





Designing and Implementing a Safer Work Zone

A Discussion on Developing Processes and Procurement Methods to improve Traveler and Worker Safety





 Improve work zone safety through sharing best practices in technology, process and improved safety culture

Work Zone Fatalities



Fatalities In Work Zones

2000-2012

Source: Fatality Analysis Reporting System (FARS) 2012 ARF, NHTSA



What is Required?



23 CFR 630.1106 Policy and procedures for work zone safety management. (Emphasis added) (a) Each agency's policy and processes, procedures, and/or guidanceshall include the consideration and management of *road user and worker safety* on Federal-aid highway projects.These processes, procedures, and/or guidance, to be developed in partnership with the FHWA, shall address the use of Positive Protection Devices....Exposure Control Measures....Other Traffic Control Measures including uniformed law enforcement officers; and the safe entry/exit of work vehicles onto/from travel lanes

Methods to Improve Safety in Work Zones

- Improve Safety Culture
- Reduce Actual Speeds in Active Work Zone (AWZ)
- Use of Positive Protection



Making Work Zones Safer





Culture, What is it? How to change it?

- Organizational culture is a set of shared assumptions (values) that guide what happens in organizations by defining appropriate behavior for various situations. Ravasi and Schultz (2006)
- If safety culture of an organization is positive, employees at all levels will value safety and act accordingly.

Changing Culture



Steve Denning in Forbes

Examples of Safety Culture Change

TxDOT – Safety Contingency

- Every project has a safety contingency
- Collecting safety performance data and looking to use it as a bidding criteria
- UDOT Behavior Based Safety
 - Employee and Management Driven
 - Focus on accountability for personal safety I am the person most responsible for my safety

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Process and Policy

- Reducing Speeds in the Active Work Zone
 - Significant reduction in speed limit (limited effectiveness by itself)
 - Increase in compliance with posted speed when:
 - Uniformed Officer Presence
 - Uniformed Officer Enforcement
 - Training the public to obey speed limits School Zone
 Analogy





Canadian Journal of Civil Engineering June 2014

Treatment	Speed reduction (kph) ~Goal 20 kph
Floating WZ	14.5 kph
Floating WZ w/VMS	19.3 kph
Floating WZ w/ radar speed display	21.0 kph
Floating WZ w/TCP	23.9

 Utilizing the floating work zone with a Traffic Control person or "Your Speed Is" sign reduced median speed to below posted speed!

Richfield, UT Project Case Study

- SCOPE: PCCP Slab Replacement
- LOCATION: I-70 in Richfield, UT





Traffic Engineer Order (TEO) Summary



- Original posted speed 75 mph
- 65 mph -- to be used through the project limits during working hours
- 45 mph -- to be used adjacent to active work areas when workers are present
- If the distance between areas of active work is greater than 2 miles, the speed limit will be increased to 65 mph between active work areas.

VSL Trailers

Trailers were UDOT furnished

 Manufactured by Information Display Company



Spot Speed Study Results



STATISTICS - 99% CI with error of 2mph

- 47 free flow samples
- Location 1: 1000' upstream of AWZ, at VSL sign
 - 85th percentile speed of 51 mph
- Location 2: 100' upstream of AWZ, 900' downstream of VSL sign
 - 85th percentile speed of 49 mph

SUCCESS!



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Risk Allocation

- How does an owner allocate risk for safety items in work zone? In other words who (contractor, agency, third party) is responsible for what, and how is it defined in the contract?
- Risk Assessment principle is that the risk is assigned to the party best able to manage or eliminate it.

2013 Survey on Positive Protection

Response from 27 State Departments of Transportation

- Who makes the decision to use Positive Protection on a project?
 - Design 7 states
 - Design and Construction 14 states
 - Design, Construction, Contractor 6 states
 - Depends on the project and type of work and is a joint decision between design and construction.
 Contractor can suggest a change to the method.
 - All of the above may institute positive separation.



Implementation



- If much of the design for work zone traffic control is done during the project design phase, this presents some challenges:
 - How does the designer know how the contractor will phase the job or set up the work zone?
 - How does the contractor propose or make changes to the work zone traffic control design?
 - If it is phased differently than the designer envisions, this can lead to additional cost and time.
 - How are high dollar items such as positive protection accounted for in the design?

