

- Best Practices for Mitigating the Effects of Workzone Intrusions



- **Oldcastle®**  
Materials





## Work Zone Safety

# Best Practices for Mitigating the Effects of Work Zone Intrusions

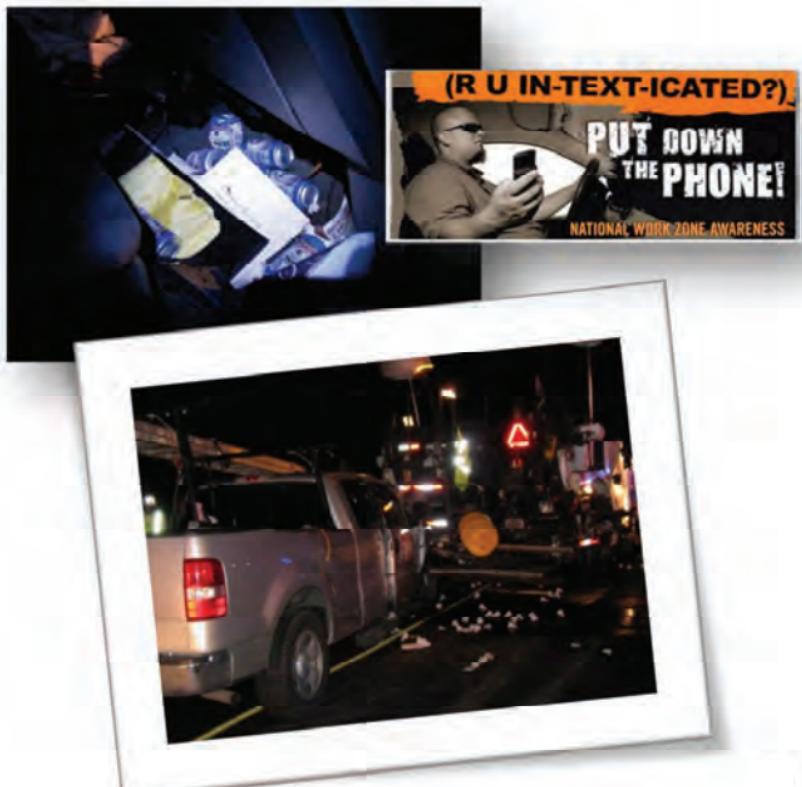
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## Introduction

Vehicle intrusion incidents occur when a vehicle, generally operated by the motoring public, enters the work zone area. Oldcastle Materials (OMG) has several work zone intrusions each year in which workers lives are threatened and/or lost. In some of the incidents the driver of the vehicle may be impaired. This fact highlights the need for controls that do not rely on the motorist's assessment and judgment of the situation and go beyond the plans and specifications (MUTCD). Examples of these controls may include, but are not limited to, removing unnecessary people from the work zone, using positive protective devices, early warning systems, etc. Outlined within this document are several recommendations/best practices for the prevention of work zone intrusions.





## Management

- Traffic control supervisors should have training and certification regarding the control of traffic. It is advisable for project managers and engineers to have training in work zone traffic control plan design.
- Provide the OMG Work Zone Awareness training for all workers annually.
- Local company management should meet with local and state law enforcement agencies to request additional visibility and enforcement presence. Representatives from these agencies should be invited to your safety meetings. (Refer Appendix A for more information)
- Meeting with state associations and DOT's regarding lowering speed limits in work zones.
- At start-up of new projects, distribute information to major trucking

companies and state trucking associations requesting them to communicate with truck drivers regarding the hazards of the work zone and to seek alternate routes.

## • **Risk Assessment and Reduction**

### • **Work Zone Daily Risk Assessment**

- We recommend that every shift begin with a safety meeting that identifies and mitigates all hazards/risks. This raises safety awareness every day because worksite changes are reviewed and specific concerns can be addressed.
- The ongoing risk assessment of the work site should include the hazards and changing conditions in the work zone. It is important for everyone on the crew to understand where within the project work zone intrusions are most likely to occur.
  - The assessment should include:
    - ✓ Safety processes to be used on-site
    - ✓ Specific work zone training for all workers on-site
    - ✓ Hazards/risks relevant to that work area and the applicable risk reduction methods
    - ✓ Past and potential incidents/injuries/near misses
    - ✓ Safety Equipment

- ✓ Proper PPE (high-vis clothing, reflective tape on hardhats, etc.)
- ✓ Daily meeting between the project supervisor and the project TCS to talk about special concerns, ramp closures, and set up / break down times for the next shift's closure
- ✓ Truck ingress and egress
- ✓ Dedicated spotters for intrusions

## Other Risk Reduction Methods

- Laminated copies of traffic control plans (external and internal) given to field staff so they have the needed documents to ensure that the traffic control installation is compliant with the contract documents and that it addresses the identified risks. It is important to use these documents to identify any additional means, methods or processes that may provide intrusion protection.

