Telecommunications Industry Foundation

The Telecommunications Industry Foundation is pleased to announce publication of the following TIF White Paper:

AN EXAMINATION OF "CHANGED CONDITIONS"; AS DEFINED BY ANSI/TIA-222-H

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CHAPTER I
INTRODUCTION AND CONCEPT OF A 'CHANGED CONDITION'

Wireless telecommunication supporting structures (**"Structures"**) are among the most scrutinized infrastructure in the world. These Structures are used in varying capacities such as supporting wireless networks used for cellular communication, radio and TV broadcasting, and emergency management coordination. The technologies supporting these services are constantly evolving, which ensures the telecommunications infrastructure is exposed to changing equipment demands on a continual basis. The International Building Code (**"IBC"**) references the ANSI/TIA-222-H standard for the assessment, design, analysis, and maintenance of Structures and telecommunications infrastructure. Under this standard, Structures are evaluated based on climatic risk as well as serviceability demands. Due to continual changes in technology and equipment demands, Structures are regularly re-evaluated by engineers, assessors, and construction teams to confirm their reliability (*See TIF White Paper "Reliability of Telecommunications Structures"* (Nov. 2020)).

Structures utilized for telecommunications take a number of forms, which adhere generally to the same standards. These forms include, but are not limited to: (i) mounts, which support the wireless equipment mounting positions, elevations, and orientations; (ii) towers and foundations, which support the mount and corresponding wireless equipment; and (iii) small cell structures, which may be composed mainly of small masts, existing utility equipment and other commercial forms. Structures must be evaluated to assess the impact of wireless equipment installations on each aspect of the supporting structure.

To compartmentalize the general impact of these changes, ANSI/TIA-222-H introduces the concept of a **"Changed Condition"**. A Changed Condition is any change in the telecommunication equipment, equipment service, Structure scale / geometry, or a Structure's primary use that implies a 5% change in Structure demand-capacity ratio of any load bearing member in the Structure. Changed Conditions on either side of the 5% threshold can have material impacts on the expectation of performance and investment of a Structure. While application of the 5% threshold can be complex, appropriate use can result in a powerful tool to evaluate risk assessment and investment into network development which positively impacts network resiliency.

The net impact of evaluating a Changed Condition generally revolves around the required due diligence to access the risk. For an insignificant Changed Condition (less than 5%), the risk to the Structure due to increased climatic loads is practically identical to the Structure as it exists prior to the change. Therefore, a thorough assessment of the Structure may not be warranted. For a significant Changed Condition (greater than 5%), a more thorough assessment, which may entail a field assessment of tower member sizes, appurtenance locations and quantities (often referred to as a mapping), foundation assessment, and structural analysis of the Structure may be required. The effort associated with both time and capital for a significant Changed Condition may be substantial. Thus, reasonable consideration of a Changed Condition and when to expect / demand the more rigorous assessment is valuable to ensure sound speed to market solutions while adhering to demands for proper evaluation of telecommunications infrastructure and public safety.

This TIF White Paper (**"White Paper"**) will delve into the background, development, and application of a Changed Condition. Examples of best-practices in how to evaluate Changed Conditions will be made, along with discussion on when the best-practice may not be appropriate.

CHAPTER II
BACKGROUND

The basis of a Changed Condition comes from the ANSI/TIA-222-G standard, specifically, Section 15.4 which references the changed conditions necessary to require a new structural analysis, including reclassification of the tower [*See TIF White Paper* "*Risk Categorization in Accordance with ANSI/TIA-222-H and the 2018 IBC*" (May 2018)], structural upgrades, and changes in serviceability requirements. The other Changed Condition requiring a structural analysis is when a significant change was made to the wireless equipment installed on the Structure. Although an exact definition of a "significant change" was not provided in ANSI/TIA-222-G, allowance of the Structure to meet ANSI/TIA/EIA-222-F was permited, provided that the demand-capacity ratio changed by no more than 5% and the Structure was designed to an earlier revision of the TIA-222 standard. With no other formal definition to provide guidance, the 5% demand-capacity ratio change was generally adopted by the telecommunication industry as the line between an insignificant / significant change in wireless equipment.

