:

- When it meets the criteria in the Region Lane Closure Policy.
- It depends on location and individual work zone set up.
- It depends on the traffic counts and number of travel lanes available.

Recommendation:

- Delete this question – This is similar to Question #7.

9. What policy, procedure and/or guidance were used to determine the use of positive protection?

Answers include:

- Clear zone criteria.
- AASHTO Roadside Design Guide.
- CDOT Guidelines for the Use of Positive Protection in Work Zones.

Recommendation:

- Rephrase the question.

10. What policy, procedure or guidance was used to evaluate and mitigate safety and mobility impacts?

Answers include:

- Transportation Management Plan (TMP).
- CDOT WZSM Procedures document.
- Work Zone Safety Memo.
- Region Lane Closure Policy.
- MUTCD.
- AASHTO Roadside Design Guide.

Recommendation:

- None – Continue to measure.

11a. Is the crash history studied on a project, regional or state level?

Answers include:

- All three levels.
- Statewide.

Recommendation:

None – Continue to measure.

b. Where did you receive the crash reports from?

Answers include:

- CDOT Staff Traffic.
- Region Traffic Engineering staff.
- Vision Zero Suite software application.

Recommendation:

- None – Continue to measure.

12. Please provide a lesson learned or a possible improvement to the Work Zone Safety and Mobility (WZSM) Procedures document
(http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/lane-close-work-zone-safety/work-zone-safety-mobility/WZSM_Procedures.pdf/view)

Answers include:

- Highlight and emphasize the WZSM more on the design and construction phases, and relate it to the Traffic Control Review (TCR).
- Some days will have higher-than-average traffic, so the Region Lane Closure Policy was altered to reflect the traffic count variations on highways that have marginal reserve capacity.

Recommendation:

- Need to make the WZSM Procedures document easier to read.
- Make a stronger WZSM Procedures document that requires consideration on all projects.
- Publicize the WZSM Procedures document, statewide; Area Engineers need to announce the document during annual RE visits. Also, announce the document at TE, PE II and PE III meetings.

13. Was there communication between traffic designers and the Region Traffic Operations Engineer?

5 of 5 answered "Yes"

Recommendation:

- Add to this question, "If no, why not?"

Traffic Control Supervisor

1a. If you had crashes in your construction project, did you receive copies of the crash reports?

Answer include:

- No crashes occurred on projects.

Recommendation:

- None – Continue to measure.

b. If you had crashes, what crash types (i.e. rear-end, sideswipe (same direction), sideswipe (opposite direction)) occurred during construction and off-construction hours?

Answer include:

- Rear-end.

Recommendation:

- None – Continue to measure.

c. What caused the crash, in your opinion?

Answer include:

- Heart attack.

Recommendation:

- Rephrase the question to read, “If you had crashes, did the traffic control or phasing contribute to the crashes?”
- Add another question, “What adjustments did you make to mitigate crashes in the work zone?”

2. Was the TCP adequate to develop the appropriate Method of Handling Traffic (MHT) for the project?

5 of 5 answered “Yes”.

Recommendation:

- Add to the question, “If no, what was lacking or needed?”

3. What lessons did you learn that would improve work zone safety in future projects?

Answers include:

- Make sure flaggers are prepared for changes that might occur throughout the day.
- Make sure equipment is properly set up.
- Pay attention to new employees’ footwear.
- Safety is priority #1.
- Have flaggers watch traffic coming to the other flagger station, as well as their own station.

Recommendation:

- None – Continue to measure.

4. Are the training requirements adequate for traffic control personnel?
4 of 5 answered “No”.

Recommendation:

- Add to the question, “If no, what else needs to be done?”
- Rephrase the question to read “Are the training requirements adequate for traffic control personnel?”

5. How did you address traffic personnel with inadequate Personnel Protective Equipment (PPE)?

Answers include:

- Conduct a meeting to find out what is needed on projects.
- Address to personnel that proper PPE is required on our projects; if you don’t have proper PPE, you need to leave the job site.
- Prepare a write-up on the person with inadequate/missing PPE, and provide proper PPE to that person.

Recommendation:

- None – Continue to measure.

- 6a. Are CDOT’s contract requirements for traffic control difficult for a traffic control company to adhere to?
5 of 5 answered “No”.

Recommendation:

- Add a text box to give explanations to why the CDOT contract requirements were (or were not) difficult to adhere to.