- Before start-up or during maintenance work all equipment in work zone is parked on an angle to push traffic away from employees.



- Training employees to dismount on the side away from traffic.
- LED or balloon lights on equipment.



## Intrusion Alarms

- Intrusion alarms are impact-activated safety devices that warn/alert work crews and vehicle drivers simultaneously to help prevent crashes and injuries in work zones.
- Intrusion alarms can be mounted on drums, cones, delineators, barricades, and/or machinery.
- To protect QC personal, use of specific traffic control and intrusion alarms in QC work areas as a buffer determined by field conditions (normally set at a 500 ft. buffer).
- Finish Roller operators, or another designated person, should be charged with monitoring/maintaining the closed lane devices and the intrusion alarm system (horns, whistles, etc.) as the work advances to ensure that these critical devices are maintained through the progression of work.
- Provide flaggers, equipment operators and other crew members with aerosol type

- warning horns and/or high decibel whistles to warn crew members of immediate hazards. The flaggers should have the horns and/or whistles on their person and equipment operators should have the air horn affixed to the machine and/or the whistle on their person.

- Train QA/QC lab personnel as flaggers so they can flag for each other while cutting cores or doing other short term work adjacent to traffic.
- Train all company drivers and hired haulers to stop when they hear the warning horn and also sound their air horn in the truck.

## • **Air Horn**



## Whistle



## Sonoblastor

- The Sonoblastor is one example of an Intrusion alarm that has a built-in CO<sub>2</sub> powered horn that blasts a 125 dB alert to workers that their protective zone has been violated/intruded; giving them critical



- reaction time to move out of harm's way.
- Some applications for using the traffic devices with a Sonoblaster intrusion alarm include paving lane closures, flagger protection, patching repairs, cutting core samples, hauler backing safety, grading construction, placing temporary striping and road markings, equipment loading and unloading, and for any other operations conducted within the work zone.

## Equipment Mounted Air Horns

- Air horns mounted on equipment such as rollers can give advanced warning to crew members that a vehicle has intruded the work zone and is another example of an intrusion alarm.





## Safe Work Practices

- In all cases, minimize your time spent working directly adjacent to traffic.
- Exit equipment on the side away from live traffic.
- When traveling on foot in the work zone, deliberately maximize your distance from live traffic.
- Never walk down the middle of the lane or anywhere within the width of the lane if other options are available.



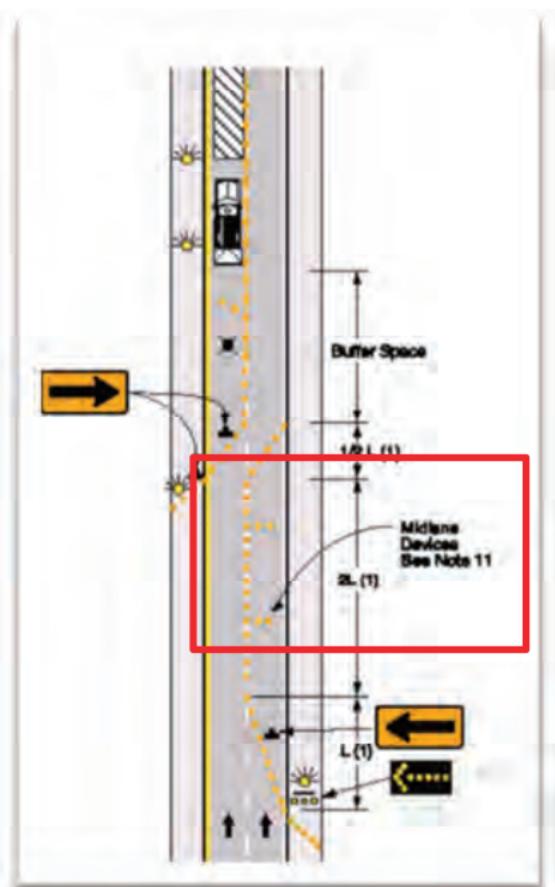
- Walk on a nearby sidewalk.