Implementation



- If much of the work zone design is done by the contractor in construction, assuming a traffic control lump sum, this can lead to some challenges as well.
 - How does the owner ensure that positive protection, exposure control measures, or other TC measures are used where needed?
 - How do owners prevent contractors from not including positive protection or other items in a low bid environment?
 - What do owners do to encourage ownership of work zone safety from contractors?

Risk Allocation



Who can best manage the risk of WZ safety during construction?

Can the risk be shared, how is that risk assigned?

Utah's Positive Protection Process

	FACTOR 1- DURATION C	DF SPECIFIC WORK ELEMENT (SEE NOTE 3)	POINTS POSSIBLE	POINTS			
	LONG TERM STATIONARY WORK W	ITH DURATION GREATER THAN TEN MONTHS	10				
뷛고	LONG TERM STATIONARY WORK WITH DURATION OF THREE THROUGH TEN MONTHS						
OOSE O	LONG TERM STATIONARY WORK WITH DURATION OF MORE THAN THREE DAYS TO LESS THAN THREE MONTHS, AND THE PROCUREMENT AND INSTALLATION OF POSITIVE PROTECTION DEVICES CAN BE COMPLETED PRIOR TO WORK STARTING						
30	NITERMEDIATE TERM STATIONARY WORK, AND PROCUREMENT & INSTALLATION OF POSITIVE PROTECTION DEVICES CAN BE COMPLETED PRIOR TO WORK STARTING						
	SHORT TERM STATIONARY, SHORT DURATION, AND MOBILE WORK						
	FACTOR 2 – EXPOSURE	(WORK CLEAR ZONE, SEE STD. DWG. TC 3A TABLE 1)	_				
¥-	WORKERS ARE EXPECTED TO BE WITHIN WORK CLEAR ZONE						
	WORKERS ARE EXPECTED TO BE OUTSIDE OF THE WORK CLEAR ZONE, BUT WITHIN TWICE THE WORK CLEAR ZONE						
	Workers are expected to be outside of twice the work clear zone						
90	WORKERS ARE EXPECTED TO BE C	DUTSIDE OF THE AASHTO CLEAR ZONE	0				
	FACTOR 3 – POSTED SF						
Lu	POSTED SPEED IS 55 MPH OR GRE	ATER	10		1		
NO	POSTED SPEED IS 40 MPH, 45 MPH	, OR 50 MPH	6				
ISOC	POSTED SPEED IS 30 MPH OR 35 M	PH	3				
120	POSTED SPEED IS 25 MPH OR LESS	8	0				
	Factor 4 – Location of W	ork			-		
	BRIDGE STRUCTURES, DROP-OFFS 5 FEET OR GREATER, FILLS OR CUTS STEEPER THAN 2:1, OR CONFINED AREAS WITH NO ESCAPE ROUTE FOR WORKERS		10	3			
NOE	AREAS WITH BARRIERS OR OTHER IMPEDIMENTS THAT HAVE A VIABLE ESCAPE ROUTE FOR WORKERS		6				
180	AREAS WITH DROP-OFFS LESS THA	IN 5 FEET THAT HAVE A VIABLE ESCAPE ROUTE FOR WORKERS	3				
190	OPEN AREA WITH MUITIPLE ESCAPE ROLITES FOR WORKERS						
			TOTAL				
			POINTS]		
	UNDER EACH FACTOR CHOOSE WHICH	I CONDITION BEST DESCRIBES THE WORK ZONE. THE POINTS ACCUMULATED WILL DETERMINE WHAT ACTION NEEDS TO BE TAKEN.					
RESULTS:							
	TOTAL IS 31 POINTS OR MORE	- POSITIVE PROTECTION DEVICE(S) ARE REQUIRED IN ADDITION TO STANDARD TRAFFIC CONTROL AND ANY OTHER MITIGATION EFFORT	S.				
	TOTAL IS FROM 20 THRU 30 POINTS	 POSITIVE PROTECTION DEVICE(S) OR OTHER MITIGATION EFFORTS AND STANDARD TRAFFIC CONTROL ARE REQUIRED TO MITIGATE WORKER EXPOSITE. MITIGATION WILL INCLUDE, AT A MINIMUM, ONE OF THE FOLLOWING AT THE WORKER LOCATION: 					
		 PROVIDING POSITIVE PROTECTION DEVICE(S). REDUCING TRAFFIC DEVICE SPACING TO A MAXIMUM OF ONE-HALF THE REQUIRED DEVICE SPACING. PROVIDING A BUFFER SPACE AND/OR PROVIDING A TRUCK MOUNTED ATTENUATOR. 	NOTES: POSITIVE PROTECTION I VEHICLES AND MEET CR	DEVICES ARE DEVIC	ES THAT CONTAIN AND/OR REDIRECT CRITEREA.		
	TOTAL IS LESS THAN 20 POINTS	- USE OF STANDARD TRAFFIC CONTROL IS REQUIRED.	POSITIVE PROTECTION E FILLED BARRIERS, STEE ATTENUATORS AND VEH	DEVICES INCLUDE PO L BARRIERS, MOVAB IICLE ARRESTING SY	ORTABLE CONCRETE BARRIER, BALLAST ILE BARRIERS, SHADOW VEHICLES WITH 'STEMS.		
	3. WORK DURATION DEFINITIONS: A. LOG-TERM IS WORK THAT OCCUPIES A LOCATION MORE THAN B. INTERNEDIATE TERM STATIONARY IS WORK THAT OCCUPIES A INTERNEDIATE TERM STATIONARY IS DAYING WORK THAT OCCUPIES A SHORT TERM STATIONARY IS DAYING WORK THAT OCCUPIES A MORE THAN ONE HOLD TO THE THAT IN THE AND THE OCCUPIES A MORE THAN ONE HOLD TO THE THEORY OF THE OCCUPIES A MORE THAN ONE HOLD THE THEORY OF THE OCCUPIES A MORE THAN ONE HOLD THE THEORY OF THE OCCUPIES A MORE THAN ONE HOLD THE OCCUPIES A MORE THAN ONE HOLD THE OCCUPIES A MORE THAN THE OF THE OCCUPIES A MORE THAN THAN THAN THE OCCUPIES A MORE THAN						
	US	E OF POSITIVE PROTECTION DEVICES FOR WORKERS IN WORK ZONES					