- b. If yes, in what ways?

N/A

Recommendation:

- Delete this question.

Construction Superintendent

1. Please explain specific concerns you have with the Work Zone Safety and Mobility (WZSM) Procedures.

Answers include:

- Very few motorists acknowledge any temporary traffic control signs.
- Need more Uniformed Traffic Control (UTC) personnel on construction projects.

Recommendation:

- Look into providing more UTC personnel in work zones.
- Rephrase this question involving deletion of “Work Zone Safety and Mobility (WZSM)” because the WZSM is not part of the construction contract between CDOT and the Contractor. An example could be, “Please explain specific concerns you have with the traffic control procedures.”

2. Are there any WZSM procedures that were difficult to comply with, and why?

4 of 5 answered “No”

- Transportation Management Plans (TMPs) are difficult to plan and maintain on small projects.

Recommendation:

- Rephrase this question involving deletion of “Work Zone Safety and Mobility (WZSM)” because the WZSM is not part of the construction contract between CDOT and the Contractor.

3. Are there any conflicting requirements that are difficult to comply with? If yes, what are they?

4 of 5 answered “No”

- Conflicting requirement that was difficult to comply with is scheduling.

Recommendation:

- Rephrase this question to read, “Were there any conflicting requirements?”

4. Did the Contractor maintain a log of accidents that occurred in the work zone? If no, why not?

3 of 5 answered “Yes”

- No, because there were no worker accidents in the work zone to report.

Recommendation:

- If this question is answered “No”, the Construction Superintendent should still maintain a log if accidents with no entries.
- Rephrase the question to be consistent with Sec 630.11 of the Specifications book.

5a. Did the Contractor maintain worker injury reports? If no, why not?

3 of 5 answered “Yes”

- No, because there were no worker accidents in the work zone to report.

Recommendation:

- None – Continue to measure.

b. How about traffic-related injury reports? If no, why not?

3 of 5 answered “No”.

- There were no traffic accidents to report.

Recommendation:

- Add a “N/A” radial button.

6. On a scale of 1 (worst) through 10 (best), how would you rate the performance of the Traffic Control Supervisors (TCS), and why?

One (1) was rated a “7”, one (1) was rated an “8”, and three (3) were rated a “9”.

- Flaggers were frequently late.
- Too many closers and only one TCS.
- TCS had a good attitude, very professional, and was willing to help out where needed.

Recommendation:

- None – Continue to measure.

7. On a scale of 1 (worst) through 10 (best), how would you rate the performance of the flaggers?

One (1) was rated a “4”, one (1) was rated a “5”, two (2) were rated a “6” and one (1) was rated an “8”.

- Flaggers lacked proper training.
- Flagger wages are terrible.
- Flaggers were frequently late.
- Flaggers appeared tired easily.
- Some flaggers were good.

Recommendation:

- Look into raising the wages of flaggers.
- Add “N/A” radial button to this question, and continue to measure.

8. Did you meet with the project coordination team (*Project Engineer, incident management, Colorado State Patrol, TCS, CDOT Traffic, and construction personnel*) regularly to discuss ongoing issues?

4 of 5 answered “Yes”.

Recommendation:

- Add “N/A” radial button to this question, and continue to measure.

9. Are you familiar with the TMP, PI, and Lane Closure Strategies (LCS)?

5 of 5 Answered “Yes”

Recommendation:

- Move and combine this question with Question 1c in the Traffic Control Supervisor Questionnaire.

10. What standard operating procedures of the WZSM did you implement as a Construction Superintendent that ensured the safety of your workers and the traveling public, as well as the efficient mobility of vehicles through your work zone?

Answers include:

- MHT's; including lane closures, detour routes, flaggers and signs.
- Be courteous and polite.
- Hold pre-construction meeting(s) prior to the beginning of construction with all construction personnel; prime and sub-contractors. Discuss work zones, and let everyone know that only qualified traffic control personnel is allowed to deal with traffic.
- Shift traffic away from work zones to provide as much buffer as possible, and maintain a constant flow of traffic.

Recommendation:

- None – Continue to measure.

11. Please provide comments, or lessons, learned to improve WZSM procedures, the effectiveness of traffic control, and phasing.

Answers include:

- Train flaggers, and raise the flaggers' wages.
- Provide better attention-to-detail scheduling.
- Open lines of communication with Project Engineers and TCS, daily, to encourage proposing new ideas during the construction phase of a project and prevent issues during construction.
- Contractors should have more control over project phasing, with agreements from the Project Engineer.