From the passage of ANSI/TIA-222-G, significant change emerged as a common industry term used to delineate the difference between changes in tower equipment loading. Structure Class (now called Risk Category in ANSI/TIA-222-H) and serviceability rarely change during the lifespan of a Structure, however, any upgrades to the Structure almost always imply the need for at least an initial post modification baseline structural analysis to confirm the changes in demand-capacity ratio for the upgraded Structure. The telecommunications industry has used significant change for any multitude of applications, including determining the type of structural documentation needed for permitting applications (feasibility vs. comprehensive structural analysis) and whether an existing Structure needs to be upgraded to meet the current ANSI/TIA-222 standard or remain consistent with design and maintenance requirements from an earlier ANSI/TIA-222 standard.

It should be noted that in cases where there is not a significant change, a letter sealed by a professional engineer (a **"PE Letter"**) explaining the minimal equipment changes can be an appropriate response. This PE Letter must be: (i) based upon sound engineering judgement following the requirements of ANSI/TIA-222-H for a significant change; and (ii) rooted in information about the Structure including, but not limited to, a previous comprehensive structural analysis, modification drawings, post modification inspection, and/or an effective maintenance and condition assessment program.

Additional understanding of the 5% demand-capacity ratio can be discerned from the 2003 IBC - Chapter 34. Within this chapter, which references alterations, additions, upgrades, etc., the structure in question will not require any upgrades to the main vertical or lateral load bearing system so long as the alteration results in a less than 5% (vertical) or 10% (lateral) change in demand-capacity ratio. In telecommunications, Structure design is generally governed by wind (i.e., lateral loads), whereas other commercial structures are commonly governed by combinations of climatic and gravity loads. Because of the potential sensitivity of the equipment location, the lateral allowance is reduced to 5% (from 10%) to ensure appropriate risk assessment. For a tower, the installation location is less significant, so simple comparisons work more effectively. However, for a mount, installation of new equipment on the centerline of the mount, as opposed to the highest point on the mount, would have very different impacts on the mount demand-capacity ratio. As a result, ANSI/TIA-222-H adopted a conservative approach that utilizes the 5% demand-capacity when completing these comparisons, across all Structures.

CHAPTER III
CURRENT STANDARD APPLICATION

Changed Condition is first referenced in ANSI/TIA-222-H - Section 15.5. In this section, the factors denoting a Changed Condition are largely consistent with recommendations per ANSI/TIA-222-G.; those factors are as follows:

1) Change in the size and/or number of mounted appurtenances;
2) Change in Risk Category, to a more stringent Risk Category;
3) Change in serviceability (twist / sway of the Structure mast, applied construction or maintenance loads to mounts); or
4) Structural modification to the lateral and vertical load supporting system.

In the telecommunications industry, only condition 1 regularly necessitates additional evaluation, as conditions 2 and 3 rarely change and condition 4 would almost always be accompanied by Comprehensive Structural Analysis.

ANSI/TIA-222-H - Section 15.5 also lists various definitions used in analyzing a Changed Condition, namely, the terms **"Feasibility Study"** and a **"Comprehensive Structural Analysis"**. A Feasibility Study is a high-level structural analysis which considers the change in demand-capacity ratio of the main structural members. Feasibility Studies are effectively used to determine the extent of a Changed Condition and are generally limited to a cursory comparison of the existing Structure loading to the proposed loading installed. A Comprehensive Structural Analysis is the assessment required when a Changed Condition is determined to be significant (i.e., demand-capacity ratio exceeds 5% or the cursory review determines the loading change to be large). Comprehensive Structural Analyses require more detailed data, take more time to complete, and may require a greater investment.

Changed Condition evaluation also ensures determination of when adherence to ANSI/TIA-222-H is required. This is significant as many Structures in use have lifespans exceeding 20 years; Structures with significant service time were likely designed to ANSI/TIA-222-C through ANSI/TIA-222-F standards, which considered drastically different wind, ice, and serviceability loads, as well as minimal consideration for seismic loads. In fact, many Structures currently in use which have exhibited satisfactory performance would not meet ANSI/TIA-222-H standards (however, they do continue to meet the standard in which they were originally designed to meet). As telecommunications infrastructure has proven to be reliable, if the Changed Condition is proven to be insignificant then Structures are exempted from complying with the latest ANSI/TIA-222 standard (note: this assumes that the Structure has been properly maintained).

