CPWR – The Center for Construction Research and Training *Pilot* Planning Program to Prevent Struck-by Incidents

CPWR is currently seeking feedback on this FREE resource to improve it before sharing more broadly. We are looking for construction contractors or project owners willing to pilot test it on the job and report back.

The planning program is intended for project managers, safety directors, and any others responsible for keeping construction workers safe on the job. The tool includes three main sections. The first section is a tool intended to help you think through the specific struck-by hazards that may be present on each job site before work begins – both on any given project and on any given day. Based on the risks you identify, the tool provides more information to help you plan for prevention based on the hierarchy of controls and links to supplemental resources to increase awareness and train workers.

The second section helps you keep track of your overall struck-by prevention plan. For each struck-by hazard you identify in the first section, you can use this tool to plan out the prevention and protection solutions you intend to use to address the hazard.

The third section of the program includes a series of nudges that can be used to influence employees' pre-shift or pre-task planning decisions. CPWR is currently pilot testing the use of nudges to support decision-makers and *nudge* them toward safer choices – in this case planning. Nudges are techniques that change the way choices and information are presented, with the idea that small changes can help people make better (safer) decisions. To be considered a nudge, the technique must be: (1) easy to implement; (2) low cost; (3) transparent to the decision-maker; and (4) a free choice made by the decision-maker.

To provide feedback on the planning program and nudges by participating in our pilot study, email Grace Barlet at gbarlet@cpwr.com.

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Why should you have a plan to prevent struck-by incidents?

Struck-by hazards exist across all sectors, trades, and job sites. Transportation incidents are the second leading cause of death and contact with objects and equipment is the fourth leading cause of death in construction.[1]

By planning ahead of the project – starting at the bidding stage – you can eliminate struck-by hazards at the source by making sure the site is set up correctly and getting the appropriate equipment, controls, and PPE in place before work begins.

Who should be involved in planning at the pre-bid and pre-job phase of the project?

Bidding on a new project may involve the estimator, project manager, safety director, competent person and, if needed, manufacturer/suppliers, owner, and/or general contractor. Pre-job planning before a project starts may involve the project superintendent/manager, competent person, foreperson, manufacturer/suppliers, owner, and/or general contractor.

By planning daily once work begins – before each shift and before engaging in tasks that present struck-by hazards – you can keep all employees engaged and aware of hazards, solutions, and workplace safety policies.

Who should be involved in daily planning?

The short answer here is ***everyone***. Those making major decisions like the foreperson and those carrying out the work *or other work nearby* should all be included in pre-task planning. The planning meeting is a critical time for those working together *and* others working nearby to communicate, get on the same page about potential hazards, and figure out how to protect one another.

Struck-by injuries are produced by forcible contact or impact between the injured person and an object or piece of equipment.[2] Struck-by hazards can resemble caught–in or –between hazards, but can be identified by asking, w*as it the impact of the object alone that caused the injury?*

When the impact alone creates the injury, the event is categorized as a struck-by incident. On the other hand, when the injury is the result of crushing injuries between objects, the event is categorized as a caught-in or -between incident. Struck-by hazards are categorized as follows:

- Struck-by falling object
- Struck-by flying object
- Struck-by swinging object
- Stuck-by rolling object

Start by reviewing the lists of questions for each of these categories in Section 1. For every question you answer “yes” or “maybe” to, there is a link for more information on how to eliminate or reduce the risk of exposure to those hazards. Each link takes you to background information and useful resources like

[1] (Average of 2018-2020). CPWR. https://www.cpwr.com/wp-content/uploads/DataBulletin-May2022.pdf.
[2] OSHA. https://www.osha.gov/sites/default/files/struckby_ig.pdf.

planning checklists, commercially available solutions, and training handouts. For the most comprehensive and up-to-date list of struck-by prevention resources, visit https://cpwr.com/struck-by-hazards.

