TOWER ICING AND SHEDDING

There is not a lot of information available on the issue of controlling falling ice. Perhaps the most comprehensive that I have located is Chapter 16.3 at tvhandbook.com (a copy has been provided). The lack of an easy solution is made clear in Section 16.3.3b of this resource "Prevention and Ice Control" which states, "Falling ice is a difficult problem because there is no feasible proven means of prevention available for tall masts. The best way to guard against damage to adjacent property is to restrict land usage in the icefall shadow of the tower." Consistent with this article, further internet research and conversations with various Western Wireless employees have disclosed no prevention method.

Evidently, ice falling from towers is not that uncommon but usually doesn't come to light because most installations are in fields or open areas. For cellular providers, the problem is also less widespread in more populated areas because many of the sites are attached to existing structures such as water towers or buildings or involve monopoles of 150' or less which because of their shorter height and lack of the horizontal cross pieces present in the lattice of self-support or guyed towers have less surface area for ice formation.

Some TV and FM radio broadcasters have antennas which include built-in heating elements that inhibit ice formation on the antennas themselves in order to prevent interference with the broadcast signal, however, the towers themselves are not heated and can still present ice fall problems. In fact, antenna heating can raise a liability issue because man-made ice melting and reformation could cause a more dangerous nonnatural condition.

Western Wireless does not use heating elements or any other method to prevent ice formation on either antennas or towers. No one at Western Wireless is aware of any other of its sites where attention has been called to falling ice. On the internet I have run across some mention ice falling from towers. However, each situation dealt only with secondary measures such as shielding or signage to warn of the hazard. In no case was any measure put forward that would prevent ice formation itself.

Unfortunately, in the present case the tower and the fire station are close together. Evidently no architect or engineer in the design process for either structure raised the ice issue. Neither does the city have a "fall-zone" requirement in its ordinance that could have triggered discussion of the issue at the time zoning approval was sought. At the time everyone viewed this as a win-win situation with revenue for the city and a benefit to emergency services both from enhanced public communication and from the possible location of future emergency services antennas on the tower.

In summary, I have been unable to find any feasible method to prevent ice formation. Shielding of the entire fire station premises is not economically or architecturally feasible. I will continue to research this issue. In the meantime, more specific information about the precise area affected by falling ice and the frequency and size of pieces falling would be helpful in further assessing the threat and methods to deal with it. The shedding of glaze ice generally follows precipitation events and is generally not a problem with frost or rime ice arising from atmospheric condensation. When does ice formation at this tower occur? Is it frequent or does it only occur in conjunction with identifiable weather events? Based on its experience does the city have any suggestions regarding proposed resolution of this issue?

Chapter

16.3

Tower Construction and Maintenance

Jerry C. Whitaker, Editor-in-Chief

16.3.1 Introduction

The transmitting tower is the most visible component of any broadcast transmission facility. It is also the component most vulnerable to hostile elements. The basic task of the station engineer is to keep the tower erect in the face of natural and man-made forces until the structure is no longer needed. The most common reasons for tower failure are poor construction, poor maintenance, overloading, icing, and accidents.

16.3.2 Antenna Tower Lighting and Marking Requirements

The FCC has been given the authority by Congress to require the painting and/or illumination of antenna towers when it determines that such towers may constitute a menace to air navigation [47 U.S.C. § 303(q)]. The FCC's rules governing antenna tower lighting and painting requirements are based upon the advisory recommendations of the FAA, which are set forth in two FAA Advisory Circulars [47 CFR §§ 17.21–17.58]. Although the FAA lighting and painting standards are advisory in nature, FCC rules make the standards mandatory.

The FCC always requires an FAA determination that an antenna tower will not pose an aviation hazard before it will grant permission to build the structure. The FAA's determination takes into consideration the location and height of the proposed tower, and its safety lighting and marking.

Each new or altered antenna tower structure registered must conform to the FAA's painting and lighting recommendations set forth on the structure's FAA determination of "no hazard," and must be cleared with the FAA and filed with the FCC. If the FAA determines that the tower would be a physical hazard, the FCC will not approve the construction permit application. When, however, the FAA determines that there is an aviation hazard due to possible radio frequency interference (RFI) with aviation communication signals, the FCC makes an independent analysis of who will be responsible for resolving possible conflicts, and may not automatically defer to the FAA determination as to what party should bear the cost of any needed equipment changes.

The FAA advisory circulars set forth detailed specifications for lighting and painting. If, however, the FAA's standards allow more than one lighting or painting option for a particular structure, the organization seeking FAA clearance for a tower may indicate which of the specified types of marking and lighting systems is desired. With respect to telecommunications towers, the most common option approved by the FAA is the substitution of white flashing lights for a combination of red lights and painting. Any preferences or requests for deviation from standards must be submitted to the FAA regional office that services the area where the structure would be located. The FAA regional office then conducts an aeronautical study of the safety of the structure and considers the proposed deviations or preferences in conducting its analysis.

