



# Chubb Construction Risk Engineering

Work Zone Safety

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## Work Zone Safety

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### Background

Working in construction zones can be very dangerous for both the worker and general public.

Consider the facts: According to the Federal Highways Administrations Work Zone Safety Fact Sheet:

- U.S. roadway system's have seen positive trends with a 2007 fatality rate of approximately 1.37 deaths per 100 million miles of travel (down from 5.5 fatalities in 1966) and in 2007, nearly 2.5 million people were injured and 41,059 people died on our Nation's roads.
- Although the numbers are trending downward in recent years, work zone safety is still serious concern. In 2007, there were 835 work zone fatalities. This represents 2 percent of all roadway fatalities for the year. Over four out of every five work zone fatalities were motorists. In addition, there are more than 40,000 injuries in work zones.
- What does this mean? This amounts to:
- 1 work zone fatality every 10 hours (2.3 a day) and 1 work zone injury every 13 minutes (110 a day)
- In addition, of the 835 work zone fatalities in 2007, 297 or 36 percent were alcohol related.

In the summer and fall, large portions of the population will travel on vacations, seasonal events, day trips and holidays. These travelers want to get to destinations as quickly as possible and when a construction zone is encountered along the way, it is considered a nuisance and can result in agitation, impatience and recklessness of the driver. Add severe weather in the mix, which can affect driver's ability to see clearly and stay

alert in the work zone, and you have the making for a very dangerous situation.

Other drivers or site workers may be preoccupied or could be under the influence of drugs or alcohol (36 percent of accidents are alcohol related). When considering work zone safety, you must realize the general public may not fully understand your warning signs, channeling devices or the direction they must travel in order to safely traverse the work zone.

As the General Contractor (GC), if an accident occurs in your work zone, you are likely assumed responsible until proven otherwise. Legal counsel for the injured parties will look to the contractor to pay for all or part of the costs related to the accident. If found that the Temporary Traffic Control (TCC) in place was inadequate or inappropriate for the conditions, you may be found liable.

### **Always plan ahead for the worst scenario and never take work zone safety for granted.**

#### **Objective of work zone safety control**

- Provide a safe and pro-active environment for the traveling public and construction workers
- Minimize inconvenience and impact on the traveling public and the neighborhoods where the work is being performed
- Facilitate a timely and unimpeded completion of a quality construction project

#### **Applicable standards**

The most widely recognized standard is the Manual on Uniform Traffic Control Devices (MUTCD), Part VI. This document sets national standards for temporary traffic control in work zones and for all Traffic Control Devices (TCDs) installed

on any street, highway or bicycle trail open to public travel. It describes the application of traffic control devices but the ultimate decision as to whether or not to use a device at a particular location should be made on the basis of either a documented engineering study or the application of engineering judgment.

Be aware that state and local authorities may have their own standards regarding temporary traffic control. These requirements can be more stringent and detailed than the MUTCD but the MUTCD will be the minimum standard for them. It is critical that in addition to following the MUTCD when creating your traffic control plans and setting up and maintaining your work zones, that you also find out what additional measures you must take to ensure compliance with the local and state authorities.

In addition to the MUTCD, the Occupational Safety and Health Administration (OSHA) Construction standard, 29 CFR 1926.200 Subpart G, has four sections that pertain to work zone safety: The subpart is called Signs, Signals, and Barricades and includes the following sections:

- 1926.200 - Accident Prevention Signs and Tags
- 1926.201 - Signaling
- 1926.202 - Barricades
- 1926.203 - Definitions

Sections 1926.200, 201 and .202 "incorporate by reference" the MUTCD. "Incorporate by reference" means, where standards, practices or references are already established and considered the safest, most practical means, OSHA will "incorporate by reference" within the federal standards so employers are required to follow them and if found in violation, can be cited.

### **Subcontractor management**

Highway construction projects can have numerous types of subcontractors performing operations from site work and clearing, underground utilities, signage and lighting to maintenance and protection of traffic (M&PT). Subcontracting the M&PT is a common occurrence in highway construction today. There are many companies which specialize in this type of work, however, even if this aspect of the operation is subcontracted to another party, overall responsibility for work zone safety cannot be delegated.

