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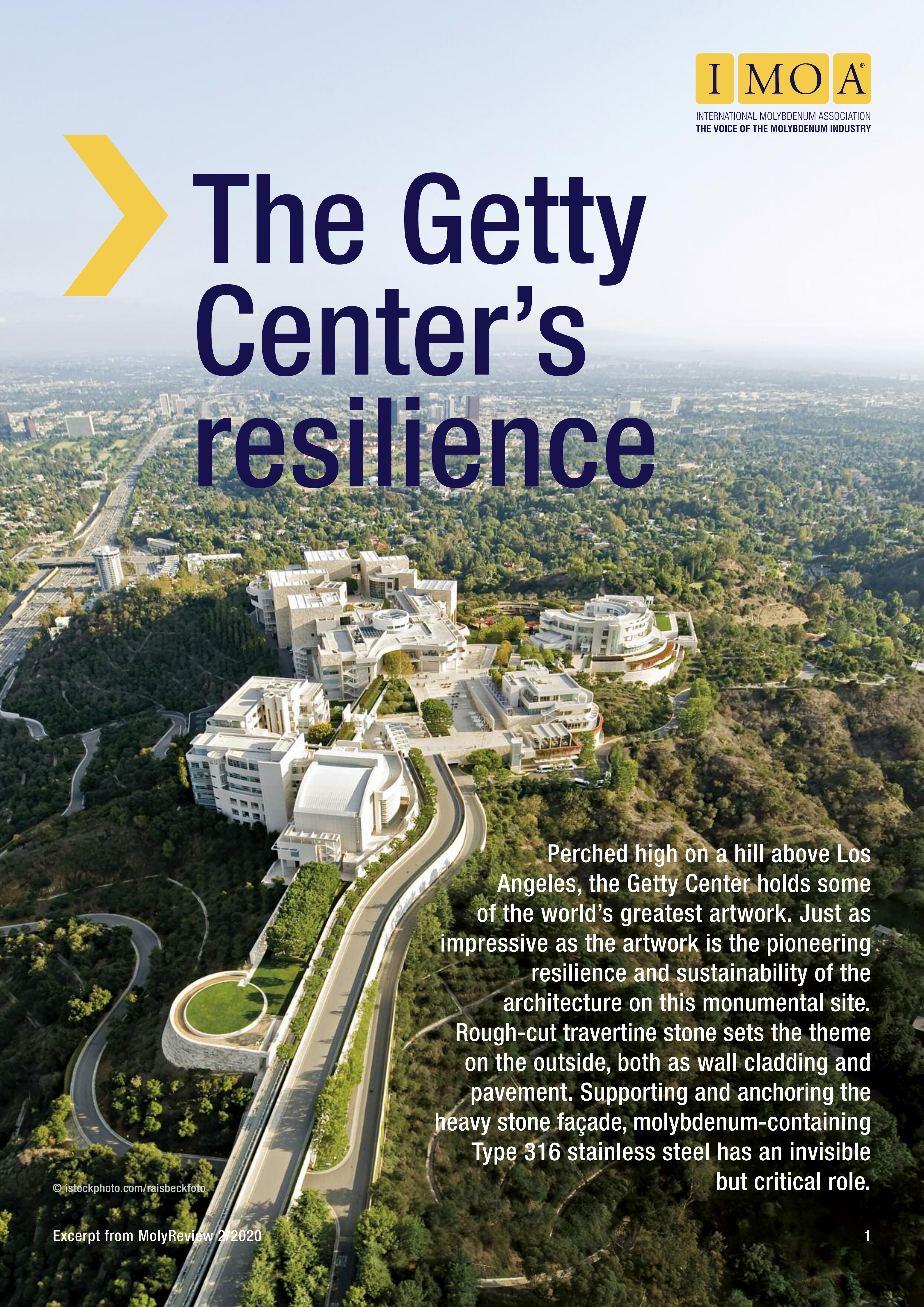
The Getty Center's resilience



Perched high on a hill above Los Angeles, the Getty Center holds some of the world's greatest artwork. Just as impressive as the artwork is the pioneering resilience and sustainability of the architecture on this monumental site. Rough-cut travertine stone sets the theme on the outside, both as wall cladding and pavement. Supporting and anchoring the heavy stone façade, molybdenum-containing Type 316 stainless steel has an invisible but critical role.