Where the FAA approves the substitution of high intensity white lights for a combination of red lights and painting, and the antenna tower is located in a residential neighborhood, the Commission requires the applicant to prepare an environmental assessment [47 CFR § 1.1307(a)(8)]. The Commission, upon review of the environmental assessment, may determine that the proposed substitution of high intensity white lights would not have a significant impact, and may process the application without further review [47 CFR § 1.1308(d)]. If, however, based upon a review of the environmental assessment, the Commission determines that the proposed high intensity lights would have a significant environmental impact upon the human environment, the Commission will inform the applicant. The applicant will have the opportunity to amend its application to eliminate the environmental problem. If the problem is not eliminated, the Commission will publish in the Federal Register a Notice of Intent that an Environmental Impact Statement be prepared [47 CFR § 1.1308(c)]. The Commission may, to assist in the preparation of an Environmental Impact Statement, request further information from the applicant, interested persons, and other agencies or authorities. The Commission may also direct that objections to the proposed lighting be raised with the appropriate state or local authorities [47 CFR § 1.1314(d)].

As part of the its aeronautical study, the FAA may—if it considers it necessary—solicit comments from or convene a meeting of all interested persons for the purpose of gathering all facts relevant to the effect of the proposed construction on the safe and efficient utilization of the navigable airspace. (See 14 CFR §§ 77.35, 77.41–77.69.) The FAA regional office forwards its recommendation to FAA headquarters in Washington for final approval. The final FAA determination also must be submitted to the FCC with any antenna construction permit application that requires FAA notification. These structures are subject to inspection and enforcement of marking and lighting requirements by the FCC.

Examples of various tower lighting options are given in Figure 16.3.1.

16.3.2a Tower Height

Although there is no absolute height limit for antenna towers, both the FCC and FAA have established a *rebuttable presumption* against structures over 2,000 ft above ground level. The FCC has a policy that applications filed with the FCC for antenna towers higher than 2,000 ft above ground will be presumed to be inconsistent with the public interest and the applicant will have a burden of overcoming that strong presumption. The applicant must accompany its application with a detailed showing directed to meeting this burden. Only in the exceptional case, where the Commission concludes that a clear and compelling showing has been made that there are public interest reasons requiring a tower higher than 2,000 ft above ground, and after the parties have complied with applicable FAA procedures, and full Commission coordination with FAA on the question of menace to air navigation, will a grant be made. (See 47 CFR § 1.61 Note.)

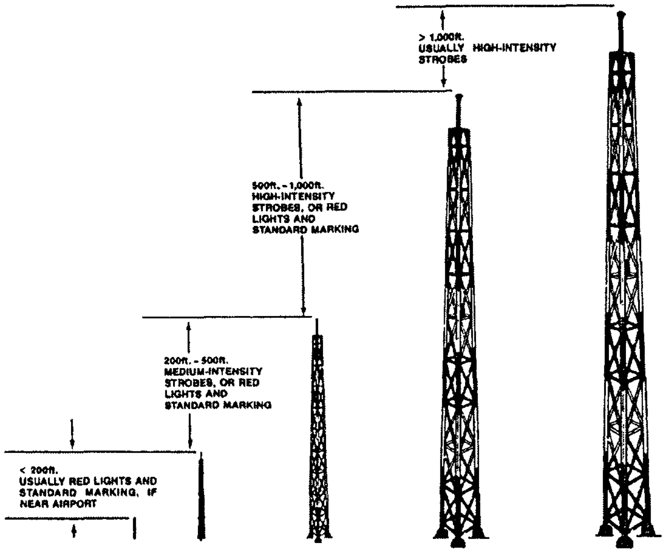

Figure 16.3.1 Common approaches to tower obstruction marking and lighting. (*After* [1].)

16.3.3 Ice

Tower owners have long known that atmospheric icing of transmission towers can cause problems ranging in severity from transmission pattern distortion to complete tower collapse. Ice forming between antenna radiating elements can cause electrical shorting and equipment burnout. Ice can stretch guy lines. Also, towers near populated areas are subject to the added liability of falling ice, which threatens lives and surrounding property.

There are two recognized sources of ice accretion. The first is *in-cloud icing*, in which supercooled water droplets float in the air and contact a surface because of air movement. The second is *precipitational icing*, where the droplets are massive enough to fall from the atmosphere onto the tower structure.

These two sources form three types of ice, as illustrated in Figure 16.3.2. *Glaze ice* is usually the product of freezing rain or of airborne spray from nearby bodies of water. It forms at relatively high temperatures (0°C to −3°C) and forms on surfaces as a tightly bonded, clear, dense, glass-like coating. This type of icing is the most serious threat to structures because of its density and the large additional loads it may impart.

Rime, or fluffy, white ice, forms more frequently than glaze in mountainous areas. Rime ice varies from "soft" to "hard" depending on its density, clarity, and crystal structure. Soft rime forms at low temperatures (−5°C to −25°C) and low wind speeds. The impinging droplets freeze

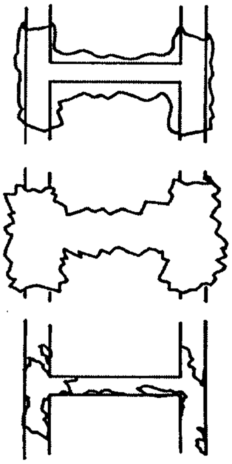

Figure 16.3.2 Common types of ice formation on tower structures. (*After* [1].)

quickly, trapping air as the accretion grows. The large amount of entrapped air is responsible for the opaque-white and fluffy appearance of rime.

