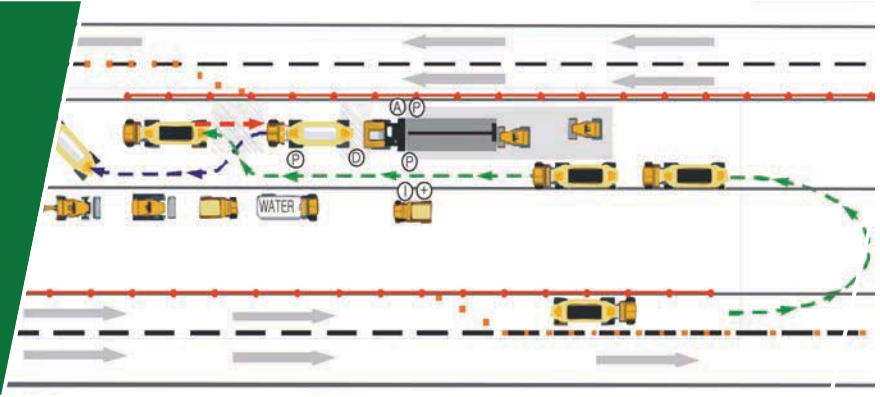

Guidance

Developing Internal Traffic Control Plans (ITCPs) for Work Zones

March 2016

Work Zone Safety Consortium

Preface

While the use of Internal Traffic Control Plans (ITCP) in work zones is not regulated by the U.S. Department of Transportation, Federal Highway Administration (FHWA) or by the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), adoption of an ITCP approach is an effective method of organizing the work space to reduce work zone injuries and fatalities. The concepts described herein are best practices gathered and evaluated by government researchers and private contractors who have studied ITCPs for nearly two decades.

ITCPs align with regulations issued by both FHWA and OSHA that require development and execution of safety programs for construction workers. For example, the national *Manual on Uniform Traffic Control Devices* (MUTCD)[1] contains the following description in Section 6B.01–Fundamental Principles of Temporary Traffic Control: "Road user and worker safety and accessibility in temporary traffic control (TTC) zones should be an integral and high-priority element of every project from planning through design and construction."

Objectives

This document explains the concept of Internal Traffic Control Plans or ITCPs, as applied in roadway construction work zones. Construction contractors, contracting agencies, and others responsible for work zone safety face the challenge of providing a safe workplace while ensuring the safe movement of all road users through and around the work zone. The concept of an ITCP involves coordination of construction traffic inside the activity area of a TTC zone. The purpose of an ITCP is to separate — to the extent possible — work vehicles and equipment from workers on foot.

Those involved in roadway construction are likely familiar with temporary traffic control plans (TTCPs), which describe how a specific work zone is to be set up to ensure the safety of the motoring public. However, workers, vehicles, and equipment within the work space are usually not addressed in the TTCP. The ITCP is a plan that project managers and others who have production responsibility for roadway construction projects can use to coordinate and control the flow of work vehicles, equipment, and workers operating in close proximity within the work space.

This document is organized into the following sections:

- ITCP Defined
- Need for ITCP
- ITCP Components
- Steps in Developing an ITCP
- Other Considerations
- Example ITCP Diagrams of Typical Work Operations and Worker Safe Zones
- Regulatory Background

Refer to http://www.workzonesafety.org for a copy of this document.

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Developing Internal Traffic Control Plans (ITCPs) for Work Zones

Internal Traffic Control Plans Defined

An ITCP is a method or protocol to coordinate worker, work vehicle, and equipment movements in the activity area of a work zone and to inform all parties operating within the activity area about the locations of others. The activity area is the section of the highway where the work activity takes place. It is comprised of the work space, the traffic space, and the buffer space. The ITCP goal is to minimize interaction between workers on foot and work vehicles and equipment. ITCPs also serve to reduce backing and other maneuvering by large trucks in the activity area.

The movement of workers, vehicles, and equipment within the work space should be planned in a manner similar to the way a TTCP (temporary traffic control plan) guides road users through the work zone. Whereas TTCPs focus on moving motorists safely through a work zone, ITCPs focus on keeping workers on foot from being struck by work vehicles and equipment within the work space. TTCPs and ITCPs share common principles, including:

- providing clear direction about the proper travel path to follow,
- separating moving vehicles from workers on foot,
- using TTC (temporary traffic control) devices to mark traffic paths, and
- maintaining a smooth traffic flow.

An ITCP can use TTC devices to mark travel paths *(Source: FOF/Kojadinovish).*

ITCPs help accomplish these functions by:

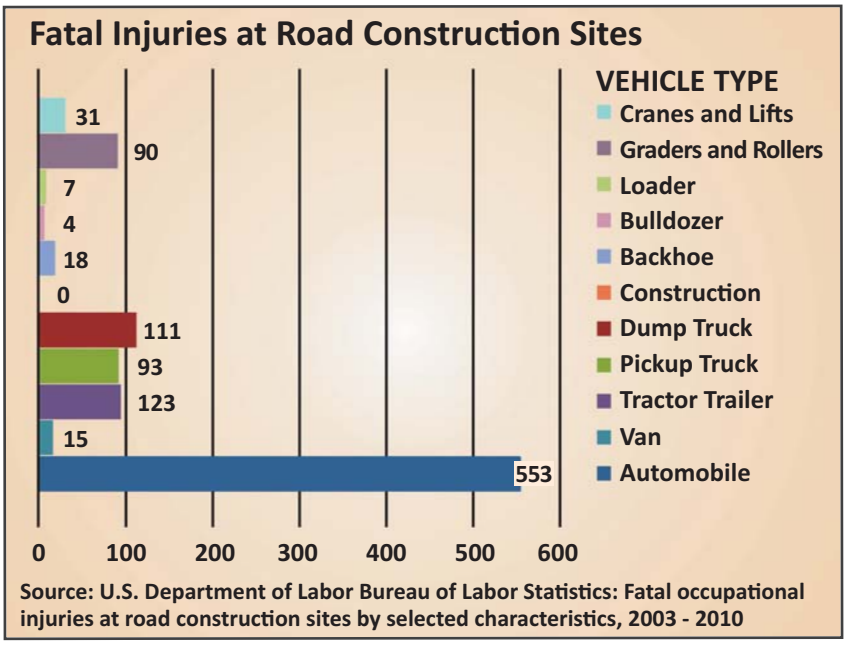
- designating safe areas for workers and appropriate routes for work vehicles and equipment,
- establishing “no go” zones for workers as well as for work vehicles and equipment, and
- defining specific operating procedures for trucks delivering materials in the activity area.

Need for Internal Traffic Control Plans

Each year, 50 to 60 highway workers are killed and thousands more are injured when struck by vehicles or equipment at road construction sites.[2] Although some of these fatalities are caused by motorists not paying attention or driving recklessly or impaired and intruding into the work space, an equal number of fatalities occur when work equipment or vehicles drive over or back over a worker.

ITCPs help protect workers on foot in the work spaces of an activity area. Because workers on foot often must work close to large vehicles and equipment, the movements of workers, equipment, and vehicles must be well coordinated. The hazard of proximity to equipment and vehicles is compounded by blind spots. A blind spot (or blind area) is the area around a vehicle or equipment that is not visible to the operator, either by direct line-of-sight or indirectly by use of internal and external mirrors. Each vehicle has its own unique blind spots. When a worker on foot enters a blind spot, the worker is virtually invisible to the operator.[3]

ITCPs also help reduce risks for vehicle and equipment operators by identifying hazardous locations (i.e., drop-offs, overhead power lines, etc.) and safe travel paths around the job site.



Source: U.S. Department of Labor Bureau of Labor Statistics: Fatal occupational injuries at road construction sites by selected characteristics, 2003 - 2010

ITCP Components

The main components of an ITCP are:

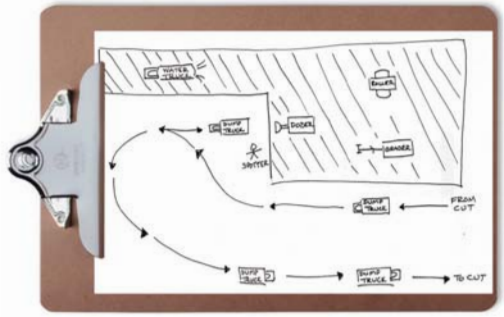
- ITCP diagrams,
- ITCP legend, and
- ITCP notes.

The above ITCP diagram includes a legend and notes *(Sources: ARTBA and FOF Communications; clipboard drawing below: FOF).*

The heart of the ITCP is the diagram showing the layout of the work space and the movement of personnel and construction vehicles within the work space. The ITCP will include the access and egress points for the work space, so it may also show portions of the overall work zone. While the diagram does not have to be to scale, it should be adequate to give those reviewing the plan a good concept of how the safety features will function.

The ITCP legend explains the symbols used on the ITCP diagram. Standard symbols for devices and vehicles can be based on those used in the national *MUTCD*, if desired. However, additional details on classes of personnel (e.g., spotters, other workers) and vehicle types are needed in developing an ITCP. In many cases, simple hand-drawn symbols are adequate such as those for the dozers, spotter, and dump trucks in the hand-drawn example below.

The ITCP notes contain safety points, injury reduction measures, site-specific provisions, and duties of various contractor personnel. The ITCP notes should include provisions for communication between workers, assignment of spotters for backing trucks and equipment, and site speed limits.



While some ITCPs can be fairly informal and quickly implemented as part of the daily work shift safety briefing (see example to the left), others may need to be more extensive and involve several hours of staff time to develop and implement. The method of getting the information out to workers should be covered in the communications plan (see Step 8 on page 9). The level of detail included in an ITCP should be consistent with the size of the project and the number and frequency of worker safety risks that will exist. For example, items that may be included in the ITCP notes and diagrams for a more complex jobsite might include the following:

- contact information for the general contractor and all subcontractors,
- designated worker and visitor parking areas,
- procedures for orienting independent truck drivers to the activity area/work space and ITCP,
- delineated areas around specific equipment and operations where workers on foot are prohibited,
- designated locations for storing materials and servicing equipment,
- schematic diagrams depicting movement of workers on foot, work vehicles, and equipment within the activity area,
- descriptions of internal signs and other internal traffic control devices that will be used,
- speed limit for operating vehicles and equipment within the activity area,
- specifications for any lighting that will be required in the activity area,
- description or drawing of how the ITCP relates to the TTCP,
- a training plan about the ITCP for all site personnel, and
- an operations communications plan including how the ITCP will be monitored and enforced (the development of this plan is discussed in greater detail in the following section).

