



INDIANA DEPARTMENT OF TRANSPORTATION
Driving Indiana's Economic Growth

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Mitchell E. Daniels, Jr., Governor
Michael B. Cline, Commissioner

April 11, 2011

CONSTRUCTION MEMORANDUM
11-04

TO: District Deputy Commissioners
District Construction Directors
District Area Engineers
District LPA Coordinators
Field Engineers
Technical Services Directors
Project Engineers/Supervisors

FROM: Mark A. Miller, Director 
Division of Construction Management

SUBJECT: Annual Work Zone Findings Report for 2010

The 2010 Work Zone Findings Report has been issued. The report cites some improvements from 2009 and includes updates on areas that were previously addressed for improvement. On page 5 of the report are 10 Recommendations for Improvement that resulted from the 2010 job site inspections that should be reviewed and implemented.

A copy of the report is attached and can also be found at <Y:\TrafficManagement\Work Zone Safety\2010 Work Zone Reviews> for those who have access to the Y: drive.

MAM/TEH



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Driving Indiana's Economic Growth

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Mitchell E. Daniels, Jr., Governor
Michael B. Cline, Commissioner

Memorandum

To: Troy Woodruff, Deputy Commissioner, Operations

From: Ryan Gallagher, Director Traffic Management 

cc: Michael B. Cline, Commissioner
Jim Stark, Deputy Commissioner, Planning Operations
Jason Jones, Director, Maintenance Management
District Deputy Commissioners
David Holtz, Director, Engineering Services & Design Support
Mark Miller, Director, Construction Management
Greg Pankow, State Construction Engineer
District Construction Directors
FHWA

Date: December 14, 2010

Re: Annual Work Zone Findings Report for 2010

Attached herein is the Annual Work Zone Findings Report. This report summarizes the data collected by Work Zone Safety personnel on a variety of construction projects all over the State. It also includes recommendations for improvements to the traffic control policies, procedures, and practices of INDOT.

Over the next few months, the Work Zone Safety staff will be making presentations on these findings and recommendations at District Construction meetings and at Road School.



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ANNUAL WORK ZONE REVIEW FINDINGS REPORT 2010 CONSTRUCTION SEASON

INTRODUCTION

Work zones reviewed in 2010 were generally found to have more problems with temporary traffic control than those reviewed in 2009. Some of these problems include positioning of flaggers, lack of advance warning signs for flaggers, delineation on temporary barrier walls, and the quantity of barricades provided. There were some factors where improvements were found, including activation of flashing lights on Work Site Speed Limit Assemblies, covering of permanent speed limit signs, and barricade orientation.

The reports for the 2010 construction season can be viewed at:

<Y:\TrafficManagement\Work Zone Safety\2010 Work Zone Reviews>.

The findings data can be viewed at:

<Y:\TrafficManagement\Work Zone Safety\2010 Work Zone Reviews\2010 Review Findings Tabulation>.

SUMMARY OF STATISTICS AND FINDINGS

During calendar year 2010, the Work Zone Safety Section performed 99 work zone reviews on 90 different projects. This compares to totals of 142 reviews in 2009, 126 in 2008, 64 in 2007, and 46 in 2006.

The reviews considered 121 different work zone traffic control factors. The inspections yielded 4,538 items for potential non-compliance. There were a total of 327 variances from preferred procedures or standards, which renders a deficiency rate of 7.21% for 2010. The deficiency rate is the number of variances divided by the number of opportunities on a total project basis. As an example, if there are two projects with barricades and on one project the barricades are oriented incorrectly, then the rate would be one deficiency divided by two opportunities for a rate of 50%. The deficiency rate in 2009 rate was 4.31%. Among the six Districts, the lowest 2010 rate was the Seymour District at 5.89%. The highest 2010 rate among the Districts was 9.57%.

The 2010 reviews were performed over a range of functional classifications of highways. The classes and percentage of inspection locations are as follows:

Interstate	52%
US Routes	17%
State Routes	29%
Local/Other	2%

Reviews were performed in all six Districts at a ratio proportionate with the number of projects under construction during the year. The number of reviews done in each District was as follows:

Crawfordsville	13
Ft. Wayne	17
Greenfield	35
LaPorte	9
Seymour	15
Vincennes	10

The reviews also included a number of special category inspections as listed below:

Nighttime	3
Flaggers	12
Detour Routes	21
Temporary signals	8

The inspections also encompassed a wide range of work types. Twenty-eight (28) different work types were inspected during the year. The 13 most frequent types are listed below along with the percentage of each type.

