

Risk Categorization in Accordance with ANSI/TIA and the 2018 IBC

The ANSI/TIA-222 Standard and the IBC have traditionally adopted the methodology of the ASCE 7 Standard for determining the minimum loading requirements for new and existing structures. The ASCE 7 Standard has evolved since the publication of the ANSI/TIA 222-G Standard (Rev G). The release of Revision H of the ANSI/TIA-222 Standard (Rev H) in January 2018 and the publication of the 2018 International Building Code (IBC) brings these standards up-to-date with the latest ASCE 7 Standard (ASCE 7-16).



Introduction

The Rev H minimum wind, ice and earthquake loading requirements for a new or existing structure are based on reliability requirements. Reliability requirements are established by considering the consequences (risk) of failure of a structure depending on its use and location. For a communication structure, use is defined by the types of services provided by the equipment supported by the structure. Rev G had 3 categories of structures based on reliability requirements. Rev H now has 4 categories and has updated the terminology used to describe the categories from "Structure Class" to "Risk Category" to be consistent with ASCE 7 and the IBC.

The order of increasing reliability remains the same numbering from the lowest reliability (category I) to the highest reliability (category IV). Using 4 categories allows the TIA-222 Standard to better categorize the wide range of use (services) and locations of communication structures. This approach is consistent with the intent of the ASCE 7 standard where the definitions of risk for each category is presented in general terms allowing the interpretation and application of risk categories and their associated loading requirements to communication structures and other specialty structures.

The Rev H risk categories based on the services provided by a communication structure and the risk to human life and/or damage to surrounding facilities in the event of failure were established by a consensus process in accordance with ANSI and have been accepted by the IBC.

The use and description of communication structures for each of the 4 risk categories are provided in Table 2-1 of the Rev H standard and is reproduced at the end of this paper with permission from TIA.

The intent of this document is to provide clarity and insight regarding the Risk Category for a new or existing communication structure by comparing the risk categories from Rev H (Table 2-1) to the risk categories defined in IBC for buildings and other structures.

The authors of this paper have provided commentary for each of the risk categories. The commentaries are opinions of the authors and do not represent any form of endorsement by TIA, ASCE or IBC.

Risk Categories

Risk categories for new and existing communication structures are based on considerations such as primary use, location, proximity to other facilities, redundancy of the services provided, site hardening requirements, etc. For each higher Risk Category, the wind, ice and earthquake loading requirements increase which results in a progressively lower probability that a failure would occur due to a design load being exceeded over the life of a structure. As an example, the following table illustrates how the probability of failure due to wind loading reduces as the Risk Category increases and how the design wind speed increases accordingly.

Extreme Wind Loading Based on Risk Category			
Risk Category	Return Period	5-yr Probability of Exceedance	Example Design Wind Speed, MPH
I	300 years	15%	106
II	700 years	7%	114
III	1700 years	3%	122
IV	3000 years	1.6%	127

The Rev H return periods and probabilities of exceedance based on Risk Category for wind, ice and earthquake loading were adopted from ASCE 7 and are identical for the IBC and the Rev. H Standard. The wind speeds tabulated above are shown as a typical example. The design wind speeds for a specific area may vary.

Following are the definitions of risk categories, first per ANSI/TIA-222-H (Rev. H) Table 2-1, followed by the definitions from the 2018 International Building Code (IBC).

RISK CATEGORY I

ANSI/TIA-222-H: Structures that due to use or location represent a low risk to human life and/or damage to surrounding facilities in the event of failure.

Structures in this category are used for services that are optional and/or where an extensive delay in returning the services would be acceptable such as: redundant wireless antennas; low-power radio access nodes (small cell); single-appurtenance supporting

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structures that allow for rapid repair or replacement, residential wireless and conventional 2-way radio communications; television, radio and scanner reception; wireless cable; amateur and CB radio communications.

2018 IBC: Buildings and other structures that represent a low hazard to human life in the event of failure, including but not limited to:

- Agricultural facilities
- Certain temporary facilities
- Minor storage facilities

Author's Commentary: The TIA and IBC definitions share the same "low risk/hazard to human life" terms. Failure of structures classified as Risk Category I would not be expected to endanger the general public and the loss of use of the structure would be limited to the private user of the services provided or would have a minimum impact on the well-being of the general public.

RISK CATEGORY II

ANSI/TIA-222-H: Structures that due to use or location represent a moderate risk to human life and/or damage to surrounding facilities in the event of failure.