Steps in Developing an ITCP

The following section describes an 8-step approach that can be followed to achieve a safe and effective ITCP.

Step 1. Identify project and ITCP scope.

Ideally, the ITCP should be considered from the very beginning of a project because some important elements — such as the size of the work space — will be dictated by such things as the amount of right-of-way available and the number of lanes that will be closed. To facilitate proper separation between workers on foot and the required work vehicles and equipment, adequate space is necessary. If such considerations are not anticipated from the beginning, it will be more difficult to organize a complete ITCP.

The site-specific portion of the ITCP development will generally begin after the contract is awarded, but before construction work actually begins. This is an ideal time to negotiate responsibility for executing certain elements of the ITCP. Duties can be assigned to the roadway owner, project engineer, superintendent, foremen, and other personnel. Risk can be properly allocated and processes can be defined – such as participation in safety meetings, how and if law enforcement will be used, location of access and egress points, and the amount of lane encroachments.

STEPS IN DEVELOPING AN ITCP

1. Identify project and ITCP scope.
2. Determine construction sequence.
3. Determine locations and safe movements for vehicles, equipment, and workers within each operation; draw diagram(s).
4. Determine vehicle and equipment movements to and from each operation.
5. Determine safe movements for workers to and from and within each operation.
6. Assess and resolve potential internal traffic conflicts.
7. Identify individuals who will need to understand and use the ITCP.
8. Develop the ITCP communication plan.

The ITCP should be completed and distributed before the work begins *(Source: ARTBA).*

Development begins with an assessment of what the ITCP needs to cover from the list of potential topics provided above. The ITCP designer should determine the limits of the project and also asses the amount and speed of traffic that will be passing by the work space. In addition, any equipment and materials staging areas, batch plants, etc., should be included. In many cases, these will have been identified during bid preparation activities for the project. The contract document most relevant to ITCP preparation is the project plan, which is annotated with information such as access points and work sequencing plans. Also, a plan and cross section of the site and the construction sequence should be reviewed.

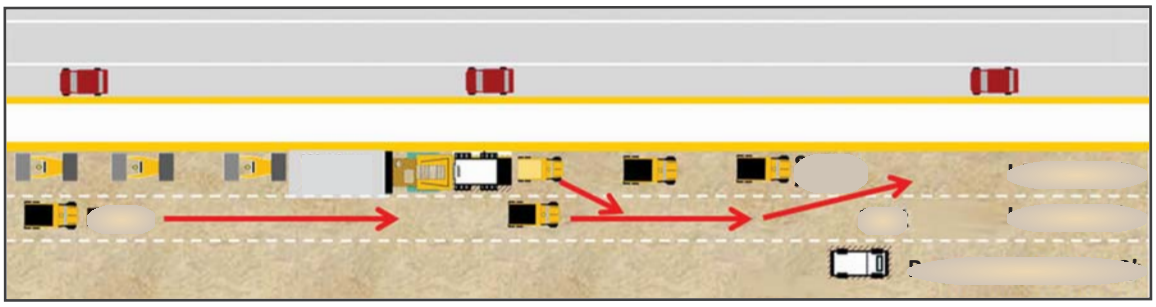
The location of any hazardous areas should be identified at this time. Hazardous locations to be identified and checked include, but are not limited to:

- areas where work will have to occur close to moving traffic without positive protection,
- overhead power lines,
- underground utilities,
- bridges and overpasses (especially if these are or will be near or below minimum height requirements), and
- any holes, trenches, or significant drop-offs that will exist during the project.

Underground utilities are one example of the hazards to be identified in the ITCP *(Source: Interserv).*

Step 2. Determine the construction sequence during the project.

In this step, major work tasks or operations (paving, trenching, or earthwork, etc.) should be identified. The overall space requirements for each operation during a particular work shift should be estimated, as should the frequency with which these operations move (e.g., daily, for each phase or stage of construction, etc.). Any significant sub-operations for each task (such as sampling, watering, loading/offloading material and equipment, equipment cleanout, etc.) and the locations of those sub-operations should be identified as well.



ITCP diagram for paving *(Source: NIOSH/ARTBA).*

Finally, the types of vehicles and equipment required for each operation and sub-operation should be listed, along with an estimate of the numbers of workers on foot.

Paving *(Source: pavementinteractive.org).*

Step 3. Determine locations and safe movements for vehicles, equipment, and workers within each operation and draw the basic work area diagram(s).

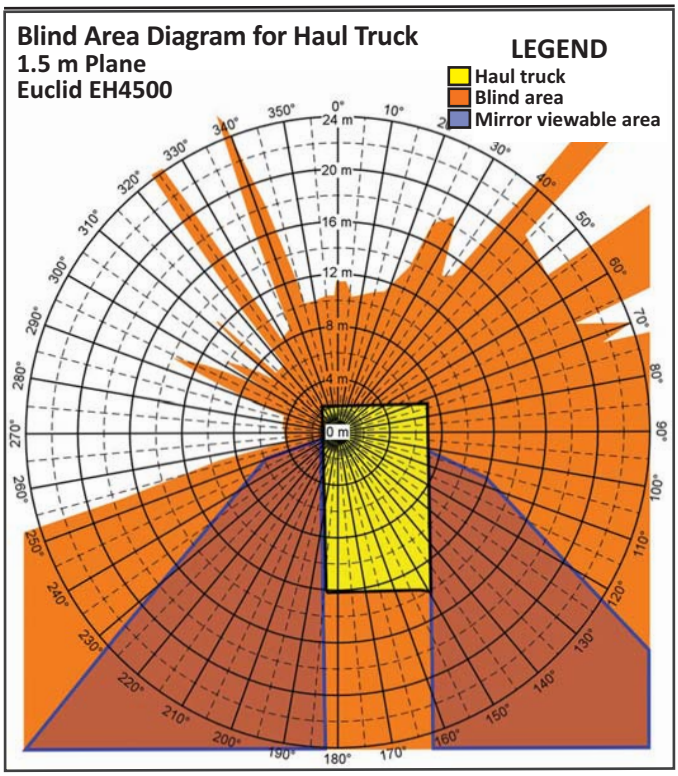
This step is where the actual planning and design of the ITCP begins. For each operation and sub-operation that will occur in the project, the following should be noted on a site drawing:

- layout of each vehicle and equipment used,
- typical location of each within the operation,
- typical range of movements,
- equipment swing radii,
- potential pinch points between work vehicles and equipment during work activities, and
- blind areas around each vehicle or equipment.[4]

Long backing maneuvers for trucks, other work vehicles, and equipment should be avoided.

Workers on foot should be located as far as possible from vehicle paths. Parking, toilet, and break areas should be staged away from the principal conflict points.

Construction equipment is typically large and has an enclosed cab. These characteristics can make the blind areas very large. Also, the size of construction vehicles and equipment often place truck drivers and equipment operators high above the ground. They cannot see workers on foot passing close to them.

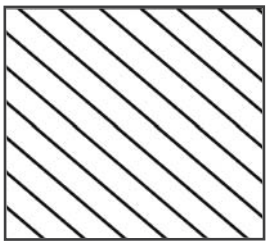


Example blind spot diagram for a haul truck *(Source: NIOSH).*

The National Institute of Occupational Safety and Health (NIOSH) has produced diagrams of the blind areas around a large number of vehicles. These diagrams provide information on where workers on foot cannot be seen directly and

areas where they can only be seen through rear-view mirrors.[4] The diagrams can be accessed and downloaded at http://www.cdc.gov/niosh/topics/highwayworkzones/BAD/imagelookup.html). These diagrams can be placed directly onto a drawing, if desired.

Once the typical layout of vehicles and equipment is created for the operation, locations where workers on foot should and should not stand or walk ("worker-free zones" or "no-go" zones) can be determined and placed on the diagram.

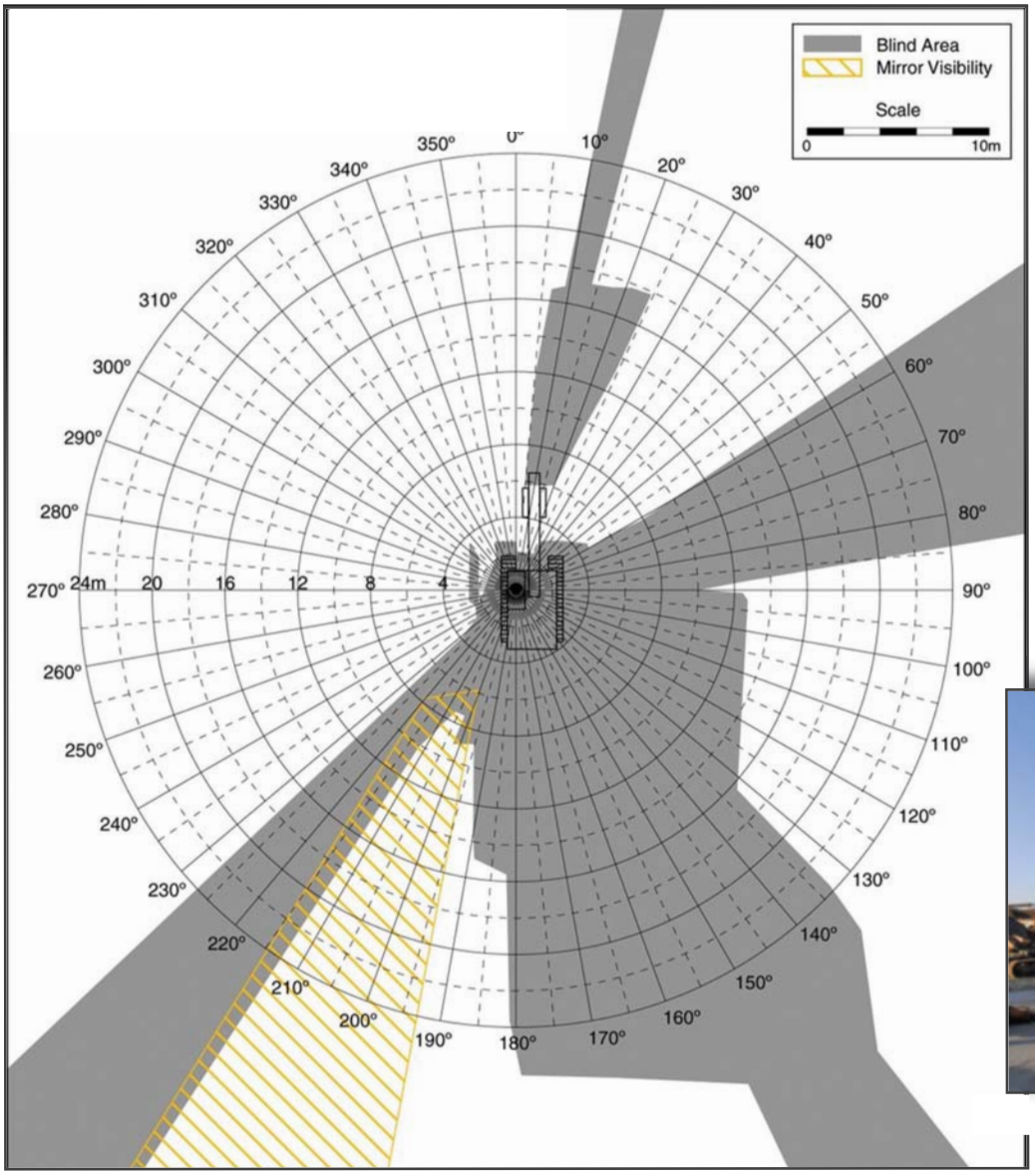


Symbol for worker-free or no-go zone.