To evaluate when a Changed Condition is significant and warrants adherence to ANSI/TIA-222-H, the standard allows evaluation in comparing a Feasibility Study per the following design criteria considering (i) baseline appurtenance loading (demand-capacity ratios of the main load bearing members considering the appurtenances that the Structure was originally designed to support) compared to (ii) proposed appurtenance loading (demand-capacity ratio of the main load bearing members considering the appurtenances currently installed on the Structure, together with any proposed appurtenances). After completion of both studies, the main load bearing member demand-capacity ratios are compared; if no changes of greater than 5% are observed, adherence to a previously approved, grandfathered standard (which implies no structural changes are required) is acceptable. This is true even if Feasibility Studies, completed per ANSI/TIA-222-H, reveal demand-capacity ratios in excess of 105%. For example, assume

the baseline appurtenance loading study revealed a maximum demand-capacity ratio of 150% and the proposed appurtenance loading study revealed a maximum demand-capacity ratio of 153%. In this case, no structural upgrades would be needed as the stress the Structure would experience would be largely consistent when comparing the baseline loading to the proposed loading. Conversely, if the proposed appurtenance loading revealed a demand-capacity ratio of 156%, structural upgrades would be required because of the greater stress (more than 5%) when comparing the baseline loading to the proposed loading. In this case, adherence to the ANSI/TIA-222-H standard would also be required.

In some instances, aged infrastructure has been structurally upgraded, but to an earlier Revision of ANSI/TIA-222. If the appurtenance loading for the structural upgrade was compliant with the ANSI/TIA-222 standard at the time the upgrade was completed, then the associated appurtenance loading may replace the original base line appurtenance loading. Effectively, the baseline loading would be updated, and then frozen, until the Structure was upgraded again.

CHAPTER IV
INDUSTRY APPLICATION

Consideration of a Changed Condition is reasonably clear assuming a Feasibility Study is completed. While the effort necessary to complete a Feasibility Study is not as strenuous as a Comprehensive Structural Analysis, it can still be onerous and other less demanding comparisons may adequately reach the same conclusion in an insignificant vs. significant Changed Condition study. Alternative and reliable methodologies considering the Structures are provided below in Chapter V.

When determining the appropriateness of using these alternate methodologies for determining a Changed Condition, it is imperative that structural documentation of the existing condition, or a prior preexisting condition in which the comparison is made against, is not just available but is also reputable and demonstrates that the telecommunications infrastructure has adequate strength to support the existing appurtenances. Moreover, it must be confirmed that a material upgrade, change / modification, demolition, or failure of the Structure has not occurred following the date of the available structural documentation. To confirm no such material event exists, it may be appropriate (among other things) to review recent site photos, mappings, or conduct a site visit.

If the applicable structural documentation and above Structure status confirmations are unable to be obtained, the alternative methodologies discussed in Chapter V should not be used to determine a Changed Condition. Proceeding with an alternative method in such a scenario would not only run contrary to ANSI/TIA-222-H, but more significantly, could lead to structural damage. To provide an example; if structural documentation of an existing condition is supplied and it states the Structure has been maintained in like-new condition, but recent site photos show the Structure is in a compromised structural condition (e.g., Structure is tilted / leaning; deformed member(s); non-superficial material loss due to corrosion), then an alternative method should **NOT** be employed as it was confirmed that a material change to the Structure has occurred.