Structures in this category are used primarily for redundant services (i.e. services that may be provided by other means) such as: commercial wireless communications (cellular, PCS, 3G, LTE, 4G, 5G, etc.); television and radio broadcasting; community access television (CATV); microwave communications; non-hardened sites that support antennas or equipment that may be used for redundant communications by police and fire departments, first responders, etc. during emergencies and small wind turbines.

This category applies to all structures except those identified in Risk Categories I, III, and IV.

2018 IBC: Buildings and other structures except those listed in Risk Categories I, III and IV.

Author's Commentary: Risk Category II is the default category for Rev H unless otherwise specified in the procurement specification for a new structure or the modification of an existing structure. For the IBC, this category is for all structures not specifically classified as conforming to another risk category. Risk Category II includes the vast majority of commercial communication structures and buildings such as Commercial Mobile Radio Services (CMRS), AM/FM Radio Broadcast, Television Transmission and Microwave



Communications as recognized by the FCC. This includes communication structures that may be used by police, fire and first responders during emergencies when there are alternate means of communications available. The Rev H definition includes the term moderate risk.

The Rev H risk categorization depends on the primary use of the communication structure, not on whether a particular service provided, such as cellular communications, "could be" used during an emergency as just one of the methods available for communication.

RISK CATEGORY III

ANSI/TIA-222-H: Structures that due to use or location represent a substantial risk to human life and/or damage to surrounding facilities in the event of failure.

Structures with the potential to cause mass disruption (loss of power, transportation, water, etc.) of day-to-day civilian life in the event of failure.

Structures in this category are used for communications across non-redundant and hardened networks such as: civil or national defense; rescue or disaster operations; military and navigation facilities.

2018 IBC: Buildings and other structures that represent a substantial hazard to human life in the event of failure, including but not limited to:

- Buildings and other structures whose primary occupancy is public assembly with an occupant load greater than 300.
- Buildings and other structures containing Group E occupancies with occupant load greater than 250.

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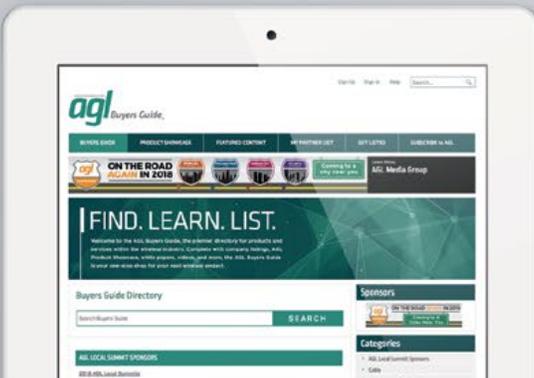


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- Buildings and other structures containing educational occupancies for students above the 12th grade with an occupant load greater than 500.
- Group I-2 occupancies with an occupant load of 50 or more residential care recipients but not having surgery or emergency treatment facilities.
- Group I-3 occupancies.
- Any other occupancy with an occupant load greater than 5,000.
- Power-generating stations, water treatment facilities for potable water, wastewater treatment facilities and other public facilities not included in Risk Category IV.
- Buildings and other structures not included in Risk Category IV containing quantities of toxic or explosive materials that:
 - Exceed maximum allowable quantities per control area as given in Table 307.1(1) or 307.1(2) or per outdoor control area in accordance with the International Fire Code;
 - Are sufficient to pose a threat to the public if released.

Author's Commentary: The TIA and IBC definitions share the same "substantial risk/hazard to human life" terms. Risk Category III applies to communication structures that in the event of their collapse could impact surrounding facilities that support operations that are necessary for day-to-day civilian life or when the services provided by a communication structure for such operations are not available by other means and there is a contractual agreement to provide and maintain a hardened communication site.

The Rev H definition for Risk Category III includes the terms "non-redundant" and "hardened". Examples are provided of services that may not have alternative communication services (i.e. non-redundant). The term "hardened" is a new term for Rev H. The definition provided in Rev H is provided below. It should be noted that the term "hardened" applies to the entire communication system including such related items as back-up power, site security, etc. and not just to the structure supporting the service.

Hardened Network: A network intended to provide the level of reliability and resiliency of an emergency communication system during and immediately following a natural or manmade disaster in accordance with a service level agreement with the operator of the emergency communication system that specifies requirements including, but not limited to, the



following: protection from storm damage, immediate and long-term clean power backup systems, surge protection for electronics, monitoring, security and maintenance schedules.