Recommendation:

- None – Continue to measure.
- Rephrase this question involving deletion of “Work Zone Safety and Mobility (WZSM)” because the WZSM is not part of the construction contract between CDOT and the Contractor. An example could be, “Please provide comments, or lessons, learned to improve traffic control procedures and phasing.”

12. Were all conflicting pavement markings removed?

5 of 5 answered “Yes”

Recommendation:

- Add “N/A” radial button to this question, and continue to measure.
- Add to this question, “If no, why not?”

13. Where were the materials stored for this project?

Answers include:

- Staging areas throughout work zone.
- On-site yard area.
- Off-site yard area.

Recommendation:

- Add “N/A” radial button to this question, and continue to measure.
- Rephrase this question to read, “If materials were stored on your project, where were they stored?”

14a. Was a detour required for this project?

4 of 5 answered “Yes”

Recommendation:

- Rephrase this question to be field relevant.

b. If yes, were traffic impacts on detoured routes analyzed?

4 of 5 answered “Yes”.

Recommendation:

- Rephrase this question to be field relevant and to further define the term, ‘analyzed’.
- Add “N/A” radial button to this question, and continue to measure.

15a. Was this project being completed in phase construction?

5 of 5 answered “Yes”.

Recommendation:

- Add “N/A” radial button to this question, and continue to measure.

b. Did the Contractor build the project as per project phasing plans?

4 of 5 answered “Yes”.

Recommendation:

- Add to this question, “If no, why not?”
- Combine Questions 15a and 15b, and rephrase the question.

16. Do you have anything further to add?

Answers include:

- If flaggers were paid better, they would train harder.
- It is important that there is good communication between traffic control supervisors

Recommendation:

- None – Continue to measure.

General Recommendation:

- Add temporary pavement marking questions.

Maintenance Personnel Questions

1. What Traffic Control Plan (TCP) and Work Zone Safety and Mobility (WZSM) Procedure required strategies were commonly utilized on this project?
http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/lane-close-work-zone-safety/work-zone-safety-mobility/WZSM_Procedures.pdf/view)?

Answers include:

- Multiple lane closures and limited turn-lane closures.
- Double speed reduction.
- MUTCD, Chapter 6.
- CDOT night time MHT.
- Pilot car and tailgate before start of project.
- Normal operating procedures.
- CE Memo on speed reductions.

Recommendation:

- None – Continue to measure.

2. Have the WZSM procedures affected project delivery and costs? If yes, specifically how?

8 of 9 answered “No”.

- Work zones take longer to set up.

Recommendation:

- Rephrase the second part of this question with, “If yes, to what extent?”

3. Please explain specific concerns you have with the WZSM procedures, in terms of time, convenience and safety.

Answers include:

- Some Regions do on-line flagger and Traffic Control Supervisor (TCS) certifications at Camp George West; and apparently, the TCS card is not good for flagging.
- Shouldering procedures on overlays are less than two (2) inches thick.
- The WZSM procedures puts maintenance personnel in work zones longer, due to the extra time taken to place additional construction signs.

Recommendation:

- Maintenance personnel needs to review their shouldering procedures on overlay projects, as it is not related to the WZSM procedures; the listed concern is a materials issue.

4. Are there any WZSM procedures that are difficult to comply with? If yes, what are they?

9 of 9 answered “No”.

Recommendation:

- Combine and rephrase this question with Question #5.

5. Are there any conflicting requirements that are difficult to comply with? If yes, what are they?

8 of 9 answered "Yes".

- Requirements difficult to comply with is the shouldering requirement.

Recommendation:

- Maintenance personnel needs to review their shouldering procedures on overlay projects, as it is not related to the WZSM procedures; the listed concern is a materials issue.
- Combine and rephrase this question with Question #4.

- 6a. Was the traffic control plan (TCP) adequate to handle traffic on your project? Why or why not?

9 of 9 answered "Yes".

- TCP was adequate because traffic volumes were low.

Recommendation:

- Add "N/A" radial button to this question, and continue to measure.

- b. As the traffic control supervisor (TCS), do you have the authority to make changes to your TCP in the field?

9 of 9 answered "Yes".

Recommendation:

- Add "N/A" radial button to this question, and continue to measure.