A key component to controlling losses due to the performance by a subcontractor is to use reputable, qualified, experienced and when possible, licensed contractors. Subcontractors should be hired based on sound practices such as those above and not simply by the lowest bid price.

Evaluating a potential subcontractor's safety performance and history is a critical component that needs to be part of the risk management process. The work is not done once the subcontractor has been selected, but rather, it has only just begun.

There are many proactive steps that can be taken to ensure that the subcontractors you hire meet and live up to your expectations and criteria. At a minimum, a good subcontractor management program should be established which contains policies and procedures for prequalification, accountability, preplanning, routine and regular inspections of the work areas, effective contractual risk transfer language and a review of the subcontractor's safety program.

### **Pre-qualification**

All contractors should be pre-qualified before they are selected for the job. It is

important that as a general contractor or construction manager, you perform your due diligence to ensure -- as much as possible -- that the contractors ultimately hired for the job are knowledgeable, experienced and have a proven track record of completing the work they are contracted to perform.

Pre-qualification should include, but is not limited to:

- Verifying the experience of the contractors: Have they performed this operation in the past? Were they successful?
- For high risk applications such as maintenance and protection of traffic: Are the contractors and their workers qualified? Are they trained and where required? Are they certified to perform the work?
- Do all contractors hire workers who are skilled and trained and are these workers trained in the specific products/materials they are installing?
- What is the claims history for the contractor? Have they had previous claims filed against them relating to the work they are considered for?
- Does the contractor have a formalized safety and health program in place? Is there a designated supervisor who will perform safety and quality inspections and oversee operations?

### **Accountability and enforcement**

Each hired contractor must be dealt with in a fair and consistent manner. The contractors you hire should be held accountable for complying with federal, state, local and project safety standards and completing their contract work according to approved plans, drawings, and manufacturer's specifications.

As soon as concerns are identified, they should be dealt with immediately. If necessary, a corrective action plan

should be created and implemented to ensure that the problem does not reoccur. Allowing laps in safety policy and/or procedure will more than likely pave the way for a potential loss later on as the uncorrected issues continue to occur.

Accountability policies should have pre-determined consequences, whether administrative or financial (monetary penalties) that can be applied based on the degree of the problem. This policy should be included in contract documents so all parties are aware of it when their portion of the job begins.

### **Risk transfer and contract requirements**

Insurance companies insuring contractors often work with risk managers to ensure proper risk transfer language is drafted into the contracts that general contractors exercise with their subcontractors. This form of agreement is known as a "hold harmless" or indemnity agreement.

In such an agreement, one party promises to reimburse the other against claims or suits brought by a third party. Properly written hold harmless and indemnity agreements will afford the GC the right to collect from the subcontractor's action. It is important for GC's to check with their legal adviser whether there are any restrictions on the scope of hold harmless and indemnity agreements, since state laws vary.

It is also important that all contractors who submit bid packages for a project take into consideration the policies and programs, you as the CM or GC are requiring. Including such requirements as substance abuse testing, job hazard analysis, 100 percent fall protection, work zone training for all employees, requiring certified flaggers, and minimum insurance requirements into the bid specifications, ensures that those



contractors who choose to participate in the process are:

- Including the costs associated with those programs into their bid price and leveling the playing field.
- Acknowledging the requirement to have those programs in place while working on the project.
- Provides a means to hold the contractors accountable in the event they violate the terms of the contract by not complying with the project specifications.
- Checking local law concerning project documentation and materials.

### **Preplanning**

As with any construction operation, the level of success achieved is directly related to how well each aspect of the operation or task is preplanned and carried out. From mobilization through tear down and final clean up of the work zone, each aspect should be well thought out, conceptualized and documented.

Without proper preplanning, there is the chance that otherwise known hazards will go uncontrolled or unprotected, some equipment or safety devices may not be available when needed, emergency responders may be unaware of new access routes through the work zone or how to respond in the event of an accident and site contractors may not be provided with the appropriate training or direction they need to safely work to complete their tasks.

Regularly scheduled project planning meetings are an essential step to make sure that the job is built correctly, on-time and safely. Planning meetings should take place regularly and include project management, including quality control and safety staff, as well as all active and upcoming subcontractors.