These zones should include:

- locations of potential pinch points between vehicles,
- locations within equipment turn radii, and
- blind areas around vehicles and equipment. .

Similarly, equipment and vehicle no-go areas should be identified around the different hazards that may exist on site. An example of identifying unsafe areas is shown in Figures 1 and 2 on pages 6 and 7.



Example blind spot diagram for a hydraulic excavator *(Source: NIOSH).*

It should be noted that it is not necessary for an agency or contractor to perform this step each time it prepares an ITCP for a particular project. Rather, agencies and contractors can examine their common work operations and determine these typical vehicle and equipment layouts and movements for each one. Then, for future projects, these typical diagrams can be adapted as necessary on future project ITCPs, with attention focused primarily on how vehicles and workers move to and from the various work operations within each project.

325B *(Source: cervettitractor.eu).*

ITCP Diagram: Dirt Spreading Operation With Limited Backing Distance

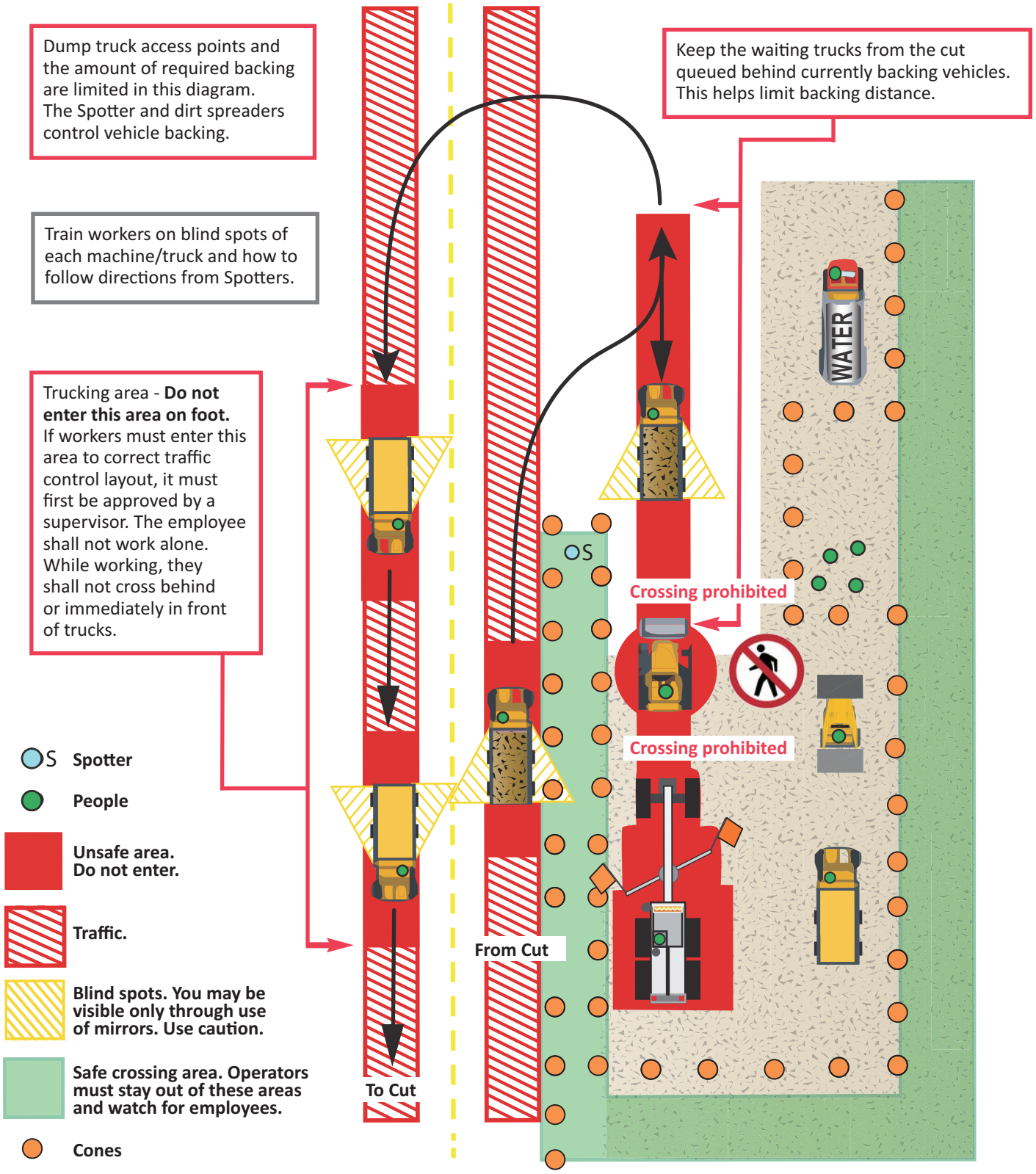


Figure 1. Example diagram of vehicle, equipment, and worker locations and movements for a dirt spreading operation *(Source: Adapted from The Roadway Safety Alliance, Internal Traffic Control Plans, 2008)*[5]

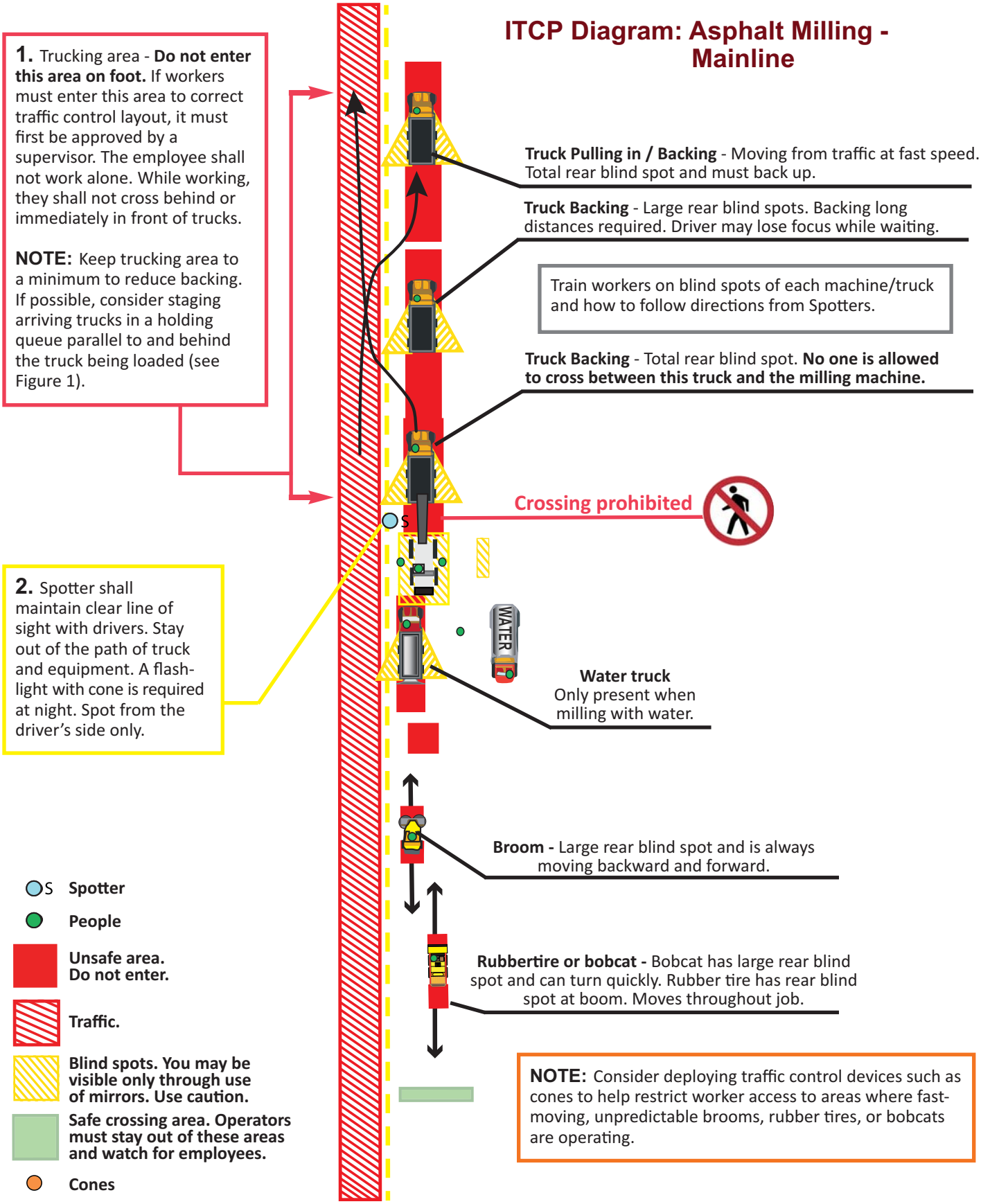
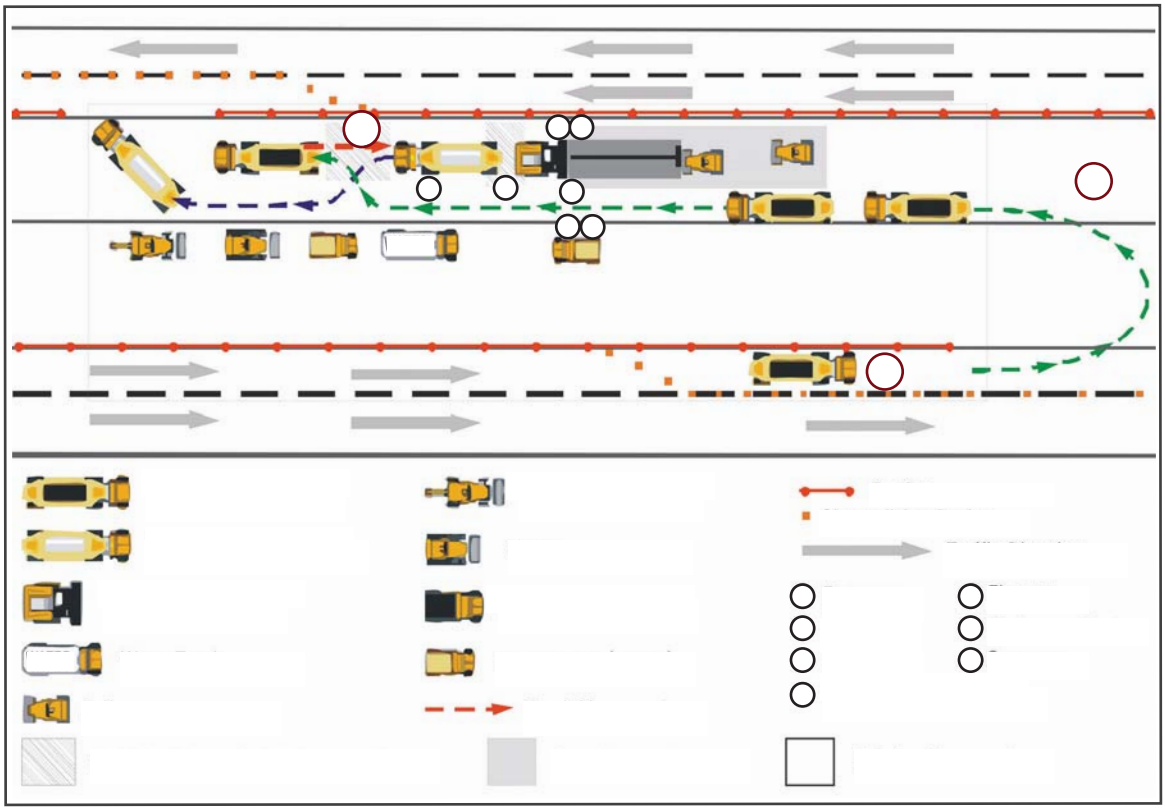


