

## 2025 Outstanding Architecture Project



Angkor Wat-inspired entrance to Fresno Chaffee Zoo's "Kingdoms of Asia" exhibit

# “Kingdoms of Asia” at Fresno Chaffee Zoo: **BRINGING ANGKOR WAT TO CALIFORNIA WITH SHOTCRETE ARTISTRY**

By Jared Stanwyck and John Hawkinson

Imagine stepping through a towering stone gateway crowned with a serene Brahma head, flanked by guardian lions, and wrapped in the sinewy roots of untamed ancient fig trees. Beyond the archway, the air feels heavy with jungle mist, and the distant roar of a Malayan tiger echoes through crumbling temple walls. It's easy to forget this is not Cambodia: It's Fresno, California. This breathtaking experience is the result of years of planning, cultural collaboration, and the artistry of COST of Wisconsin Inc., whose mastery of shotcreting transformed a bold vision into reality.

The “Kingdoms of Asia” exhibit at Fresno Chaffee Zoo, which opened to the public in 2023, represents a major achievement in immersive zoo design and construction. This \$46 million, 3.5 acre (1.4 hectares) project integrates

thematic architecture with creative building techniques, and was recognized by the Association of Zoos & Aquariums with its Top Honor award, a prestigious accolade in the zoo world. More than just a new attraction, it serves as a compelling case study in how shotcrete can bring ambitious architectural visions to life, faithfully recreating elements of the eighth wonder of the world thousands of miles away.

### **PROJECT OVERVIEW: AN IMMERSIVE JOURNEY THROUGH SOUTHEAST ASIA**

“Kingdoms of Asia” transforms the heart of the Fresno Chaffee Zoo into a miniature Southeast Asia. Themed after Cambodia's famed Angkor Wat temple complex, the exhibit features expansive new habitats for several endangered

species and vividly recreates the atmosphere of a tropical Asian forest. Visitors enter through a towering gateway resembling a weathered Khmer temple ruin. Atop the gate sits a carved Brahma head, representing the four-faced Hindu deity. Flanking the path are two hulking “Singha” stone lions, mythical guardians from Khmer mythology symbolically protecting the realms beyond. Passing under this elaborate portal, guests leave Fresno behind and step into a world of antiquity — crumbling stone walls entangled with faux fig tree roots and lush vegetation, with the calls of exotic animals echoing through the air.

Inside, the exhibit is laid out as a series of zones highlighting the wildlife of South and Southeast Asia. Malayan tigers roam overhead across two interconnected forest habitats, slipping in and out of temple corridors. A clear underwater viewing window lets visitors watch the tigers swim in a stream that runs through the temple courtyard, a favorite activity, since “tigers ... love the water,” according to Fresno Chaffee Zoo CEO, Jon Dohlin. Nearby, a pair of Sunda gharials lurk in a moat-like pool amid stone ruins, and a family of sloth bears snuffle around a tree-shaded grove they share with small-clawed otters. Siamangs swing and whoop in the canopy, while the zoo’s orangutans look on from their renovated ‘treetop’ exhibit, which now seamlessly adjoins the Kingdoms of Asia realm. In total, the exhibit provides homes for dozens of animals of eight distinct species from Komodo dragons to Asian songbirds.

All these spaces are connected by winding visitor pathways designed to evoke a sense of exploration through ruins. Guests walk under archways being ‘strangled’ by vine-like roots, past mossy shrine sculptures, and over footbridges with carved balustrades. Educational signage and cultural details accompany the visual experience as well. In one spot, visitors learn how the exhibit’s realistic fig tree roots mirror what real fig trees have done to Angkor Wat’s masonry over the centuries. An interpretive center, styled as an archaeological field house, shares stories of Southeast Asian cultures and diaspora. Inside this education building, actual artifacts and reproductions honor the people behind the animals.

“Everybody has come from somewhere,” says Dohlin. “This exhibit is about connecting those journeys of people, of cultures, of wildlife — and showing how deeply intertwined they are.”

The project was years in the making. Funded by Fresno County’s Measure Z, design work began around 2019, and construction began in earnest in early 2021. By June 3, 2023, “Kingdoms of Asia” had its grand opening, with more than 8000 visitors pouring in during the first weekend. It was an instant hit.



*Guests walk under part of a fig tree that has overtaken the ruins*



*The amount of intricate detail is what makes this new expansion so immersive*



*Untamed ‘fig trees’ strangle the ruins throughout the expansion*



*Viewing area of habitat with crumbled stone ruins scattered about*

## DESIGN & CULTURAL COLLABORATION: HONORING A SACRED THEME

CLR Design is known for zoo projects that marry thematic storytelling with animal welfare. They worked on reflecting the advisors' input in the plans, refining the look of everything that would be fabricated while ensuring the environments would meet the animals' needs.

On the construction side, COST of Wisconsin, Inc. also consulted the committee's cultural experts during fabrication. COST's project director and artists often met with community elders to verify that a particular statue or mural they were carving in concrete was acceptable. In one case, the team was sculpting a replica of a famous bas-relief depicting warriors on elephants. Photographs of the work-in-progress were sent to a local Cambodian Buddhist temple for feedback; the monks' responses helped the sculptors adjust postures and facial expressions to match those of the 12th-century originals. Such synergy between modern builders and cultural tradition enriched the project immensely.