- c. If you could make changes, how would you do this?

Answers include:

- Communicate plan changes with on-site personnel.
- Make the proposed changes on the TCP; then, discuss it with the proper work zone personnel.
- Note the changes on the TCP, date the changes, list the time of each change, and initialize each change.
- Record the changes in the project diary.

Recommendation:

- Rephrase this question to generate more responses from CDOT Maintenance personnel.
- Add "N/A" radial button to this question.

7. What lessons did you learn that would improve work zone safety in future projects?

Answers include:

- Make sure messages on VMS are clear and conforms to MUTCD.
- Be aware of what's going on around and within the work zone, and be prepared to make changes, when needed.
- Perform more drive-through inspections throughout the work zone to make sure everything is operating smoothly.
- Have all paperwork needed for the project in one place.
- Have excellent communication between work zone traffic personnel.
- Make sure traffic cone placement has proper spacing.
- Double-check everything.

Recommendation:

None – Continue to measure.

8. You have a signal within your project and you have to flag this intersection. What do you have to do to accomplish this?

Answers include:

- Implement the services of Uniform Traffic Control (UTC) officers.
- Contact the Region Traffic Engineer to see if the existing traffic signal can be temporarily shut off to allow flaggers to regulate traffic flow and mitigate confusion to motorists.
- Set up flagger (symbol) and “BE PREPARED TO STOP” construction signs in the proper locations within the work zone (and shown in the traffic control plans (TCP), shut off the permanent traffic signals, and have good communication between flaggers.
- Follow the MUTCD.

Recommendation:

- Rephrase this question to, “If there was an existing traffic signalized intersection(s) within the boundaries of your project work zone, what kinds of temporary traffic control did you implemented at this signalized intersection?”
- Add a “N/A” radial button to this question.

9. You are the traffic control supervisor on the project, and throughout the day, traffic continually increases, and traffic is starting to stop outside your work zone. Explain what your plan is to correct this situation.

Answers include:

- May need to reschedule the project, and analyze what might be causing the traffic queuing. Then, implement changes to reduce the length of the traffic queue.
- Review the work zone setup, and address any changes needed; possibly add a pilot car and/or flagger to maintain better traffic flow.
- Move signs back to where the traffic queuing begins, if possible. Then, figure out what is causing the traffic queuing, and solve the problem.
- Increase the advance warning area ahead of the work zone. Activate message signs in the area to notify motorists of work ahead and to expect delays, and find alternate route(s). Implement a detour route, if feasible.
- Locate the traffic bottleneck section, and see what needs to be done to improve traffic flow.
- Move the construction signs outside the work zones, or shorten the work zone.

Recommendation:

- This type of question is more like a 'quiz' question, rather than a question of what maintenance staff did on their project. Delete this question.

10. As a TCS of a project, please explain what you will need to prior to the project starting.

Answers include:

- Site inspection and locate where necessary traffic control devices (TCD) will need to be placed. Perform Job Safety Analysis (JSA), Job Hazard Analysis (JHA), tailgate talk, inspection on TCDs and inventory on required devices. Check the Region's Lane Closure Strategy guide for lane closure time periods. If required, get a work zone speed reduction approved by the LTC Operations or Region Traffic Engineer. A traffic control plan (TCP) must be developed and approved by the Construction Superintendent.
- Be familiar with the exact location of the work zone, have a meeting with the traffic crew, address any issues and concerns so everyone would have a full understanding of the project and its requirements.
- Prepare a TCP appropriate for the area and traffic volume. Get approval for a speed reduction, if requested. Prepare a Method for Handling Traffic (MHT) diary with pertinent information. Make sure flagger certification is current for anyone who is flagging traffic during the construction of the project. Also, notify law enforcement to enforce traffic laws within the work zone; including location, time of day, and duration.
- Prepare a TCP, showing correct signage. Make sure to have the right amount of traffic personnel, conduct safety tailgate talks, and have operating communication devices (i.e., two-way radio).
- Prepare a TCP, determine whether to include work Zone speed reduction, and prepare a lane closure report.
- Prepare a MHT, have a signed Form 568, correct construction signs, MUTCD, and traffic personnel.

Recommendation:

- This type of question is more like a 'quiz' question, rather than a question of what maintenance staff did on their project. Delete this question.

11. As the TCS, do you have the authority to implement a speed reduction?

5 of 9 answered "No".