Figure 2. Example diagram of vehicle, equipment, and worker locations and movements for an asphalt milling operation *(Source: Adapted from Barriere Construction, Safe Zones, 2014)*[6]

Step 4. Determine vehicle and equipment movements to and from each operation.

Access to and egress from the work space and to each operation/sub-operation is the next activity to consider in ITCP development. Guidance on methods of providing good access and egress can be found in *Guidelines on Work Zone Access and Egress.*[7] Once the vehicle or equipment enters the work space, the ITCP should illustrate how vehicles are to progress to the operation destination.

On major projects with multiple simultaneous operations, specific work vehicle and equipment travel lanes may be designated using TTC devices to provide clear path guidance to drivers and to warn workers on foot. In these situations, care should be exercised regarding the types and placement of TTCDs used to ensure motorists passing through the traffic space either do not see the devices or do not clearly understand that the devices are intended for work vehicles and equipment, and not for the traveling public.



Example ITCP diagram of material delivery vehicle queuing locations with legend. This layout is designed to reduce backing *(Sources: NIOSH/ARTBA/FOF).*

For certain operations, continuous deliveries and/or removals of materials by multiple vehicles are required. Establishing a safe location for such vehicles to queue and wait their turn is critical. In the example ITCP above, asphalt delivery trucks queue both in the opposite direction closed lane ◯ and in the direction of paving ◯, behind and to the left of the paving operation. (Proper temporary traffic control is used in the closed lane to create the queuing location via a temporary lane closure.) Backing maneuvers but one ◯ are eliminated in this example ITCP.

Step 5. Determine safe movements for workers to/from and within each operation.

After determining vehicle and equipment locations and movements within each operation and the travel paths to and from the operations from the work space access and egress points, consideration must be given to how workers on foot will move, as needed, around the project. The following should be noted on the drawing:

The many elements of a project should be diagramed or noted in the ITCP *(Source: Arkansas Democrat-Gazette).*

- location of worker parking and visitor parking (if applicable),
- path workers will take from the parking lot/staging area to the work operation,
- location of portable toilets relative to work operation,
- location of break areas, such as shady spots, relative to the work operation, and
- staging areas.

The objective of this effort is to ensure that workers will not cross active work vehicle and equipment paths before or after work shifts, as part of normal work duties, or during rest breaks. In addition, workers should not have to cross active travel lanes. In more complex work zones, TTCDs may be needed to delineate the safe worker movement areas and travel paths.

Step 6. Assess and resolve potential internal traffic conflicts.

An internal traffic conflict between workers on foot and equipment *(Source: pavementinteractive.org).*

After all work operations, vehicle and equipment paths, and worker movements and paths have been laid out, the next step is to identify and resolve potential conflicts, such as the one in the photo on the left.

Many work operations move along the project, whereas others occur at a fixed location for only a few days. Taking a critical overview of how work will progress will aid identification of potential ITCP conflict times and locations so that adjustments can be made to the task schedule and/or sequencing of work operations.

ITCP conflicts may also occur sporadically due to weather or other shifts in schedule as work progresses during a project.

The shift supervisor responsible for ensuring the implementation of the ITCP should perform a daily check of potential conflicts that could occur, make appropriate changes to the plan, and communicate those changes to all individuals who need to understand and use the ITCP (see Steps 7 and 8).

Step 7. Identify individuals who will need to understand and use the ITCP.

The ITCP should be an integral part of the project's safety plan and contractor planning phase. If safety professional(s) are employed, they typically will lead the creation of the ITCP, and the site supervisor will oversee implementation. In other situations, project managers, foremen, supervisors, and other lead persons may need to work together to come up with a safe ITCP. For this reason, they all should be taught the principles of safe construction traffic control. Some of these personnel will also be in charge of daily setup and monitoring of the ITCP. Table 1 on page 10 displays the personnel and their specific duties.

A variety of key people must understand and use the ITCP *(Source: ARTBA).*

Safety professionals (safety managers, safety coordinators, company safety directors, etc.)	Ensure site-specific ITCP is created
	Ensure all construction supervisors are familiar with the plan
	Assist and advise in plan execution
Superintendent/project manager, project or area engineer	Oversee ITCP implementation
	Assign personnel to carry out the plan
	Ensure changes are made to ITCP as site conditions change
	Learn ITCP elements and how to comply
	Take responsibility for personal safety and apply training lessons
Truck supervisors or managers	
	Assist in communicating safe site procedures with all truck drivers
	Receive navigation assistance (spotters) when appropriate
Equipment operators	Stay out of areas designated for workers on foot
	Do not move until the blind area is checked or a spotter is designated
	Ensure equipment operators know where the spotter is located; make eye contact with the operator
	Receive training in safe spotting procedures and know the signals

For high-profile projects, there may be a number of visitors to the site from time to time. These could include surveyors, OSHA, senior management, and others. Ensuring that these individuals are properly and fully informed of the ITCP is an important consideration.

Step 8. Develop the ITCP communication, monitoring, and enforcement plan.

The final step in the ITCP development process is to establish the plan for communicating, monitoring, updating, and enforcing the implementation of the ITCP. Ultimately, the ITCP should fold into the overall safety plan for the site. One of the greatest contributions of ITCPs is improved communications.

A communications plan will likely include one or more of the following elements:

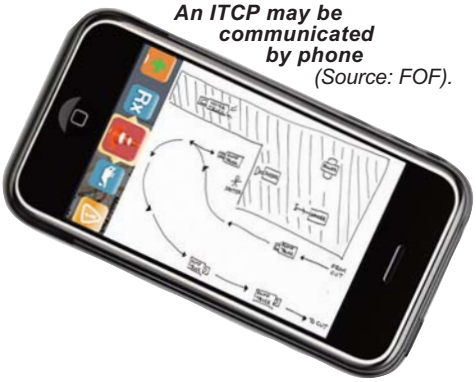
- specific notes regarding safe zones and unsafe (no-go) zones identified during development of the ITCP diagrams,
- statements of the consequences of violating the zones and other aspects of the ITCP (such as the internal vehicle path speed limits),
- statements on how violations of the ITCP will be identified and reported,
- notes on safe backing requirements, such as how workers will communicate with truck drivers during any backing operations (designating the spotter, common hand signals, etc.),
- procedures on how workers may enter any areas not designated for workers (QA or Quality Assurance tests, for example),
- protocols to be followed by workers in communicating with equipment operators and specific directions on where workers will stand when equipment is working,
- rules for workers to follow if they must cross vehicle or equipment paths (e.g., making eye contact and receiving confirmation from operator, maintaining 360^{o} awareness while crossing, etc.),
- the chain-of-command review that will be followed regarding any necessary changes to the ITCP, and
- method(s) to be used to assess how well the ITCP is working and the steps that will be used to adjust the plan if necessary.

An ITCP should provide rules for workers if they must pass vehicle paths *(Source: ARTBA).*

During this step, responsibilities for key personnel are assigned and any remaining training is conducted to implement the communications plan and educate project staff on its content. Onsite workers are provided training in both overall ITCP concepts and in specific implementation elements at their assigned work areas.

The methods by which all individuals requiring knowledge of the ITCP will be educated must be defined. These may include:

- pre-project training of staff assigned to the project,
- drawings and bullet points regarding the acceptable vehicle and equipment access points and travel paths that will be provided to all delivery drivers, and
- daily updates of the ITCP as part of the pre-shift safety talks.



