Fire Engineering®

Construction Concerns: Temporary Structures

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By Gregory Havel

For www.fireengineering.com *Photos by author*.

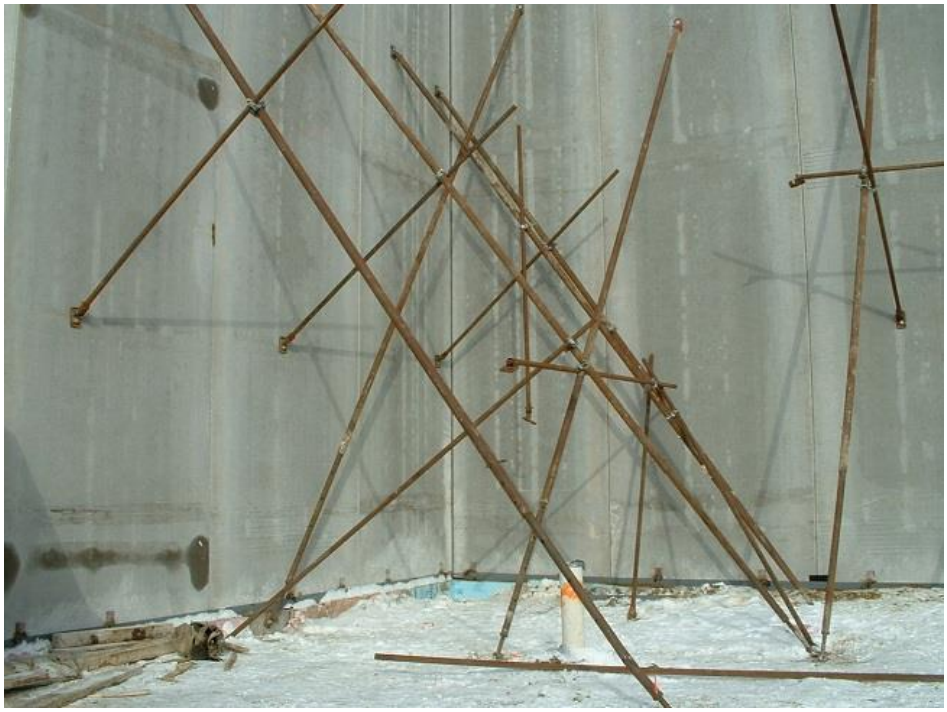
Most buildings and other construction work require the use of temporary structures for support until they are complete enough to be self-supporting.

Photos 1 and 2 show the temporary diagonal bracing that holds precast concrete wall panels plumb until permanent bracing, floors, and roofs are installed.

The braces are bolted to the wall panels they support and to anchor bolts set in the concrete-filled holes augered into the ground.

After the temporary bracing is no longer needed, the anchor bolts in the concrete will be cut off with a power saw and then buried under the concrete floor.

(1)



(2)

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In photo 2, some of the braces are bolted to the foundation walls rather than to anchor bolts set in holes filled with concrete. Photo 2 also shows additional bracing between the wall panels and the midpoints of the wall braces because of the height of the wall panels to prevent the wall braces from buckling under wind load.

Photo 3 shows the temporary structure (falsework) that supports a plywood form for a steel-reinforced structural concrete floor.

(3)

From the top, this system includes the following:

- The plywood form for the bottom of the structural concrete floor.
- The aluminum alloy joists that support the plywood.
- The wood beams that support the aluminum joists.
- The “shoring scaffold” that supports the wood beams.
- The screw jacks at the bottom of the shoring scaffold that allow precise adjustment of the level of the plywood form.
- Wood mudsills resting on compacted soil.

Photo 4 shows the temporary structure that supports the plywood form for a sloped, steel-reinforced structural concrete floor in an auditorium.

(4)

From the top, this system includes the following:

- The plywood form for the bottom of the structural concrete floor.
- The wood joists that support the plywood.
- The wood beams that support the wood joists.
- The telescoping steel columns with screw jacks in the middle that allow precise adjustment of the level of the plywood form.
- Wood mudsills resting on a concrete slab supported by compacted soil.