The goal is to provide a means for project management and subcontractors to help stay apprised of unforeseen events, actions or other issues detrimental to the safety or completion of the project to occur.

### **The traffic control plan (TCP)**

Once preplanning is completed, the Traffic Control Plan should be prepared. This document will be the guiding document for all aspects of the set up, maintenance and eventual tear down of the work zone, as well as all safe working procedures.

Temporary Traffic Control (TTC) zones provide for the efficient completion of work activities that interrupt normal use of the roadways. Consideration for road users, construction workers and emergency responder safety and efficiency of road user flows, must be an integral part of your work zone, from planning to completion.

Officially, traffic control plans and devices are the responsibility of the authority or public body or “official having jurisdiction” for guiding road users. For example, this can be the state department of transportation, the county highway department or others. The authority is then passed down to you when contracted to perform the work zone operations. As the contractor, you are responsible for what takes place within the work zone, regardless if the state or other body is involved. Always remember, your responsibility for work zone safety cannot be delegated.

Defining every detail in the traffic control plan to adequately cover all applications is not practical. The TCP selected for each situation depends among other things on:

- Road user conditions
- Type of highway

- Low volume
- Urban street
- Minor urban
- Duration of operation
  - Long term: 3 days or more
  - Intermediate: overnight to 3 days
  - Short term: daytime (1 to 12 hours)
  - Short duration: 1 hour or less
  - Mobile: moves, stops less than 15 minutes
- Physical constraints, and
- The nearness of the work space or incident management activity to road users

The TCP needs to be prepared far in advance of the work being performed and reviewed with:

- Local/governing authorities
- Emergency responders who may use this route
- Railroads (if applicable)

The TCP should be written and communicated to all parties with operations in the work zone. Depending on the operation and local traffic environment, the TCP may be simple or very complex. The plan should meet - at a minimum - follow or exceed current Manual on Uniform Traffic Control Devices (MUTCD) guidelines and be approved by an authorized/trained person.

If the plan becomes insufficient, it must be immediately reviewed and modified accordingly. Any changes should be approved by an official who is knowledgeable in proper temporary traffic control (TTC) practices, such as someone who is trained and/or certified in TTC.

### **Emergency responders and railroads**

Coordination with emergency responders is critical in the design of the TCP. Contact should be made with emergency

responders to provide dates and times of planned construction operations and detour routes and provide any preplanned communication protocols needed between work zone activities and emergency vehicles for advance warning.

Work zone employees should be trained on proper signaling and/or other communication protocols to safely warn site staff of approaching emergency responders as well as flagging procedures to safely expedite and route responders through the work zone.

When working with railroads, there may be additional requirements such as:

- Providing formal notification and preplanning with the railroad itself
- Specialized training for all workers
- Specific signaling procedures
- Preplanned and coordinated track outages and/or authorized work schedules and
- Track crossing and material storage limitations

When conducting operations over active roadways or railroads, additional planning needs to occur. Working over open lanes of traffic or railroads should never be allowed unless overhead or other protection is in place to prevent personnel, debris, materials or equipment from falling onto the roadway or railway below and protection must remain in place until the hazard no longer exists.

## Components of the work zone

### Traffic control devices (TCD)

TCDs are all signs, signals, markings and other devices used to regulate, warn, or guide road users into, through and out of a work zone. They can be placed on, over, or adjacent to streets, highways, pedestrian facilities or bikeways.

Examples of TCDs are signs, signals and markings, channeling devices such as cones, barrels and barricades, tubular markers, vertical panels and drums.

TCDs are selected after an engineering study and should be visible in all conditions, should not create hazards and always maintained in good condition. They are typically installed upstream to downstream and removed downstream to upstream.

To prevent road users from becoming complacent or ignoring work zone warning signs and devices, all TCDs should be removed, moved off to the shoulders and/or covered when not in use. Road users can become desensitized to advanced work zone warnings when they are routinely passing through inactive work zones with all the warning signs and devices still in place, eventually ignoring them all together. Then when that work zone does become active, road users will continue to believe the area is not active, ignoring the warnings, potentially causing serious accidents.

