

Out in the Open

BY KEITH A. GRUBB, P.E., S.E.

Weathering steel is a steel alloy containing quantities of copper, chromium, nickel, and other alloying elements that enhance corrosion resistance.

MENTION THE TOPIC OF WEATHERING STEEL to a group of designers, and two things usually come to mind: COR-TEN and bridges. COR-TEN is a trade name developed by U.S. Steel to market weathering steel. And bridges—well—they're the most common application for weathering steel today.


So what is this stuff? Weathering steel is a steel alloy containing quantities of copper, chromium, nickel, and other alloying elements that enhance corrosion resistance. When the steel rusts under normal atmospheric conditions, it forms a protective patina that bonds with the surface of the steel. Over a relatively short period of time, the patina forms into an impervious layer that precludes further corrosion. Minor damage to the coating is self-healing. In its early stages, the coating is a reddish-orange brown color. Over time, the coating thickens, the texture becomes a bit rougher, and the color deepens to a

rich purple-brown. With the patina protecting the steel from further rusting, there is no need for the expense of painting the steel to protect it from the weather. Its low maintenance requirements and rustic appearance make it a popular choice for highway bridges.

In the 1960s, the novelty of weathering steel (and its then-new 50 ksi yield stress) led to its application in



The base of each of the Daley Center's exterior columns is encircled by a continuous drain. In the building's early life, rainwater runoff would have been laden with rust as the protective patina was forming, and the drains prevented the granite plaza from becoming stained.



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ness ranges. ASTM A242 is the original COR-TEN specification, which varies in yield strength from 42 ksi to 50 ksi depending on the shape or plate thickness. HSS with weathering steel characteristics are available as ASTM A847.

Buying Basics

Because of the “exotic” nature of using weathering steel for building applications, AISC’s Steel Solutions Center often gets questions about the availability of weathering steel. Usually, relatively small quantities are required for specific architectural features, such as pedestrian bridges or canopies. An informal survey of AISC-member steel service centers found that many had at least some ASTM A588 material on hand for immediately delivery. Some

had extensive inventories (angles, channels, W-shapes, bar, sheet, and plate), and those that didn’t stock it would source it or could recommend another supplier. For a complete list of AISC-member service centers, visit www.aisc.org/servicecenter.

HSS in weathering steel grades are somewhat more difficult to come across. According to Jim Collins, vice president of marketing for Metals USA, weathering steel HSS may only be available from one or two specialty service centers in the U.S. (See “Rare Shapes,” next page.)

Keep in mind that the weathering-steel-for-buildings market is extremely small: The most extensive inventory at any one service center was in the 200- to 300-ton range, and that total includes *a* shapes stocked. For projects

of any size, getting into a mill’s rolling schedule is definitely something to consider and discuss with a local fabricator or service center.

Location, Location, Location

Frequent wet/dry cycles are key for the protective coating formation. Moisture from precipitation and dew, dried by the wind and sun, is essential for the formation of the patina. Because of this, weathering steel isn’t a good choice in environments that are constantly wet or humid—where the steel can’t dry. Also, weathering steel is not recommended for subsoil applications because the chemistry of some soils can corrode the steel.

Applications where the steel would be subject to salt spray, salt splashing,

On the Road

Short-span bridges are ideally suited to weathering steel. Jim Collins of Metals USA notes that his com-

or salt-laden fogs from de-icing salts or coastal conditions are not good candidates for weathering steel. Salt precludes the development of the protective patina and dramatically accelerates corrosion.

Devilish Details

The success of Chicago's Daley Center, from an aesthetic perspective, is largely due to the control of rainwater runoff and good maintenance. For example, the base of every exterior column is encircled by a continuous drain. In the building's early life, rainwater runoff would have been laden with rust as the protective patina was forming, and those drains prevented the granite plaza from becoming stained. Rust stains on the stone plaza from the façade of the building appear to be minimal, probably due to periodic stone maintenance. Also, the good condition of the columns is a sign that corrosive de-icing chemicals have either not been used on the plaza or have been kept away from the steel.

Other Details to Watch for

Design for drips: Pay attention to drainage details by controlling rust-laden runoff. Drip pans and overhangs can keep water away from stainable surfaces below. Detail exposed slab expansion joints (such as in pedestrian walkway slabs) with troughs below to catch runoff if the joint fails. Masonry surfaces subject to runoff can be sealed or coated to minimize stain penetration. After the steel's initial weathering process, stain-