



Marisa “Reese” Fortin, CSP, ASP, CHST, STSC
Area HS&E Manager
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Occupational Safety and Health Standards Board
2520 Venture Oaks Way, Suite 350,
Sacramento, California 95833

OSHSB:

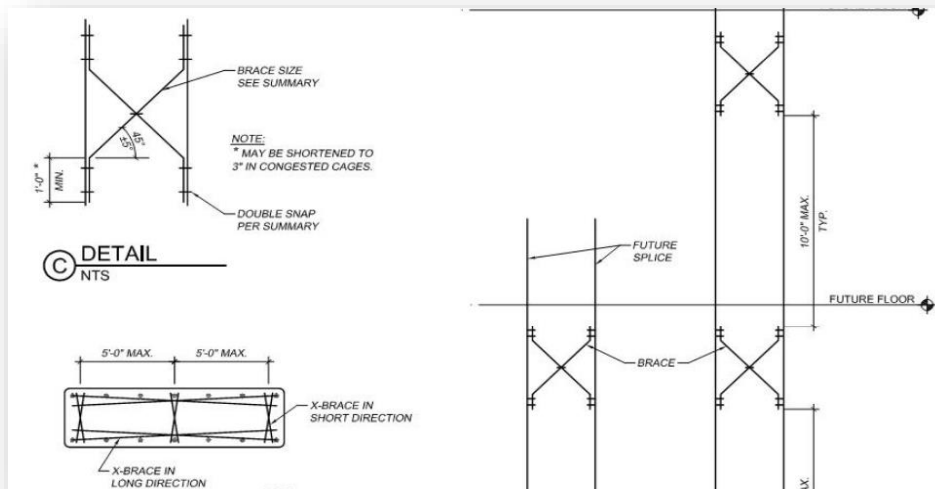
Upon request by the OSHSB on 5/29/2020, I updated my previous petition (Board’s petition file No. 582). The original petition has been amended as follows.

In summary, Cal/OSHA’s 1711 states “Reinforcing steel for walls, piers, columns, prefabricated reinforcing steel assemblies, and similar vertical structures shall be guyed, braced, or supported to prevent collapse. Systems for guying, bracing, or supports shall be designed by a qualified person. Guys, braces, and supports shall be installed and removed as directed by a competent person. Reinforcing steel shall not be used as a guy or brace.”

In addition to several colleagues in the industry and a voiced agreement with the Association of General Contractors’ San Diego Safety Committee members, I see an issue with the verbiage “Reinforcing steel shall not be used as a guy or brace.” The issue is that if a contractor erected a column rebar cage that was designed by a qualified, Registered Professional Engineer to have internal bracing consisting of rebar X-braces, then this would be considered an illegal practice by Cal/OSHA (despite the statement in the standard “Systems for guying, bracing, or supports shall be designed by a qualified person”).

If designed by a qualified RPE, why can’t rebar be used as an internal brace—especially if multiple analyses show that it will create safer conditions in the field? Sundt has contracted a qualified RPE to analyze internal bracing. Their full report is attached to this petition, but here are two relevant snapshots for reference:

To provide for buckling stability of column rebar cages under their own weight and for the required strength to resist bending moments due to wind loads, X-bracing at all faces of rebar cage is required.



This qualified engineer's analysis prescribes reinforcing steel to be used as internal bracing in an "x" configuration. Additionally, internal bracing can eliminate the need to adjust or remove external braces which poses a serious risk to workers. Given Sundt's experience with and knowledge of the risk of removing external bracing, we want to ensure our work is carried out as safely as possible while minimizing mistakes that can occur in the field with communication. We see the use of internal bracing as a step in eliminating potentially catastrophic incidents. Our stance is that internal bracing, when designed by an RPE, is a safer option than relying on external bracing. The industry should not forego a safer practice that is available and proven effective.

Internal bracing does not impact formwork before or after its installation. Also, once installed, internal bracing stays in place and is incorporated into the design and final structure. This prevents the need to have coordination between various contractors to maintain safety (i.e., general contractor, formwork, rebar, and concrete contractors).