Because of its lower density, soft rime is not usually problematic. Hard rime, on the other hand, is halfway between glaze and soft rime in terms of density, clarity, and hardness; it can be as dangerous as glaze ice. *Frost*, a fairly harmless form of icing, forms when in-cloud moisture freezes on a surface, in still air.

Many forms of ice can form simultaneously on the same structure, depending on surface features such as shape, exposure, and heat-dissipation characteristics of the structure.

16.3.3a Problems Caused by Icing

Icing imparts additional dead weight to the structure and also presents a larger surface area to the wind. Towers must be periodically surveyed for signs of structural fatigue from repeated ice accretion and windloading, and guy lines should be inspected for wear and retensioned to counteract stretching.

When ice falls, it is called "shedding." Guyed towers are especially prone to failure from uneven shedding. Heavy ice-loading on the guys exerts tremendous tension, and when individual guy lines suddenly release a load, torsional forces may overcome the strength of the tower.

Harmonic oscillation of guy lines, or "guy galloping," is a rare but extreme type of ice-induced stress. It has been proposed that a small amount of ice building up on the windward side causes a cable to assume the shape on an airfoil. A moderate wind then can induce the cable to move because of an aerodynamic lift and drop phenomenon. Galloping occurs when the movement matches the resonant frequency of the cable, resulting in increasing oscillation amplitudes. The danger lies in the fact that galloping usually affects only one or two lines of an entire guy system, which can produce violent twisting of the tower. An added danger is the fact that metal becomes more brittle and subject to failure when cold. Damping guys can be installed, which tend to limit such oscillation.

Tower-mounted items are subject to damage from falling ice shed from the upper levels. Threatened items include transmission lines, reflector dishes, and antenna elements. Falling ice chunks of considerable size, weighing tens of kilograms, are common during shedding events.

Icing and shedding are usually the result of specific storm patterns, and facility personnel often can predict from past experience the onset of a dangerous situation. In light of the likely storm track and the associated wind directions, buildings beneath the tower normally are situated to the windward side, for protection from falling ice. Transmitter roof buildings are likely to be constructed to absorb impacts and resist punctures. Vulnerable items on the tower can be shielded from above with wood, sheet metal, or wire-frame construction.

16.3.3b Prevention and Ice Control

Falling ice is a difficult problem because there are no feasible proven means of prevention available for tall masts. The best way to guard against damage to adjacent property is to restrict land usage in the icefall shadow of the tower. Initially, the tower should be constructed on a vacant parcel of land large enough to encompass the highly probable fall zone. Thereafter, land-use planners should be cognizant of the danger and restrict development in this zone.

Many different approaches have been taken to prevent ice accretion, to minimize its severity, or to aid in its removal. "Anti-icing" methods minimize or prevent accretion, whereas "de-icing" methods remove the ice once it has formed. Because of the large size of transmitting towers, many of the traditional anti-icing and de-icing methods are not cost-effective when applied to the whole tower. They usually are applied only to sections immediately surrounding the antennas.

Popular techniques for ice control include the following:

- *Shrouding.* Atmospheric icing has been shown, in theory, to be diminished by increasing the diameter of superstructure elements. This reduces the ability of the structure to collect water droplets. This idea has been used with success on arctic oil drilling platforms by enclosing the superstructure in a solid panelwork. Radomes are an example of the use of this principle. Application of this concept to broadcasting is limited to short, sturdy towers that are not subject to excessive windloading.
- *Flexure.* It has been discovered that outfitting radomes or exposed elements with a flexible sheathing has been successful at some installations. Flexure is caused either passively by wind and vibratory action, or by an active pneumatic system.
- *Low-adhesion coatings.* Another approach to icing protection has been in the areas of icephobic or low-ice-adhesion coatings. The types of coatings studied have been freezing-point depressants and low-wettability substances. Freezing-point depressants, such as glycol solutions, soluble salt solutions, and gas-evolving coatings, function by contaminating the accreting droplets and reducing the freezing point to below that of pure water. Sloping or vertical surfaces then will shed the liquid so ice doesn't form. As such, freezing-point depressants are classified as "sacrificial coatings" because they are continually being washed away and must somehow be replenished. Highway salting and aircraft wing de-icing are common applications of these materials.

Low-wettability oils, greases, and permanent coatings have been pursued because of their hydrophobicity. However, it is incorrect to assume that because a coating sheds water it will necessarily shed ice. During the early stages of icing, these substances allow the droplets to run off a sloping surface more rapidly before freezing can occur. Eventually, some droplets accrete before they can be shed. In turn, these create sites for further accretion and the hydrophobic coating thereafter rapidly becomes coated with ice.

Studies have shown that certain polymer coatings exhibit a lower adhesive strength for ice than bare metal surfaces. Some broadcasters insist that the glossy surfaces of their antennas' radiating elements help prevent the formation of ice.

