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PLANNING ADVISORY NOTICE

Maintenance and Condition Assessment Programs

Based Upon Section 14.0 and Annex J of the ANSI/TIA-222-H Standard, as Referenced in the IBC

This Planning Advisory Notice (PAN) is based off the ANSI/TIA-222-H Section 14.0 "Maintenance and Condition Assessment" and is intended to provide clarity on the intent of this section; not being prescriptive, but rather a guide to allow structure owners to develop a program for the maintenance of their structures based on their intended use. Structures designed in compliance with the ANSI/TIA-222 Standard can have an indefinite life if they are properly maintained with an understanding of the use requirements. For this maintenance to be effective it must consider: (i) the structure owner and tenant's intended use of the structure; (ii) the location of the structure; (iii) the activity around the structure; (iv) the structure's significance with respect to wireless network or broadcast support; (v) age of the structure; (vi) environmental issues; (vii) issues with vandalism; and (viii) the type of structure.

A Maintenance and Condition Assessment Program implemented by a structure owner should consider the recommendations of the ANSI/TIA-222 Standard as referenced by the International Building Code (IBC). The ANSI/TIA-222-H Standard highlights that Section 14.0 on maintenance and condition assessment offers guidance to structure owners based upon their intended use. Specifically, these sections provide guidance on multiple topics that, as part of proper assessment and maintenance, should be evaluated including inspection intervals, climbing facilities, safety climbs, guy anchors, structure condition, lighting, and grounding. Consistent assessment and the addressing of deficient conditions will contribute towards the structure's expected indefinite lifespan, as noted above.

Development of a Maintenance and Condition Assessment Program requires nuance. In principle, this seems inconsistent with the ANSI/TIA-222 Standard, but the application, as well as evaluation of the text, illuminates the reasoning for this conclusion. The logic of this conclusion is founded with the knowledge that infrastructure supporting wireless networks varies significantly across wireless network providers, market expectations, and significance to the public it serves.

> *Varying needs result in different expectations for structure performance, both from a sustainability and operational perspective, which leads to different assessment and maintenance demands on the structure.*

ANSI/TIA-222 is very clear in acknowledging the owner of the infrastructure is responsible for the performance of the infrastructure, which includes maintenance. As a result, ANSI/TIA-222 lists expectations as guidelines, not requirements. This may appear contradictory with both Section 14 and Annex J being normative, meaning required. However, the requirement is to simply have a Maintenance and Condition Assessment Program in place, dutifully prepared by the structure owner to ensure performance and operations expectations are achieved. This is seen in the way assessment cycles are recommended as opposed to required. In addition, paragraph one of Annex J states, "The maintenance and condition assessment for a site-specific structure may vary depending upon the type of structure and site-specific conditions."

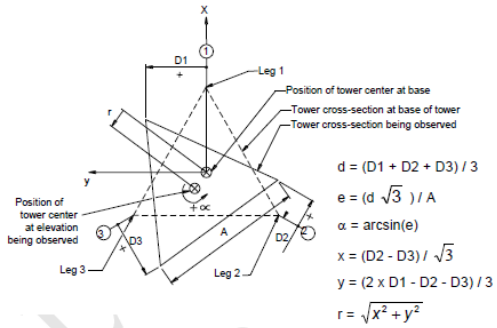
ANSI/TIA-222-H **Annex J**

Figure J-1: Twist and Out-of-Plumb Determination for Triangular Towers

Site Name: _____ Date: _____

Wind: _____ Temperature: _____

The transit is to be set up on each leg azimuth at the base of the tower. The corresponding tower leg at the base of the tower is used to set the vertical baseline. The deflection at each point of interest on the tower is measured from this vertical baseline, as shown below.



$d = (D1 + D2 + D3) / 3$

$e = (d \sqrt{3}) / A$

$\alpha = \arcsin(e)$

$x = (D2 - D3) / \sqrt{3}$

$y = (2 \times D1 - D2 - D3) / 3$

$r = \sqrt{x^2 + y^2}$

OBSERVED LEG DISPLACEMENTS					CALCULATED TWIST			CALCULATED OUT-OF-PLUMB		
SIGHTED ELEV. ft. [m]	A in. [mm]	D1 in. [mm]	D2 in. [mm]	D3 in. [mm]	d in. [mm]	e	∝ deg.	x in. [mm]	y in. [mm]	r in. [mm]

Annex J goes on to state that, "It is not the intent of this Annex to provide guidelines for reconciliation of items identified in a maintenance and condition assessment" (Annex J, (2017), para. 2). The ANSI/TIA-222-H Standard does not specifically set requirements for maintenance and condition assessment because it is recognized that, as stated above, there are many different structures, intended use of structures, structure locations, and approaches that qualified personnel must take into consideration in order to properly maintain a structure for its intended purpose.

The critical requirement is that maintenance and repairs are being performed on structures when required, with consistency and as identified by a structure owner's Maintenance and Condition Assessment Program. It is also incumbent upon the structure owner to deploy a program that addresses both planned and unplanned maintenance and repair activities. Planned maintenance and repair activities are those such as twist, plumb, and tension; replacing members that degrade over time; maintaining marking and lighting on the structure; maintaining the structure foundation; and protecting galvanic coatings and paint. Planned activities such as these are meant to preserve the structure, over time, so that it may perform its intended purpose.