TCDs must be inspected every day and as often as needed to ensure they are in proper condition. If TCDs are damaged, dirty, displaced, or missing they must be repaired, cleaned, or replaced. Remember to always document safety inspections and use photos and videos if you can.

### Advance warning area

As a road user, the first component of the work zone encountered will be the advance warning area. This area is set up in advance of the work areas. To effectively safe guard workers and the public, road users must be adequately informed about upcoming work zone/incident areas well before they encounter them. When properly placed, appropriate warning signs and markers become more

specific as you approach, varying from single signs and lights to series of signs advance of the TTC zone.

The placement of the warning devices varies depending on speed and other conditions that affect reaction times.

For example:

- Warning areas for freeways and expressways should be longer because drivers are conditioned to uninterrupted flow and traffic speeds are excessive.
- On urban streets, placement of the first warning sign should range from four to eight times the speed limit in miles per hour (mph) and if single warning signs are used (typically in low-speed residential areas), the warning area can be as short as 100 feet.
- If two or more signs are used on higher-speed streets, the warning area should extend a greater distance. Rural highways normally characterized by higher speeds have the placement of the first sign substantially longer; from eight to 12 times the speed limit in mph. Since two or more signs are normally used, the advance warning area should extend 1,500 feet or more for open highways

### Transition area

The transition area is the section of highway where the road users are redirected out of their normal path and into the work zone. This area occurs before traffic reaches the actual work area. Road users must be safely channelized from the normal path to a new path with minimal disruption.

In mobile operations, the transition areas can move with the work space. This may be a detour and is frequently a taper.

### Tapers

Tapers are created by using a series of channeling devices and/or pavement

markings (cones, barrels, etc.) to redirect the road user. Tapers may be used in both the transition and termination areas. As with any aspect of the work zone, where there are influencing factors, the length of tapers may be adjusted.

There are several types of tapers that are available depending on the work zone conditions such as the:

- Merging taper (2 lanes into 1)
- Shifting taper (all lanes move)
- Shoulder taper (shoulder work)
- Downstream or Termination taper (moves traffic back to original path) and
- 2 way or Flagger's taper

The length of any taper can vary depending on the speed and width of the lane in feet. To determine the length of the taper, there are two formulas that can be used: one for speeds of 40 mph or less and the other for speeds of 45 mph or more. It is critical that only trained and experienced personnel calculate these distances to ensure the work zone tapers are appropriate for the work zone and location.

### **Buffer space**

The buffer space is the lateral or longitudinal area separating road users from the work space or unsafe areas. It may also be used to provide a recovery space for an errant vehicle. Neither work activities, storage of equipment, vehicles, or materials should occur or be stored in a buffer space. The width of lateral buffer spaces should be determined by engineering judgment.

When work occurs on high-volume, highly congested roadways, a vehicle storage/staging space may be provided for emergency incident response such as emergency vehicles, tow trucks and fire apparatus. Having such an area provides these vehicles with the ability to respond

quickly to road user incidents or other emergency situations within the work zone. If used, this area should not extend into the buffer space.

Because every work zone can be different, each may have its own inherent limitations. In situations where due to these limitations an appropriate buffer zone cannot be established, other measures can be used for protections such as impact attenuators and soft barriers that will stop vehicles. These barriers can be fixed, portable, or vehicle mounted depending on their capability.

In situations where a taper is designed to shift traffic onto opposing lanes, a buffer should separate the two opposing lanes of traffic which serves to reduce head on collisions.

### **Work space or activity area**

The work space or activity area is the section of the highway where the work activity actually takes place. This area must be closed to road users and set aside only for workers, equipment, materials, etc.

On large projects (with more than one work area), if work spaces are separated by several miles within the project limits, each should be appropriately signed to inform road users and reduce confusion.

For safe entry and exit of construction vehicles and equipment, you must always ensure a safe way in and out of the work zone that road users won't try to follow. Construction traffic entry and exit points should not interfere with road user traffic. For example, you will need to provide an entry and exit space where construction traffic can pull into and out of at speeds that will not cause traffic to have to quickly slow down, and cause congestion or stop suddenly.