RISK CATEGORY IV

ANSI/TIA-222-H: Structures that due to use or location represent a substantial hazard to the community in the event of failure.

Structures in this category are those that in the event of failure would threaten the functionality or integrity of facilities that are designated as Risk Category IV facilities.

2018 IBC: Buildings and other structures designated as essential facilities, including but not limited to:

- Group I-2 occupancies having surgery or emergency treatment facilities.
- Fire, rescue, ambulance and police stations and emergency vehicle garages.
- Designated earthquake, hurricane or other emergency shelters.
- Designated emergency preparedness, communications and operations centers and other facilities required for emergency response.
- Power-generating stations and other public utility facilities required as emergency backup facilities for Risk Category IV structures.
- Buildings and other structures containing quantities of highly toxic materials that:
 - Exceed maximum allowable quantities per control area as given in Table 307.1(2) or per outdoor control area in accordance with the International Fire Code; and
 - Are sufficient to pose a threat to the public if released.

- Aviation control towers, air traffic control centers and emergency aircraft hangers.
- Buildings and other structures having critical national defense functions.
- Water storage facilities and pump structures required to maintain water pressure for fire suppression.

Author's Commentary: TIA's Risk Category IV applies to communication structures where a failure may impact an entire community as opposed to a failure that would have a limited local impact. The failure of a communication structure may represent a substantial hazard due to the loss of a service provided or due to a collapse of the structure itself impacting the functionality of a surrounding Risk Category IV facility.

Application of Risk Category

The categorization of a communication structure should be based on the risk to human life and property, damage to a facility in the event of failure and on the primary use and intended purpose of the structure.

The concept of redundancy is critical to the categorization of a communication structure when considering the primary use and intended purpose of a structure. This concept is unique to communication structures and is not a consideration for most buildings and other structures addressed in the IBC. For Risk Category II communication structures, the term redundant applies to the service provided by equipment supported on the structure as opposed to the redundancy of the operations and equipment supporting the service. An example would be the loss of a structure supporting cellular communications. The loss of the structure in most cases would not represent a substantial risk as there are generally many alternate methods of communication available to a community such as other cellular communications equipment supported on other structures in the area, land lines, radios, etc. The redundancy of the background network operations or facilities of the wireless carrier network has no value or impact on the consequences of failure in this case. These types of communication structure sites are typically not hardened as they do not represent a substantial risk to the public in the event of failure and are categorized as Risk Category II structures.

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Communication structures that support services that do represent a substantial risk to the public are expected to be hardened. As defined above, hardened means that special precautions are taken for the entire operations and equipment supporting the service (not just the increase in strength requirements for the supporting structure) to ensure that the non-redundant service will be operational when needed.

The consequence of failure must consider the potential impact on surrounding facilities. For example,

although a communication structure may be categorized as a Risk Category II structure based on its use, a higher category may be necessary when there may be an impact of failure on an adjacent facility with a higher Risk Category. In these cases, the Risk Category of the communication structure should not be less than the Risk Category of the adjacent facility. It should be noted, however, that just because a communication is adjacent to a facility with a higher Risk Category, it is not necessary in all cases to match the Risk Category of the communication structure with

the Risk Category of the facility. This is only required if the failure of the communication structure could cause damage or otherwise physically impact the facility.

It is common for communication structures to support multiple types of services. Rev H Section 2.2.2.1 stipulates that Risk Category II applies to commercial services such as cellular telephone services even when other types of equipment are supported by the structure that may happen to be used during an emergency. It is important to note that when any service is intended to be the primary non-redundant service to be used during an emergency as contractually agreed upon with the owner of the structure, it is expected that the site will be hardened with the structure categorized as either a Risk Category III or IV structure.

The flow charts on the following page summarizes the considerations for establishing the Risk Category for a communication structure required by Rev H. The Risk Category required for a structure is the higher risk category considering the service provided and the risk/hazard in the event of failure.

The flow chart is intended to illustrate the minimum requirements of Rev H. An owner may specify a higher Risk Category than illustrated regardless of the hardened status of the site or of the location or type of service provided.