Recommendation:

- Speed reduction training for CDOT Maintenance personnel is needed.
- Rephrase this question to, "Who has the authority to authorize a speed reduction?"

12. As the supervisor of a project, how are you going to ensure the safety of your workers and the traveling public throughout the work zone?

Answers include:

- Drive through the lane closure several times, daily. See what the traveling public sees when traveling through the work zone, observe the traffic personnel to make sure they are utilizing Positive Protection Equipment (PPE) and following the traffic control plan (TCP).
- Make sure the work zone is set up in accordance with the MUTCD and the Method of Handling Traffic (MHT). Address any issues that have the possibility of becoming a hazard. Make sure all traffic personnel within the work zone has an understanding of what is expected entering and leaving the work zone, and that safety is the #1 priority. Call the Traffic Operations Center (TOC); relay to them what is happening, and the work zone location. Relay the times and dates of the construction activity for public notifications. Use detours, if needed.
- Stay on top of the situation. Have all construction signs in place. Be clear, as a flagger, where traffic control needs to be. Before work begins, conduct tailgate meetings with traffic personnel; and conduct these meetings anytime during the day, if needed. Check sign conditions and locations, and make sure traffic is moving safely throughout the day. Make changes, if needed.
- Coordinate with all traffic personnel in work zones by two-way radio or visual communications. Maintain a safe speed through the work zone by authorized vehicles, including a pilot car. Determine correct location of advance warning construction signs and flaggers, including well-lighted areas, and good line-of-sight.
- Monitor and document changes, inspections and complaints. Address them appropriately.
- Provide relief for flaggers at appropriate times, daily. Also check conditions of construction signs and speed trailers.

Recommendation:

- This type of question is more like a 'quiz' question, rather than a question of what maintenance staff did on their project. Delete this question, or rephrase this question to be more oriented to WZSM.

13. As the supervisor of a project, whom did you meet with to ensure that the project runs smoothly when it starts up?

Answers include:

- Public information consultants.
- Traffic Operations Center (TOC).
- Uniform Traffic Control (UTC)
- All traffic control personnel on the project.
- TM III

Recommendation:

- None – Continue to measure.

14. As the supervisor, what training are you requiring your employees to have prior to the start of the maintenance project?

Answers include:

- Traffic Control Supervisor (TCS)
- Flagger Certification
- Basic knowledge of traffic control, and the ability to follow instructions.
- Working knowledge of the Method of Handling Traffic (MHT) and the MUTCD.
- Safety contact and tailgate talk.
- Maintenance Training Academy (MTA) and Job Safety Analysis (JSA).

Recommendation:

- None – Continue to measure.

15. What policy or guidance was used to determine speed reductions in the work zone?

Answers include:

- MUTCD.
- Form 568.
- CE Memo.

Recommendation:

- None – Continue to measure.

16. What transportation operation strategies being used?

http://www.dot.state.co.us/Traffic_Manuals_Guidelines/Work_Zones/WZSM/WZSM_Procedures.pdf

Answers include:

- MUTCD
- Region Lane Closure Strategy guide.
- Method of Handling Traffic (MHT).
- Standard Operating Guide (SOG).
- Variable Message Sign (VMS).
- M & S Standard Plans.

Recommendation:

- None – Continue to measure.

17. On a scale of 1 (worst) to 10 (best), how would you rate the flaggers, and why?
Seven (7) were rated a “9”, and two (2) were rated an “8”.

Reasons include:

- Some flaggers lack training and do not ask questions about their expectations.
- Flaggers are attentive; but on occasion, flaggers do not communicate thoroughly.
- Flaggers were very good with keeping traffic moving.
- Flaggers have a vast amount of experience.
- Flaggers have general knowledge of the roads in the work zone vicinity.
- Flaggers were very professional; they were observant of traffic and maintenance operations.
- Flaggers communicated well with each other.
- Flaggers pay attention to details and always have the safety of the people on the project and the motoring public in mind.

Recommendation:

- None – Continue to measure.

General Recommendation:

- Add the following question, “How familiar are you with the Work Zone Safety and Mobility (WZSM) Procedures document?”
- Add the following question, “Was WZSM implemented with maintenance forces?”

