

Confined Space Considerations for Bridges

A practical look at mitigating hazards due to confined spaces

by John Kinkle, PCL Civil Constructors Inc.

Confined spaces encountered during construction and maintenance of bridges present safety hazards in the construction industry that require mitigation. The construction industry's understanding of these physical and atmospheric hazards has increased in recent years, allowing the industry to mitigate hazards associated with confined spaces and reduce related worker issues. The hazards associated with confined spaces, such as engulfment, oxygen deficiency/enrichment, flammable gases, and other physical hazards, are severe and can have dire consequences if not addressed properly.

On May 4, 2015, the Occupational Safety and Health Administration (OSHA) issued a new standard for construction work in confined spaces, which became effective August 3, 2015. The new standard, Subpart AA of 29 CFR 1926, is intended to “prevent construction workers from being hurt or killed by eliminating and isolating hazards in confined spaces at construction sites similar to the way workers in other industries are already protected” by the confined-spaces standard. An electronic copy of the full regulatory text of the *Confined Spaces in Construction* standard can be found at https://www.osha.gov/confinedspaces/1926_subpart_aa.pdf.

As defined by the standard, a confined space has a limited means of entry and exit, is large enough for a worker to physically enter it, and is not intended for regular or continuous occupancy. A permit space, one requiring a permit, “is a confined space that may have a hazardous atmosphere, engulfment hazard, or other serious hazard, such as exposed wiring, that can interfere with a worker's ability to leave the space without assistance.”

Given their enclosed shapes, segmental concrete box-girder bridges are an obvious context in which to

review confined spaces. However, given the above definitions of what constitutes a confined space, all bridge types will have some element of confined spaces and they should be identified during the project-planning phase. Once identified, these safety concerns can be mitigated through proper planning and best practices.

What's New?

OSHA has identified five key differences between the new *Confined Spaces in Construction* standard and the general industry standard. The five new requirements follow:

1. More detailed provisions requiring coordinated activities when there are multiple employers at the worksite. This will ensure that hazards are not introduced into a confined space by workers performing tasks outside the space. An example would be a generator running near the entrance of a confined space causing a buildup of carbon monoxide within the space.
2. Requiring a competent person to evaluate the worksite and identify confined spaces, including permit spaces.
3. Requiring continuous atmospheric monitoring whenever possible.
4. Requiring continuous monitoring of engulfment hazards. For example, when workers perform work in a storm sewer, a storm upstream from the workers could cause flash flooding. An electronic sensor or observer posted upstream from the worksite could alert workers in the space at the first sign of the hazard, giving the workers time to evacuate the space safely.
5. Allowing for the suspension of a permit, instead of cancellation,

in the event of changes from the entry-conditions list on the permit or an unexpected event requiring evacuation of the space. The space must be returned to the entry conditions listed on the permit before reentry.

For contractors that already abide by the general industry standard, the new confined-spaces standard for construction activities will likely not have a significant effect on their procedures, aside from the differences described previously.

Designing for Confined Space

The design stage is an excellent time to begin thinking about potential confined spaces both during bridge construction and during regular maintenance inspections. Each bridge type presents a unique set of circumstances during bridge inspection. Temporary and permanent hatches for construction should be considered to maximize ingress and egress of construction workers as well as to increase ventilation. This also aids the maintenance and inspection teams down the road. Simple considerations for the installation of electrical outlets for ventilation fans along with interior lighting can aid the inspection or maintenance team in their duties as well.

Confined Space during Construction

Planning is key to identifying upcoming hazards associated with confined spaces and ensuring that those hazards are communicated properly to the frontline worker. One best practice is for the contractor performing the evaluation to identify a space as a permit-required confined space until determined otherwise. The number of workers, their varying familiarity with the constantly changing hazards, and working in close proximity to one another are hazards addressed by the new standard and



Enclosed outer cells were identified as confined spaces, separately from other interior sections of the bridge segments. Photo: Kenneth Payne.



Signs help identify confined spaces to workers or inspectors not directly involved with an operation. Photo: Andrew Mahoney.

should factor into the space-identification process. Signage that identifies potentially confined spaces is a great way to protect crews from unknowingly entering a confined space.

The nature of construction means that possible confined spaces are constantly changing. In segmental concrete bridge construction, the inside of a form traveler is a constantly changing environment, where short sections of a bridge are constructed with many different trades occupying the same space at overlapping intervals, each introducing a different set of hazards. A confined space may not be present at the start of a segment cycle, but if thermal blankets are used to enclose the space for heating, and the same space is then occupied by a gas-powered concrete vibrator, the environment needs to be reevaluated to confirm that it is safe for all workers present. If the exhaust is found to be creating a hazard, one solution would be switching to electric vibrators using



Introduction of a gas-powered concrete vibrator requires a review of the space to determine if it is a confined space. Photo: John Kinkle.


external power sources.

The inside of a bridge, where crews may be applying an elastomeric coating to post-tensioning anchors, is a likely example of a permit space, given the enclosed environment and any health hazards associated with the product. Specific conditions will warrant varying controls, but entry and exit points to the areas where hazardous work is occurring should be clearly marked. Those involved should be well trained on the hazards. Those occupying the same confined space must also understand how the environment has changed so they can take the proper precautionary measures.

Whether the confined space is considered a permit-required or nonpermit space, emergency rescue procedures must be built into the construction plan, as it may be difficult to extract an injured person from the space. An emergency response plan should be developed and reviewed with local fire departments for the most efficient and safest way to rescue an injured employee. Considerations to discuss include access to the employee, such as high-angle rescue, or rescue from a snooper truck, truck ladder, aerial lift, or crane and rescue basket; atmospheric hazards, such as oxygen, carbon monoxide, hydrogen sulfide, or lower explosive or lower flammable limits, and any exposure above the permissible exposure level; and

physical hazards, such as lighting, slips, trips, falls, and electric shock. Prior to workers entering a confined space, the lead contractor must coordinate and communicate emergency response procedures, OSHA requirements, and the responsibilities of the confined space supervisor, attendant, and entrants with all employees, subcontractors, and owners.

Summary

There is an OSHA standard for construction work in confined spaces that has different requirements from the one for general industry. It is vital that the construction industry be proactive and institute a thorough program to keep employees safe and to mitigate the hazards due to confined spaces. 

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EDITOR'S NOTE

The information required by the new standard is taken from the OSHA webpage "Confined Spaces in Construction – Frequently Asked Questions" found at <https://www.osha.gov/confinedspaces/faq.html>.