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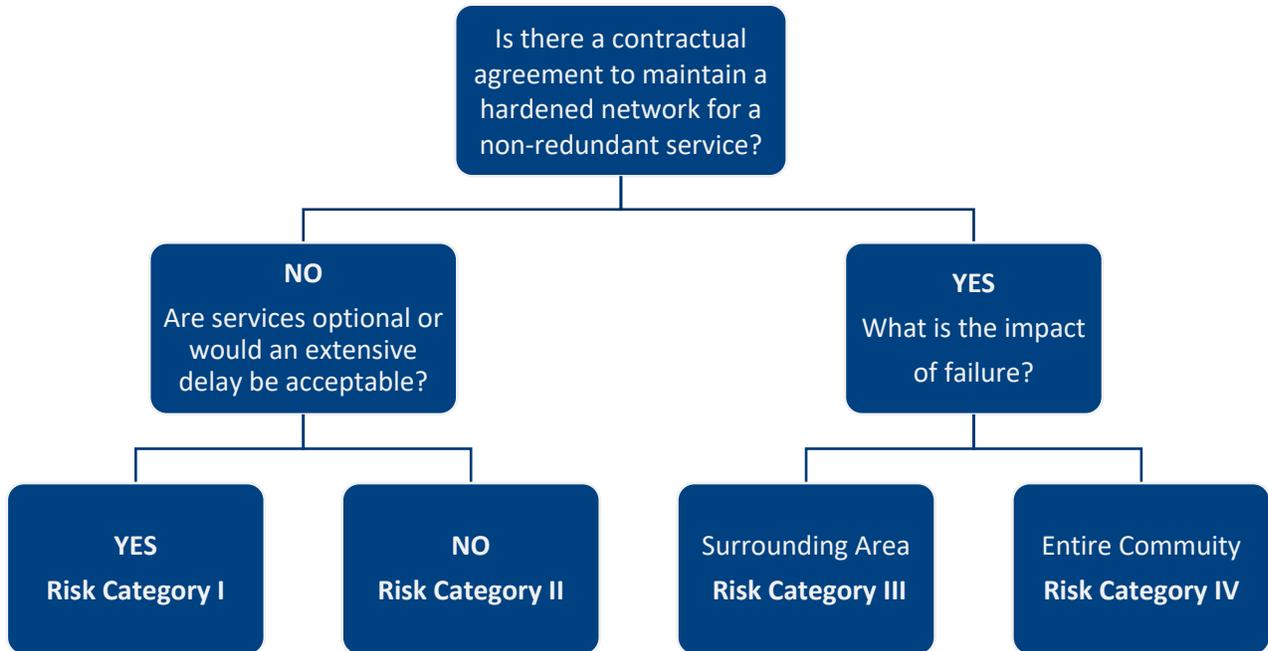
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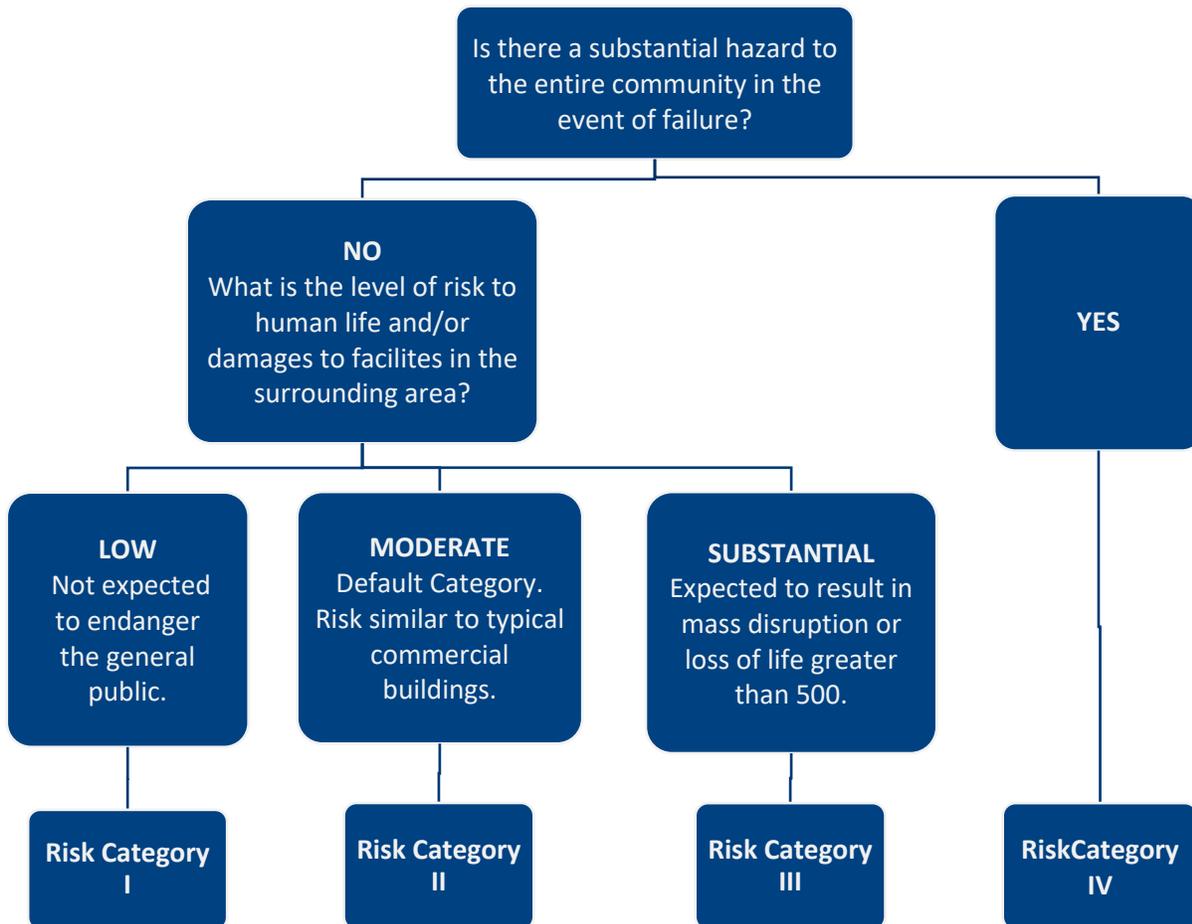
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Structure Categorization Based on Service Provided