Appendix B

Summary of CDOT Traffic Control Review Activities for FY15

In conjunction with 23 CFR 630.1008, CDOT has continued to perform annual review of traffic control activities around the State of Colorado in order to enhance the work zone safety in our state. This review was performed in cooperation with the Operations Engineers at FHWA. Results of the reviews were prepared by the CDOT Contracts and Market Analysis Branch and distributed to the CDOT Regions and to FHWA.

SUMMARY OF TRAFFIC CONTROL REVIEWS BY REGION		
Region	Number of Reviews Per Region	Average Scores Per Region
1	8	95.5
2	6	88.0
3	6	90.2
4	6	93.8
5	5	88.0
Statewide	31	91.5

Beginning in July 2004, CDOT implemented a new Traffic Control Review procedure in response to management concerns for the quality of temporary traffic control, and to comply with FHWA requirements. This program was modified in 2009 to include “No Notification” reviews of one construction project per region to compare against the scores of the three projects per region that received prior notification of the review.

The purpose of the program is to gather information to evaluate the overall quality and effectiveness of work zone traffic control throughout CDOT, to identify areas where improvement is needed, and to facilitate open discussion of traffic control issues. Regions are expected to use the inspection results to address and correct both project-specific and Region-wide issues.

The work zone inspection procedure involves an on-site inspection of a sample of projects in each Region. The standard procedure for the inspections is described in the attached document titled, “FY 2015 Quality Assurance Inspection for Work Zone Traffic Control”.

The inspection teams typically consisted of five to six members. Contracts and Market Analysis Branch Area Engineer, a Staff Traffic Engineer, a FHWA Operations Engineer (when available) or the FHWA Traffic Engineer (when available), a Region Maintenance Representative, a Region Safety Officer (when available) and the Region Traffic Engineer (or designee) formed the nucleus of the team.

Typically, six (6) inspections were conducted in each Region during the summer of 2014 (eight inspections in Region 1 due to the Region realignment). In each Region, the team attempted to review at least one nighttime operation (if available), two CDOT Maintenance operations (only one inspection of Region 5 maintenance was completed this year, two separate trips were attempted; however, work was complete prior to the team arriving to the project site) and one full office review of a construction project, including traffic control documents.

Inspections consisted of a drive-thru of each project with information and comments recorded on a standard form. The office review included a review of project safety plan, the Method of Handling Traffic (MHT) and other traffic control related documentation. Following completion of the inspection and entry of data and comments, an overall percentage score was assigned to each project. The percent score was communicated to project or region personnel and is being reported to FHWA with this document. Project percentages were averaged to formulate a Region and Statewide average. Maintenance operations were scored similarly but are reported separately. The scores for the construction projects reviewed without prior notification are also reported separately below.

Following each Region inspection, a debriefing memo was sent to each Region with copies of the inspection forms. The Regions were allowed to respond with comments and questions.

Results of the annual inspections form the basis for identifying needed changes and improvements to ensure continuous improvement in program results. Region staff will be expected to make changes as appropriate in the design process and in maintenance procedures, as well as in individual project management. Staff Branches will use the results to identify and support needed improvements in standards, specifications, procedures and training.

The goal for FY15 was a statewide average quality rating of 90%, with no individual projects rated below 85%. As indicated by the attached document, the average statewide quality rating for the 22 engineering projects was 91.3%. There were 2 construction projects of the 22 (17 with prior notification and 5 with no notification) reviewed with a score below 85%. The statewide average of the 17 construction projects that received notification was 91.6%. The statewide average of the 5 construction projects that did not receive prior notification was 90.2%. The statewide average for the 9 maintenance activities was 92.0%.

The results of the recent inspections indicated some deficiencies. These are listed below. In general, the team documented acceptable sign quality and work zones that provided adequate safety and guidance to motorists.

- Signs not properly masked or completely covered.
- Signs not in use are on side of road with sign stand on its side or laying in work area. Signs not in use need to be stored out of clear zone, stored flat or stored in a proper location to not create a hazard.
- Signs needs to be in satisfactory conditions, readable and at locations that can be read.
- Full compliant temporary striping. Conflicting markings need to be fully removed.
- Temporary signs placed 1' above the ground.
- Correct taper length, cone spacing and devices in satisfactory condition.

CDOT will continue to address the noted deficiencies with the use of training, construction bulletins, and other methods to be determined in the next fiscal year unless there is an imminent safety threat in which case immediate corrective action will be taken by the project personnel.