For additional protection of both the road user and construction personnel, portable concrete barrier (Jersey barrier) can be used to separate construction activities from active roadways. For improved day and night visibility, the barriers can be supplemented with standard delineation devices, pavement markings and channeling devices. To prevent oncoming traffic from impacting protruding ends of concrete barrier, ensure that the barrier ends are flared in until the ends are outside of the roadway and in an acceptable clear zone or provide crashworthy end treatments.

### **Termination area**

Finally the termination area is used to return road users back to their normal path upon exiting the construction work zone. This can be done using shifting tapers or merging tapers. At a minimum, you should provide 100 feet of taper length while using at least five to six traffic control devices per lane.

The termination area shall extend from the downstream end of the work area to the last traffic control device such as an "END ROAD WORK" sign.

Upon exiting the termination area, the use of end road work, speed limit or other signs may be used in order to inform road users that they should resume normal operations.

### **Setting up and tearing down the work zone**

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This operation is one of the most dangerous for both the construction worker as well as the general public. During these operations, construction vehicles and workers as well as road users, are sharing the same roadways.



During the set up and tear down of the work zone, some safety concerns include:

- Road users struck by construction vehicles
- Road users struck by or striking traffic control devices loose on the roadway
- Construction workers struck by road users and
- Workers struck by construction vehicles.

Preplanning, coordination and communication are essential to ensure that these activities occur safely and without incident.

### **Setting up the work zone**

When setting up the work zone, crews that are placing traffic control devices should be followed by an attenuator vehicle or other safety buffer. If used, attenuators should have an illuminated arrow and message boards warning of the activity. These vehicles/devices protect the workers setting up the zone.

Crews will place advance warning signs, with the farthest one out first, then additional signs and/or devices placed in order, moving towards the work zone. The idea is that the road user should see the work zone in front of them, allowing adequate time to react to warnings, devices and shift as directed. Workers must be protected and isolated from road users as much as possible during these activities.

To create initial tapers, TTC devices are placed working from the shoulder or closure area into the work areas. Additional devices are placed moving toward and through the work zone.

Throughout this process, the attenuator/buffer is always in position, advancing with the crew, until the taper and/or work zone is fully set up.

Whenever in the work zone, worker and public safety is paramount and should never be compromised. Workers should never place devices outside of the established taper or work zone (traffic side).

If working from or with a vehicle to place or pickup up work zone devices:

- The vehicle should be designed to transport workers safely
  - The vehicle should provide a mechanical means for loading/unloading to facilitate placing/picking up of traffic control devices
  - The vehicle should be fitted with an audible back up alarm (heard above traffic noise)
  - The vehicle should be fitted with a working platform and guardrails and be designed to support the use of a fall restraint device
  - The vehicle should have all required and appropriate lighting and signage
  - And if possible, the vehicle should have back up cameras with in-cab monitors and vehicle proximity devices with in-cab alarms should be installed.
- These will warn the driver of unseen or sudden obstacles or if persons enter the danger area at the rear of the vehicle while backing up.

### **Tearing down the work zone**

When tearing down the work zone, the activity is completed in reverse order as when it was set up; removing the farthest device beyond the work zone first, then picking up each additional device all the way back to the warning signs/flags (if necessary).

When performed in this manner, workers and vehicles performing the activity are always behind the established taper or devices as they are removed. In the public's eye, they are still in a visible work zone until the final device and/or warning sign is taken away.

Whenever setting up, performing maintenance or tearing down the work zone:

- Always use sound and consistent safety procedures.
- Always be aware of your surroundings.
- Never jeopardize your safety or the public's.
- And work at a safe and consistent pace

When you hurry, mistakes are made. A mistake in a work zone can be deadly!

### **Pedestrian safety**

If pedestrian travel routes - sidewalks or footpaths - are closed or altered due to construction activities, pedestrian traffic control is needed and should be included in the preplanning stages of the operations as well as the traffic control plan. TTC devices should be used to direct the public safely through or around the work zone, always allowing enough distance between them and the construction activities so no one is put in a dangerous situation.

When setting up pedestrian traffic control, do not guide pedestrians into potential contact with site vehicles and equipment; work zone operations, any unsafe conditions created by the work or into main traffic areas.