Heating

The only totally effective anti-icing method commonly available is heating, and it is the method of choice for most station owners. Given the large power demands, heating is—in general—used only to prevent icing of the radiating elements of FM and TV antennas. Heating units are factory-built into antennas and must be activated before icing can begin. These low-wattage heaters usually cannot keep up with the accretion rate if ice is allowed to accumulate appreciably before the heaters are activated. Some station operators manually activate heaters based on the local weather forecast or individual judgment. Others prefer the more cautious alternative of operating de-icers for the entire season. A third alternative is to provide for automatic activation via thermal, precipitation, and/or icing sensors.

16.3.4 References

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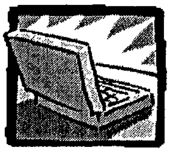
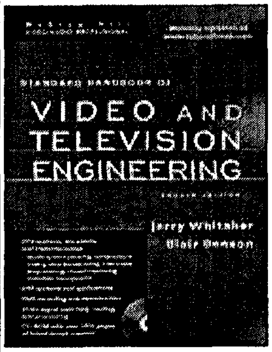
tvhandbook.com Update Port



Update Port: New and Expanded Chapters and On-Line Articles

Because of the rapidly changing nature of video/audio technology, updates to the *Standard Handbook of Video and Television Engineering* and the *Standard Handbook of Audio and Radio Engineering* are an important on-going element of **tvhandbook.com**. The following updated chapters are now available for download. Please check this page regularly for the latest on-line updates and downloads.



Now Available:

4th edition of the *Standard Handbook of Video and Television Engineering*

This latest edition continues the rich tradition of the "TV Handbook" series with dozens of new and updated chapters. A companion CD-ROM (included) provides thousands of additional pages of information from previous editions, and new standards and informational documents relating to digital television. For more information on the fourth edition, click on the cover image or follow the link: http://books.mcgraw-hill.com/cgi-bin/pbg/0071411801.html. To see what specific chapters have been revised, see What's New in the 4th Edition.

Important Note to TVHANDBOOK.COM Visitors:

With the publication of the fourth edition of the *Standard Handbook of Video and Television Engineering*, updated chapters and new material relating to the previous (third edition) have been removed from this site. This page will now focus on updated and new chapters relating to the fourth edition of the TV handbook, and the second edition of the *Standard Handbook of Audio and Radio Engineering*.

Updated Chapters: Video/TV

Chapter 9.5: Digital System Architectures. This update adds new information on lip sync issues as identified and addressed by the ATSC Implementation Subcommittee. Chapter 9.5

Chapter 13.6: Data Broadcasting. This update adds new information on industry standards relating to data broadcasting for DTV. Chapter 13.6

Chapter 13.7: Media and Metadata Management. This update adds new information relating to the recently-published "Content Identification and Labeling" standard of the ATSC. Chapter 13.7

New Chapters: Video/TV

An Introduction: The Principles of Electronics Reviewed, K. Blair Benson and Jerry C. Whitaker. This chapter provides an overview of basic electronics principles in the form of an introductory chapter to the *Standard Handbook of Video and Television Engineering*. TVHB Introduction

Chapter 3.3: DTV Satellite Transmission, Jerry C. Whitaker. This chapter provides an overview of the two ATSC standards for satellite transmission—one for contribution applications and the other for direct-to-home applications. (Note the chapter numbering inconsistency witth the current edition of the *Standard Handbook of Video and Television Engineering*. Chapter 3.3

Chapter 14.3: Frequency Assignment and Allocations, Jerry C. Whitaker. This chapter outlines the U.S. and international frequency assignment procedures and provides the official NTIA U.S. Government Table of Frequency Allocations. Chapter 14.3

Chapter 14.4: Frequency Sources and References, Ulrich L Rohde and Jerry C. Whitaker. This chapter examines basic frequency generation devices and circuits, including synthesizers and PLL systems. Chapter 14.4

Chapter 14.5: Modulation Systems and Characteristics, Jerry C. Whitaker. This chapter explains the fundamental modulation principles and systems in use today for various communications links. Chapter 14.5

Chapter 15.6: Ghost Canceling Reference Signal, Jerry C. Whitaker. This chapter explains the ATSC ghost canceling signal for NTSC specified in document A/49. Background information on the effects of multipath on the reception of analog signals is also provided. Chapter 15.6

Chapter 15.8: RF Voltage and Power Measurement, Jerry C. Whitaker. This chapter explains the principles of peak, average, and rms voltage measurements, and addresses the impact of distortion components on the measurement of RF signals. Chapter 15.8

Chapter 15.12: Standby Power Systems, Jerry C. Whitaker. This chapter discusses options for standby power generation and control at a broadcast facility. Chapter 15.12

Chapter 16.3: Tower Construction and Maintenance, Jerry C. Whitaker. This chapter outlines the basic structural requirements for transmitting towers and discusses maintenance issues, including ice formation. Chapter 16.3

Chapter 17.1: Television Reception Principles. This update adds new information on industry standards relating to television receivers. Chapter 17.1

Chapter 17.2: ATSC DTV Receiver Systems. This update includes new information on DTV receiver design and optimization identified by the ATSC Task Force on RF System Performance. Chapter 17.2

Chapter 17.3: Consumer Video and Networking Issues. This update expands upon the digital home network concept and explains the standardization work now underway in this area. Chapter 17.3