Added Travel Lanes	19%
Asphalt Resurface	13%
Bridge Rehabilitation	8%
New Road Construction	7%
Maintenance	6%
Interchange Modification	6%
Road Rehabilitation	4%
New Bridge Construction	3%
Small Structure Replacement	3%
Replace Superstructure	3%
Bridge Replacement	3%
Bridge Deck Recon/Widening	3%
Median Construction	3%

These 13 types of construction accounted for 80% of the projects reviewed.

PROGRESS ON 2009 RECOMMENDATIONS IN 2010

1. **Flaggers Not Properly Positioned:** This continues to be an issue and problems increased by a significant amount in 2010. The topic was discussed in presentations at District Construction Meetings and Road School.
2. **Work Site Speed Limit Assemblies:** There were significant improvements in proper flasher activation, the use of advance speed reduction assemblies, and correct speeds being displayed. Copies of specifications for the illumination of flashers have been sent to the District Construction Directors. This issue was also discussed at District Construction Meetings and Road School.

3. **Barrier Walls Not Properly Delineated:** This issue continues to be found on projects and the frequency actually increased significantly in 2010. This was discussed at District Construction Meetings and Road School.
4. **Barricades:** The overall incidence of barricades not being oriented correctly decreased significantly in 2010. However, the number of projects with improperly positioned, staggered or missing barricades increased this year. Quality Standards have been distributed to the Districts. Project Engineers and Project Supervisors have also been asked to document in the project diary the verification of the information in the S&B report with spot checks during reviews of this documentation.
5. **Construction Signs:** Problems with improperly placed, missing, incorrect or damaged signs increased slightly in 2010. Quality Standards have been distributed to the Districts. As noted above, Project Engineers and Project Supervisors have been asked to document in the project diary the verification of the information in the S&B report.
6. **Drums:** Improper placement and marginal drum condition increased slightly in 2010. Quality Standards have been distributed to the Districts.
7. **Flagger Ahead Sign with No Flagger Present:** In 2009, the improper placement of flagging signs when no flagger present was less frequent, but is still a significant issue. This issue was discussed at District Construction Meetings and Road School.
8. **Portable Changeable Message Sign Content:** The frequency of poor content in portable changeable message signs increased slightly in 2010. Guidelines submitted for the consideration of the Standards Committee in September and were tabled for additional development. This topic is also discussed in presentations to District Construction Meetings and at Road School.
9. **Crossovers Not Properly Protected:** There were no reported cases of improperly protected crossovers in 2010. A standard for protection on or near crossovers has not yet been developed.
10. **Glare from Lighting on Night Projects:** Glare was only found on one project in 2010. Ways to mitigate this problem were discussed in presentations at District Construction Meetings and Road School.

2010 FINDINGS AND RECOMMENDATIONS

The majority of the work zones reviewed were generally set up correctly and well maintained. However, most projects had some incorrect or unconventional applications. Some of the major items under review showed improvement. Noteworthy improvements from 2009 to 2010 include flasher activation, covering of permanent signs when using Work Site Speed Limit Assemblies, and orientation of barricades. Based on field observations and subsequent analysis certain issues were determined to merit full and prompt attention.

TOP TEN TARGETS FOR IMPROVEMENT

1. **No Flagger Ahead sign / Flaggers not properly positioned:** “Flagger Ahead” signs were not in place with flaggers present in 25% of projects with flagging in 2010, which was a significant increase from 2009. The warning signs are critical to alert motorists that there are flaggers ahead and that traffic may be stopped. Flaggers not properly positioned continues to

be a problem that worsened significantly in 2010 to 50% of projects with flagging occurring at the time of the review.