An ITCP may be communicated by phone *(Source: FOF).*

The process required for setting up an ITCP communications plan can translate into better communications and productivity for the overall project. Relevant ITCP elements include:

- creating notifications for the chain of command,
- creating lists of key contact persons and emergency responders, and
- organizing daily communications with site personnel.

Such elements create a process for dealing with day-to-day project management issues.

An air horn may signal to stop work *(Source: Slater-Gartrell).*

The ITCP communications plan requires specific items that may not be considered for other project communications. The ITCP will anticipate a means to communicate with workers, operators, truck drivers, etc., about routine changes to the plan. The ITCP communications plan will cover worker-to-operator/driver communications when internal traffic and worker paths cross. This includes hand signals, radio communications, lighting, etc. The ITCP will cover a process for communicating with the truck boss and drivers daily to explain the routes and precautions.

A very simple communications tool is an air horn, which can be sounded if there is a problem, with instruction to stop all operations.

A radio may convey instructions *(Source: UTV Inc.).*

To function properly, the ITCP must be reviewed and modified each day before the beginning of each shift so employees can receive instruction on how it will be implemented that day. In addition, ITCPs may be modified more frequently as conditions change throughout the day.

Other Considerations

In addition to the concepts discussed above, two other basic issues should be considered during ITCP development and implementation: worker visibility and human factors.

Worker Visibility.

Workers must be clearly visible to drivers and operators. Section 6D.03.04 of the 2009 MUTCD[1] states that all workers, including emergency responders, within the right-of-way who are exposed either to traffic or to work/construction vehicles in the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements. High visibility garents are now required by both FHWA and OSHA for all workers, not just those exposed to motorists/on-road traffic. These agencies require workers to be dressed in a minimum ANSI Class II vest. The composition of these vests is explained in a standard known as the ANSI/ISEA 107 "American National Standard for High-Visibility Apparel."[8] This standard describes three classes of vests. An ANSI Class I or “unrated” vest is not appropriate for roadway construction workers.

Example Class III high-visibility garments *(Source: ARTBA/FOF).*

The most common class of garment for road construction work is Class II. A Class II vest will not likely have sleeves, but is closed on the sides and must be fastened in front to provide coverage at 360 degrees. The background fabric must be fluorescent and have retroreflective tape on the front, back and sides.

A Class III garment is appropriate for night work and some daylight situations where workers need maximum visibility. Class III garments may be created by adding pants (Class E) to a Class II vest, or by using a vest or jacket that covers the full torso and has full or partial sleeves.

When choosing a garment, consideration should be given to the appropriate fluorescent color. Some states have speciific regulations as to garment color. If a jurisdiction is not specific, follow the ANSI/ISEA standard that requires the worker to be distinguished from the background. In other words, if workers are near a lot of orange barrels and equipment, then yellow-green might be the best color. If they work around green foliage and trees, then orange-red would be best.

Human Factors.

When developing an ITCP, it is important to consider human behavior. The checklist in the box to the right identifies some of the critical human factor elements for an ITCP. Radio and cell or mobile phone use poses unique safety challenges on the job site. When talking on the phone, people often plug the ear away from the phone and look to the ground so they can concentrate on the call in a busy, noisy environment. When they do so, they will not see dangers or hear alarms.

Example ITCPs

The following figures present some examples of how a contractor can establish “typical” diagrams of work operations for vehicles, equipment, and workers. Consistency is evident in the example diagrams so that the fundamental concepts are easy to grasp and maintain by the work crews on site. Notes that can be used to review these diagrams during each pre-shift safety meeting are included.

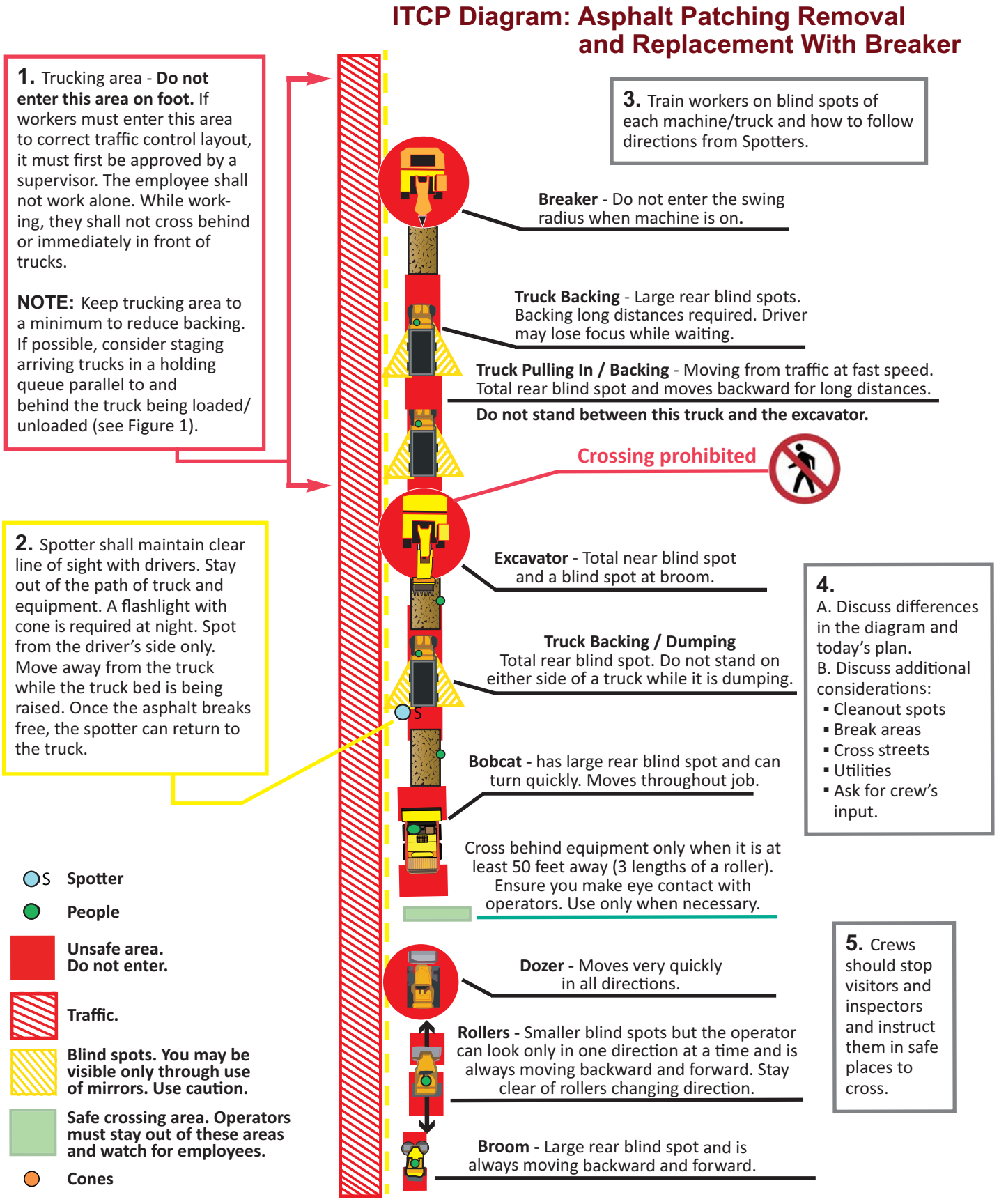


Figure 3. Example diagram of vehicle, equipment, and worker locations and movements for asphalt patching removal/replacement *(Source: Adapted from Barriere Construction, Safe Zones, 2014)*[6]

ITCP Diagram: Asphalt Patching Removal and Replacement With Milling Machine

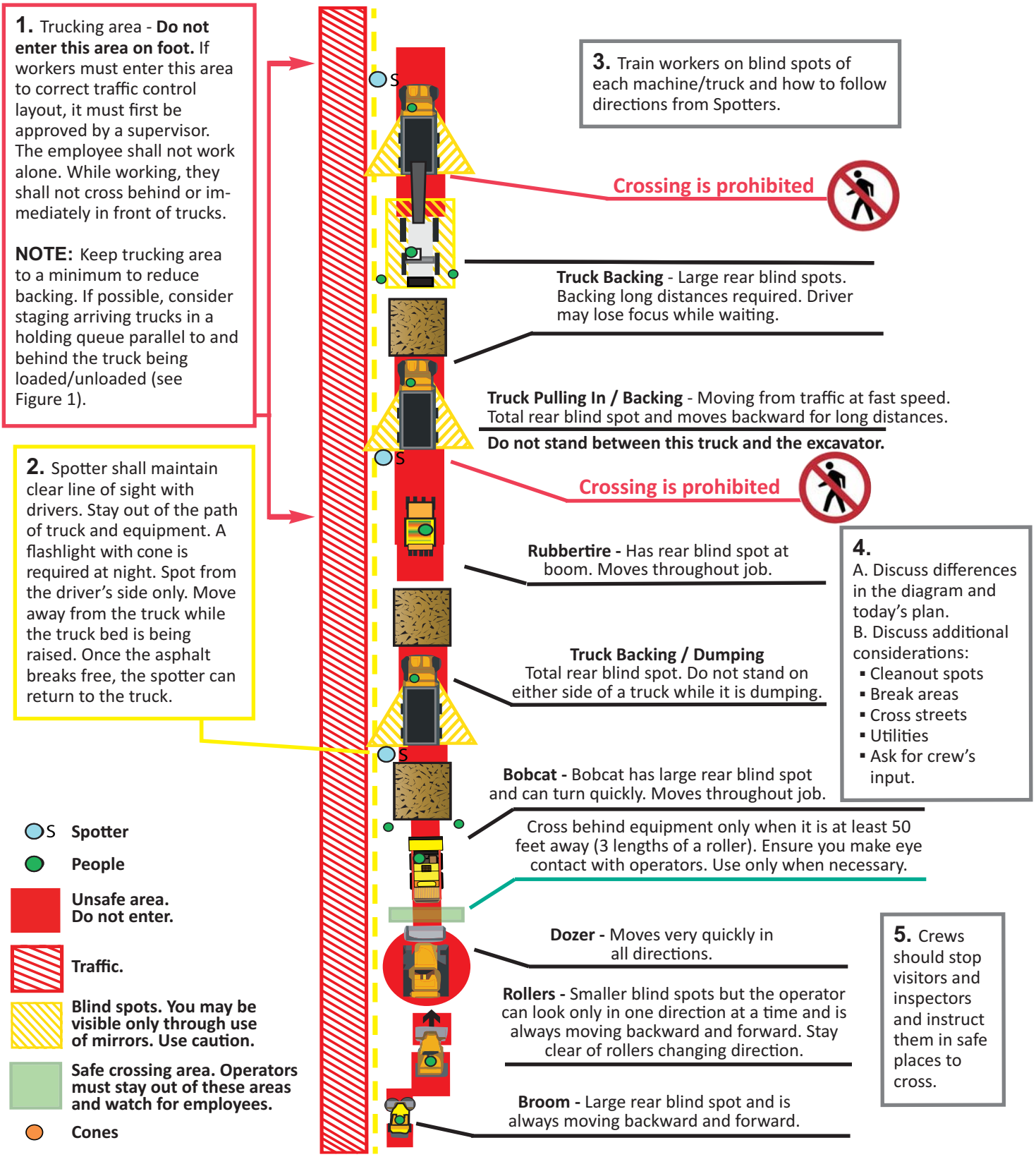


Figure 4. Example diagram of vehicle, equipment, and worker locations and movements for asphalt patching removal/replacement with milling machine *(Source: Adapted from Barriere Construction, Safe Zones, 2014)*[6]

