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## **TIAA-222 Revision G, Structural Standards for Communication Towers**

February, 2009

An Interview with Dave Brinker, ROHN Products, LLC.

*Revision G of the TIA-222 Standard contains many new provisions that are having a significant impact on communication structures. Following are frequently asked questions answered by Dave Brinker, Vice President of Engineering for ROHN Products, LLC. Dave is a member of the TIA-222 Executive Committee and was Chairman of the Rev G Editorial Committee.*

*Does the TIA-222-G Standard apply to all wireless applications?*

Yes, the TIA-222 Standard applies to all structures that support antennas. This includes the simplest applications from home TV reception and private 2-way radio systems to the more complex cellular and broadcast applications. It also applies to antennas, mounts and platforms.

*Are existing towers required to be upgraded to Rev G?*

Existing structures are not required to be upgraded to Rev G except when the addition of antennas or other appurtenances requires a modification. The structure and the modification in these cases must conform to the requirements of Rev G.

*Will new towers become more expensive?*

The focus of Rev G was to incorporate the latest weather data and the most accurate techniques for predicting wind and ice loads. The intent was to then adjust the magnitude of these loads according to the importance of a specific tower application. Rev F used a "one size fits all approach" to wind and ice loading which inevitably resulted in requiring more or less loading than necessary for some locations and tower applications. As a result, some towers will see an increase and some a decrease in cost.

*What help is available to apply Rev G to a specific application?*

Rev G contains an annex that is intended to assist in the procurement of a new tower or for the evaluation and modification of an existing tower. The annex summarizes the options available and identifies applications where supplementary requirements may be desired.

*Does Rev G require certification of tower manufacturers?*

The TIA Standard traditionally has not addressed the certifications required for manufacturers, as there is a wide range of sophistication required for different tower types and applications. The Standard leaves this decision to the purchaser. Many manufacturers of complex structures are certified by the American Institute of Steel Construction (AISC). This is a voluntary certification program and requires a manufacturer to develop an approved Quality Management System that addresses fabrication methods, material certifications, welder certifications, etc.



*How were the new wind and ice loading requirements justified?*

The TIA Standard does not establish its own loading requirements for wind, ice and earthquake. There is a standard published by the American Society of Civil Engineers (ASCE) that specifies wind, ice and earthquake design criteria. ASCE periodically updates their standard as more data is collected and better techniques for predicting loads are established. The TIA Standard, starting with Rev D, has traditionally adopted the latest ASCE loading requirements. The loading requirements for the International Building Code (IBC) are also based on ASCE loading requirements.

It should be noted that the wind speeds published in Rev G are gust wind speeds per ASCE and are generally higher than the average wind speeds published in Rev F. The higher Rev G wind speeds do not necessarily result in more stringent design requirements due to other compensating factors outlined in the Standard.

*Why are there different classifications of structures in Rev G?*

Rev G recognizes that reliability requirements for towers vary with each application and that towers with higher reliability requirements need to have more stringent loading requirements. The classifications of towers in Rev G are intended to categorize towers according to their reliability requirements based on height, use and location. Loading requirements become more stringent as reliability requirements increase. For example, the loading requirements for a home TV antenna tower are less stringent than the loading requirements for a major TV broadcast tower. Three classifications, Class I, II & III, are provided based on the type of service a tower provides and the potential hazard to human life and property damage. The reliability and loading requirements progressively increase as the structure classification moves from Class I to Class III.

*Why is the area surrounding a site important?*

Specific options are provided in Rev G that decrease or increase wind loading based on the type of area surrounding a site. For example, reduced wind loads are used for sites in wooded or urban areas compared to sites located next to large bodies of water. Different terrains are given specific designations. Wooded or urban terrains are designated as Exposure B. Flat open terrains are designated as Exposure C. Smooth terrains, such as sites next to large bodies of water, mud flats, etc. are designated as Exposure D. The wind loads used for design increase as the exposure designation moves from B to C to D.