- Walk as far off the shoulder as practical or in the grass off the roadway surface.
- If traffic is on both sides of the closure, walk closest to the side facing traffic for your direction of travel.
- If someone needs to work directly adjacent to traffic, utilize a spotter to watch oncoming traffic.
- All idle or meeting time (T5) should be spent in a safe area far from traffic.
- If the paver is stopped for a period of time and workers need to be at the rear of the paver, park a roller on an angle immediately behind the paver (the angle should redirect traffic back into the live lane if it should be struck).



- When maintenance needs to be performed on equipment, it should be moved off the roadway and away from traffic or behind protective devices (i.e. barrier wall).
- If equipment cannot be moved off the roadway during maintenance, position other equipment at an angle as mentioned previously and/or a spotter to watch oncoming traffic during the maintenance activity.
- Delineators can also be used as “Mid Lane Devices” to give the closed lane a three dimensional look. Refer to next page for an example diagram.





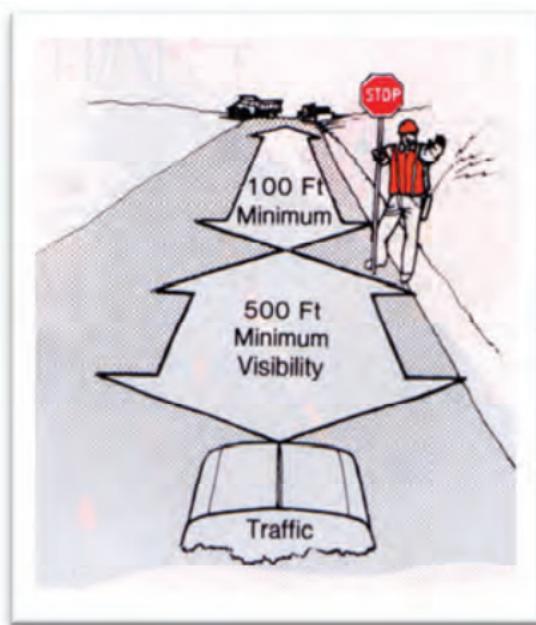
- Use extra delineators whenever possible to tightly close the radius at crossovers, side streets, and driveway entrances.

**Work Zone Safety**  
What are we doing to provide a safer work environment?

**Work Zone Intrusion Protection**

Close the radius at intersections and crossovers to prevent traffic from entering the closed lane as shown by the large red arrow.  
Do not leave this radius open.

- Ensure that flaggers position themselves properly on the shoulder in a safe location that is visible to the traveling public from at least 500 ft. (distances may vary depending on speed and other state/local standards).





## Personal Protective Equipment (PPE)

- Ensure that all workers are wearing the appropriate PPE for the task and lighting conditions at hand to be sure that employees are as visible as possible to the travelling public and mobile equipment.
- OMG requires that at least ANSI Class II High-Vis apparel is worn by all employees while on an OMG project site during the day.
- ANSI Class III apparel is required for all flaggers day or night.
- An ANSI Class III Vest and Class E Pants or Retro-reflective Gaiters or Ankle bands are required for night work.
- The current ANSI standard also recommends that retro-reflective material be applied to the employee's hard hat while working at night. The retro-reflective material must be visible from 360°.

## High-Vis Apparel on Workers-Day



ANSI Class II Vest and  
Hard Hat with Retro-  
Reflective Material  
with 360° Visibility

## High-Vis Apparel on Flaggers-Day



Flaggers must wear  
ANSI Class III vests at  
all times (vest must  
have sleeves to be  
Class III)

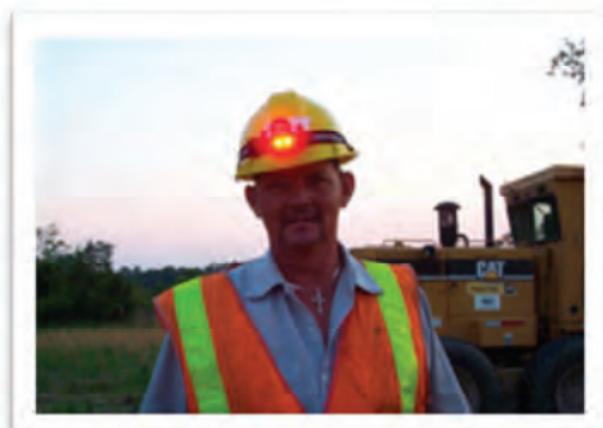
## High-Vis Apparel-Night



ANSI Class III Vest and  
Class E Pants with retro-  
reflective material on  
hands (**required for**  
**flaggers**)