On October 14, 2014, CDOT sent the Region and Statewide summaries for FY 15 to John Cater, FHWA Colorado Division Administration for his review, and to permit comparison of the progress CDOT and our traffic control safety partners have made in this area. Also attached was a separate summary of the "No Notification" project scores spreadsheet.

FY 2015 QUALITY ASSURANCE REVIEWS FOR WORK ZONE TRAFFIC CONTROL (TRAFFIC CONTROL REVIEWS)

INTRODUCTION:

CDOT places a high priority on the safety of workers and the traveling public in the management of its construction and maintenance programs. Minimizing traffic congestion and adverse impacts on the local community are also important considerations. To support these objectives, work zone traffic control is an integral element in the management of Department programs. Work zone management in turn is comprised of several distinct elements. These include:

- Establishment of overall goals and objectives
- Development of standards and specifications
- Provisions for project-specific traffic control plans
- Providing staff training and development
- Contractor/industry outreach
- Maintaining an accident reporting and analysis system
- Maintaining an ongoing traffic control quality assurance program

CDOT annually review randomly selected projects throughout its jurisdiction for the purpose of assessing the effectiveness of its procedures.

The CDOT Quality Assurance program will be utilized for all temporary traffic control on CDOT roadways and projects—construction, maintenance, and permits. The statewide work zone review program, also known as the Traffic Control Review (TCR) program, was initiated in July 2004 in response to management concerns for the quality of temporary traffic control, and to comply with FHWA requirements.

The purpose of the program is to gather information to evaluate the overall quality and effectiveness of work zone traffic control throughout the Department, to identify areas where improvement is needed, and to facilitate open discussion of traffic control issues. Regions are expected to use the review results to address and correct both project-specific and Region-wide issues.

The responsibility for administration of these requirements will rest with the Project Development Branch and the Traffic and Safety Engineering Branch.

DESCRIPTION OF REVIEW PROCEDURE:

The work zone review procedure involves an on-site review of a sample of projects in each Region. The standard procedure for the reviews is described in the sections that follow.

1. **Review scheduling** - Reviews will be conducted statewide each year. Each Region will be scheduled separately. Two or three review days will be scheduled in each Region. In addition, time will be allotted at night to conduct reviews at a limited number of sites to observe nighttime operations if suitable projects are available. Following completion of each review, a debriefing meeting will be held with Region staff to provide a preliminary discussion of the results. Depending on the schedule, this meeting may be held the same day as the reviews or the following day.

2. **Sample size and selection** – The reviews will include a number of projects in each Region. The goal is to inspect at least six (6) projects and activities per Region, which may encompass traffic control for a full range of activities from minor utility repairs to full-scale construction. The construction sample will be selected in advance by the Review Team, based on several factors. At least one project will include nighttime operations, if a suitable project is available, and at least two (2) CDOT Maintenance operations will be reviewed. Factors considered include geographic location to economize on travel time and distance, type of work, and Contractor. The intent is to select a range of characteristics that provide a representative sample of work active at that time. Adjustments are made to the initial list to account for actual work status on individual projects. Maintenance work activities are typically not scheduled far in advance. Advance notice will be given for TCR's again this year.

3. **Review Team makeup** – The Review Teams will typically consist of five to six members. A Project Development Area Engineer, a Staff Traffic Engineer, an FHWA Operations Engineer and/or the FHWA Traffic Engineer, a Region Maintenance Representative and the Region Traffic Engineer (or designee) will form the nucleus of the Team.

4. **Review process** – Reviews will consist of a drive-through of each project with information and comments recorded on the standard form. A percentage score will be given to each reviewed project. In addition, an office review will be performed on one project in each Region. The office review will include review of the Methods of Handling Traffic (MHTs) and other traffic control related documentation. The office review will also include a review of the Project Safety Management Plan (PSMP) by the Region Safety Officer. The standard form will record descriptive information about the project or maintenance operation and the temporary traffic controls observed. Features are listed in ten broad categories: traffic control management, method of handling traffic, worksite traffic control supervisor, flaggers, construction/maintenance signing, traffic control devices, pavement markings, miscellaneous items, traffic impacts and work zone area, and inspector safety. In addition to check-offs on the form, narrative comments will be added to describe individual features observed. These will typically include points of concern and areas that need improvement, as well as features or treatments viewed as positive. The review will consist of driving through the project in each direction, generally on each of the main approaches. In addition, one or more minor approaches, such as intersecting roadways or major driveways, will also be examined. The Review Team's vehicle may stop from time to time to observe specific features in more detail, as traffic conditions and space permit. However, nearly all observations are completed from inside the vehicle. Depending on the nature and complexity of the project, multiple trips through the project may be required to obtain the needed details. On simple projects, a single drive-through in one direction may suffice. The objective is to obtain adequate information to characterize the project. On projects with multiple work sites, one or more sites may be omitted. Because the focus of the program is on obtaining a representative sample for quality assurance purposes, rather than detailed project management, this is a reasonable compromise. In every case, the project description will clearly indicate the portions of the project reviewed, if not reviewed in its entirety.