2. **Barrier Walls Not Properly Delineated:** There was a significant increase in the incidence of improperly delineated temporary barrier wall in 2010. Poorly delineated wall could increase the potential for crashes.
3. **Work Site Speed Limit Assemblies:** While the proper use of advance signage for WSSLA speed reductions and correct speed usage improved in 2010, incorrect signage occurred on 13% of the projects and 10% of projects still have problems with advance speed reduction signage. These are particularly important, not only from a safety point of view, but also because of the enforcement and legal implications.
4. **Barricades:** There continue to be problems with the quantity, position, staggering, and orientation of barricades. These problems can lead to motorists entering an area with significant hazard or drop-off. While orientation improved significantly in 2010, the deficiency rate was still 22% for this factor in 2010.
5. **Construction Signs:** While there was some improvement during 2010, there continue to be problems with construction signs in the work zone. The problems include signs that are incorrect, poorly placed or spaced, obscured or improperly covered. Any of these has the ability to compromise the motorist's ability to navigate the work zone safely.
6. **Channelizing Devices:** The number of drum spacing and placement issues increased slightly from 2009 to 2010. The number of projects exceeding the acceptable number of marginal or unacceptable drums also increased slightly. Tubular marker installations were properly planned and placed, but some of the installed markers were found to have been knocked down or were missing at a rate of 44%. Cone placement was generally good, but there was a significant increase in the use of cones without retro-reflective striping. The percentage of projects with sub-standard cone striping was 36% in 2010. Channelizing device placement and condition are critical safety issues, especially for night driving where road paths and drop-offs are more difficult to see.
7. **Plan Design:** There were a number of instances where incorrect installations in the field were directly attributable to design. This was especially true for "Added Penalty" signs and sign placement in general. Incorrect sign placement can have safety and legal ramifications.
8. **Flagger Ahead Sign with No Flagger Present:** The frequency of "Flagger Ahead" signs being posted without a flagger within the required distance or for a longer than acceptable time frame, has decreased slightly in 2010 but still occurred in 17% of flagging situations. Often such signs are posted every mile on both sides of the road on a project when there is only one or even no flagger working at a given time. This can reduce respect for the sign and reduce its effectiveness. Signs should be moved as necessary and should be removed upon the termination of flagging.
9. **Changeable Message Signs:** The number of issues with portable changeable message signs increased in 2010. Poor message content was found in 16% of CMS uses. Signs should give specific information but not repeat information supplied by a static sign in place for a significant period of time. This also applies to maintenance work. Too many frames were also used on 14% of work zone projects with CMS boards. The number of frames per sign is limited to two. Legibility, visibility, and not putting unused signs in caution mode were also increasing problems this year.

10. **Arrow Boards:** There was an increase in visibility concerns with arrow boards in 2010. There was also a slight increase in projects with bulbs burned out. These boards are key visual cues in the merge process in many work zones, and ambiguous identification of the arrow can decrease safety in the work zone.

RECOMMENDATIONS FOR IMPROVEMENT

1. **No Flagger Ahead sign / Flaggers not properly positioned:** INDOT should institute a training and certification requirement for anyone who flags on state Right-of-Way. This could include requirements for training, experience, and periodic re-training. The Standard Specifications should be amended to require certification. This topic was discussed in Joint ICA/INDOT Regional meetings and at the Asphalt Pavement Association of Indiana meeting in December 2010 and will be discussed further at the ICA/INDOT winter construction conference on January 27, 2011.
2. **Barrier Walls Not Properly Delineated:** A reminder should be sent to all District Construction Engineers that the contractor is to maintain the barriers with proper reflectorization.
3. **Work Site Speed Limit Assemblies:** Continued effort to educate construction personnel about proper use of Work Site Speed Limit Assemblies is needed. This should continue to be discussed at District Construction Meetings and at Road School.
4. **Barricades:** District Construction Engineers should be reminded of the standards for barricades. This topic should also be covered at District Construction Meetings and Road School.
5. **Construction Signs:** Sign and Barricade (S & B) reports should continue to be reviewed by INDOT project personnel. Checks for correct Worksite Traffic Control Supervisor certifications should continue.
6. **Channelizing Devices:** Continued emphasis should be placed on the importance of maintaining channelizing devices and applying the specifications for unacceptable devices at Road School and in District Construction Meetings.
7. **Plan Design:** The development of temporary traffic control plans could be improved by requiring training for designers.
8. **Flagger Ahead Sign with No Flagger Present:** Construction Directors should be reminded of the standards for flagging in the MUTCD. This topic should also be covered at District Construction Meetings and at Road School.
9. **Changeable Message Signs:** INDOT should continue to develop PCMS guidelines and should encourage designers to include recommended messages in temporary traffic control plans. Proper message content should be discussed at District Construction Meetings and Road School.
10. **Arrow Boards:** Continue emphasize the need to properly maintain bulbs and dimmer switches on arrow boards at District Construction meetings and at Road School.