ANSI Class III Vest and  
OMG Ankle Bands with  
retro-reflective material  
on hands (**option only**  
**for workers**)

## Personal Illumination for Night Work



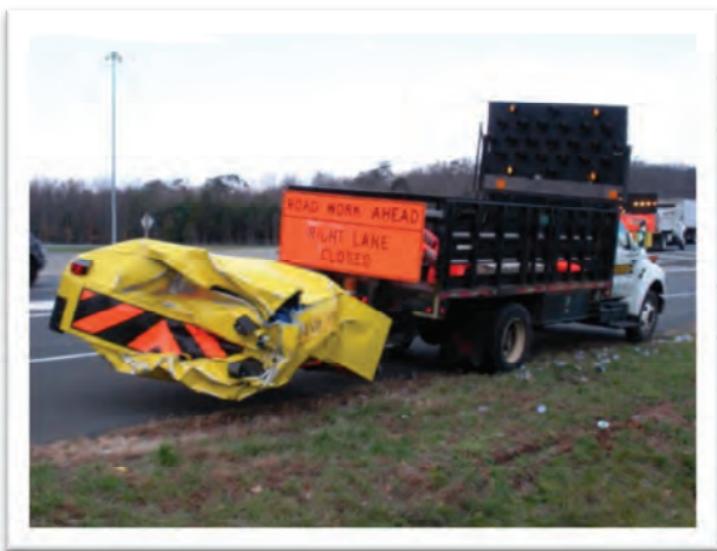


## Equipment for Work Zone

### Intrusion Prevention

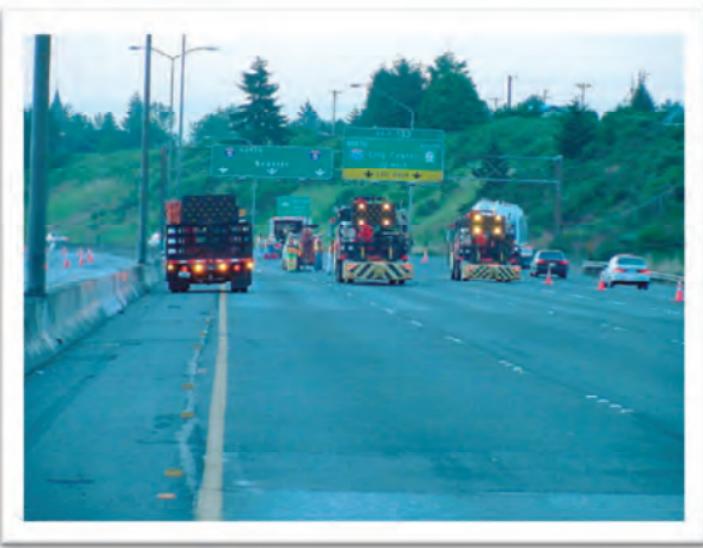
#### Crash Attenuators

- Consider the use of crash attenuators on job sites that may be deemed as high hazard such as: night projects, heavily travelled roads, the initial phase of a long-term project, when traffic control signs and devices are being set out or picked up, etc.

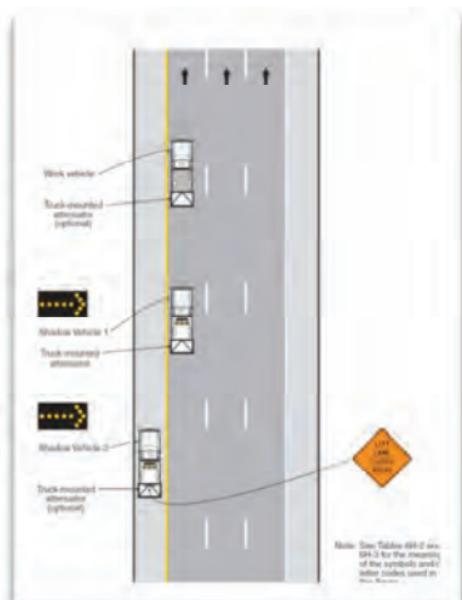


- Crash attenuators must be used strictly according to the manufacturer's specifications.

