The ESG Report
SPRING 2007

How to Communicate With Your Structural Engineer

In this edition of the ESG Report, we're taking a slightly different approach by writing a multi-part article about how to communicate with your structural engineer, or "Engineer-Speak 101".

Many of you have already experienced projects requiring direct involvement of a professional engineer. However, in cases where you have no established relationship with an engineer, that first discussion can be awkward. In this article, we'll describe some of the basic concepts and terms you should understand in order to better communicate with your engineer. This is essential from many perspectives: you better anticipate the engineer's needs, you help clearly define the engineering scope, and you facilitate an accurate and efficient execution of that scope, which usually consists of stamped drawings and calculations. Let's start with basic, global project concepts. Certain design requirements apply to all projects, and defining the correct criteria from the project's onset is probably one of the most important aspects of the engineer's scope.

The project's geographical location is important. Locale determines the applicable building code, which then dictates the required design criteria. Most projects can be categorized as either permanent or temporary. Equating permanent to indoor and temporary to outdoor is an easy analogy, but it's the duration of time the equipment will be installed that matters most. The term "temporary" clearly applies to an outdoor roof truss system for a one-day event, but that same roof system might also be permanently installed as part of a theme park attraction. The distinction is critical because the building code requirements for "temporary" and for "permanent" can be quite different.

Particularly with outdoor systems, the engineer must know how the system relates to its particular site. Installing a system on a concrete or asphalt surface is different than installing on sand or soil. Other geographical conditions also directly impact the design criteria that the engineer is required to consider. What methods can you use to convey this information to your engineer? Detailed project drawings describe the equipment and associated layouts. Usually, more detail on drawings is better than less detail, but there is a caveat of "over-detailing". Consider the quality of information being conveyed, not the quantity. There's no substitute for a well-coordinated set of drawings showing a complete system, including the site plan, and with detailed information regarding connections and loads. As we'll discuss further on, the system loads need to be defined. If you don't know what these elements should be, ask your engineer for guidance. Ultimately, this helps define the engineering scope, and a clearly defined scope always translates into efficiency.

Project specifications help identify any project-specific operational requirements, but a project specification doesn't take precedence over building code requirements. The engineer is required by law to show compliance with building codes, not project specifications. However, project specifications might impose design criteria well in excess of basic code compliance. If you are obliged to comply with a project specification, the engineer needs to know this up front, so the supplemental considerations aren't overlooked or ignored.

Now, let's talk about a few specific terms that you should know.

AHJ is a common acronym, meaning the "Authority Having Jurisdiction", and is usually the building code official responsible for enforcing building code requirements.

Design Loads are the loads that the engineer must consider in the analysis – they are the loads you intend to place on the system, and may be based upon building code, specifications, project constraints, or a combination of those criteria.

ESG
Entertainment Structures Group
Engineering for the Entertainment Industry

Entertainment Structures Group
A Division of Steven Schaefer Associates, Inc.
10411 Medallion Drive Suite 121 Cincinnati OH 45241
(800) 542-3302 www.entertainmentstructures.com

Load Combinations are important enough for a thorough discussion. Design manuals describe a number of loading conditions beyond just dead load and live load, including other potential loading factors such as environmental (high wind, snow and rain) and seismic conditions, each of which could impart significant loads to the system. Essentially, the worst case combination of loads applicable to a given location governs how an engineer analyzes a system.

For example, a pipe grid has its *dead load*, which is the self weight of its pipes, connections, and components. It may only support lighting fixtures and electrical raceways comprising its *live load* capacity. Those two loads together – *Live load + dead load* is the simplest form of a *load combination.* However, if the grid is installed in a high seismic zone, then the engineer must consider the increased probability of a seismic event, and the potential loads associated with the event. Now, the *load combination* includes *Live load + Dead Load + Seismic*, which can change the required component capacity, certainly affects the suspension and attachment methods, and almost always requires a supplemental lateral bracing system. High wind conditions are another example of how *load combinations* affect the analysis. An outdoor truss system installed in a high-wind area is subject to increased wind loads, whereas they might not be subjected to the same magnitude of loads in another locale. In that case, the governing load combination might become *Live Load + Dead Load + Wind.* The effects of *Load Combinations* are important to your engineer because they govern the analysis by determining the worst case loading possibilities. Remember the earlier statements we made about temporary versus permanent systems? For permanent structures, the governing *load combinations* can be vastly different than those for temporary structures.

So far, we've used *analysis* as though it's a ubiquitous term, but to the engineer it identifies only part of the engineering process. *Analysis* generally means the process of separating something into its constituents in order to examine the individual parts, or to study the structure of the whole. Conversely, design generally means to create a detailed plan of something – in this case, define a piece of equipment – a batten, a bracket, a brace – that is capable of supporting the design loads, within a given set of design criteria. Whereas *analysis* asks "does what you already have work?" *design* says "build something new that works." *Design* is a more iterative process of first making an educated guess at materials and components, then verifying the selections by analysis. If the analysis fails, a time-consuming process of reselection and reanalysis occurs, and time is money. Understand the difference between *analysis* and *design*, because they each represent two distinctly different parts of an engineer's scope. We've also frequently mentioned *loads*. We can't talk about them without also mentioning *reactions,* which are the equally opposing forces acting against the loads (Newton's Third Law). They are a fundamental part of your engineer's work. For example, an engineer will use your design load criteria for a permanently installed system to determine the reactions to the existing structure. Those reactions will be shown on the final sealed drawing set because the building's Engineer of Record will want to know that information.

Speaking of the final sealed drawing set, another very important term to understand is *due diligence*, which is *the degree of care that a prudent person would exercise*, and is also *a legally relevant standard for establishing liability*. Professional engineers have a legal, professional, and ethical obligation to ensure the protection of public safety, and are required to exercise due diligence in every aspect of their work. Failure to do so can result in serious - perhaps even fatal - accidents, and can result in suspension or revocation of the engineer's licensure. Because of the serious implications of due diligence, your engineer needs as much information as possible about your particular system, in order to apply the correct analysis procedures. You might be asked a lot of questions that may seem naïve, but they are really just a required exercise in due diligence. We'll dedicate another article to that topic in upcoming ESG Reports.

In summary, you don't necessarily need to comprehend everything the engineer does as part of an analysis scope, but understanding some basic engineering concepts will help you convey concise project information, which helps the engineer work more efficiently for you. More to come in our next issue…

Disclaimer

This article is not intended to be a thorough treatment of the topic of structural evaluation. Local, state and national building codes should be consulted. The author cannot be responsible for any evaluation based solely upon this article.

News and INFORMATION:

Check out our new LOGO and newsletter layout!

That's not all that's been happening…

The ESG group now has more dedicated engineers, we continue to be licensed in every state and we're working on a new web site that will allow you to get the information you need — and more of it (Summer 2007).

If you would like to receive the ESG Report via email, please email elizabeth.baron@entertainmentstructures.com Our web site has previous ESG Reports and more about our services.

Project SPOTLIGHT:

GRENADA THEATRE — Santa Barbara Center for the Performing Arts

The engineering scope for the renovation of the Granada Theatre in Santa Barbara, CA included both manual and motorized rigging systems, motorized fire curtain, custom trolley beams, and chain hoist suspension points. The project is currently under construction, with anticipated opening in January 2008.