Use the worksheet in Section 2 to keep track of your overall struck-by prevention plan. This take-away piece can be used to support conversations pertaining to everything from the bidding process to job site scheduling. If you already have a planning document or software, simply skip Section 2 and track your struck-by prevention plans there instead.

Finally, Section 3 contains a series of recommended nudges to support planning efforts. Nudges are techniques that can help both employers and employees make safer decisions. They are simple, transparent, and cost-effective strategies that can be incorporated into existing health and safety interventions to empower individual decision-makers and encourage ongoing planning and communication around struck-by safety.

Section 1. Identify the Risks

It is critical to think through the potential struck-by hazards that will be present on each unique job site before the project begins *and* on a daily basis.

FALLING OBJECTS

Struck-by falling object hazards are present when something falls from an elevation to a lower level and strikes, crushes, or pins a person.

1. **Will there be work at heights?**
   If workers on ladders, scaffolds, aerial lifts, roofs, decking, etc. are conducting work above where others are working, resting, or walking below, there is a risk for struck-by incidents. Tools, equipment, or materials could be dropped, knocked, or blown by wind, ultimately striking another worker or bystander.

   If yes, click here for more information on planning and solutions.

2. **Will materials be transported by truck, crane, or other moving equipment?**
   If the load is not secured properly, materials can fall from a truck bed or off a crane hook, striking workers behind or below.

   If yes, click here for more information on planning and solutions.

3. **Are there materials or tools heavy enough to injure someone when dropped on the same level?**
   Tools or materials dropped by an individual could cause injury to themselves or coworkers nearby.

   If yes, click here for more information on planning and solutions.

FLYING OBJECTS

Struck-by flying object incidents occur when something has been thrown, hurled, or is being propelled across space.

1. **Will workers use pneumatic or powder-actuated tools like nail guns?**
   Tools or equipment that eject an object through use of powder or compressed air automatically create flying object struck-by hazards. Powder-actuated fasteners are designed to go through wood, concrete, and steel, and can easily go through a person. Using compressed air to clear out a pipeline could eject something with enough force to injure or kill others in the surrounding area if it is not secured properly.

   If yes, click here for more information on planning and solutions.

2. **Are there unsecured materials that could be pushed, kicked, or blown by wind with enough force to cause a collision injury?**
   If a strong wind picks up a piece of plywood or blows over an extension ladder, workers nearby could be struck. If a worker is throwing materials during cleanup without proper planning and communication, another person could be struck.

   If yes, click here for more information on planning and solutions.

3. **Is there demolition or other work using shears or material processing attachments for heavy equipment?**
   Shearing or cutting materials can cause pieces to become projectiles, striking personnel or damaging equipment and property.

   If yes, click here for more information on planning and solutions.

ROLLING OBJECTS

Struck-by rolling object incidents occur when an object is rolling, moving, or sliding on the same level at which the worker is located. These include instances in which the worker is struck or run over by a moving vehicle without being caught under it or instances in which the worker is struck by a sliding object or equipment on the same level.

1. **Will there be heavy equipment or work vehicles in use?**
   Drivers and equipment operators can unintentionally create struck-by hazards just by moving through the job site as they are told, so work zone traffic planning and communication between different crews is critical.

   If yes, click here for more information on planning and solutions.

2. **Will there be delivery trucks coming onto the job site?**
   It's important that drivers who are not regularly on site have a clear understanding of where to drive to avoid the possibility of striking anyone, and that those on site also know how to avoid crossing the path of those vehicles.

   If yes, click here for more information on planning and solutions.

3. **Will employees be driving/parking personal vehicles on or near the site?**
   When employees are driving to and from work, parking on or near the site, and walking to and from their vehicles – especially in large numbers and for overlapping shifts – there are struck-by hazards present.

   If yes, click here for more information on planning and solutions.