ITCP Diagram: Cutting Soil Cement

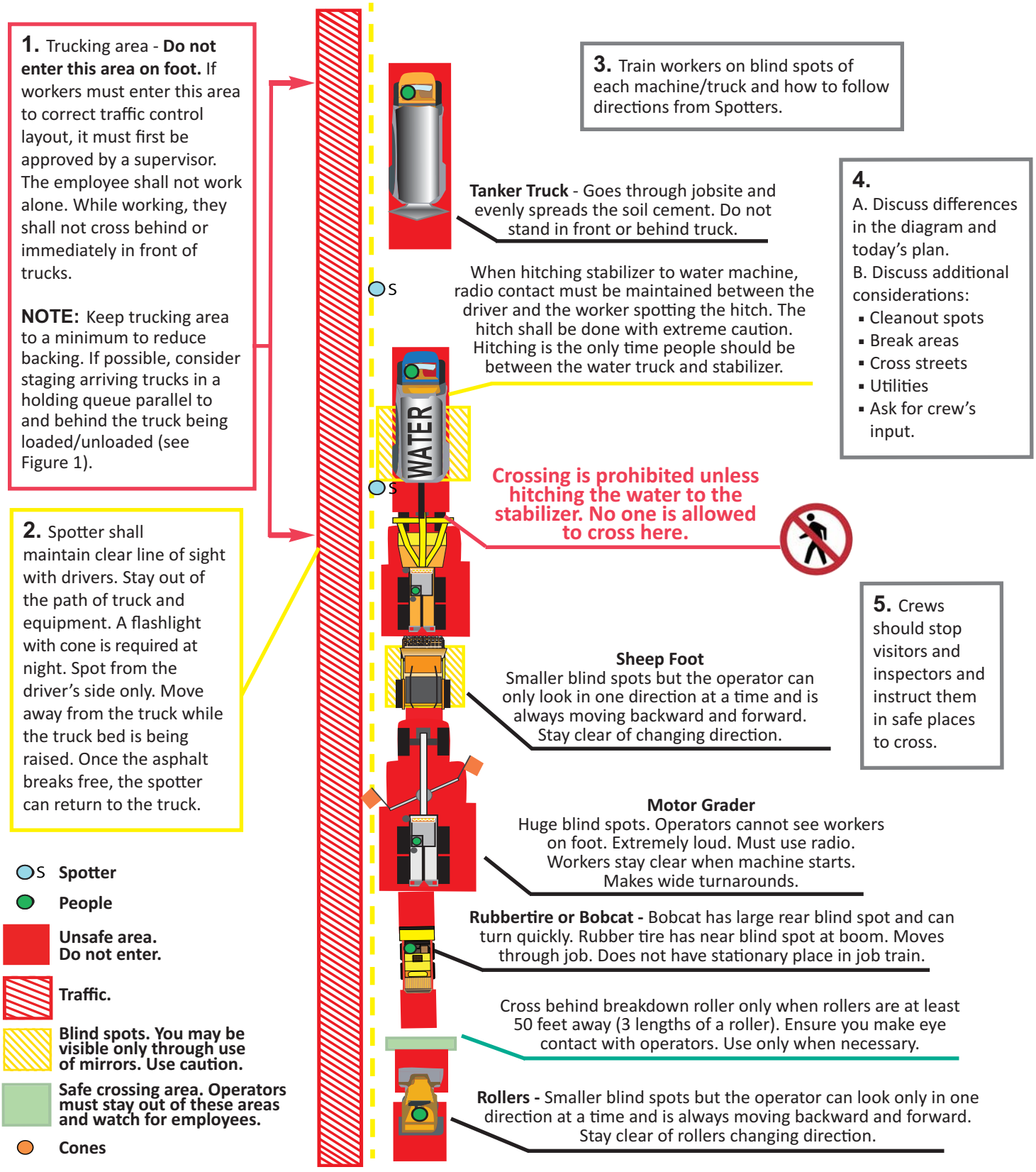


Figure 5. Example diagram of vehicle, equipment, and worker locations and movements for cutting soil cement
(Source: Adapted from Barriere Construction, Safe Zones, 2014) [6]

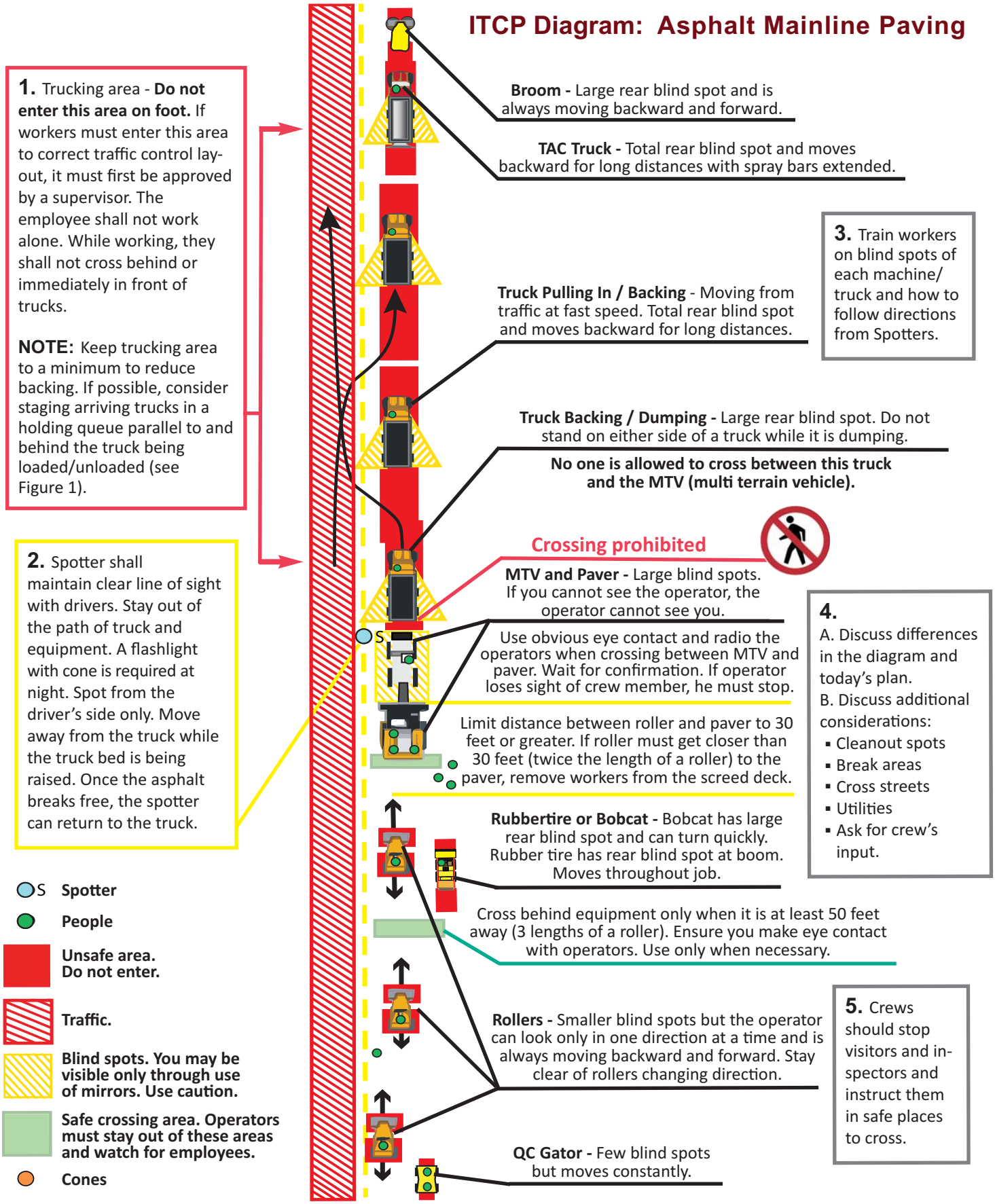


Figure 6. Example diagram of vehicle, equipment, and worker locations and movements for asphalt mainline paving *(Source: Adapted from Barriere Construction, Safe Zones, 2014)*[6]