Structure Categorization Based on Risk/Hazard in the Event of Failure



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Conclusion

The categorization of communication structures has been enhanced with the publication of the ANSI/TIA-222-H Standard. The use of 4 categories, now termed “Risk Categories”, allows the fine tuning of reliability requirements unique to communication structures based on the wide range of services provided. Although the term “Risk Category” replaces the term “Structure Class” used in Rev G of the standard,

the order of increasing reliability remains the same numbering from the lowest reliability (category I) to the highest reliability (category IV). The Risk Category assigned to a structure directly impacts the magnitude of wind, ice and earthquake loading. The use of risk categories to define reliability requirements for communication structures is consistent with the ASCE 7-16 standard and the 2018 IBC for establishing the reliability requirements for buildings and other structures.

Table 2-1: Risk Categorization of Structures	
Use or Description of Structure	Risk Category
<p>Structures that due to use or location represent a low risk to human life and/or damage to surrounding facilities in the event of failure.</p> <p>Structures in this category are used for services that are optional and/or where an extensive delay in returning the services would be acceptable such as: redundant wireless antennas; low-power radio access nodes (small cell); single-appurtenance supporting structures that allow for rapid repair or replacement, residential wireless and conventional 2-way radio communications; television, radio and scanner reception; wireless cable; amateur and CB radio communications.</p>	I
<p>Structures that due to use or location represent a moderate risk to human life and/or damage to surrounding facilities in the event of failure.</p> <p>Structures in this category are used primarily for redundant services (i.e. services that may be provided by other means) such as: commercial wireless communications (cellular, PCS, 3G, LTE, 4G, 5G, etc.); television and radio broadcasting; community access television (CATV); microwave communications; non-hardened sites that support antennas or equipment that may be used for redundant communications by police and fire departments, first responders, etc. during emergencies and small wind turbines.</p> <p>This category applies to all structures except those identified in Risk Categories I, III, and IV.</p>	II
<p>Structures that due to use or location represent a substantial risk to human life and/or damage to surrounding facilities in the event of failure.</p> <p>Structures with the potential to cause mass disruption (loss of power, transportation, water, etc.) of day-to-day civilian life in the event of failure.</p> <p>Structures in this category are used for communications across non-redundant and hardened networks such as: civil or national defense; rescue or disaster operations; military and navigation facilities.</p>	III
<p>Structures that due to use or location represent a substantial hazard to the community in the event of failure.</p> <p>Structures in this category are those that in the event of failure would threaten the functionality or integrity of facilities that are designated as Risk Category IV facilities.</p>	IV