4. **Will there be road or other work that exposes workers to non-construction motor vehicles?**
   Experience shows that we cannot rely on drivers to keep workers safe from vehicles driving, falling, or overturning into the site. Plan ahead to prevent motorists from intruding and endangering workers and other bystanders.

   If yes, click here for more information on planning and solutions.

SWINGING OBJECTS

Struck-by swinging object incidents occur when objects which are attached at a point or are being held by the worker, strike an individual. This includes instances where a hinge-like motion retracts, creating a swinging or slamming motion.

1. Will cranes be used to lift and move materials?
   When materials are mechanically lifted, they have the potential to swing and strike workers. As the load is lifted, the materials may swing, twist or turn. This movement can catch workers by surprise, and they could be hit by the swinging load. **Windy conditions are especially hazardous because the load will swing more.**

   If yes, click here for more information on planning and solutions.

2. Will there be other workers in the vicinity of the crane?
   Depending on where the worker is standing and the force behind the load, the worker may fall to another level after being struck and sustain even greater injuries. In addition to swinging, loads can slip from their riggings and strike workers. Loads must be rigged properly to prevent slippage.

   If yes, click here for more information on planning and solutions.

3. Will there be any other situations in which material or equipment is suspended and tied/attached to an anchor point, creating a possible swing or pendulum effect?

   If yes, click here for more information on planning and solutions.

Section 2. Make a Pre-Job Plan

For any questions you responded “yes” to in Section 1, it is important to plan out the prevention and protection solutions you intend to use. Solutions include everything from employee training to traffic planning to the use of specific equipment and PPE. Consider the hierarchy of controls and refer to the supplemental resources available in Section 1 for assistance in determining the best and most complete range of solutions for each hazard. Skip the questions that don’t apply or write N/A.

Date:

Job site:

Completed by:

FALLING OBJECTS

How will you address falling object hazards from work at heights?

How will you prevent materials or other objects from falling during transport by truck, crane, or other moving equipment?

How will you prevent heavy materials or tools from being dropped on the same level?

ADDITIONAL COMMENTS OR CONSIDERATIONS:

FLYING OBJECTS

How will you prevent flying objects from pneumatic or powder-actuated tools such as nail guns?

How will you protect workers from materials that could be pushed, kicked, or blown by the wind with enough force to cause a collision injury?

How will you protect workers from flying projectiles from demolition or other work involving shearing and cutting of materials?

ADDITIONAL COMMENTS OR CONSIDERATIONS:

ROLLING OBJECTS

How will you protect those on site when heavy equipment or work vehicles are in use?

How will you coordinate with delivery trucks to ensure the safety of workers and drivers?

How will you protect employees as they drive onto and away from the site or park personal vehicles nearby?

How will you protect employees from non-construction motor vehicles on or near the job site?

ADDITIONAL COMMENTS OR CONSIDERATIONS:

SWINGING OBJECTS

What will you do to protect those working with cranes?

What will you do to protect those working near cranes?

How will you eliminate or protect against other swing hazards identified?

ADDITIONAL COMMENTS OR CONSIDERATIONS:

Section 3. Nudges to Support Planning

Nudges are techniques that can be used to improve safety decisions and contribute to safer work practices on job sites by *nudging* decision-makers toward better choices. To be considered a nudge, the technique must be: (1) easy to implement; (2) low cost; (3) transparent to the decision-maker; and (4) a free choice made by the decision-maker.

Nudges are effective in supporting a wide range of safety and health decisions and related practices across different groups, including employers, supervisors, and employees, and across diverse worker subpopulations. The nudges often used to influence safety and health decisions include prompts, reminders, feedback, social norms, simplifications, and incentives. These nudges can be tailored and used in combination with one another. **CPWR has adapted the use of nudges from the existing literature and application in other industries to be flexible and responsive to the real-world conditions of construction job sites, and will be not only testing the use of these techniques, but also recording best practices for adapting them to the construction industry.**

To learn more about nudges, see: *A Literature Review of Behavioral Economics in the Construction Industry.*

Nudges for Safety and Health Decisions

Prompts: Use standardized explicit verbal, visual, and/or numeric information to make previously *unknown or inaccessible information* more available. Prompts are designed to nudge individuals at key times to think through how and when they should make a decision.