- Using two attenuators when setting up and removing tapers on major highways is a good best practice.



- When used in traffic, a crash attenuator truck would be used as a shadow vehicle.



## Work Zone Lighting

- Lighting is extremely important for protecting our work zone employees when performing night work. Provide glare-free illumination for night work. Work vehicles should have appropriate beacons and lights to ensure visibility.



- Lights can be used on either mobile equipment and/or in a stationary position.

- Lighting added to rollers and other equipment behind the illuminated paving operation will enhance visibility.



- Lights plants can be placed in tapers to better illuminate work zones and draw needed attention to the beginning of work areas to alert the traveling public.

- Installing additional lighting on QC and core drill equipment to both illuminate the work area and to make the operation more visible.



- LED lights can also be useful on the paver or strategically placed on ancillary equipment such as a distributor truck for better visibility.



- Hand tools such as rakes, shovels, lutes, and levels can also be enhanced to increase visibility.





## Manual on Uniform Temporary Traffic Control

- The first step in preventing work zone intrusions is to ensure that the traffic control devices are set out as prescribed in the traffic control plan.
  - Ensure these controls are in place:
    - ✓ Establish an internal and external Traffic Control Plan (TCP). Follow MUTCD and state/local guidelines for the specific work zone.
    - ✓ Channel and taper traffic into the appropriate lane or lanes well in advance of the work area.
    - ✓ Use appropriate signage for the type of work zone activity according to the MUTCD and state/local guidelines.
    - ✓ Once they are in place, the devices should be checked daily to ensure that they are still in place and in working order.

- ✓ Workzones need to be inspected periodically with a frequency at least weekly. The inspections must be documented with corrections or enhancements noted on the inspection form.
- ✓ Use the proper lengths for tapers and buffers and when possible extend those for extra protection. Also use the proper spacing of devices and when possible use extra devices spaced closer together for added protection. Refer to the Commonly Used Tables for Device Setup on the next page.

Speed Limit(s)	Minimum Taper Length (L)			
	Width (W) in Feet			
MPH	9	10	11	12
≤ 25	95	105	115	125
30	135	150	165	180
35	185	205	225	245
40	240	270	295	320
45	405	450	495	540
50	450	500	550	600
55	495	550	605	660
60	540	600	660	720
65	585	650	715	780
70	630	700	770	840
75	675	750	825	900
80	720	800	880	960

	5	L	2L	½ L	1/3 L
25	125	250	63	42	
30	180	360	90	60	
35	245	490	123	82	
40	320	640	160	107	
45	540	1080	270	180	
50	600	1200	300	200	
55	660	1320	330	220	
60	720	1440	360	240	
65	780	1560	390	260	
70	840	1680	420	280	
75	900	1800	450	300	

Distance Between Signs				
Speed	Spacing (ft)*			
	A	B	C	D
40 mph or less	200	200	200	100
45 mph	350	350	350	175
50 mph	500	500	500	250
	2640	1640	1000	500

\*When Buffer Space cannot be attained due to geometric constraints, the greatest attainable length shall be used, but not less than 200 ft.

\*Check state and local standards for sign spacing requirements

For lateral transitions other than 12', use formula for L shown in the notes column.

Where:

L = Length of taper in feet

W = Width of lateral transition in feet

S = Posted speed limit (mph)

Suggested Clear Zone Widths for Work Zones		
Work Zone Speed (mph)	Travel Lanes & Multilane Ramps (feet)	Auxiliary Lanes & Single Lane Ramps (feet)
60-70	30	18
55	24	14
45-50	18	10
30-40	14	10
All Speeds	4' Behind Face of Curb	4' Behind Face of Curb

Combination Table for Multiple, Shifting, and Shoulder Taper Lengths				
Speed (mph)	Buffer Space*	Taper Length (12' Lateral Transition)	Distance (ft)	Length (ft)
25	155	125	Speed ≤ 40 mph	
30	200	180		
35	250	245	$L = \frac{WS^2}{60}$	
40	305	320		
45	360	540		
50	425	600	Speed > 40 mph	
55	495	660		
60	560	720		
65	620	780		
70	670	840		
75	730	840		

Buffer Space and Taper Length				
Speed (mph)	Buffer Space*	Taper Length (12' Lateral Transition)	Distance (ft)	Length (ft)
25	155	125	Speed ≤ 40 mph	
30	200	180		
35	250	245	$L = \frac{WS^2}{60}$	
40	305	320		
45	360	540		
50	425	600	Speed > 40 mph	
55	495	660		
60	560	720		
65	620	780		
70	670	840		
75	730	840		