John Paul Getty was once the richest private citizen in the world and an avid collector of arts and antiques. After his death in 1976, his entire property was turned over to the Getty trust. When the museum outgrew its original location at Getty's former residence in Malibu, California, management of the trust looked for a suitable site that would be more accessible from Los Angeles. The trust also wanted to consolidate all its entities at the same location. They found a large, rugged piece of land, at the top of a hill in the Santa Monica Mountains, with stunning views of both Los Angeles and the Pacific Ocean. The Pritzker Prize winning architect, Richard Meier, was chosen to design the campus in 1984. Thirteen years later, in 1997, the Getty Center opened to the public. The project was so innovative and focused on sustainability that it became the first existing facility in the U.S. to be awarded a U.S. Green Building Council LEED (Leadership in Energy and Environmental Design) certification in 2005.

Picturesque as it is, the Getty's coastal location is subject to both wildfires and earthquakes. In fact, southern California is one of the most seismically active places in the world. The likely impact of such natural disasters, and also of atmospheric corrosion near the sea, must be considered in the construction of the area's buildings. At the Getty Center, Type 316 austenitic stainless steel helps to address all three issues in a variety of applications. For example, austenitic stainless steels in general are very ductile and tough, so they absorb energy from an earthquake or other impacts exceptionally well without breaking. The two percent molybdenum in Type 316 stainless steel adds high-temperature strength in fires and corrosion resistance in chloride containing coastal environments. Therefore, this alloy contributes to a design that is as durable and resilient as it is sustainable. Indeed, over 20 years after it has been installed, the stainless steel shows no signs of corrosion or degradation and looks as good as it did the first day.

Visitors to the Getty Center enjoy panoramic views of Los Angeles.