Reminders: Are similar to prompts but make important information *that is already known or available* more visible and accessible. Reminders are used to ensure that salient information is used to make safer decisions and practices and is often used to combat procrastination.

Feedback: Involves providing direct and clear information to the decision-maker about the results of their safety decisions and safety practices. Feedback provides information about their use of the appropriate safety decisions and serves to reinforce the related safety practices.

Social Norms: Provides a point of comparison by presenting information relative to others in a work group. Because humans are influenced by what others do, social norms influence decisions by providing guidance regarding the expectations or rules within a work group.

Simplify: Involves revising and presenting relevant information so that it is more apparent or readily available to decision-makers. Simplifying the message reduces the attentional demands and cognitive effort needed to make the safer decision.

Incentives: Involves changing decision consequences and motivators. Incentives are designed to provide positive rewards in response to desired decisions in an effort to promote desired outcomes.

Not all nudges will work for every safety decision or every population. It is important to select those that are appropriate for your job sites and crews. Below are some additional details on how the nudges described above can be applied to improve struck-by planning.

Prompts:

Jobsite signage and posters are an easy way to visually convey important information at key times (e.g., before using a crane to lift materials).

Posters/Infographics

Hazard	Posters/Infographics
General Struck-by	• In 1 Strike You Could Be Out (English PDF & JPEG) • Struck-by Incidents Are a Leading Cause of Injury in Construction (English PDF & PNG; Spanish PDF & PNG) • Struck-by Incidents are the 2nd Leading Cause of Work-Related Death in Construction (English PDF & PNG; Spanish PNG) • Preventing Struck-by Incidents (English PDF & JPEG) • Head Protection (English PDF & JPEG)
Falling Objects	• Stop the Drop (English PDF & JPEG) • How Heavy is Deadly? (English PDF & JPEG)
Flying Objects	• Nail Safety (#1) (English PDF & JPEG; Spanish PDF & JPEG) • Nail Safety (#2) (English PDF & JPEG; Spanish PDF & JPEG) • Nail Safety (#3) (English PDF & JPEG; Spanish PDF & JPEG)
Rolling Objects	• STAY ALERT IN WORK ZONES! (English PDF & JPEG; Spanish JPEG) • OPERATORS! 4 Steps for Work Zone Safety (English PDF & JPEG; Spanish JPEG) • CONTRACTORS! Work Zone Safety Starts with Your Internal Traffic Control Plan (English PDF & JPEG; Spanish JPEG)
Swinging Objects	• Crane and Lift Zone Safety: Planning for a Safe Lift (English PDF & PNG; Spanish PDF & PNG) • Best Practices for Safe Crane Lifts (English PDF & PNG; Spanish PDF & PNG)

Reminders:

Reminders are one of the easiest and most effective nudges for supporting safer decision-making in construction. These nudges are low cost, easy to use, and can improve safety decisions and related practices for workers and supervisors. Several reminders have been created to use at your job site to support pre-shift or pre-task planning (below), but you can also create your own. When using reminders, the following guidelines are offered:

- Reminders can be **conveyed using electronic** (emails, text messages, electronic alerts), **written** (posters, placards, stickers) **or verbal methods** (voice messages).
- The **placement of the written (visual) reminders** should be close in proximity to targeted action (point of choice) to make specific information for the safer decision more accessible. The reminders should also be placed in areas with high visibility (break rooms, entrance/exits).
- Information should be provided by a **credible source** such that the reminder is perceived as accurate and persuasive.
- Reminders should include **specific information** about recommended decisions or actions. To draw attention to key messages, the information should be as clear as possible about the safer decisions and practices.
- Remove all unnecessary information and **keep the messaging simple**. Attention is more likely drawn to information that is easy to understand.
- Reminders can include **use of visuals and images to supplement the text**. This can include the use of highlighting or bolding as well as use of color (green, yellow, red) to increase emphasis on the relevant information.
- **Continued use of reminders is often necessary** until the safer decisions and actions become habits (i.e., the reminders are no longer needed to support decision-making).