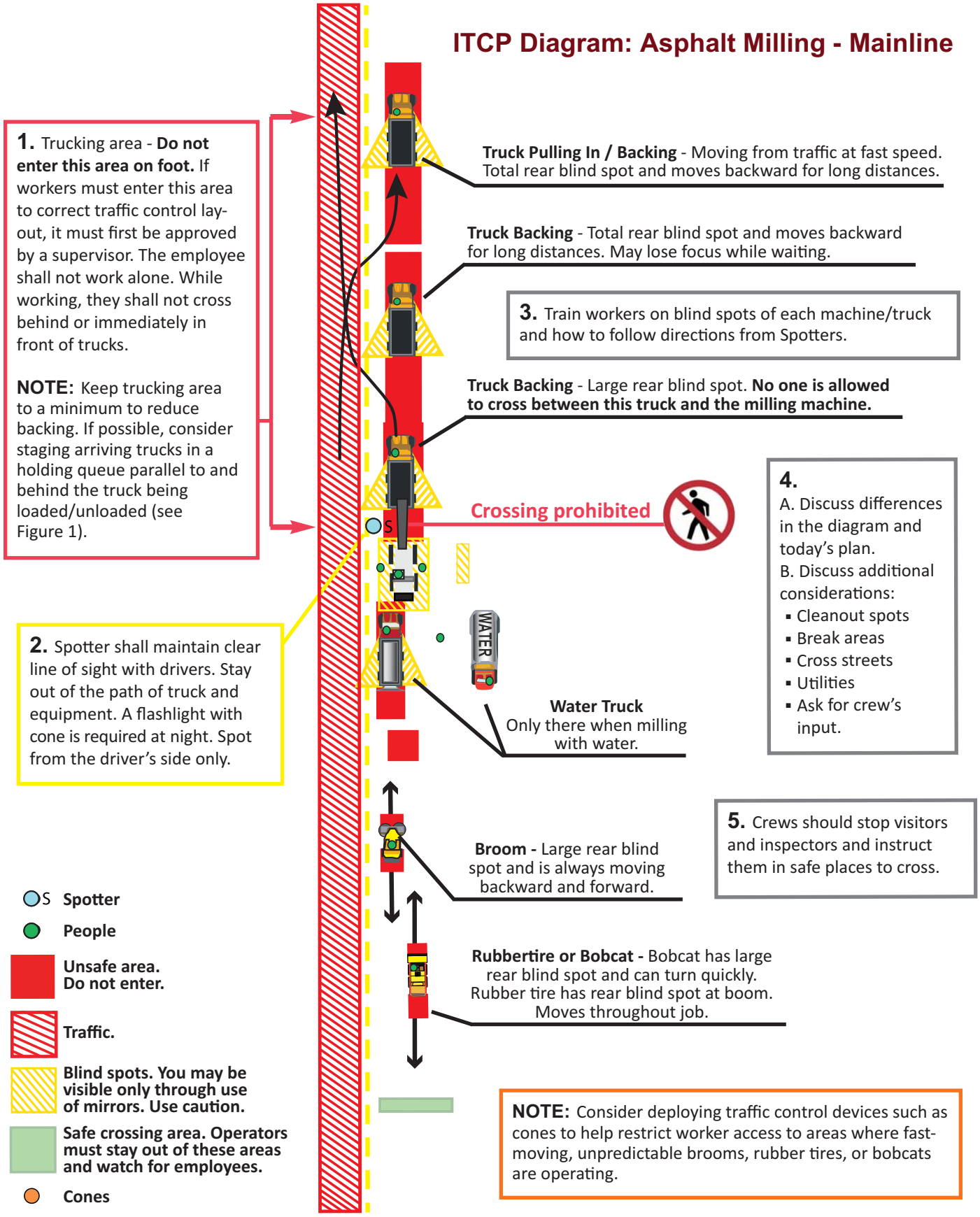


Figure 7. Example diagram of vehicle, equipment, and worker locations and movements for asphalt milling mainline ***(Source: Adapted from Barriere Construction, Safe Zones, 2014)***[6]

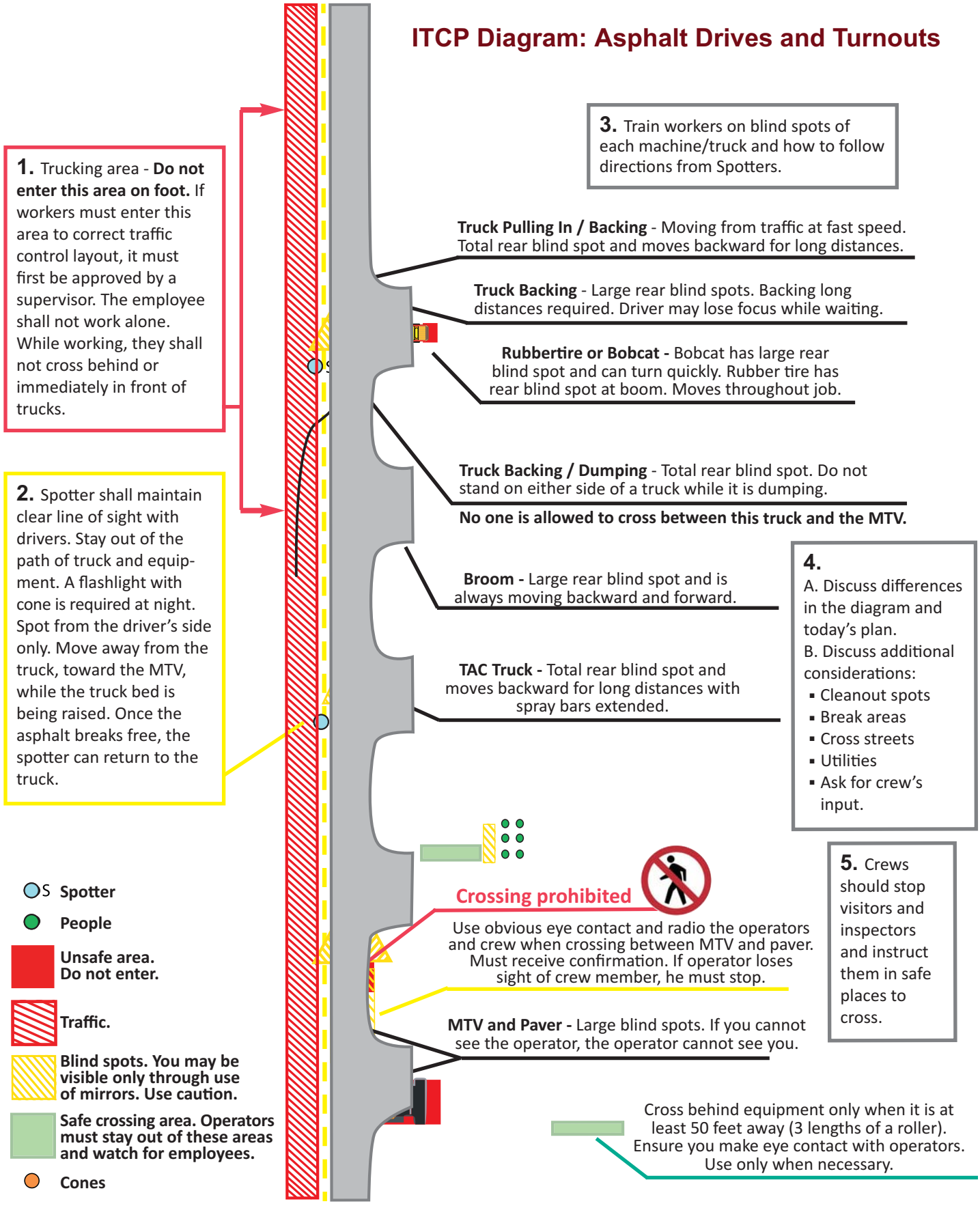


Figure 8. Example diagram of vehicle, equipment, and worker locations and movements for for asphalt drives and turnouts ***(Source: Adapted from Barriere Construction, Safe Zones, 2014)***[6]

ITCP Diagram: Asphalt Milling - Parking Lot

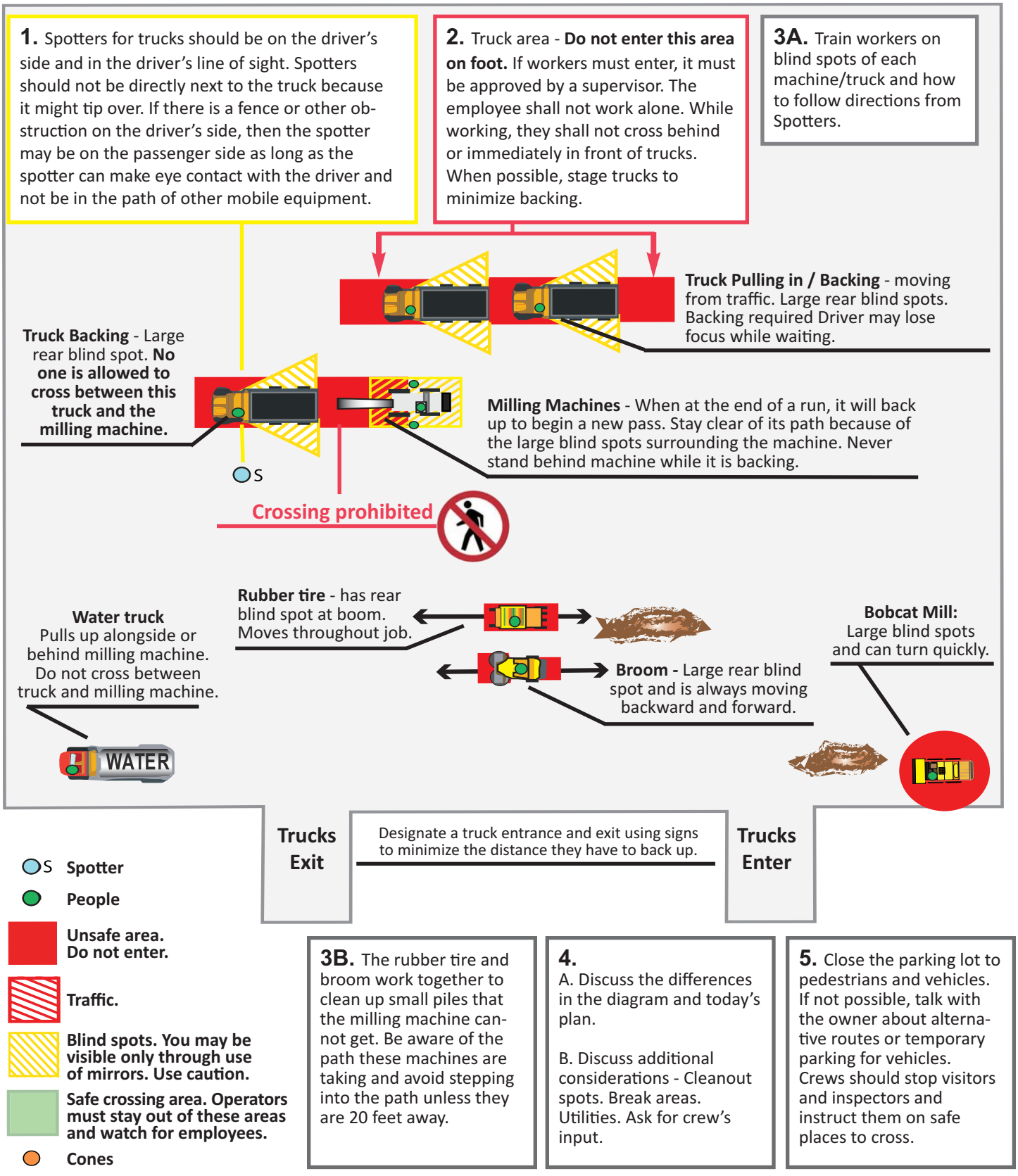


Figure 9. Example diagram of vehicle, equipment, and worker locations and movements for an asphalt milling parking lot ***(Source: Adapted from Barriere Construction, Safe Zones, 2014)***[6]