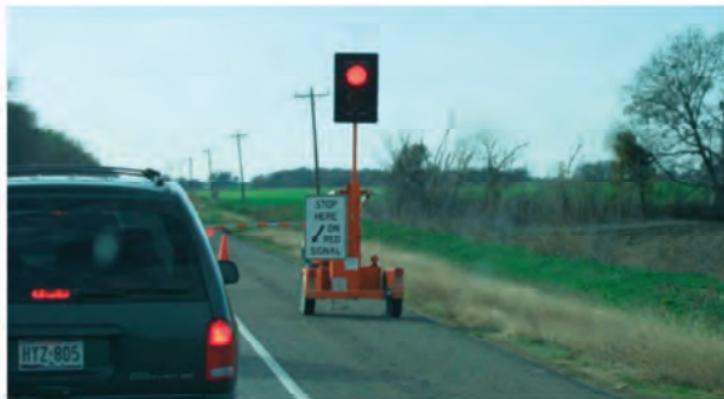


## Beyond Compliance

### Other Best Practices that *may* require

#### agency approval:

- Close the road to traffic. Also, consider closing intersecting roads that would allow merging traffic to adversely affect worker safety in the work zone.
- Use impact-resistant protective barriers to separate traffic from workers. Place barriers between traffic lanes and workers.
- Use approved Automated Flagging Assistance Devices (AFADs) or portable traffic signals per MUTCD guidelines.



- Strategically locate approved delineators, positioned horizontally across and within the work zone area prior to worker location. Delineator cross bars may be used in areas that may appear to be confusing to the motoring public such as near side roads.



- Install temporary rumble strips along roadway, especially adjacent to the Flagger Ahead sign.



- Illuminate tapers.
- Install vehicle speed indicators.
- Utilize vehicle arresting systems behind the taper or mobile type barrier systems.



(Example of mobile barrier below)



The Mobile Barrier Trailer configures from  
42 feet to more than 100 feet in length.

- Use an intrusion alarm system that utilizes an air hose stretched across the closed lane that activates an audible warning device such as an air horn.



- Inform, train and utilize law enforcement officers in our work zones (See Appendix A for Law Enforcement Guide).



- Use a large sign with a personal type message and/or picture of an employee with his/her family denoting that this is his/her workplace and to please slow down. Perhaps several throughout a large job.





## Communicating with the Traveling Public

- Where applicable, utilize the amber alert system to better communicate with the traveling public.
- Changeable Message Signs (CMS) used to inform motorists of conditions ahead such as closed ramps, detours, or other regulatory information.
- Billboards along highways with work zone safety awareness messages.
- Radio/TV spots for work zone safety.
- Utilize DOT Public information system.
- Utilize mobile devices for traffic construction work updates.



## Emergency Strategy

- No two work zones are alike. It's important to know who and how emergency services will be responding to issues such as vehicle accidents, fire, medical and any other emergency. Identify these providers, let them know of your plans, and incorporate their input into the work zone planning. For longer duration or more complicated work zones, invite responders to your site for their considerations.
- Access is a key element. If your work involves bridges, excavations, concrete barriers, etc., it is important to consider how emergency services will be accessing the area, and properly communicate changes to affected parties.
- Employers must ensure adequate communication among all workers in a roadway work zone. Flaggers should have mobile radios so they can easily

- communicate with each other or their coworkers.
- Emergency access points are always marked with signs. Maps are provided to the emergency services coordinator if/when the work zone changes.
- Expect the public to follow the path of least resistance, which could mean that they will enter protected work zones to get around accidents. Secondary accidents can also be a result of initial accidents. Be alert for vehicles crashing into crashed vehicles.

## Appendix A

### SAFETY GUIDANCE

#### ROAD CONSTRUCTION SUPERVISORS

##### **Law Enforcement in Road Construction**

Police surveillance and enforcement activities are often essential to safe and efficient traffic operations during highway reconstruction. The primary purpose of law enforcement's presence on road construction sites is to calm and/or control traffic throughout the highway corridor under construction. Here are a few things to help guide the assistance of officers in your work zone:

- 1. Communication with the individual law enforcement officers assigned to your site is crucial.**

The construction manager on site should communicate our safety and performance expectations to law enforcement officers when they are assigned to assist in our work. Do not expect that officers will know exactly what to do or where to position their vehicle to best help us, since construction requirements are often new to them. As with our own employees, when people meet expectations with the highest levels of safety, efficiency and quality this is

because they have received proper training, oversight and follow-up.