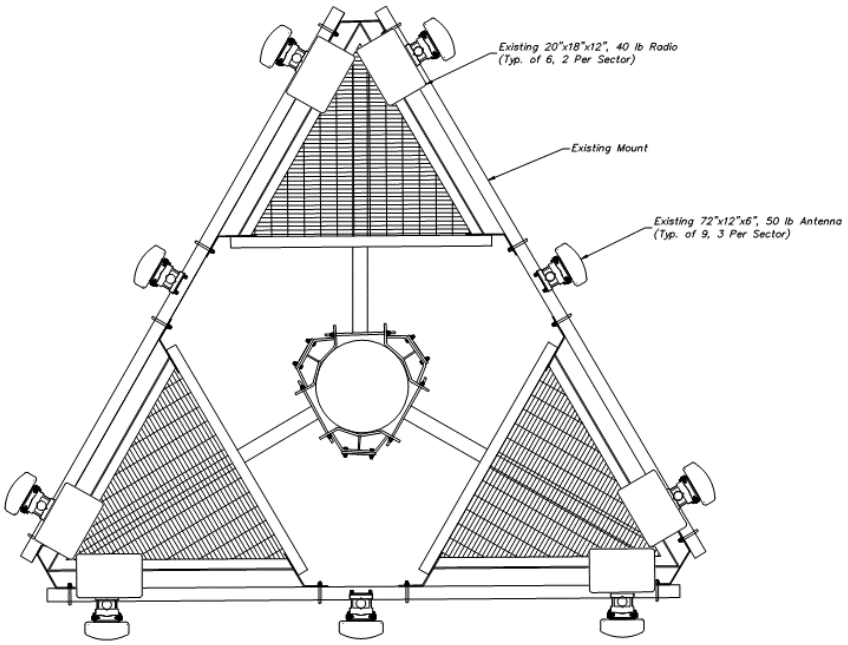
CHAPTER V
COMPARISON OF APPURTENANCE DIMENSIONS, QUANTITIES AND WEIGHT

The simplest and most conservative method for evaluating a Changed Condition is comparing the total combined Projected Area (**"PA"**) and weight of the existing installed telecommunications equipment to the PA and weight of the proposed final configuration of the telecommunications equipment to be installed. If the percentage change in PA and weight are both less than or equal to 5%, then the demand-capacity ratio of the structure is likely negligible; thus, an insignificant Changed Condition. If either the PA or weight change is greater than 5%, then this is classified as a significant changed condition and a comprehensive analysis is warranted. Example applications are as follows:

Example 1: Insignificant Change (≤ 5% Change)

Existing wireless equipment installation (Installation 1):

- (9) 72" x 12" x 6" antennas; weighing 50 lb, evenly distributed on 3 sectors
- (6) 20" x 18" x 12" radios; weighing 40 lb, evenly distributed on 3 sectors
- PA: 72" x 12" x 3 + 20" x 18" x 2 + 6 * (72" x 12" x 0.25 + 72" x 6" x 0.75) + 4 * (20" x 18" x 0.25 + 20" x 12" x 0.75) = 53 ft^2
- Weight = 9 * 50 lb + 6 * 40 lb = 690 lb

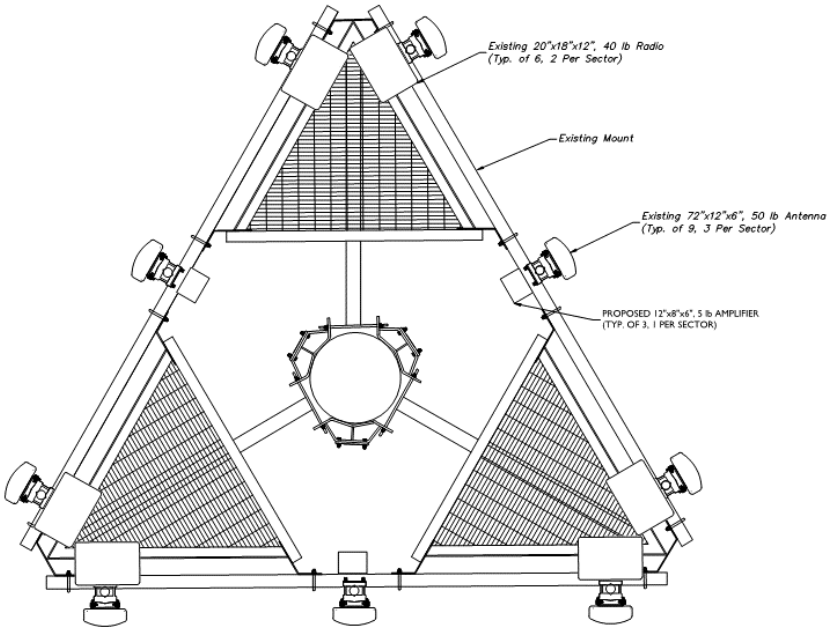


EXISTING ANTENNA LAYOUT
NOT TO SCALE

EXISTING WEIGHT AND PA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	72"X12"X6"	50 LBS	40.50 FT^2
RADIO	6	20"X18"X12"	40 LBS	12.50 FT^2
		TOTALS	**690 LBS**	**53.00 FT^2**

Proposed wireless equipment installation (Installation 2):

- (9) 72" x 12" x 6" antennas; weighing 50 lb, evenly distributed on 3 sectors
- (6) 20" x 18" x 12" radios; weighing 40 lb, evenly distributed on 3 sectors
- (3) 12" x 8" x 6" amplifiers, weighing 5lb / amplifier, evenly distributed on 3 sectors
- PA: 72" x 12" x 3 + 20" x 18" x 2 + 12" x 8" x 1 + 6 * (72" x 12" x 0.25 + 72" x 6" x 0.75) + 4 * (20" x 18" x 0.25 + 20" x 12" x 0.75) + 2 * (12" x 8" x 0.25 + 12" x 6" x 0.75) = 54.75 ft^2
- Weight = 9 * 50 lb + 6 * 40 lb + 3 * 5 lb = 705 lb