*How are sites located on hills treated differently?*

As with surrounding terrain, options are provided to account for increased wind effects associated with hills, ridges and other elevated locations. In these cases, wind loads are increased to account for the action of wind as it travels over the site. As with terrain, specific designations are given to different types of elevated site locations.

Sites surrounded by relatively uniform terrain where no increase in wind load is required are designated as Category 1. Sites separated from lower elevations with gently sloping terrains are designated as Category 2. Topographic Category 3 designation is for hills and Category 4 is for ridges. Design wind loads are progressively increased as the topographic category moves from Category 1 to Category 4.



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Topographic Category 5 is reserved for sites where site-specific investigations are performed to determine wind speed-up requirements. These requirements may be more or less stringent compared to the standard categories depending on the characteristics of the site.

*How has the design philosophy changed, have the safety factors changed?*

The design philosophy in Rev G has fundamentally changed from the traditional approach of using safety factors. Instead of using safety factors, the new Standard uses survival (also called extreme) loads to verify the stability of a structure and to determine strength requirements. Safety factors are no longer required since extreme loads are considered in analysis and design. One could think of the safety factor as being applied to the wind load as opposed to member strength. This approach has proven to be more accurate for communication structures.

The design philosophy for determining appurtenance loading has also changed. Very specific approaches are presented in Rev G compared to Rev F. The intent was to provide an accurate consistent approach for determining appurtenance loading. The determination of appurtenance loadings using Rev F was not consistent and resulted in much confusion in the Industry when third parties analyzed existing towers for the purposes of adding appurtenances.

*What has been done to enhance climber safety?*

It is now mandatory to provide a climbing facility with a safety climb device for all structures over 10 ft in height. In addition, for safety cable systems, a stamped or engraved metal tag must be attached to the structure identifying the safety cable size and type so that climbers can verify compatibility with their safety sleeve. There are also requirements for signage to warn climbers when there are potentially hazardous climbing locations on a tower.

The Standard also specifies detailed strength and clearance requirements for climbing facilities and climber attachment points. There are now two Classes of climbing facilities. Class B systems are similar to Rev F and are intended for structures that are to be climbed by professional climbers. Class A systems are for less skilled climbers and require more stringent clearance requirements.

*How does Rev G address the problems associated with guy anchor corrosion?*

The Standard identifies soil conditions that may result in accelerated corrosion of steel guy anchors in direct contact with soil. For these conditions, it is now mandatory for Class II and III structural reliability class towers to provide a corrosion control method in addition to hot dip galvanizing. Acceptable additional corrosion control methods are provided in an annex to the Standard.

*What change has been made to guy hardware requirements?*

Only heat treated shackles and turnbuckles may be used in guy assemblies for guyed masts. This requirement was adopted due to reported problems associated with the use of non-heat treated hardware on existing guyed masts.



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*How have the requirements for grounding changed?*

Grounding requirements are now in terms of a performance specification. The maximum resistance to ground is specified as 10 ohms. In order to achieve this in most soil conditions, the minimum length of standard ground rods was increased from 8 ft to 10 ft and the minimum lead size was increased from No. 6 to 2/O A.W.G. A higher number of ground rods is also specified for standard grounding. For example, for a typical self-supporting tower, 6 ground rods are required for Rev G as opposed to 3 for Rev F.

Another significant change is that ground rods are no longer restricted to only galvanized ground rods with tinned copper leads. Now copper, copper clad, stainless or galvanized steel rods are acceptable as long as compatible ground leads and connections are used.

*Can standard foundations still be used for Rev G?*

Yes, however, the soil strengths assumed for standard foundations have been reduced compared to Rev F. The intent was to encourage obtaining geotechnical reports for most applications while recognizing that there are many applications where standard foundations will continue to be used. For these cases, it was intended to provide conservative design soil strengths to minimize the need for changes when actual soil conditions were verified at the time of installation. Geotechnical reports have been made mandatory for Category III structures due to their stringent reliability requirements. The Standard contains an annex that outlines the information that should be included in a geotechnical report.