- Make sure the assigned officers are aware of their role in the Traffic Control Plan (TCP) prior to beginning work. Provide them with a daily WZ briefing before getting started.
- Ask them to arrive 15 minutes before traffic control devices are being placed or moved to ensure they know how to best assist us in these critical moments.
- Make sure the officer(s) know who the Traffic Control Supervisor is and his/her phone number in case of emergency.

**2. As with all road workers, the first order of importance for law enforcement is keeping themselves safe.**

Instruct the officer that our concern for their safety is of primary importance. As for how to achieve that goal, different safety guidance or best practices may apply to the different phases of work that are ongoing. We must talk directly with each assigned officer about how to best maximize the individual officer's safety, as well as the safety of others, in each of these phases or operations. Some best practices in this regard are outlined below.

•

• 3. Proper positioning of the law enforcement vehicle is very important to safety on site and the safety of the officer. In general:

•

- The key to calming traffic entering the active construction area is to position the police vehicle in the advanced warning area, before a transition or where we need the motorists to pay attention. Generally, this is slightly in advance of the immediate area of the work - 1/4 mile is recommended.
- Do not allow the officer to park in the buffer space.
- The law enforcement vehicle must be in the safest position possible (i.e. on the shoulder, median, etc.) that is also highly visible to approaching traffic.
- The law enforcement vehicle must be in a position that appears ready to respond in enforcement activities.
- The officer and the vehicle must be ready to move in the event of developing situations. An errant vehicle is one such example.
- The officer may also relocate as needed, based on traffic and job conditions.
- Ask the officers(s) to have their lights on low intensity during night work. Too much lighting and intensity will add confusion.

When work progresses away from the upstream taper, officers should place their patrol vehicle inside the barricaded or coned area. The vehicle, if at all possible, should be placed on the shoulder in a position that allows the officer to monitor traffic and be in a position from which the motoring public can assume that the officer is ready to take enforcement action.

**4. Law enforcement activities should not be limited to passive monitoring and could also include positive guidance of traffic.**

Assisting road crews through difficult intersections and other complex situations is appreciated and an officer's presence outside of the vehicle controlling traffic may be necessary. Ask them for their direct assistance. If outside their vehicle and within the work zone, we should request that they wear a retro-reflective vest.

**5. Enforcement of traffic laws and writing tickets will help in certain situations, where appropriate.**

When an officer writes a citation in a construction work zone, hundreds of motorists can witness this event making an impression the next time they travel

- through. Therefore, where possible, we should recommend that officers engage in mobile patrol operations within the immediate work zone. Of course, enforcement activity will depend on the agency's rules and protocols and that of the project owner.

- 6. Generally, and in most cases, law enforcement should position their vehicle as far away from the open travel lanes as practical yet still highly visible to approaching motorists.**

- Some exceptions to this may exist, such as participating in rolling roadblocks for construction activities, but maximizing distance from open travel lanes is advised in almost all cases.

- 7. Other than a properly executed rolling roadblock, police vehicles should never be positioned in an open travel lane to block traffic for ongoing construction work.**

- Road construction supervisors should evaluate the need for appropriate traffic control devices including a truck mounted attenuator, as necessary.

- 8. In a moving or mobile construction operation, law enforcement vehicles**

**should not be positioned within the line of moving construction vehicles nor should they be placed at the rear of the moving operation.**

A police vehicle is intended to provide additional advanced warning and to slow traffic before it travels past the moving construction operation. When escorting a moving operation, law enforcement vehicles should travel approximately  $\frac{1}{4}$  mile in advance of the operation, **but out of the travel lanes** (i.e. on the shoulder, median, etc.).

When the rear most vehicle is a truck mounted attenuator (TMA), law enforcement vehicles should **never travel behind the TMA**. Officers should again be positioned on the shoulder, median, etc. as appropriate.

**9. The use of unmarked law enforcement vehicles for traffic control should be avoided.**

Unmarked vehicles are unmarked for a reason – so the general public will not recognize their presence. This is the exact

- opposite effect of what we are trying to achieve.

- 10. Whether or not law enforcement is used on your project, it is strongly recommended that we communicate with the local police in seeking their assistance.**

- A template letter can be found on the next page outlining suggested wording.