Chapter 17.4: Cable Television Systems. This update adds new material regarding hybrid fiber-coax systems and regulatory provisions for cable systems. Chapter 17.4

Chapter 17.6 Content Distribution. This update adds information regarding Internet content distribution options, including PC-based DTV receivers. Interactive videoconferencing is also discussed. Chapter 17.6

Chapter 17.7: Receiver Antenna Systems. This update adds information on diversity reception techniques and provides typical characteristics of downlead cables. Chapter 17.7

Chapter 17.8: Receiver Characteristics, Ulrich L. Rohde and Jerry C. Whitaker. This chapter outlines the basic principles of receiving systems in general, and television receivers in particular. Chapter 17.8

Chapter 17.9: The Radio Channel, Ulrich L. Rohde and Jerry C. Whitaker. This chapter examines the important characteristics of radio reception in general, and digital reception in general. Chapter 17.9

Chapter 17.10: Adaptive Receiver Processing, Ulrich L. Rohde and Jerry C. Whitaker. This chapter details the primary techniques of adaptive equalization for digital receivers. Chapter 17.10

Chapter 18.1: The Video Spectrum. This update adds information relating to video fundamental principles. Chapter 18.1

Chapter 18.3: Camera Performance Verification. This update provides additional

From: "John Rayfield, Jr. - Rayfield Comm., Inc." <johnjr@r...>
Date: Sun Feb 20, 2000 3:14 pm
Subject: Re: Towers next to buildings

We are probably going to use an expanded metal 'shield' over part of the building roof. However, there are other towers here in Springfield, where there is no such protection, and they've had very little (if any) trouble.
We really get very little ice, of the size that causes any problems. We've alse re-figured and will probably end up with about 26 feet between the tower and the back of the building. The tower on which our 800 mhz. SMR system is presently located is about 25 to 30 feet from the back of the building, and they only get ice falling from the guy wires, for the most part. In the absolute worst ice storm that we've ever seen, in over 20 years in this area, the ice from that tower only fell 15 to 20 foot, at most, from the tower itself - all the rest was from the guy wires. The tower is a Rohn 80, that has been up for somewhere close to 30 years. Using an expanded metal 'shield' over part of our roof will give 'added protection', 'just in case'.

As to damage to microwave dishes and antennas - there's a 300 foot self-supporting tower, just a few blocks from where I live (and just a few blocks from where our tower will be located) and they have no protection for their microwave dishes on that tower. The feed horns are completely exposed to any falling ice. But, I've never seen any trouble there. In fact, I've never seen anyone on the tower, in the 18 years that I've lived in this area and driven by that tower hundreds and hundreds of times (literally). The tower is owned by Southwest Power District (a U.S. Government facility).

Oh, and there is a LOT of difference in the weather, between the southern most parts of Missouri (where we are) and the northern parts.

I know what some others have experienced in this area, but I was curious as
to what others had experienced in other areas, as well.

John Rayfield, Jr.
Rayfield Communications, Inc.
Springfield, Missouri

----- Original Message -----
From: John Hettish <jhettish@u...>
To: <Tower-pro@onelist.com>
Sent: Sunday, February 20, 2000 9:00 AM
Subject: Re: [Tower-pro] Towers next to buildings

> From: John Hettish <jhettish@u...>
>
> I can't imagine going to the expense of erecting a 300 foot Self Supporting
> tower without protecting the valuable equipment below. One site I maintain
> has a standard tar and gravel roof over steel. It is a former MCI site and
> they attacked the problem by lining the roof with Oak two by eights about
> ten feet long. Other sites I maintain have an actual carport type roof over
> the building made of perforated steel planking or PFP. The standard ice
> bridge is a form of PFP. It bends slightly with ice strikes and the jagged
> teeth in the pattern help to break the ice up before it can do much damage.
> As for your assumption that the ice will come down the center of the tower,
> things falling tend to hit other things and go in all sorts of directions.
> Many companies that expect ice accumulation actually go to great lengths to
> protect even their antennas from ice, especially microwave dishes.
>
> I believe that in Missouri you get all of Tennessee's bad weather before it
> can get to us. Now is the time to protect from blocks of hard stuff that
> weigh from a pound to twenty pounds and are accelerating at 32 feet per
> sec/sec. (slower at the equator, but there's no ice there).
>
> John
> John Hettish
> Middle Tennessee Two-way Inc.
> http://www.mt2w.com
> -----Original Message-----
> From: John Rayfield Jr - Rayfield Comm <johnjr@r...>

> To: Tower-Pro@onelist.com <Tower-Pro@onelist.com>
> Date: Friday, February 18, 2000 4:20 PM
> Subject: [Tower-pro] Towers next to buildings
>
>
> >From: "John Rayfield, Jr. - Rayfield Comm." <johnjr@r...>
> >
> >We're in the process of building a 300 foot self-supporting tower (a
> PiRod). We also are building a new shop, and the tower will be right
behind
> the shop (15 feet from the bottom of the tower to the back of the
building).
> >
> >Someone mentioned that we will need to have some 'ice shields' of some
kind
> over at least part of the building roof, to prevent ice off of the tower
> from coming through the roof - that this is a BOCA code requirement.
We're
> trying to find the specific requirement, but we're having trouble
finding
it
> in the book. Does anyone know the specifics about this? Since the tower
is
> a self-supporting one, and the base will be 30 feet from leg to leg, I
don't
> expect much ice to come down very far away from the base of the tower -
most
> of it should come down 'in' the tower. But, I guess there's a
possibility
> that some might find it's way away from the base a little ways. Does
anyone
> have any experience with a tower like this, this close to a building?
> >
> > John Rayfield, Jr.
> > Rayfield Communications, Inc.
> > Springfield, Missouri
> >
> >
> >Discussion of communication tower issues on a professional basis are
> encouraged. Amateur topics are discouraged.
> >
>
>