Unplanned maintenance and repair activities address items that typically occur during unique events such as damage through installation fault, environmental issues, or vandalism. It is also recommended that a structure owner's Maintenance and Condition Assessment Program allows for the escalation of unplanned maintenance and repair activities so that repairs may proceed expeditiously to restore the structure. Some additional examples of unplanned activities include tower member damage from the installation of additional equipment on the structure, guy wire rupture from a tree falling on a guy anchor, and hardware theft that can impact the performance of the structure or the systems installed (e.g., tower lighting cables).

While the ANSI/TIA-222 Standard is not prescriptive, there are recommendations given that a Maintenance and Condition Assessment Program should consider. A recommended best practice would be to have a program that outlines the following:

1. Defines structure owner specific requirements based on:
   a. Structure type
   b. Location of the structure
   c. Risk category of the structure
   d. Intended use of the structure
   e. History of the structure
      i. If available, original structural drawings or mapping
      ii. Past analysis of the structure
      iii. Past modifications of the structure

(CONTINUED ON NEXT PAGE)

iv. Previous maintenance work on the structure

v. For sites with directly buried steel (most commonly guy anchor shafts), a corrosion management plan should be developed in accordance with ANSI/TIA-222-H Annex G.

vi. Frequency of vandalism and/or protection of site from public.

2. Assessment intervals

   a. Intervals, with guidance from ANSI/TIA-222 Section 14, that consider the structure visitation frequency, reporting of observations, and remediation schedules.

   b. Plan to coordinate for extreme conditions such as severe wind, ice, or seismic events.

   c. Means to monitor through evaluation of network electrical performance.

It should be noted that there are guidelines for non-structural items that the Maintenance and Condition Assessment Program may need to address as well, but these are not within the requirements of the ANSI/TIA-222 Standard as recognized by the IBC. However, these items may need to be assessed to ensure expected network performance and should consider the impact on non-structural requirements such as transmission line support, antennas, lighting, and grounding.

The term "maintenance" was intentionally used in the title of ANSI/TIA-222-H Section 14.0 "Maintenance and Condition Assessment" to indicate the level of oversight required for necessary maintenance activities. A common industry term referring to the condition assessment of a structure is "TIA inspection." It is necessary that a qualified person be involved in reviewing these maintenance and condition assessments (TIA Inspections) to determine what maintenance and repairs are required based on the structure owner's Maintenance and Condition Assessment Program. Not all items identified by a condition assessment require immediate maintenance or repairs; some information can simply be for the structure owner's history, which allows them to plan to address in the future when it may be determined necessary to address. An example of this is minor or superficial corrosion. Often, reporting of this condition is tracked as knowledge to assess with future condition assessments and confirm when remediation is required to ensure structure performance.

It can be problematic for structure owners to focus only on the condition assessment (TIA Inspection) and neglect the actual maintenance, or remediation of the structure. Having a Maintenance and Condition Assessment Program allows for a qualified person to review the assessment report to determine what items identified are necessary to resolve, and in what order of priority, to properly maintain the structure in accordance with the structure owner's intended use and applicable codes and the standards.

A Maintenance and Condition Assessment Program must be funded, and that funding should account for the condition assessments as well as the maintenance or repairs necessary to achieve the structure owner's intended use, which may vary widely. For example, a structure owner with licensed telecommunications carrier equipment may need to maintain the structures based on a Risk Category II, while a structure owner with communication equipment for a mining yard may only need to maintain the structure based on Risk Category I. In both cases, some items may require immediate action, whereas others may be delayed or continue to be observed, with variances in action on both based on the Risk Category. The inverse can also occur where a structure owner may have a Risk Category IV structure in an area that is corrosive. In this case, the structure owner's Maintenance and Condition Assessment Program may increase the frequency of the assessment and increase the requirements of the assessment to implement additional checks for material loss.

Maintenance and Condition Assessment Programs should also consider the need for assessments after severe weather or seismic events. One approach that is often taken in good Maintenance and Condition Assessment Programs is to use the NOC's (Network Operations Center) data and information from other Risk Category II structures to determine when an assessment is needed, "after severe wind and/or ice storms, severe seismic events or other extreme conditions." An observation is

that these programs account for notice when there are extreme conditions forecast in the area, then based upon network performance data (e.g., antennas being blown off path, system performance degradation, and lighting failures) as well as information about other Risk Category II structures taking structural damage, an assessment schedule for the structures can be developed. Routine visits from personnel tasked with work other than a maintenance and condition assessment may also identify areas of concern. Depending on the concern identified, a maintenance and condition assessment by a qualified crew should be completed to ascertain additional maintenance or repair concerns as well as other non-related issues as part of a standard condition assessment. In fact, it is well within the intent of the ANSI/TIA-222 Standard to allow a PMI (Post Modification Inspection) or PII (Post Installation Inspection) of work that occurred on the structure to serve as a method of satisfying the maintenance assessment requirements of Section 14.0, provided that the PII or PMI addresses the structure considerations as well as the intent of the owners Maintenance and Condition Assessment Program.

In conclusion, telecommunications structures are incredibly reliable and sustainable, especially when operated under a strong Maintenance and Condition Assessment Program. The ANSI/TIA-222 Standard, through the IBC, provides a strong baseline for establishing criteria with respect to implementation of the program, based on network, ownership, and public safety needs. Infrastructure ownership is responsible for developing an appropriate program to ensure these needs are consistently met and maintained, specific to the infrastructure in place. In short, Maintenance and Condition Assessment Programs are essential to telecommunications infrastructure performing in compliance with their design and intended use, and effective programs based on the ANSI/TIA-222 Standard can provide immense value to the owners of this infrastructure, and society.