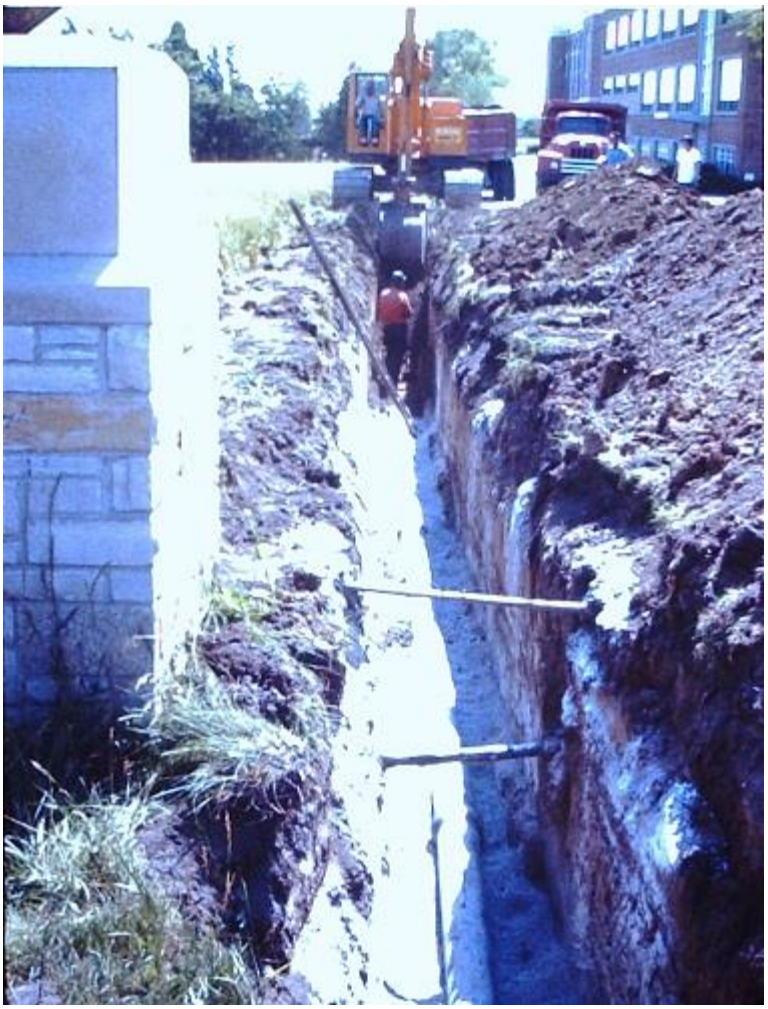
Photo 5 shows the temporary structure that supports the plywood form for a post-tensioned concrete floor in a hotel.

(5)

From the top, this system includes the following:

- The plywood form for the bottom of the post-tensioned concrete floor.
- The aluminum alloy joists that support the plywood.
- The beams that support the joists.
- The telescoping columns with screw jacks in the middle that allow precise adjustment of the level of the plywood form. These columns have wood “X” bracing to stiffen the columns because of their height.
- Wood sills resting on the finished post-tensioned concrete floor, running perpendicular to the length of the tendons in the concrete.

Photo 6 shows a trench for installation of a sanitary sewer main in the early 1970s before the days of the U.S. Department of Labor’s Occupational Safety and Health Administration (OSHA).



(6)

OSHA's regulations are intended to preserve the lives and health of construction and industry workers. Although this trench [about seven feet (2.133 meters) deep] has no obstructions to the laying of the pipe; there is a high risk of the collapse or cave-in of the vertical walls of the trench, which can bury workers and cause serious injury or death.

Photo 7 shows a modern method of horizontal trench shoring that complies with OSHA's regulations for excavation and trenching. This device is called a "trench shield" or "trench box," and is made of two vertical steel panels that protect the workers in the trench from a cave-in. The two steel panels are separated by square tubular struts whose length can be adjusted to the width of the trench. Although the trench is somewhat obstructed when the pipe is laid, this is a reasonable trade-off for the safety of the workers on this project. Since this method of shoring has a limited safe work area at the bottom of the trench, the inspectors must be on site at all times while trenching and pipelaying are under way. As the pipe is laid, the trench box is pulled forward by the excavating machine, and the trench with the completed pipe is backfilled behind it.

(7)

Emergency response to construction job sites can be challenging because of the restricted access, the obstacles provided by the vertical or horizontal shoring, and the infrequent need for these responses. Vertical and horizontal shoring members usually cannot be removed for rescue access unless the load they carry can be transferred to other shoring members already in place, or newly constructed. If the shoring is involved in a fire, the shoring system is already weakened, liable to collapse, and may require installation of additional shoring after the fire is out (and before emergency services workers enter the area).

Emergency responders need standard operating procedures or guidelines for the work they may be require to do on construction job sites. These should cover both trench and high-angle rescue as well as work in areas with diagonal bracing and vertical shoring like those shown in photos 1-5.

On projects of long-duration such as like the 30-story hotel shown in photo 5, emergency responders should work with the management of the job site to prepare medical assistance, rescue, and firefighting plans. A key to these plans is basic fire prevention

and protection, including the prohibition of storage (especially of combustibles) in an area obstructed by vertical shoring. Other keys are onsite water supply from hydrants on the job site; construction roads capable of supporting aerial fire apparatus; and working standpipes with fire pumps, terminating no more than two floors below the present highest work level.

Most building owners and construction managers are very conscious of their public image, and they have people who promote this image in a positive way. They will usually be happy to provide assistance in preincident planning and nonemergency tours of the job site by responders, realizing that the cost of this cooperation is small when compared to the negative publicity of an emergency response and the follow-up visits by regulatory authorities.

Gregory Havel *is a member of the Town of Burlington (WI) Fire Department; retired deputy chief and training officer; and a 30-year veteran of the fire service. He is a Wisconsin-certified fire instructor II, fire officer II, and fire inspector; an adjunct instructor in fire service programs at Gateway Technical College; and safety director for Scherrer Construction Co., Inc. Havel has a bachelor's degree from St. Norbert College; has more than 30 years of experience in facilities management and building construction; and has presented classes at FDIC.*

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