Text Message Reminders

Hazard	Target Audience	Texts: General	Texts: Specific
General Struck-by	Supervisors and Workers	• Safety planning saves lives: Plan for struck-by incidents BEFORE work begins • Planning prevents struck-by incidents: Keep you and your co-workers SAFE on the job	• Struck-by incidents can occur from flying, falling, swinging, or rolling objects. Help save lives by planning before work begins to eliminate hazards and implement safe work procedures. • Develop a plan to prevent struck-by incidents before any work begins to protect you and your co-workers from injury
Falling Objects	Supervisors and Workers	• Stop the Drop: Keep you and your co-workers safe by planning to prevent dropped tools	• Planning to prevent struck-by incidents from dropped tools should include training workers on the hazards and how to prevent an incident **(Supervisors)**

		• Stop the Drop: Follow the plan to prevent struck-by incidents to keep you and your co-workers safe • Stop the Drop: Follow the plan to secure tools and materials to prevent them from falling on people below	• When working at heights, plan to prevent tools and materials from falling on people below by barricading fall zones and using measures such as tethers, toeboards, and debris nets
Flying Objects			• Choosing a full sequential trigger nail gun prevents accidental nail firings, protecting you and your co-workers from serious injury caused by flying nails
Rolling Objects	Supervisors and Workers	• Work zone safety STARTS with a traffic control plan: Planning prevents struck-by incidents in the work zone • One strike and you could be out: Traffic control plans prevent struck-by incidents in the work zone • Planning prevents struck-by incidents: Test your communication methods BEFORE working with heavy equipment and vehicles • Safety planning saves lives: Plan for struck-by incidents BEFORE work begins with heavy equipment and vehicles	• An internal traffic control plan helps protect people working within the work zone from being struck-by construction equipment and vehicles. Remember to communicate the plan every day before work begins so all parties are informed about the locations of others. (Supervisors) • Work zone safety starts with a traffic control plan. Its critical for keeping workers safe from being struck-by motorists passing through or around the work zone. (Supervisors) • A traffic control plan that includes elements such as signs, warning signals, flaggers, and positive protection like concrete barriers around the work zone is critical for preventing workers from being struck-by motorists. (Supervisors) • Develop and test the method of communication that will be used between spotters and operators of heavy equipment and vehicles to prevent struck-by incidents. • Communication signals should be used when heavy equipment and vehicles are in operation and if contact is lost, operation should stop immediately.
Swinging Objects	Supervisors and Workers	• Planning prevents struck-by incidents in the lift zone: Plan BEFORE your lift begins	• Hold a lift planning meeting before any work involving a crane begins to discuss items that will be moved, the lifting capacity of the crane and rigging, communication during the lift, obstacles the crane could

		• Plan BEFORE a lift: Protect you and your co-workers by planning to prevent struck-by incidents in the lift zone	strike, and the impact of weather and terrain. • Before a lift, plan to prevent struck-by incidents by establishing a load swing path, setting up barricades and warning signs around the lift zone, and confirming all field personnel not involved are aware and clear of the lift.