STD. DWG. NO. TC 3B

HAZARD MITIGATION AND POSITIVE PROTECTION DEVICES

UTAH DEPARTMENT OF TRANSPORTATION

Scoring

CAUTION: WORK ZONE

	FACTOR 1– DURATION OF SPECIFIC WORK ELEMENT (SEE NOTE 3)	POINTS POSSIBLE	POINTS	
	LONG TERM STATIONARY WORK WITH DURATION GREATER THAN TEN MONTHS	10		
NZ Z	LONG TERM STATIONARY WORK WITH DURATION OF THREE THROUGH TEN MONTHS			
OOSE C	LONG TERM STATIONARY WORK WITH DURATION OF MORE THAN THREE DAYS TO LESS THAN THREE MONTHS, AND THE PROCUREMENT AND INSTALLATION OF POSITIVE PROTECTION DEVICES CAN BE COMPLETED PRIOR TO WORK STARTING	6		
공이	INTERMEDIATE TERM STATIONARY WORK, AND PROCUREMENT & INSTALLATION OF POSITIVE PROTECTION DEVICES CAN BE COMPLETED PRIOR TO WORK STARTING	3		
	SHORT TERM STATIONARY, SHORT DURATION, AND MOBILE WORK			
	FACTOR 2 – EXPOSURE (WORK CLEAR ZONE, SEE STD. DWG. TC 3A TABLE 1)			
₩z	WORKERS ARE EXPECTED TO BE WITHIN WORK CLEAR ZONE	10		
10 HO	WORKERS ARE EXPECTED TO BE OUTSIDE OF THE WORK CLEAR ZONE, BUT WITHIN TWICE THE WORK CLEAR ZONE	6		
800	WORKERS ARE EXPECTED TO BE OUTSIDE OF TWICE THE WORK CLEAR ZONE	3		
50	WORKERS ARE EXPECTED TO BE OUTSIDE OF THE AASHTO CLEAR ZONE	0		
	FACTOR 3 – POSTED SPEED (PRIOR TO CONSTRUCTION)			
ш_	POSTED SPEED IS 55 MPH OR GREATER	10		
NOL	POSTED SPEED IS 40 MPH, 45 MPH, OR 50 MPH	6		
SOO	POSTED SPEED IS 30 MPH OR 35 MPH	3		
50	POSTED SPEED IS 25 MPH OR LESS	0		
	Factor 4 – Location of Work	-		
ш.	BRIDGE STRUCTURES, DROP-OFFS 5 FEET OR GREATER, FILLS OR CUTS STEEPER THAN 2:1, OR CONFINED AREAS WITH NO ESCAPE ROUTE FOR WORKERS	10		
ITION	AREAS WITH BARRIERS OR OTHER IMPEDIMENTS THAT HAVE A VIABLE ESCAPE ROUTE FOR WORKERS	6		
CHOOS	AREAS WITH DROP-OFFS LESS THAN 5 FEET THAT HAVE A VIABLE ESCAPE ROUTE FOR WORKERS	3		
	OPEN AREA WITH MULTIPLE ESCAPE ROUTES FOR WORKERS	0		