>
> Discussion of communication tower issues on a professional basis are
encouraged. Amateur topics are discouraged.
>

Message 573 of 15911 | **Previous** | **Next** [Up Thread] Message Index Msg # Go

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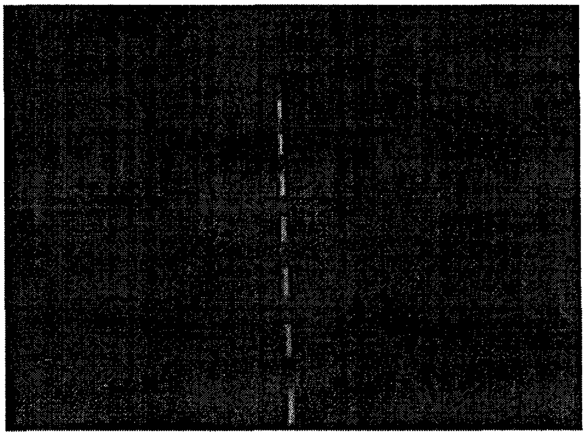
SOUTH DAKOTA 2000 FOOT TOWER

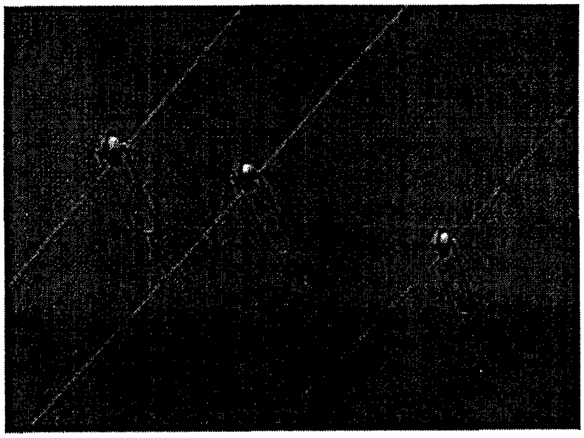
Rowena, SD

This tower is located just east of Rowena SD and serves the Sioux Falls market. It is one of the tallest antenna towers in the United States. Photos don't do this tower justice. It is BIG!



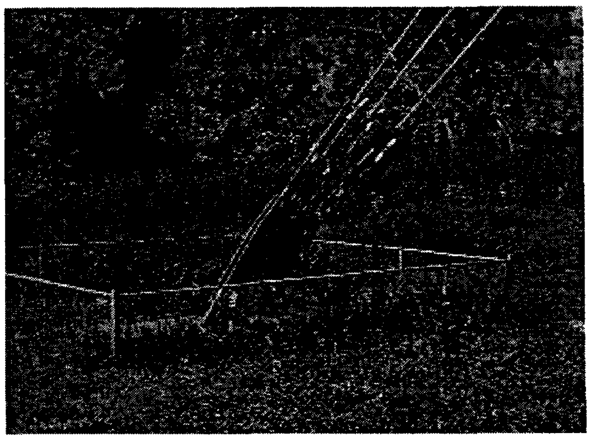
The antenna on the mast extending above the tower is KSFY-TV channel 13. The center of the array is shown as 610 meters (2,001 feet) above average terrain so the top is probably closer to 2,050 feet. Just below that, side mounted at the top of the tower, is KSFY-DT channel 29. Side mounted at 564 meters (1,850 feet) is KELO-FM at 92.5 MHz. And at 488 meters (1,601 feet) is KNWC-FM at 96.5 MHz.

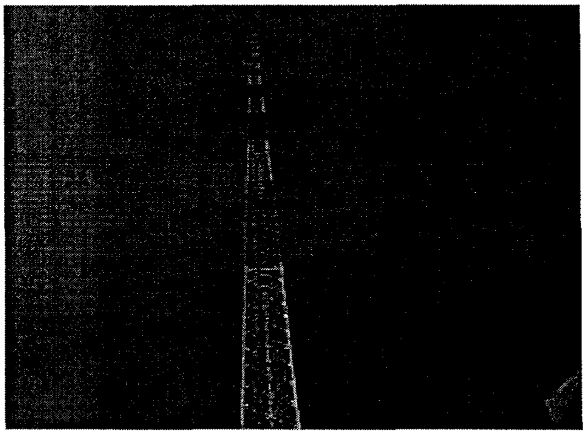
Note the large amount of sag visible in the guy wires.



These roller devices help to maintain tension on the guy wires.