PROPOSED ANTENNA LAYOUT
NOT TO SCALE

PROPOSED WEIGHT AND PA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	72"X12"X6"	50 LBS	40.50 FT^2
RADIO	6	20"X18"X12"	40 LBS	12.50 FT^2
AMPLIFIER	3	12"X8"X6"	5 LBS	1.75 FT^2
		TOTALS	**705 LBS**	**54.75 FT^2**
		PERCENT CHANGE	**2.2%**	**3.3%**

Results:

- PA % Change: 54.75 ft^2 / 53.0 ft^2 – 1 = 3.3%, ≤ 5%
  - **Insignificant Changed Condition**
- Weight % Change: 705 lb / 690 lb – 1 = 2.2%, ≤ 5%
  - **Insignificant Changed Condition**

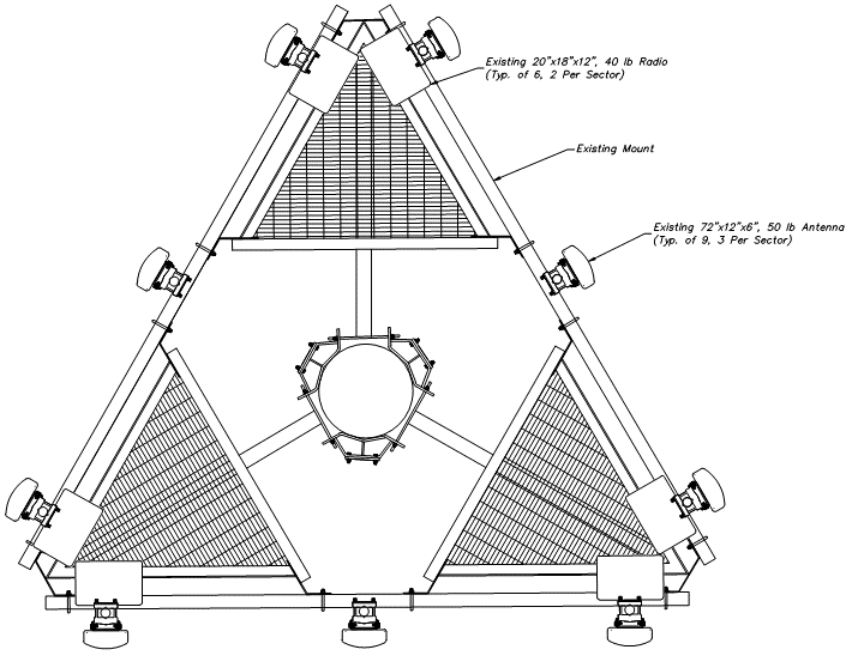
In the above example, both the PA and weight calculations result in a demand-capacity ratio change of less than 5%, thus there is an insignificant Changed Condition and no further structural evaluations would be required. Note, if one had exceeded 5%, but not the other, the conclusion would be a significant Changed Condition requiring greater assessment.

An example of how this might be applied between the Structures is provided below:

Example 2: Significant Change (> 5% Change)

Existing wireless equipment installation (Installation 1):

- (9) 72" x 12" x 6" antennas; weighing 50 lb, evenly distributed on 3 sectors
- (6) 20" x 18" x 12" radios; weighing 40 lb, evenly distributed on 3 sectors
- PA: 72" x 12" x 3 + 20" x 18" x 2 + 6 * (72" x 12" x 0.25 + 72" x 6" x 0.75) + 4 * (20" x 18" x 0.25 + 20" x 12" x 0.75) = 53 ft^2
- Weight = 9 * 50 lb + 6 * 40 lb = 690 lb