5. **Quality rating** – The scoring system will be a percentage score. The final report and scores shall be delivered as follows:

- a. Each Region's Regional Transportation Director (RTD), Program Engineers, Traffic Engineer and Maintenance Superintendent will receive a regional final report with their Region's project scores and a statewide average score. The report will also include a description of any regional or statewide issues and a description of the % scoring system.
- b. Each Resident Engineer will receive the scores for their projects and the statewide average score. Their report will also include a description of any regional or statewide issues and a description of the % scoring system.
- c. Each Project Engineer will receive their projects score and the statewide average score. Their report will also include a description of any regional or statewide issues and a description of the % scoring system.
- d. FHWA and Traffic and Safety Unit will receive a copy of all regional final reports with all project scores and issues.

6. **Review follow-up** – Following each Region review, a debriefing meeting will be held to discuss results. Debriefing meetings may be conducted by conference call or at the project site if the Project Engineer and TCS are available and should include all Review Team members. Copies of the review forms will be transmitted to the Region Program, Resident, and Project Engineers after the review. While the completed forms will not be available for several days, Region participants are expected to take adequate notes during reviews to permit timely follow-up on points requiring field changes. Since Project Personnel are expected to be familiar with their project plans and specifications and the applicable standards and other traffic control requirements, disagreements with the Review Team's comments should be raised and resolved at the time of the de-briefing.

Following completion of each annual review, two separate reports are prepared. The first is addressed to the Region Transportation Director and provides an overall summary of the regional reviews, including construction and maintenance work. The second report is submitted to the FHWA in fulfillment of requirements for the federal-aid highway program. Results of the annual reviews form the basis for identifying needed changes and improvements to ensure continuous improvement in program results. Regional staff is expected to make changes as appropriate in the regional design process and in maintenance procedures, as well as in individual project management. The results may also indicate the need to conduct training. Staff Branches will use the results to identify and support needed improvements in standards, specifications, and procedures, as well as other program needs. Results will also be used to provide executive management an overview of progress in meeting Department goals and objectives for work zone traffic control.

Anticipated Program Results:

Establishment of Program Goals - Once sufficient data is compiled from annual reviews, it will become possible to establish performance goals for work zone traffic control on Department projects.

Combined with information from review program results identifying specific strengths and weaknesses, resources can be directed to resolve specific concerns needed to improve performance.

References

CDOT Construction Manual

http://www.coloradodot.info/business/designsupport/bulletins_manuals/cdot-construction-manual

FHWA Work Zone Safety and Mobility Final Rule

Effective October 12, 2007

http://ops.fhwa.dot.gov/wz/resources/final_rule.htm

FHWA Temporary Traffic Control Devices Final Rule

Effective December 4, 2008

<http://ops.fhwa.dot.gov/wz/resources/policy.htm>

The following information on CDOT's WZSM Compliance is available at:

<http://www.coloradodot.info/library/traffic/traffic-manuals-guidelines/lane-close-work-zone-safety/work-zone-safety-mobility>

- Work Zone Rollout
- Work Zone Safety and Mobility Overview (Presentation)
- Work Zone Policy Directive 805.0
- Work Zone Procedural Directive 805.1
- CDOT Work Zone Safety & Mobility Procedures Document
- Public Information (PI) Specification
- Transportation Management Plan (TMP) Specification
- Policy Memo 28 Advanced Work Zone Management & Design
- Policy Memo 29 Safe and Effective use of Law Enforcement
- Policy Memo 30 Utilization of Law Enforcement in Work Zones
- CDOT Guidelines for the Use of Positive Protection in Work Zones
- Law Enforcement
- FHWA Work Zone Mobility & Safety Program
- FHWA Transportation Management Plan (TMP) Development Resources