A study done by Dr. Ahmad M. Itani at the University of Nevada, Reno, "Stability of Bridge Column Rebar Cages during Construction" for the California



Department of Transportation shows that internal bracing creates greater column stiffness which reduces the potential for column cage failure and collapse. This study showed three critical components to column structural stability: 1) The template hoops (orange) needed to be spaced every 8 to 10 feet and tied at every intersection with the longitudinal bar with either double U or wrap-and-saddle ties. 2) The pickup bars (green) need to be positioned 90 degrees from the adjacent pickup bar to form a square, tied at every intersection, with either double or quadruple snap ties. 3) The internal reinforcing (red), which provides rigidity, should be X-type or square with No. 8 bar, and the bracing should be

spaced every 10 feet tied to the longitudinal bars and the end rings. The full study proves the value of internal bracing and is attached to this petition.

The August 2011 issue of Concrete International included an article on “Detailing Concrete Columns” (attached). The article shares the value and practice of internal bracing with reinforcing steel.

Ideally, the column cage should be stable enough to stand on its own so that cable guying or pipe bracing (Fig. 1) is avoided, because it can obstruct construction activities. Inadvertent, “temporary” releases by other trades can result in instability, so coordination is required. A slightly more robust column cage design by the engineer may eliminate the need for guying or bracing. Certain factors will affect the stability of a



Fig. 1: Pipe bracing helps to stabilize tall column cages

For larger column cages, greater than about 36 in. (910 mm) OD, X-bracing is added to supplement the inner hoops. The brace locations are usually provided by two reinforcing bars with a Type 19 bend pattern.³ They are then placed perpendicular to one another in a three-dimensional fashion, located in the column cage interior. The bar size is usually two sizes smaller than the longitudinal bars, but this can vary by shop practice and experience.

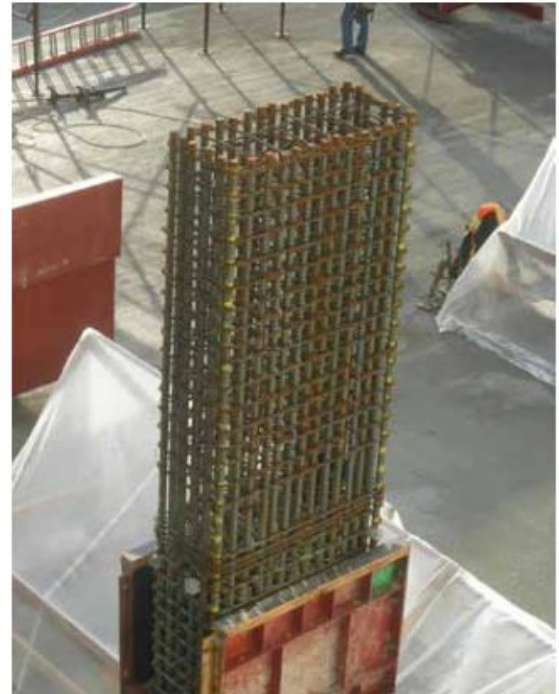


Fig. 2: A column cage with many large vertical bars and cross-ties can be stable enough to eliminate the need for temporary bracing

The completed column cage will also have bars added to the pick or lift points to add local strength. Figure 7 shows a well-braced caisson (drilled shaft) cage with X-bracing, inner hoops, and lift point reinforcing, which makes it rigid enough to be picked without deforming.



Fig. 7: A well-braced drilled shaft cage is picked with minimal distortion (photo courtesy of Dimension Fabricators, Inc.)

Since this petition shows it is possible to safely use rebar for internal bracing *in certain conditions*, I ask that the Standards Board consider updating 1711. I propose the standard be amended by adding the underlined language:

(e) Stability Requirements for Vertical and Horizontal Columns, Walls, and Other Reinforcing Assemblies.

(1) Reinforcing steel for walls, piers, columns, prefabricated reinforcing steel assemblies, and similar vertical structures shall be guyed, braced, or supported to prevent collapse.

(2)(A) Systems for gying, bracing, or supports shall be designed by a qualified person.

(B) Guys, braces, and supports shall be installed and removed as directed by a competent person.

(3) Reinforcing steel shall not be used as an external guy or brace. Reinforcing steel used for internal bracing must be designed by a Registered Professional Engineer using the Load and Resistance Factor Design. Calculations must include wind and person-on-the-cage loads.

Please consider this petition and amend 1711 to permit internal bracing with reinforcing steel.

Sincerely,

Marisa Fortin