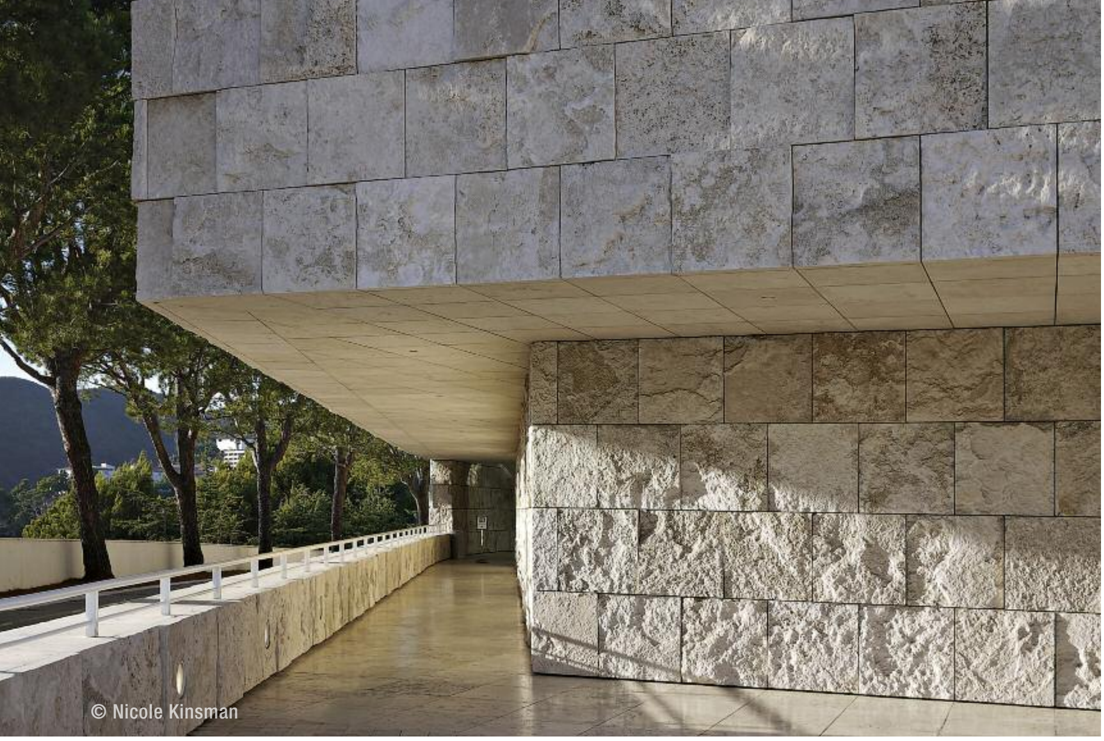
A monumental project

The 1.3-billion-dollar construction covers nearly ten hectares on a 45-hectare site and took over 14 years to plan and build. The complex contains public buildings that house the museum, performance spaces, a cafeteria, and buildings for the different entities of the Trust dedicated to administration, research, conservation, and grant programs. Inside and out of the undulating, sun-bleached buildings, visitors are immersed in countless forms of beauty: artwork, city and ocean views, sprawling gardens, music, fine food, and world-class architecture.

To reduce its visual impact on the city and neighborhood, half of the Getty Center was built below ground. "Hiding" a large part of the complex, combined with gardens and an organic, light-toned color, helps the Center blend in with the surrounding Santa Monica hills. These features also minimize heat absorption. Used in combination with louvered sunscreens and heat venting louvers, they reduce energy consumption.

Set in stone

The various buildings on the site all have different shapes and heights, but they are visually connected by large blocks of cleft travertine. The stone blocks are used as cladding on the retaining walls as well as the lower parts of the buildings and as pavers.



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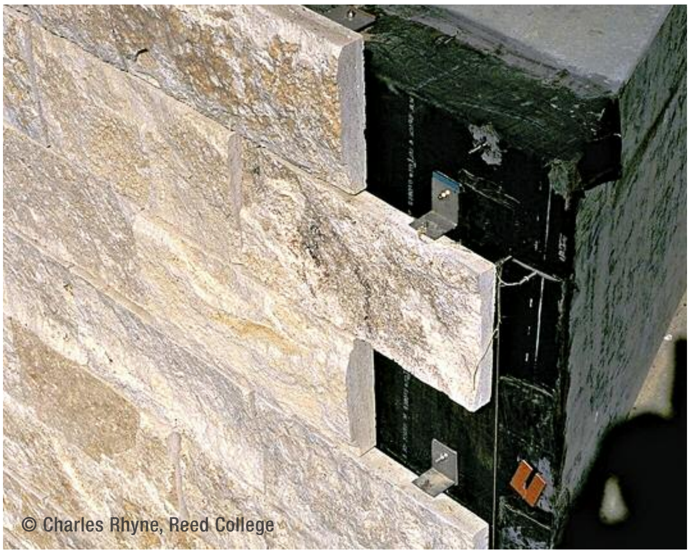
Differing installation methods for walls, facades and ceilings require a variety of special fasteners. One thing they have in common: stainless steel meets the high requirements for building safety.

After a lengthy search for a stone that had the right color and was neither too soft nor to hard, the architect chose a travertine from a centuries-old quarry in Italy. Meier and the quarry owner worked for a year to develop a guillotine technique to split the hard limestone, creating the desired rough-hewn surface. As the position of the sun changes throughout the day, the stone's color tone and vibrancy changes subtly with it. All in all, some 110,000 square meters or 375,000 pieces of travertine are installed in the walls and pavements. That translated to the delivery of two containers of stone every day for two years, or roughly 14,500 tons.

Seismic stainless steel

The design of the travertine exterior walls is based on an open joint panel system, instead of the usual technique of sealing the joints with mortar, which requires maintenance and picks up dirt over time. The open joint panel system allows water to drain behind the outer skin, protecting the surface from streaking and ensuring that the building looks as good tomorrow as today. Each individual stone piece is anchored by two invisible Type 316 stainless steel angle clips at the top, which hold the stone to the concrete

The travertine stone is attached to the concrete wall with Type 316 stainless steel stone anchors.