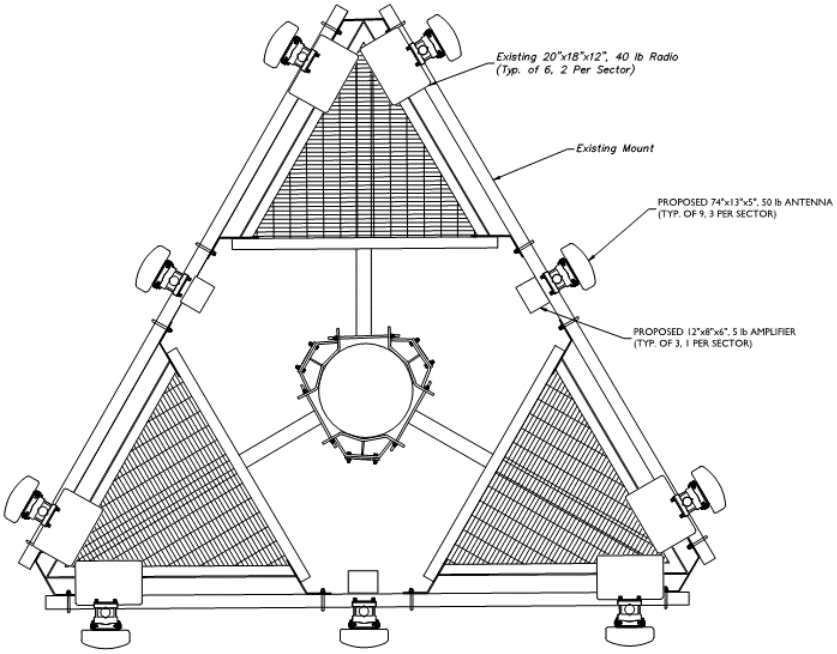


EXISTING ANTENNA LAYOUT
NOT TO SCALE

EXISTING WEIGHT AND PA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	72"X12"X6"	50 LBS	40.50 FT^2
RADIO	6	20"X18"X12"	40 LBS	12.50 FT^2
		TOTALS	**690 LBS**	**53.00 FT^2**

Proposed wireless equipment installation (Installation 3):

- (9) 74" x 13" x 5" antennas; weighing 50 lb, evenly distributed on 3 sectors
- (6) 20" x 18" x 12" radios; weighing 40 lb, evenly distributed on 3 sectors
- (3) 12" x 8" x 6" amplifiers; weighing 5lb, evenly distributed on 3 sectors
- PA: 74" x 13" x 3 + 20" x 18" x 2 + 12" x 8" x 1 + 6 * (74" x 13" x 0.25 + 74" x 5" x 0.75) + 4 * (20" x 18" x 0.25 + 20" x 12" x 0.75) + 2 * (12" x 8" x 0.25 + 12" x 6" x 0.75) = 55.88 ft^2
- Weight = 9 * 50 lb + 6 * 40 lb+ 3 * 5 lb = 705 lb



PROPOSED ANTENNA LAYOUT
NOT TO SCALE

PROPOSED WEIGHT AND PA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	74"X13"X5"	50 LBS	41.63 FT^2
RADIO	6	20"X18"X12"	40 LBS	12.50 FT^2
AMPLIFIER	3	12"X8"X6"	5 LBS	1.75 FT^2
		TOTALS	**705 LBS**	**55.88 FT^2**
		PERCENT CHANGE	**2.2%**	**5.4%**

Results:

- PA % Change: 55.88 ft^2 / 53.0 ft^2 – 1 = 5.4%, > 5%
  - **Significant Changed Condition**
- Weight % Change: 705 lb / 690 lb – 1 = 2.2%, ≤ 5%
  - **Insignificant Changed Condition**

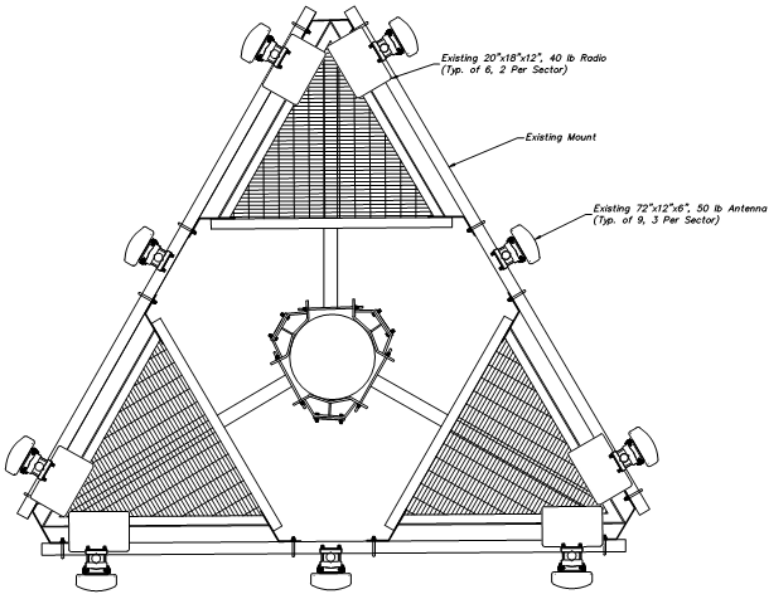
In this example, the changes are to slightly larger antennas (although their depth was less) and the addition of amplifiers. The PA calculation yields a demand-capacity ratio change of more than 5%, resulting in a significant Changed Condition. Meanwhile, the weight calculation results in a demand-capacity ratio change of less than 5%, which is an insignificant Changed Condition, but a more rigorous evaluation is necessary based on the PA changes. In this example, an updated comprehensive mount structural analysis would be required. With proper due diligence and documentation, the changes to the Structure may be insignificant.

