Failure is *Not* an Option

Danger to your tower assets may lurk unseen—*below* ground level.

by Shawn Van Giesen

At 7 a.m. on Nov. 2, 2003, a 34-year-old, 180-foot, guyed tower collapsed in winds of less than five miles per hour. Four months prior, a tower crew reported the structure was in good condition. Structural analysis revealed the tower was only at 70 percent of its design load. What happened? An *anchor* failed due to advanced corrosion six feet below grade.

An anchor shaft break that occurred during inspection. The chain visible at the top of the photo was used to secure the guy to a piece of construction equipment as a safety precaution before excavation.

What *is* corrosion? A simple definition is "the process by which refined metal returns to its original state." What *causes* corrosion? That's more complicated, due to the number of factors involved. Let's just chalk it up to "electrochemistry" and move onward. The essential issue is that there are more than 20,000 guyed towers, nationwide. The real question is, "How many of these guyed towers are at risk, and how can you find them before they collapse?"

What if tower owners could *predict* which towers were at greatest risk? PB Telecom has developed a programmatic, nationwide anchor-investigation process to do just that. Starting with one nationwide carrier, from a comprehensive database of over 2,000 towers, the process isolated 20 guyed towers matching the highest-risk profile. This profiling is the result of consultation with experts in the field, including Craig Snyder, founder of Sioux Falls Tower and AnchorGuard, a leading authority on guy-anchor corrosion. Independent corroboration reveals that guy-anchor rods are corroding faster than industry expectations.

Guyed-tower systems generate as much as 91,000 pounds of dynamic loading in high winds. (*Dynamic* loads come from winds, expansion or contraction during temperature changes and earthquakes. They occur quickly and randomly, hence "dynamic."). Therefore, a strict safety protocol is essential for protecting an investigating crew, and the structures, during inspection. Inspecting possibly compromised anchors with a backhoe is like looking down the barrel of a gun and pulling the trigger to see if it's loaded. Therefore, we chose to improve our odds of success and survival by chaining off to a heavy-duty dozer.

Late on Jan. 20, 2005, I received a report from our field crew in Southern California. The inspector had found corrosion at a site to an extent he had never seen before. The tower was a 250-foot, six-anchor, microwave backbone supporting ten other facilities. Losing the structure would shut down most of a regional network.

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The following Monday morning, the crew from Sioux Falls Tower joined me on site. After our pre-operation safety meeting, the first two anchors were excavated. They had high levels of corrosion, indicating the need for planned replacement. The inspection continued to the third anchor to further verify the tower's overall safety.

That's when it happened.

With the sound of a shotgun blast, all the safety chains engaged, the dozer lunged forward and *the anchor failed*.

After checking to see that everyone was OK, a series of preplanned emergency procedures were activated. Midnight found the tower secured by six pieces of heavy equipment and an exhausted anchor investigation team. New anchors were designed and installed with cathodic grounding protection. (Cathodic protection involves the "electrochemistry" alluded to previously. It minimizes the electrical potential in an object or structure either by applying current or by reducing the potential with the nearby implacement of a "sacrificial" anode—in simplest terms, a "lightning rod for rust.")

Of our original list of highest-risk towers, anchors were replaced at five sites. That is, one out of four towers that simply fit the profile indeed needed immediate attention.

The knowledge gained from processing over 90 towers through this program led us to develop a set of steps to ensure that tower assets are secure. Follow these simple guidelines when inspecting anchors:

1. Do not allow climbers on your guyed towers unless one or more of these conditions are met:
   - Anchor shafts are totally encased in concrete to above ground level.
   - Anchors were previously protected with a cathodic grounding system, inspected by a qualified investigation team and found to be in good condition.
   - Anchors are fully excavated and inspected and deemed safe immediately prior to climbing.
2. Develop a plan to target towers most at risk, to perform inspections and to document the condition of the anchors.
3. Install a cathodic grounding system to inhibit future corrosion.
4. Regularly monitor the cathodic grounding system.

At the same time that the communications industry is expanding, the incumbent infrastructure is aging. This is a dangerous synchroneity. It's not only steel and service at risk; it's the lives of those who maintain those structures and of those who live and work in towers' shadows. That is why "Failure is not an option." agl

Corroded anchor shaft segments.

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OSHA knows about corrosion hazards

Although OSHA is more commonly concerned with fall protection and worker procedures, it has encountered injury-accidents resulting from guy-anchor corrosion. In 1991, the agency issued a *Hazard Information Bulletin (HIB)* directly addressing "Communication Tower Guy Anchor Corrosion." The bulletin discussed a North Dakota tower collapse due to anchor failure *during* an inspection.

The 350-foot-tall tower was guyed to three anchors, five guys to an anchor. Three tower-servicing workers were performing maintenance. They checked the tower's plumbness and added tension to the guys before two of them started climbing to inspect structure and antennas. The tower fell during the ascent, and both workers sustained injuries.

Investigation revealed that one anchor shaft had separated where it entered the buried concrete anchor, three feet below ground level. The separation was caused by extensive corrosion of the galvanized, channel-iron shaft.

The *HIB* noted, "There are thousands of towers with this type of anchoring system that are susceptible to corrosion. Since corrosion can be caused by a number of mechanisms, it is essential that the type of corrosion mechanism at a given location be identified. … It is recommended that the inspection of a tower anchoring system include regular checking for corrosion of the steel anchor rods."

OSHA's *HIBs* are neither standards nor regulations, and failure to implement an *HIB* recommendation is not an OSHA violation. Nevertheless, under the general duty clause of the Occupational Safety and Health Act, employers must provide a workplace free from *recognized* hazards likely to cause death or serious physical harm. They can be cited for violating the general duty clause if there is a recognized hazard and they do not take steps to prevent or abate that hazard. Although nearly 15 years old, the 1991 *HIB* is on record, and it recognizes guy-anchor corrosion as a "hazard."

—D.A. Keckler

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