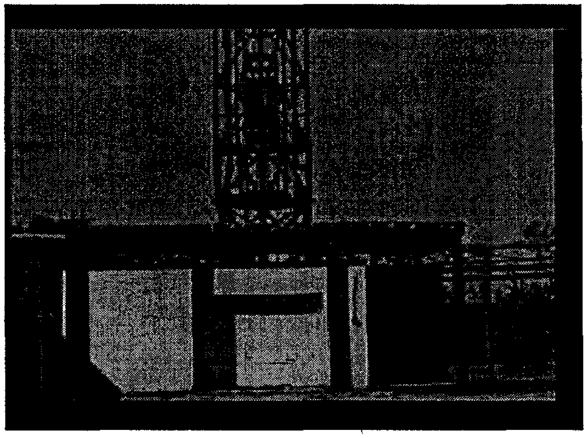
One of the massive guy wire anchor points.

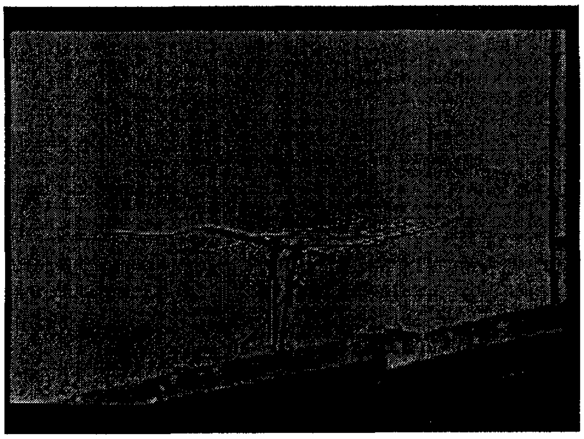




Another view looking up from near the base of the tower.

The roofs of all of the buildings located below the tower are protected from falling ice by a secondary roof located above the original roof. The secondary roof appears to be made of 4" by 4" wooden beams. Large chunks of ice falling from 2,000 feet can do a lot of damage!





This beat-up yagi antenna on the roof of one of the buildings is testimony to the damage that can be inflicted by falling ice.

The Canadian Broadcast Directory

ICE STORM INFORMATION FOR TOWER OWNERS

Tuesday January 13, 1998. The following information is posted as an advisory for our customers by LeBlanc.

Important information for broadcasters and tower owners is posted below. Several older broadcast towers have already collapsed due to the extreme icing conditions in Ontario and Quebec. As a safety precaution, technitians working in and around communications and broadcast tower sites should exercise extreme caution due to the dangers of falling ice and the possibility of tower structural collapse from the overloading weight of ice. Many towers in this region are reported to have upwards of 4" of radial ice whereas the current design code calls for only 1". Older towers may not have been designed to withstand any ice at all.

If you have a communications tower or a broadcast tower that was subjected to the ice storm in eastern Ontario or the province of Quebec, this posting will contain important information for you regarding structural safety and a recommended course of remedial action to determine if any permanant damage was sustained. Check this page for updated information in the coming days or for more information please feel free to contact LeBlanc directly at 905-844-1242.

Towers in the Eastern Ontario - Quebec area have been subject to extreme ice conditions since January 5, 1998. Environment Canada is reporting this ice storm as the worst recorded to date. To aggravate the situation, temperatures in the region have dropped over the last two days, delaying the melting of ice accreted over structures. The purpose of this newsletter is to give information on the design criteria of towers so that Owners can better assess risk to their structures, and to make recommendations on course of action.

Design of Communication Structures

Towers built in this region of Canada from 1986 to 1994 should have been designed to CAN.CSA S37-M86 or S37-94 after July 1994 using site specific wind pressures ranging between 320 - 480 Pascals (80 -100 km/hr) applied to the bare structure; and half that wind pressure combined with 1" (25mm) of radial ice; whichever condition gives the worse case. Radial ice is applied to tower members as well as guy wires.

Towers built from 1977-1986 were designed with same radial ice applied to members and guy wires but with regional wind pressures (not site-specific values).

Towers built from 1965- 1977 were not designed with any ice on the guy wires, and only 1/2" ice on the tower at half wind. Any ice accumulation on the guys of these structures would pose a threat to safety of the structure.

Towers built prior to 1965 were designed with engineering principles used in those times with guidance from Canadian Electrical Code - Radio Installations. There can be no generalization made on those structures. However, in the absence of other information, they should be considered as vulnerable as towers built between 1965 and 1977.

The method for measuring radial ice on a structural member is to measure the total thickness of the member including the ice, subtract the member thickness, and divide the result by two. For example, if a 1/2" or 13mm diameter guy wire is covered with ice, and the total diameter measures 2"(50 mm), the radial ice accumulated on the guy is (2-0.5)/2= 0.75" (19 mm).

The ice build-up may or may not be symmetrical around the member. If the structure has 1" or less of radial ice on it, and the forecasted wind speed is less than half of the design wind value, then this tower will be within safe limits. If the above conditions are exceeded, the structure could be unsafe. Note that there are a number of Safety Factors applied to the design wind pressure such as gust factor, height factor, and factors to compensate for material imperfections. These factors, if not used up by the intended reasons, will add to the structure's resistance to ice.