To evaluate whether a significant Changed Condition occurs in the tower structure for the proposed wireless equipment installation in Example 2, the total loading at that co-location level must be considered. This includes the PA and weight of the mount used in the equipment installation. Mount manufacturers typically provide these values, both for a single mount or for a combination of mounts used to support multiple sectors. Mount pipes typically are not included in this provided PA and weight, but can be conservatively ignored for the calculation. Because the area of the mount is provided in terms of equivalent projected area (**"EPA"**), the PA area calculation shown in the above examples must be multiplied by C_a, which is the drag coefficient from Table 2-9 in ANSI/TIA-222-H. Factoring PA by C_a converts the equipment area into an EPA, due to the drag coefficient accounting for the shape of the antenna. In the absence of calculated C_a, a general value of 1.6 can be applied to all appurtenances. An example of this application is as follows:

Example 3: Insignificant Change (≤ 5% Change)

Existing wireless equipment (Condition 1)

- EPA = 53.0 ft^2 x 1.6 = 84.8 ft^2
- Weight = 690 lb
- Mount EPA = 30 ft^2
- Mount Weight = 1500 lb
- Combined EPA = 114.8 ft^2
- Combined Weight = 2190 lb

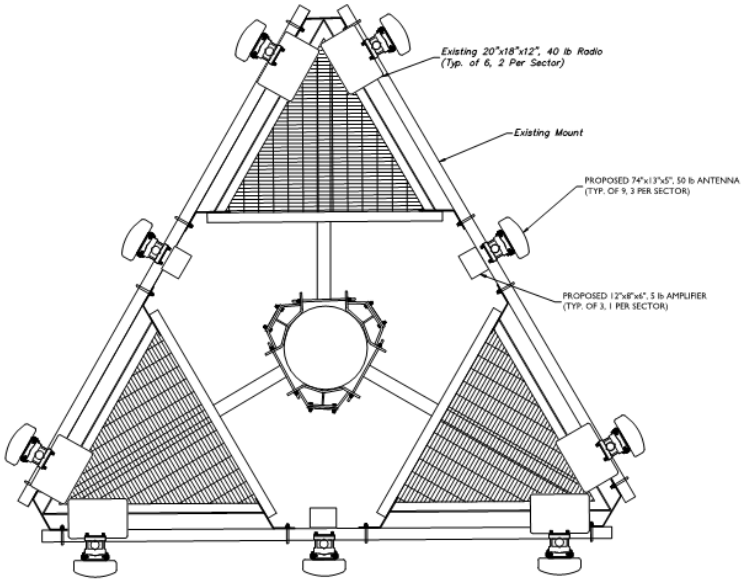


EXISTING ANTENNA LAYOUT
NOT TO SCALE

EXISTING WEIGHT AND EPA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	72"X12"X6"	50 LBS	64.80 FT^2
RADIO	6	20"X18"X12"	40 LBS	20.00 FT^2
MOUNT	1	PLATFORM MOUNT	1500 LBS	30.00 FT^2
		TOTALS	**2190 LBS**	**114.80 FT^2**

Proposed wireless equipment (Condition 2)

- EPA = 55.88 ft^2 x 1.6 = 89.4 ft^2
- Weight = 705 lb
- Mount EPA = 30 ft^2 (assume original mount is reused with no modifications)
- Mount Weight = 1500 lb (assume original mount is reused with no modifications)
- Combined EPA = 119.4 ft^2
- Combined Weight = 2205 lb



PROPOSED ANTENNA LAYOUT
NOT TO SCALE

PROPOSED WEIGHT AND EPA				
EQUIPMENT	QUANTITY	DIMENSIONS	WEIGHT	EPA
ANTENNA	9	74"X13"X5"	50 LBS	66.60 FT^2
RADIO	6	20"X18"X12"	40 LBS	20.00 FT^2
AMPLIFIER	3	12"X8"X6"	5 LBS	2.80 FT^2
MOUNT	1	PLATFORM MOUNT	1500 LBS	30.00 FT^2
		TOTALS	**2205 LBS**	**119.40 FT^2**
		PERCENT CHANGE	**0.7%**	**4.0%**