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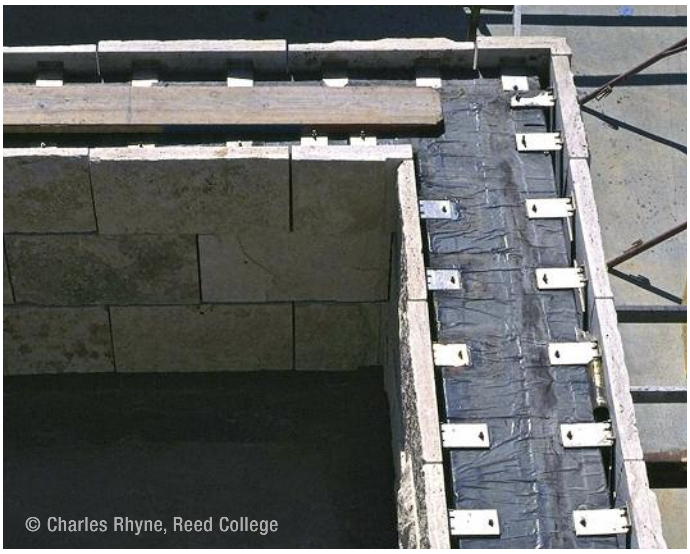

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or steel frame walls, and two stainless steel pins at the bottom, which connect the stones to one another, providing stabilization. The top clips are attached using either stainless steel expansion bolts or screws depending on the structural basis.

To protect the steel frame walls from the elements, a Type 316 stainless steel water and air barrier was installed behind the stone façade and the air gap. Similarly, the flashing that directs water outward from the walls and buildings was made from the same material. Thanks to this alloy's good corrosion resistance, even in coastal atmospheres, the stone façade will not suffer staining from corrosion runoff.

The architect's vision required that the stone pieces of the façade look uniform and are precisely aligned. To achieve this effect for the varying contours throughout the building complex, the contractor had to adjust the width and thickness of the custom clips depending on the dimensions of the stones and their positions. More than 250 different clip designs were made to create the unified look. The draftsmen spent over three years creating in excess of 2,500 architectural drawings for the stonework alone. There are some 380,000 stainless steel stone anchors in the entire project. This method allows any stone to be individually removed and repaired, if necessary.

The clip and pin system was designed to resist seismic events. It went well beyond the requirements of the California seismic code at the time of construction. In fact, the system's effectiveness was proven before the building was even completed. The Northridge earthquake occurred in January 1994 while the project was under construction, and many of the stones were already in place. No damage occurred then or during subsequent seismic events. The Type 316 anchoring system provides several advantages in seismic design, particularly its' corrosion resistance, strength and the ability to absorb far more energy during cyclic loading than other steels. Combined with the open joint system, it allows the stones to move independently in a seismic event without cracking.

Fire resistance

The stone cladding and crushed stone roofs were specifically selected for their fire-resistance; indeed, the whole complex was designed with fire resistance in mind. This is crucial considering wildfires in Southern California have intensified in recent decades. For example, in December of 2017, a fire came within a few hundred meters of the priceless Getty collection. Fortunately, the complex's fire-resistance measures were successful. As the fire approached, the sprinkler system soaked the soil surrounding the buildings with over 4.5 million liters of water, deployed from its massive underground water storage tanks, stopping the fire in its tracks.

Type 316 stainless steel handrails and door frames; more than 20 years after inauguration they look as good as new, despite the aggressive marine environment.

The sprinkler system makes extensive use of stainless steel for both its corrosion resistance and its fire resistance. Stainless steel has very good fire strength performance characteristics. And molybdenum additions increase its stiffness retention well above that of carbon steel when exposed to forest fire conditions. Therefore, the stainless steel anchoring system behind the stone at the Getty helps guard against fires as well as earthquakes; it ensures that the fire-resistant travertine will remain securely in place even during a wildfire. Together, the fire resistance measures at the Getty Center help ensure Van Gogh's Irises and other works will not go up in smoke.

In most architectural applications, stainless steel shines, both literally and metaphorically. Glimpses of this are visible in the form of the beautifully crafted stainless steel handrails, windows and architectural hardware, juxtaposed against the rugged organic stonework of the Getty Center. But the real star here is invisible, behind the façade, holding it all together. The molybdenum-containing Type 316 stainless steel clips and pins, air and water barrier and flashing, will keep the façade clean, safe and secure in the earthquake and fire prone environment of coastal Los Angeles, for as long as the stone lasts. (Nicole Kinsman)