Recommended Course of Action

It is recommended that Communication Structures Owners do the following under these exceptional environmental conditions:

- 1. Post the site as 'HAZARDOUS' and do not allow personnel on the site if:
    - a) ice accretion on the structure exceeds the design value coupled with high winds, (see above discussion), or
    - b) ice accretion exceeds the design value by a factor of 2 or more regardless of predicted wind speeds, or
    - c) ice is falling from the tower.
    - It is prudent to check the Environment Canada for forecast for your area, and check with the tower designer for the structures design wind and ice value.
- 2. For sites deemed to be safe by the above criteria, consider protecting the transmitter building roof with rubber tires or other means against falling ice from the tower. Utmost caution must be practiced so personnel are not exposed to any danger from falling ice during this activity.
- 3. After the complete shedding of ice on the structure, implement an emergency inspection/maintenance program which includes: a visual inspection and repair/replacement of tower members, connections, antennas and their mounts, transmission lines, obstruction lighting systems, grounding, anchor hardware; the measuring and adjusting of guy tensions and tower alignment; repair of any ice damage to the transmission line bridges, buildings, fences, etc.

The following approach for prioritizing the emergency inspection and maintenance of towers which have been exposed to ice accretion is recommended:

- Priority 1: Towers located in urban centers with public access around the site, including roof-mounted structures.
- Priority 2: Guyed towers built prior to 1977.
- Priority 3: All guyed towers built between 1977 and present, starting with the tallest..
- Priority 4: All remaining towers.

[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Television t

from [*Bill Coleman*] [Permanent Link][Origin

To: <towertalk@contesting.com>
Subject: [TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Television tower top...
From: aa4lr@arrl.net (Bill Coleman)
Date: Wed, 19 Dec 2001 09:03:02 -0500

On 12/7/01 8:01 AM, Pete Smith at n4zr@contesting.com wrote:

\>
\>*At 04:21 AM 12/7/01 -0500, Ron KA4INM Youvan wrote:*
\>...
\>>*The latest development is paint that doesn't allow the ice to stick*
\>>*(to the antenna), which works, disappointedly. (not as was hoped)*
\>
\>*I wonder if this is the same stuff that was developed maybe 30 years ago*
\>*for use on radomes on the DEW line. I understand it works really well on*
\>*beam elements, but can imagine that the complex shapes, surfaces and angles*
\>*of a really big tower might present a different set of challenges.*

I seriously doubt such a material exists.

If it did, it would have one rather important application -- AIRCRAFT!

Airframe icing is a powerful and deadly menace. Airliners have extensive internal equipment to prevent ice from forming on the wings and tail surfaces. Smaller aircraft are even more subsceptable, since they typically do not fly above the icing levels as the larger jets do.

If there were some kind of paint or other coating that would prevent ice from forming, there would be no need for de-ice boots, jet engine bleed air, or ground-based deicing of aircraft.

Bill Coleman, AA4LR, PP-ASEL   Mail: aa4lr@arrl.net
Quote: "Not within a thousand years will man ever fly!"
            -- Wilbur Wright, 1901

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Administrative requests:  towertalk-REQUEST@contesting.com
Problems:                 owner-towertalk@contesting.com
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[More with this subject...]

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  - **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO -Television tower top...**, *Pete Smith*

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[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Televisiontower

from [*Ron KA4INM Youvan*] [Permanent Link][Origina

To: <towertalk@contesting.com>
Subject: [TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Televisiontower top...
From: ka4inm@qsl.net (Ron KA4INM Youvan)
Date: Fri, 07 Dec 2001 04:21:17 -0500

Hi:

> *Given the large investment necessary to bring up these large towers, I all*
> *ways wondered why they do not incorporate de-icing facilities into them.!?*
> *What is an other $100K when you already spend millions on it ?:)*

Many of the TV & FM antenna have electrical de-icer heaters to keep the tuned slots etc. from developing enough ice to detune them, the cost and weight of deicing the tower and guy wires is prohibitive. The latest development is paint that doesn't allow the ice to stick (to the antenna), which works, disappointedly. (not as was hoped)

73 (= Best Regards) de: Ron ka4inm@qsl.net SENT Time and Date are UTC
I upgraded to LINUX, the more I use it, the more I love it.
It doesn't do everything for you, you must program it.
Visit my HAM Web SITE at: http://www.qsl.net/ka4inm

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  - **[TowerTalk] Fwd: KYTV, Channel 3 - Springfield, MO - Televisiontower top...**, *antipode*
    - **[TowerTalk] Fwd: KYTV, Channel 3 - Springfield, MO -Television tower**

top..., *john*

- **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Television tower top...**, *alex*
- **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Televisiontower top...**, *Ron KA4INM Youvan* <=
- **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO -Television tower top...**, *Pete Smith*
- **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO - Televisiontower top...**, *Larry McDavid*
- **[TowerTalk] ++ Fwd: KYTV, Channel 3 - Springfield, MO -Television tower top...**, *Chris BONDE*

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  - [TowerTalk] Fwd: KYTV, Channel 3 - Springfield,MO - Television tower top..., *Jerry Kincade*

Previous by Date: [TowerTalk] Fw: Television Tower Topples Very Heavy Antennas, *alex*
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