Results:

- EPA % Change: 119.4 ft^2 / 114.8 ft^2 – 1 = 4.0%, ≤ 5%
  - **Insignificant Changed Condition**
- Weight % Change: 2205 lb / 2190 lb – 1 = 0.7%, ≤ 5%
  - **Insignificant Changed Condition**

Similar approaches can be used to account for linear appurtenance (foam helix, fiber, power cables, etc.), considering comparisons to the coax width (height would not be relevant unless the installation of the heights of the existing and proposed conditions varied by more than 5 ft). Converting to EPA is unnecessary as almost all coax drag coefficients are 1.2; percentage change would be identical for PA and EPA.

More advanced analysis, considering the PA / EPA, heights and weights of other installed telecommunications equipment could also be included in the values used in the determination of a changed condition. However, this must be calculated carefully as the 5% threshold would likely change when considering this additional equipment at different elevations on the tower (e.g., EPA % Change at 150 ft may be greater than at 100 ft above ground level).

Equipment installed behind shrouds or effectively shielded from the wind (e.g., cannister installations) would be exempt from the PA % calculation as the wind impact on these installations would be unaffected. Weight calculations may still be appropriate.

CHAPTER VI
INDUSTRY IMPACT AND OTHER CONSIDERATIONS

As demonstrated above, many equipment replacements or additions have a negligible impact on Structure and mount demand-capacity ratios. Consideration can be given to the EPA and weight of the Structure, when evaluating Changed Conditions. Monopole Structures generally contribute 30% – 50 % of the demand-capacity ratio (i.e., for a maximum demand-capacity ratio of 80%, as much as 40% of the 80% may be due to the monopole alone) and 40% – 70% for lattice towers. Also, the more heavily loaded a Structure is with telecommunications equipment, the more likely an equipment change will result in a significant Changed Condition.

Other considerations include when a demand-capacity ratio is known for a Structure, then more aggressive Changed Conditions may be judged as insignificant. For example, the Changed Condition comparison of PA may reveal a 15% change, however, the most recent structural analysis of the Structure may reveal the demand-capacity ratio to be 75%. Assuming the new equipment is installed symmetrically on the Structure (tower or mount), an engineer knowledgeable in the application of ANSI/TIA-222-H may be able to comfortably confirm the Changed Condition in excess of 5% is insignificant and a Feasibility Study may be appropriate.

This is not to imply that anytime a Changed Condition is less than or equal to 5% that a Comprehensive Structural Analysis would not be required. Reasons for which a Feasibility Study may not provide enough depth into evaluation of risk, include, but are not limited to:

- The demand-capacity ratio of the mount or tower exceeded 100%, per the last Comprehensive Structural Analysis;
- Upgrades to the mount are required, potentially invalidating the Changed Condition conclusion for the Structure;
- Service level agreement between the wireless equipment operator and Structure owner and / or engineer providing technical documents (both sealed and unsealed);
- Antenna shapes changing from largely round cross-sections to flat cross-sections;
- Additional mount pipes being needed or upgraded to support new equipment;
- Changes to the code and/or standard which imply greater risk than originally considered due to topographic features, earthquake considerations or ice loading;
- Expectation of mount performance with respect to maintenance and rigging loading;
- No previous technical documentation (structural analysis or original design criteria) indicating expected capacity of the Structure or mount;
- Changes to wireless equipment, outside the equipment changes in question, that impact the structure demand-capacity ratio;
- Improper or unknown maintenance of the Structure or mount; &
- Authorities having jurisdiction, such as building officials, may demand more in-depth assessments

SUMMARY

Changed Conditions are a concept introduced in ANSI/TIA-222-G and expanded upon in ANSI/TIA-222-H. The purpose of this concept is to reasonably evaluate the potential risk of the installation of new telecommunications equipment on Structures. As the above examples illustrate, changes in equipment PA and weight by as much as 5 ft^2 and 50 lbs. often has a negligible impact on risk to the reliability of the Structure. Therefore, advanced engineering analysis of the infrastructure can be unnecessary, and the value of this advanced engineering must be weighed against the additional effort required and a decrease to network reliability through site redundancy in a market. Careful evaluation is necessary to reach this conclusion and a qualified engineer should be engaged to confirm whether a Changed Condition is significant or insignificant. At all times, the assumptions used must be based in sound reason and may require verification to ensure that the Structure performs as intended in a safe manner.