Always provide a safe, convenient, accessible path that replicates as close as possible, the normal path they would use. Ensure that paths are level, graded and smooth and that they are clear and defined. Take into consideration the young and the old, bicyclists, those who may operate baby strollers, etc. In some cases, public protection requirements may be directed by local codes and regulations. Be sure to do your homework so you understand any additional requirements for which you need to comply.

### Attractive nuisances

An attractive nuisance is a very real and potentially costly liability that must be addressed on construction projects, especially with regard to children. Children trespassing on your project can be injured by a hazardous object, equipment or condition that is likely to attract them. Many aspects of a construction project can seem inviting to a child or teen.

For example, a child or teen may want to climb on and sit in a piece of equipment or vehicle, use materials, spoil piles for ramps or other items when riding bikes, skateboards or motorcycles. Children are usually unable to determine the risks posed by the objects or conditions they are exposed to when on a construction site.

A construction site needs to be protected and secured to prevent trespass, especially to children. Some precautions that can be taken are:

- Installing perimeter fencing around accessible work areas.
- Locking out and making otherwise immobile, all construction vehicles and equipment at the end of the day.
- Placing warning and no trespassing signs at regular intervals around the project site.
- Marking, fencing, covering or otherwise protecting open excavations or other at or below grade structures that persons can slip, trip or fall into.
- Providing security lighting and cameras.
- Notifying local authorities of construction work schedules to enable off-hours monitoring.
- Hiring security personnel to monitor during off-hours.

### Equipment and technology

With advances in technology, a contractor today has the ability to supplement proven construction practices with

advances in tools and equipment. With so many advances in technology, it is critical that the contractor know what is available and when and where it can be used.

Technology available to support safe work zone operations and construction practices can play a significant role in enhancing safety procedures and minimizing losses. Some examples are:

- Rear back up cameras and sensing devices. These can be used to warn the vehicle driver of persons or other obstacles that may be in the path of the vehicle.
- Laser speed detectors used to document actual road user speeds when determining appropriate traffic control devices and measures.
- Solar powered temporary traffic signal systems used to replace or eliminate manned flagger stations.
- State-of-the-art attenuator devices for work zone protection.
- Installing mechanical lifting devices and platforms on vehicles used to set up maintain or tear down the work zone.
- Utilizing state-of-the-art communication and warning devices to control and communicate during work zone operations.
- Advances in tool design and capabilities.

### Training

All workers performing operations or activities within the work zone should be provided at a minimum, a job-specific orientation that includes:

- Training on hazards associated with the work zone
- Site safety procedures as well as any specific procedures that relate to their activities
- Training on safety equipment and or vehicles they will be utilizing, incident reporting and

- Any established communication procedures.

All workers should be trained in emergency response procedures specific to the work zone. As with the overall traffic control plan, when conditions or other factors change, the communication plan and procedures as well as worker training must be appropriately updated. Training must be specific to the site and detail established communication procedures and any traffic control procedures that must take place in the event of an incident.

Many jurisdictions have training requirements for flaggers to which you must adhere. You must understand what applies to you as the contractor working in that location. Some jurisdictions may require American Traffic Safety Services Association (ATSSA) or National Safety Council (NSC) flagger training certifications and some states or local governments have their own requirements.

### Claims Reporting

As with any type claim you may receive, whether it is workers compensation, auto or general liability, in order to achieve the benefits of effective claims handling and cost control, it is always important to properly and promptly report claims as soon as possible. It is very important that in addition to properly and promptly reporting the claim to your insurance carrier, the following practices should be considered as part of your risk management process:

- A formalized Accident Investigation program is in place which thoroughly investigates all claims with findings communicated to prevent reoccurrence.

- Always document, photograph and retain records of any accidents that occur in your work zone.
- Claim reporting procedures for field personnel are established and communicated

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### **Conclusion:**

Working within a work zone is very hazardous and simple mistakes or a lack of preplanning can lead to serious loss. Always ensure your work zone is properly designed and installed according to either a documented engineering study or the application of engineering judgment and based in part on the specific characteristics of the area, work zone operations, seasonal weather and local and state requirements.

Do everything in your power to ensure that the general public as well as the workers, who enter your work zone, exit safely!

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### **Additional References/ Acknowledgements:**

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