TOTAL POINTS

Results



UNDER EACH FACTOR CHOOSE WHICH CONDITION BEST DESCRIBES THE WORK ZONE. THE POINTS ACCUMULATED WILL DETERMINE WHAT ACTION NEEDS TO BE TAKEN.

RESULTS:		
TOTAL IS 31 POINTS OR MORE	- POSITIVE PROTECTION DEVICE(S) ARE REQUIRED IN ADDITION TO STANDARD TRAFFIC CONTROL AND ANY OTHER MITIGAT	TION EFFORTS.
TOTAL IS FROM 20 THRU 30 POINTS	- POSITIVE PROTECTION DEVICE(S) OR OTHER MITIGATION EFFORTS AND STANDARD TRAFFIC CONTROL ARE REQUIRED TO MITIGATE WORKER EXPOSURE. MITIGATION WILL INCLUDE, AT A MINIMUM, ONE OF THE FOLLOWING AT THE WORKER LOCATION:	
	1. PROVIDING POSITIVE PROTECTION DEVICE(S).	NOTES:
	 REDUCING TRAFFIC DEVICE SPACING TO A MÁXIMUM OF ONE-HALF THE REQUIRED DEVICE SPACING. PROVIDING A BUFFER SPACE AND/OR PROVIDING A TRUCK MOUNTED ATTENUATOR. 	1. POSIT VEHIC
TOTAL IS LESS THAN 20 POINTS	- USE OF STANDARD TRAFFIC CONTROL IS REQUIRED.	2. POSIT FILLE

- TIVE PROTECTION DEVICES ARE DEVICES THAT CONTAIN AND/OR REDIRECT CLES AND MEET CRASH WORTHINESS CRITEREA.
- POSITIVE PROTECTION DEVICES INCLUDE PORTABLE CONCRETE BARRIER, BALLAST FILLED BARRIERS, STEEL BARRIERS, MOVABLE BARRIERS, SHADOW VEHICLES WITH ATTENUATORS AND VEHICLE ARRESTING SYSTEMS.
- WORK DURATION DEFINITIONS:

 LONG-TERM IS WORK THAT OCCUPIES A LOCATION MORE THAN THREE DAYS.
 INTERMEDIATE-TERM STATIONARY IS WORK THAT OCCUPIES A LOCATION MORE THAN ONE DAYLIGHT PERIOD UP TO 3 DAYS, OR NIGHTTIME WORK LASTING MORE THAN ONE HOUR.
 SHORT-TERM STATIONARY IS DAYTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN ONE HOUR.
 SHORT-TERM STATIONARY IS DAYTIME WORK THAT OCCUPIES A LOCATION FOR MORE THAN ONE HOUR WITHIN A DAYLIGHT PERIOD.
 SHORT DURATION IS WORK THAT OCCUPIES A LOCATION FOR MORE THAN ONE HOUR WITHIN A DAYLIGHT PERIOD.
 SHORT DURATION IS WORK THAT OCCUPIES A LOCATION UP TO ONE HOUR.
 MOBILE IS WORK THAT MOVES INTERMITTENTLY OR CONTINUOUSLY.

USE OF POSITIVE PROTECTION DEVICES FOR WORKERS IN WORK ZONES

Best Practices in Assigning or Sharing Risk for Safety Items

- If using LS Traffic Control, have separate bid items for large dollar items, or items that could overrun.
- Have safety contingency, so safety items don't become difficult to add post bid.



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SAFET FIRST