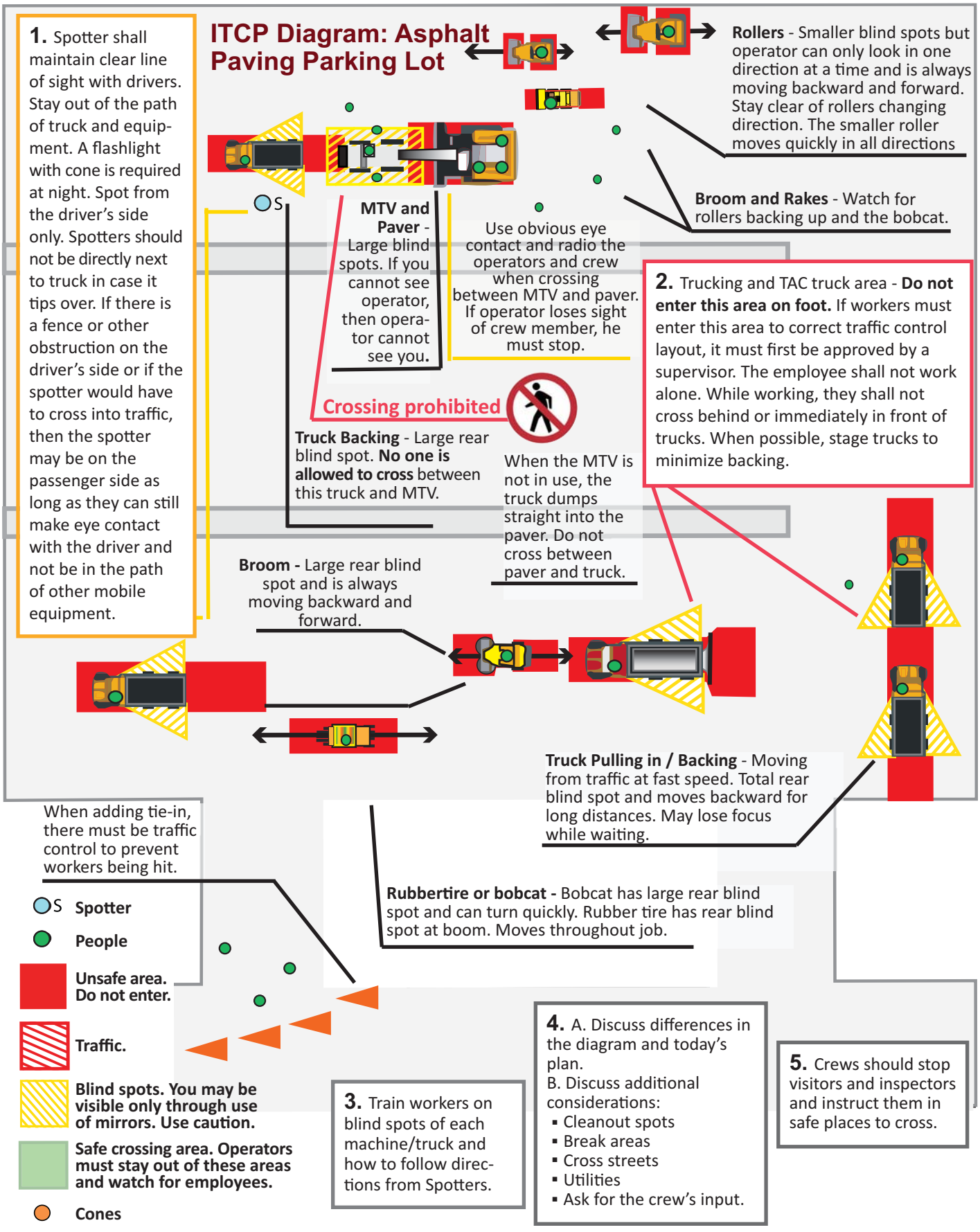


Figure 10. Example diagram of vehicle, equipment, and worker locations and movements for an asphalt paving parking lot *(Source: Adapted from Barriere Construction, Safe Zones, 2014)*[6]

Regulatory Background

Worker Safety Considerations
MUTCD[1] Sections 6D.03 and 6D.04

All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled "American National Standard for High-Visibility Safety Apparel and Headwear" (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure, except as provided in Paragraph 5. A person designated by the employer to be responsible for worker safety shall make the selection of the appropriate class of garment.

Equally as important as the safety of road users traveling through the TTC zone is the safety of workers. TTC zones present temporary and constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for workers on or near the roadway.

Maintaining TTC zones with road user flow inhibited as little as possible, and using TTC devices that get the road user's attention and provide positive direction are of particular importance. Likewise, equipment and vehicles moving within the activity area create a risk to workers on foot. When possible, the separation of moving equipment and construction vehicles from workers on foot provides the operator of these vehicles with a greater separation clearance and improved sight lines to minimize exposure to the hazards of moving vehicles and equipment.

Guidance: The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

A. Training—all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.

B. Temporary Traffic Barriers—temporary traffic barriers should be placed along the work space depending on factors such as lateral clearance of workers from adjacent traffic, speed of traffic, duration and type of operations, time of day, and volume of traffic.

C. Speed Reduction—reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers or flaggers, should be considered.

D. Activity Area—planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.

E. Worker Safety Planning—a trained person designated by the employer should conduct a basic hazard assessment for the worksite and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, "General Duty Clause" Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1926.20 (b)(2) of "Occupational Safety and Health Administration Regulations, General Safety and Health Provisions" (see Section 1A.11).

OSHA construction industry regulations (29 CFR 1926, Subpart O) address operation of vehicles and equipment within an off-highway jobsite not open to public traffic. However, Subpart O is not exhaustive in its coverage of machinery types or safety equipment, nor does it address work practices, traffic control plans, or shift work. Flagging and signaling practices are discussed in general terms in Subpart G, which covers signs, signals, and barricades. Subpart G defers to the 1988 and Millennium editions of the MUTCD on matters relating to hand signals, barricades, and traffic control devices.[9]

More on point, on March 28, 2012, OSHA issued a "Request for Information" (RFI) regarding backing safety. The RFI indicates the agency is interested in developing a new standard that may regulate backing hazards more directly. The OSHA RFI states: "One area in which backover incidents are a significant concern is incidents that occur in highway work zones. Road construction workers routinely work in close proximity to mobile equipment and construction vehicles, which exposes them to struck-by hazards on the job site. For example, flaggers and other workers on foot are at risk because they may not be visible to equipment operators or motorists. Other highway workers are at risk because they routinely work in conditions of low visibility, low lighting, inclement weather, noise, or in congested areas with high traffic volumes."

Compliance with the MUTCD and OSHA regulations is a necessary first step in providing a safe work environment. However, these sources, taken together, do not provide comprehensive guidance to ensure worker safety in highway work zones. To identify gaps in standards and regulations and to compile additional prevention measures to enhance worker safety, NIOSH undertook a comprehensive review of scientific literature, fatality and injury data, and current safety research. Many of the findings are contained in this guidance document.

References

1. *Manual on Uniform Traffic Control Devices*. Federal Highway Administration (FHWA), U.S. Department of Transportation, Washington, DC. 2009. http://mutcd.fhwa.dot.gov
2. Fatal Occupational Injuries at Road Construction Sites, 2003-2013. Census of Fatal Occupational Injuries, Bureau of Labor Statistics, U.S. Department of Labor, Washington, DC.
3. *Building Safer Work Zones: Measures to Prevent Worker Injuries From Vehicles and Equipment*. Cincinnati, OH: DHHS (NIOSH) Publication No. 2001-128. 5. Pratt, S.G., D.E. Fosbroke, and S.M. Marsh. 2001.
4. *Highway Work Zone Safety Construction Equipment Visibility Diagram Lookup.* Available at http://www.cdc.gov/niosh/topics/highwayworkzones/BAD/imagelookup.html.
5. *Internal Traffic Control Plans*, The Roadway Safety Alliance, developed under Contract No. 212-2003-M-02677 with the Centers For Disease Control, 2008. https://www.workzonesafety.org/data-resources/runover-backover/itcp/
6. *Site Safety Plan for French Branch Slidell I-10/Why 59/I-12 BCC Job #3845.* Unpublished document, Barriere Construction, *Safe Zones,* 2014.
7. *Guidelines on Work Zone Access and Egress.* The Roadway Safety Consortium and the Federal Highway Administration (FHWA), U.S. Department of Transportation, Washington, DC. 2011. https://www.workzonesafety.org/files/documents/training/courses_programs/rsa_program/RSP_Guidance_Documents_Download/RSP_Access_Egress_Download.pdf).
8. *American National Standard for High-Visibility Safety Apparel and Headwear*, ANSI/ISEA 107-2010. New York: International Safety Equipment Association.
9. Code of Federal Regulations Part 29 and 49. 2005. United States Department of Labor, Occupational Safety and Health Administration. http://www.access.gpo.gov/nara/cfr/cfr-retrieve.html.
10. *Internal Traffic Control Plans,* Mid-Continent Transportation Research Symposium, Ames, Iowa. Grahm JL, Williams CL, and Burch R, August 2005.
11. *Internal Traffic Control Plans and Worker Safety Planning Tool,* Transportation Research Record: Journal of the Transportation Research Board, Washington, DC, Grahm JL and Burch R. Volume 1948/2006. http://dx.doi.org/10.3141/1948-07.
12. *Worker Injury Prevention Strategies*. Publication FHWA/IN/JTRP-2009/13. Joint Transportation Research Program, Indiana Department of Transportation and Purdue University, West Lafayette, Indiana, Ferreira-Diaz, C. A., A. Torres-Zapata, C. A. Nanovic, and D. M. Abraham. 2009. doi: 10.5703/1288284314291

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