OTHER AREAS TO TARGET FOR IMPROVEMENTS

1. Problems with “Added Penalty” signs increased in 2010. These signs, which are mandated by Indiana Statute, were missing on 12% of work zones. Other issues were found on several

other projects. The most prevalent of these was incorrectly locating the sign and was most often found to be a design issue.

2. Many of the issues discussed above affect merges. On many, signs were missing or incorrect, there were insufficient numbers of drums provided in some of the tapers, and there were the problems noted previously for the arrow boards. This should be covered at District Construction Meetings and Road School.
3. A significant number of shift tapers with improper signage were found in 2010. Most problems involved the absence of a shift sign marking a return to the original alignment. To resolve this problem, the shift taper standard, 801-TCDV-03, should be revised to show the placement of this sign. Additionally, use of Double Reverse Curve signs (W24) should be encouraged where placement of W1-4 signs is difficult and tangent lengths are less than 600'. This topic should also be discussed at District Construction Meetings and Road School.

Appendix A
Background

BACKGROUND

Responding to issues raised in the federal review of Indiana work zones in 2005, the Work Zone Section was created during the winter of 2005/2006. This was done in a two pronged effort to focus on improving work zone safety and mobility and to provide technical support to the rest of the agency and its partners in all matters pertaining to work zone traffic control. One of the on-going duties of this section is to perform periodic, statewide reviews of construction zones, and report the findings.

Work zone reviews are performed with these goals in mind:

1. Develop better policies, standards and training through gathering information about actual work zone conditions.
2. Assist designers, contractors, and construction engineers by providing constructive feedback.
3. Identify potentially hazardous situations and notify construction staff (and the designer if appropriate) to effect prompt corrective measures.

On October 4, 2007, INDOT adopted a policy titled: “INDIANA DEPARTMENT OF TRANSPORTATION POLICIES, PROCESSES & PROCEDURES ON WORK ZONE SAFETY & MOBILITY Pursuant to 23 CFR 630 Subpart J”. This policy requires that interstate work zones that meet the criteria for significance be reviewed at least once during the construction season.

Appendix B
Scope and Methodology

SCOPE & METHODOLOGY

The reviews concentrate on observing the design, installation, geometry and condition of work zone traffic control devices. General traffic conditions are also noted.

The review procedure, which changed for 2010, is as follows:

1. Gather and examine information concerning the contract prior to the field inspection including maintenance of traffic plans if available.
2. Meet with the Project Engineer or Project Supervisor, and other persons that may have an interest in the review such as the Area Engineer, District Construction Engineer, and/or contractor's representative.
3. Perform a field inspection. This involves traveling through the work zone several times taking video, making occasional stops for detailed investigation, and taking still photographs of unusual or significant traffic control elements or situations.
4. The Work Zone Safety employee who conducts the inspection then reviews the information gathered and generates a report which summarizes the observations and notes any significant items. This report is internally reviewed and then forwarded to the Project Engineer or Project Supervisor by electronic mail. Copies are sent to the Area Engineer, District Construction Director, and the construction company's representative. The TMC also receives a copy if the project is in an ATMS area.
5. Hard copies are maintained in the Work Zone Safety files and electronic copies are stored on the Y: drive.

While the review program concentrates mostly on interstates, a number of non-interstate and local road projects are also reviewed each year. This enables review of flagging operations and detour routing.