Email Reminders

Example #1:

Dear [ ],

As a supervisor, keeping your workers safe is a top priority. If work on your job site includes lifting and moving materials using cranes, remember to hold a lift planning meeting before any work begins, and make sure everyone involved in the lift is present. Be sure to:

- Check that all workers are properly trained and licensed or certified, if appropriate.
- Plan for the items that will be moved – their weight, dimensions, contents, pick points, and center of gravity.
- Review the lifting capacities of the crane and rigging, as well as lifting points, methods of attachment, sling angles, boom and swing angles, and crane orientations.
- Ensure the crane and rigging are properly inspected and maintained.
- Discuss how the crane operator and signal person will communicate during the lift, a back-up plan if communication is lost, and an emergency stop procedure.
- Determine possible impacts of weather, terrain, or other environmental factors
- Set up barricades and post warning signs around the lift zone.
- Identify nearby obstacles the crane could strike (e.g., overhead power lines, structures, below ground hazards).

CPWR's Planning Program can help you create a more detailed plan.

Thanks for helping to instill a safety and health culture here at [company name]. Stay safe!

[Name]

Example #2:

Dear [ ],

Safety is everyone's responsibility – especially those who supervise others. If your employees are working at heights, it's important to remember that tools, equipment, materials, and other objects that are dropped or fall can cause serious injury to coworkers or others below. Create a

plan before work begins using CPWR's Planning Program and communicate it with your workers to prevent injuries caused by dropped objects. As part of your plan, you should:

- Secure tools and materials to prevent them from falling. Small tools (less than 5lbs) can be tethered to workers.
- Use measures such as toeboards, screens, guardrails, debris nets, catch platforms, or canopies to prevent, catch, or deflect falling objects.
- Barricade hazard areas and post warning signs.
- Wear a helmet or hardhat and routinely inspect it for damage.
- Inspect all tools and equipment before use. Hand tools with loose or cracked handles should not be used.
- Keep materials away from floor openings or leading edges.
- Train workers on hazards and ways to prevent an incident.

Please reach out if you have any safety concerns or questions. Stay safe!

[Name]

Printed Reminders/Stickers

CPWR has a simple "Sphere of Safety" hardhat sticker design that can be downloaded and printed. We also have limited supplies available for free, which can be ordered by contacting Grace Barlet at gbarlet@cpwr.com.

Download Sphere of Safety sticker artwork

We also have several designs reminding employees to "Stop!" and asking, "Did you plan ahead to prevent struck-by incidents?". These can be printed and stuck to walls, materials, and equipment to remind everyone to engage in planning before using a crane to lift and move materials or using tools at heights.

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Feedback:

When you see employees at any level demonstrating a good safety practice (e.g., engaging in a pre-lift meeting or raising the need for additional barriers), recognize and reinforce those actions. Similarly, when you see an opportunity for improvement, use it as a teaching opportunity to provide feedback on what could be done differently in the future.

Social Norms:

As the employer or a leader at the company, start by modeling safe decision making by planning ahead to prevent struck-by incidents in the bidding stages before work ever begins, and again at every stage of the project. When conducting training or holding a morning meeting, intentionally incorporate discussions about the importance of planning and instruction on when and how to properly plan. Mandate pre-shift and pre-task planning measures so that it becomes the daily norm for everyone on the job. When planning is a regular part of the job, it doesn't fall to employees to decide whether to engage in the process. To improve your pre-task planning (or job hazard analysis) process, check out CPWR's Pre-Task Planning (PTP) Assessment Checklist.

Simplify:

Take a look at both your training and your planning materials and procedures as they relate to preventing struck-by incidents. Are there ways to simplify the information included to make it easier for employees to identify hazards and solutions, engage in appropriate planning conversations, and implement controls at the right time and project stage? Many of the resources included in our reminders above already have simplified messaging.

Incentives:

Consider providing incentives or rewards for engaging in daily planning. Ask employees to make this commitment and demonstrate that leadership is equally committed. You may want to hold a formal contest with distinct challenges, or you can simply recognize outstanding employees with certificates, safety challenge coins, gift cards, or other prizes.

Example: Safety Challenge Coins presented to personnel for outstanding performance while operating spotting or supervising heavy equipment (courtesy of UCOR)