

## AISC Live Webinar Series: *Steel Erection – Engineering and Execution*

### Selected questions with answers from the speakers

October 16, 2020

#### Session 1: *The Erector's Perspective*

1. **Question:** How often do you see AISC Certification requirements waived?

**Tim Duke:** Most of our projects are larger and/or more complicated than a typical erection project. Generally, on our projects, we see that AISC Certification is specified and not waived. It assures that the fabricator/erector has demonstrated the ability to meet the requirements set forth by the Standard and provides a level of confidence that the work is carried out successfully.

2. **Q:** How do you include in your bid the analysis that may be required for certain projects? That seems like a large cost depending on how complex the project is.

**TD:** It can be a substantial cost depending on the magnitude and complexity of the project. We typically partner with the same engineering firm and specific engineers that know our erection history from several past projects. Our partnership allows us to review an upcoming project together, and they can estimate the cost of a finished erection plan. This can then be placed into our number and presented in our bid for the project.

3. **Q:** Do you have a rule of thumb about the size of lay down area you need?

**TD:** Typically the more, the better, but laydown is determined by available real estate. If a job is particularly tight, planning sequencing and deliveries is critical. Only the necessary members are delivered to reduce onsite storage. No matter how tight the laydown, we do NOT erect from a trailer bed. That process induces a significant hazard to the workers. Laydown is specified in OSHA 1926.752(c)(2) as a controlling-contractor responsibility. Depending on the project, we may stage the steel outside or inside the building footprint. In high-rise construction, we typically do not store structural steel on the uppermost floors for multiple reasons. Rather, we maintain laydown on the ground.

4. **Q:** On your long trusses, how do you control deflection creep as the loads build?

**TD:** I would defer to the Erection Engineer for truss deflection compensation during construction. Our plans often include shoring to control deflection before the final structure is complete.

*AISC tip: Camber may also be designed into a truss by the EOR to counter deflection.*

5. **Q:** Regarding to the wind speed question, what does the erector do when the forecasted wind speed is above the maximum specified wind speed?

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**TD:** If the forecast is calling for winds at or near the limits of the plan, we will typically fall back from erection and perform bolting, welding, misc. metals install, and other detailing during that time.

### **Session 2: *Erection Engineering of Low-Rise Buildings***

6. **Q:** Can shielding effects also be used for permanent structures?

**Ben Miller:** No, building codes do not allow shielding for the final permanent buildings.

7. **Q:** ASCE 37-14 section 6.2.2 Frameworks without Cladding states that 50% of the wind load should be applied simultaneously in the perpendicular direction to the primary wind load direction. I am assuming this is to account for quartering winds. How do you take this requirement in to consideration during your analysis?

**BM:** Correct. In the analysis models, wind is applied in the two orthogonal directions. 100% wind load in one direction, 50% load in the other. Several load combinations are run during each stage of steel erection and then the stability plan is designed for the worst case responses. Often, quartering winds control the stability design.

8. **Q:** How do you account for time in between steel being installed and cable bracing being installed? Do you think it is acceptable to say that the work has to be shored by end of the day for wind loads, but work can proceed during the day?

**BM:** Our procedures usually state the temporary bracing elements must be installed during the same work shift as the steel erected, but certainly, the temporary bracing needs to be installed prior to the end of the work shift. ASCE 37 allows for "continuously monitored work periods." If the weather (wind) is continuously monitored during the work shift, then the temporary bracing could be left out during the workday to allow the raising gang to move quickly. However, the bracing must still be installed prior to the end of the day.

9. **Q:** Do you account for any incidental loading during construction and if so, how do you determine the incidental force?

**BM:** Yes, DG10 and ASCE 37 provide guidance on incidental forces. If poor workmanship/construction practices are the cause, then the erector and erection engineer need not account for that. For example, a concrete bucket swinging into and hitting the structure is not an impact the erector must account for.

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10. **Q:** How does the shielding analysis of stacked members change when members of varying depth are oriented perpendicular to wind direction?

**BM:** I would take the deepest member in the run of parallel elements and use that for the initial area (A1 in DG 10 equation 2-1) and take the stacking factor based on the run's shallowest member. For example, if a W18 were next to W21s, I would use the W21 for the solid area of one single element and then determine the stacking factor based on the W18 and its spacing to adjacent members. I feel this is a conservative approach.

### **Session 3: *Erection Engineering of High-Rise Buildings***

11. **Q:** Since seismic analysis is not required in ASCE37-14, I want to know if you do the seismic analysis on all your projects? Or this is something requested by the owner or erector?

**Tim Nelson:** We consider seismic design on all of our erection engineering projects on the west coast, regardless of the erector or owner requesting it. We communicate our assumptions verbally and in our drawings. If seismic governs any of our designs, we aim to communicate this clearly to our client to make sure they agree with our approach, recognizing that temporary support elements for seismic will add cost.

12. **Q:** Slide 46 - Tripping was mentioned. What is this phenomenon?

**TN:** Tripping is the process of taking a column that is laid out horizontally on the ground and tilting it upwards to vertical. It is typically the step that happens immediately before lifting the column from the ground to its setting point on the building. Assuming our lifting lug is also used for tripping, it is crucial to consider the varying loading directions on the lifting lug as the column is taken from horizontal to vertical.

13. **Q:** What is the erection engineer's role in addressing column shortening in high-rise buildings?

**TN:** In certain instances, the Structural Engineer of Record may provide guidance on shortening. However, we have typically seen this responsibility deferred to the steel contractor and, in turn, to the erection engineer. In our experience, the role typically entails computing the expected column shortening under anticipated gravity loads (primarily dead loads) and then handing these over to the fabricator. When appropriate, the fabricator can lengthen the columns slightly to counteract the shortening. A structural model of the building is the most effective way to determine the shortening values. When possible, we request the structural model from the SEoR, which typically requires signing a liability release before the model is turned over to us. If getting the SEoR's model is not possible, we will build our own model.

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14. **Q:** Can you speak on instances where wind tunnel tests are used for final design, often resulting in smaller design winds than the codes? Can you take advantage of that for the partially-erected structure?

**TN:** This is definitely something to be careful about. We will sometimes try to establish relationships between a final design wind-tunnel test and standard code-generated demands to justify using a lower wind velocity (in addition to the reductions offered by ASCE 37). However, the ability to do this depends on many factors and may not always be appropriate. Additionally, we'd strongly advise against using a final design wind tunnel test for anything further than global wind demands (noted above). The wind dynamics on a clad structure (related to local demands on specific elements) will differ from that of an unclad structure. Some in our industry have suggested performing a wind tunnel test on the unclad structure to identify the actual wind demands. While we have not implemented this on any projects, we are certainly interested in exploring this in the future.

15. **Q:** Which load combinations do you usually use when checking construction stage? Do you account for special load combinations in the case of elements supporting discontinuous lateral force-resisting elements?

**TN:** We generally follow the load combinations outlined in Chapter 2 of ASCE 37-14, which are similar to those in ASCE 7 but also include additional considerations related to construction-specific loads like personnel and equipment loads.

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