Appendix C
Sample Memorandum



INDIANA DEPARTMENT OF TRANSPORTATION

Driving Indiana's Economic Growth

Memorandum

May 6, 2010

TO: Roland Fegan, Construction Director
Greenfield District

THRU: Guy Boruff, Director
Public Safety Operations

THRU: Pat McCarty, Supervisor
Work Zone Safety Section

FROM: Scott MacArthur
Work Zone Safety Engineer

SUBJECT: Work Zone Review Summary
Contract IR-30710
I-465 North Leg
Marion County

A work zone review was performed on Monday, May 3, 2010 for the Added Travel Lanes project on I-465 from .35 miles E of US 31N to .5 miles W of Allisonville Road in Marion County, IN. At the time of the review, the contractor was working at multiple locations including paving and constructing the roadbed on the south side of the EB lanes. The speed limit on I-465 was set at 45 mph by official action. At 9 am, the weather was sunny and the pavement was dry.

Conditions that were identified on the review and remedial recommendations are as follows:

- Advance signage warning of the work zone was present and appropriate. "Added Penalty" signs were present in both directions on I-465.
- The Advance Speed Limit signs used on the project (spelled out) should be replaced with similar signs on an orange background, or a sign using the international advance arrow symbol.



- Two signs EB were mounted too low relative to the driver's line of sight. The bottom of the sign should be at least 7' from the pavement being traveled in an urban area. The signs may have been mounted that high but were placed on a surface much lower than the traveled way. This was discussed with the Project Engineer Jason Deering and the problem was corrected.
- Changeable Message Signs (CMS) were used on I-465 and ramps to convey important motorist information. A total of ten CMS's were in use on the project at the time of our review. All signs were properly placed and readable within sufficient time before passing the sign. All messages were appropriate and all signs used either one frame or used the correct maximum of two frames. The only problem associated with the signs was the use of acceptable abbreviations. The following abbreviations were used: TKS for trucks, TRKS for Trucks, RT for Right, and EB for Eastbound. There is no acceptable abbreviation for Trucks. The correct abbreviation for Right is RHT and the correct abbreviation for Eastbound is E-BND, respectively.
- Overall work zone delineation and channelization was good. In general, there were an adequate number of drums used for delineation, and condition of the drums was adequate.
- Positive protection for the work site was provided by concrete barriers. The condition and placement of the barriers was excellent. All the barriers on I-465 and the ramps had proper attenuation. Reflectorization placement was very consistent and color coding to the edge lines was maintained.



- Arrow Boards in use had proper illumination. Those not being used were properly placed in the down position.
- Stone debris encroached the traveled way in some locations EB where vehicles enter the work site through openings in the concrete barrier. The stones can cause damage to vehicles or workers. Most of the locations had the stone removed within two days of our review.



- Lane shifts were used extensively throughout the project. Double Reverse Curve Signs (W24-1b) were used effectively on the project. There were two locations at the end of the project EB where there were shifts but no shift signs were present.



- A merge taper was used on College Avenue SB to close the right lane. There was no advance warning of the closure, and the taper was considerably less than the required 180 feet.



- ISP patrols had drivers pulled over in two different locations at the time of our review.
- Barricades were used to prevent access to closed roads. Several locations did not effectively prevent entrance, and a number of barricades had the wrong orientation. Barricades should be placed to completely prevent entry or staggered to allow necessary vehicle entry. Stripes on barricades for road closures should point to the Road Closed sign, or down towards where vehicles are supposed to drive. Also, cars should never be allowed to park in front of the barricades and signs are not allowed to be posted on barricades.





- Existing permanent speed limit signs were covered throughout the project. The cover shown in the photo below near MM 35 WB has a tail and should be replaced with a cover without one.



- A sign post was placed against the guardrail at approximately MM 30 EB. The post extends into an area where a vehicle could contact it and cause injury or damage to the motorist or vehicle. This should be moved.



- Detours were provided for the road closures on River Road, Westfield Avenue, College Avenue, and 96th Street. All routes were well marked and signs were in acceptable condition.
- Overall, this is a good work zone given the level of difficulty and detail.

This summary is being provided to the Construction Director only for your benefit.

If you have any questions or would like to discuss any of these items in greater detail, please contact Pat McCarty at (317) 610-7251 ext. 304 or Scott MacArthur at (317) 610-7251 ext. 292.

Thank you.

cc: file