- Remember:**

- We are the experts in road construction. However, there is no one size fits all approach to the safety of law enforcement officers in a construction work zone. We must instruct the officer(s) where and how they can best assist us achieve our goals safely. The police are also experienced professionals when dealing with public traffic so their ideas and opinions should be respected.

# Sample Letter to Law Enforcement Agencies

Sheriff//Chief of Police)

(County/City Department of Police)

**Re: Construction Site Activity**

To Whom It May Concern:

As the [Project Manager/Director of Safety] for [OMG Company Name], I am always trying to improve our safety record and help keep it as one of the safest construction companies in the United States.

We (have started/are going to start) work on (\_\_\_\_\_) which will involve (resurfacing. road widening. etc.) and will go from (\_\_\_\_\_) to (\_\_\_\_\_). This work will continue through (month, year). We will be working closely with (\_\_\_\_\_) DOT to ensure that all signage is posted according to the regulated specifications, which are designed to alert and direct the motoring public.

In a desire to make this construction work zone as safe as possible for our workers and the motoring public, we think it is important that there is an **increased police patrol presence in this zone to keep motorists within the posted speed limits.** We believe that motorists who ignore the posted speed signs are the single

- greatest cause of work zone accidents. More intense patrolling of this stretch of roadway, especially between the hours of (\_\_\_\_\_) and (\_\_\_\_\_), will significantly help make this construction zone a safer place. I am sure that you will agree that the greatest deterrent to speeding motorists is the sight of other drivers being stopped for speeding.
- We would also appreciate being informed immediately of any hazardous conditions (e.g. barrels dangerously out of place, signs down, etc.) in our construction work zone or of any accidents that you or your officers become aware of. I can be reached at (\_\_\_\_\_) or on my 24-hour cell phone (\_\_\_\_\_).
- Your assistance is greatly appreciated.
- Sincerely yours,

# **Sample Letter to Department of Transportation**

[Date]

[Name]

Resident Engineer

\_\_\_\_\_ Department of Transportation

[Address]

**Re: Project Number:**

**Project Name:**

Dear [Name]:

I am writing in regard to the above-referenced project (“Project”) on behalf of (name of OMG company). (name of OMG company) was awarded the contract for the Project and began construction in accordance with the contract documents. The contract requires (name of OMG company) employees to perform work on a heavily-traveled roadway. (name of OMG company) has observed that numerous motorists, including a significant amount of tractor trailer operators, are exceeding the speed limit and ignoring the traffic control devices set forth in the contract documents.

- The conduct of these motorists may jeopardize the safety of (name of OMG company) workers, the employees of the Department of Transportation (“DOT”), and the motoring public.
- (name of OMG company), like the DOT, strives to perform its work in a safe manner and seeks to address any condition which could endanger the public or its employees. The Temporary Traffic Control Devices Rule (Subpart K) became effective on December 4, 2008. Subpart K was entitled to expand the use of uniformed law enforcement officers, positive protective measures, and temporary traffic control devices during construction operations. In order to improve the safety of the Project, (name of OMG company) would like the DOT to amend the contract to include the following:
- (1) Reduce the speed limit within the work zone to 45 mph;
- (2) Authorize additional upstream warning devices, including variable message boards and speed monitoring devices;
- (3) Provide at least one law enforcement officer for each lane closure and authorize that officer

to issue traffic citations and use speed detection equipment;

(4) Use different color traffic barrels or cones to designate ramps; and

(5) Install temporary rumble strips in order to increase awareness of the work zone;

If the DOT fails to address these issues, (name of OMG company) may be forced to file a claim to obtain the same. Failure to address these issues may also void (name of OMG company)'s warranty, indemnification, and insurance obligations under the contract.

I appreciate your immediate attention to this matter. Please contact me if you have any questions or need any additional information.

Very truly yours,

(name of OMG company representative)

The best practices included in this Guide have been proven effective by the various paving and construction activities across the Oldcastle Materials Group. It is up to each individual supervisor and/or safety team to determine which practices would be applicable to his/her operations. Please remember that incorporating these type of innovative ideas into our day to day work plans raises our level of protection for our OMG employees, our partners, and the motoring public. As a supervisor, ask yourself ‘what if’, then take the necessary action to go ‘beyond compliance’ towards providing a safer work environment. This type of personal commitment is a great example of ‘When I SEE something, I will STOP and DO something’.