*Specialized painting of the ruins that include 'natural wear' and lichen growth*

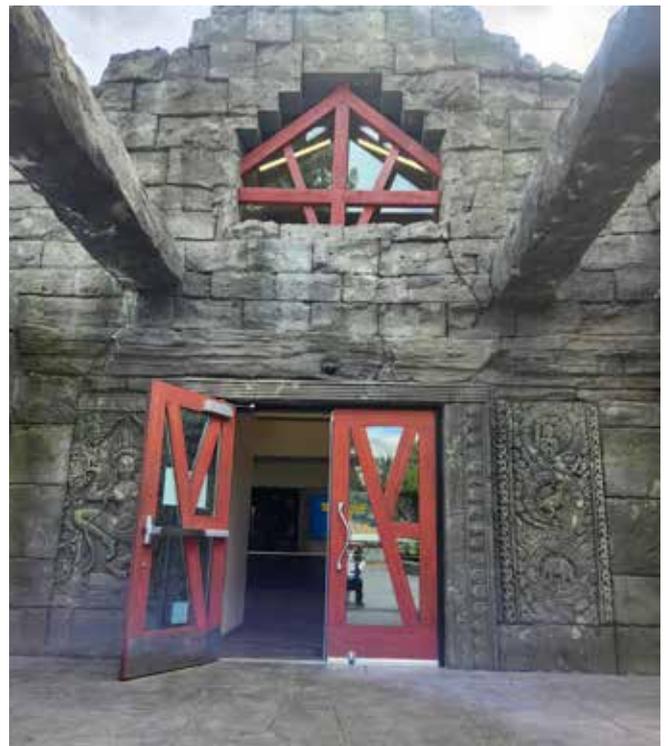


*Artists hand-carve in extreme heat surrounded by sheets to disperse direct sunlight*

Fresno Chaffee Zoo convened a special Cultural Advisory Committee early in the design phase as well. This five-member panel included respected representatives from the local Cambodian, Thai, Vietnamese, Hmong, and Laotian communities many of whom have direct ties to the art and faith traditions depicted in the exhibit. One advisor, Danny Kim (a Fresno police sergeant of Cambodian heritage), traveled to Cambodia and had family roots near Angkor. "It looks like you're traveling back to Cambodia," Kim remarked proudly during a preview tour, reflecting the overwhelmingly positive reaction from the Southeast Asian community.

## BUILDING THE VISION: TEAM EFFORT IN CONSTRUCTION

One of the first steps was erecting complex prefabricated reinforcing bar frameworks to outline the shapes of things to come, including the ruins, rock outcrops, and big tree trunks. For instance, the entry gate structure was built with a steel structure and reinforcing bar cages. This provided the structural backbone for shotcrete placement. In other areas, pre-shaped foam and wire mesh were used as fillers to bulk out large features without adding excessive weight. COST's designers, back in Wisconsin, had prepared 3D models for many of the components. Using those models, they prefabricated certain pieces to streamline on-site work. According to COST's President, Michael Schmuhl, "We created sections of the temple ornamentation in our shop, essentially practice runs, to ensure we could achieve the level of detail required." These prefabricated



*Extreme details inspired by actual aspects of Angkor Wat can be found everywhere*



*Serpents carved into temple ruins overhead*



**ABOVE & BELOW:** *Blending habitats with architectural details provides depth to immersion*



elements, such as small deity statues and decorative friezes, were cast in glass-fiber-reinforced concrete (GFRC) and later embedded into the shotcreted concrete on site, combining the efficiency of casting with the seamlessness of hand-sculpting.

## SHOTCRETE PLACEMENT IN ACTION: SCULPTING A LOST TEMPLE

At the heart of the “Kingdoms of Asia” construction is the extensive use of shotcrete placement to create naturalistic ornamentation. Shotcreting turned out to be the perfect placement method for this job, because it allowed artisans to spray concrete onto irregular, vertical, and overhead surfaces, then sculpt it to shape, which is far more efficient than traditional form-and-pour methods.

### WHY SHOTCRETE PLACEMENT?

In themed construction, shotcrete placement is the go-to technique for simulating rock outcroppings, building facades, ponds, and irregular shapes. In the zoo world, it’s been used for decades to form artificial rocks in animal habitats. What’s special about “Kingdoms of Asia” is that the shotcrete wasn’t just forming rocks; it was creating intricate architectural features with painstaking detail. This went far beyond carved lintels, statues, and faux plaster walls. When recreating the eighth wonder of the world, the bar for craftsmanship was nothing short of exceptional. For a true immersive experience, the finish had to perfectly match carved stone ruins — not just natural rock.

### APPLICATION & SCULPTING

Before the shotcreted concrete set, sculptors carved bark texture and twists into it, even pressing in real fig bark and vine cuttings to create authentic patterns. Vines were added later to give them a distinct winding look. The result is an overhead root that appears to suspend naturally, complete with tendrils and bark that look and even feel real. Having the ability to seamlessly carve such intricate detail on site is what makes shotcrete the perfect medium.

### CONCRETE MIXTURE & FINISHING

For the exhibit’s rockwork and temple facades, a fiber-reinforced concrete mixture was shotcreted. Polypropylene fibers in the mix help control shrinkage cracking and add a bit of tensile strength, useful for thin sculpted edges like the ears of the stone lions. The mixture design balanced strength with a specified compressive strength of ~4000 psi (28 MPa) with workability. Sand gradation and plasticizers gave it a pumpable consistency and a sticky quality, so it would adhere to vertical surfaces. After the initial sculpting and curing period, crews returned to apply stains and pigment washes. Using thematic techniques, they layered on different colors: Black washes to accentuate recesses and simulate shadowy grime, mossy green dappling in damp-looking areas, and sandy beige tones on highlights to mimic sun-bleached stone. The coloring process turned gray concrete into convincing ancient ruins. Additionally, certain surfaces were treated with acid etching to expose

aggregate and give a rough, sandstone-like texture, while others were gently sandblasted for a worn effect. When you run your hand along the temple wall in the exhibit, it's hard to believe it's not centuries old — a triumph of artisanship and materials science working together.

Another noteworthy technical aspect was building the animal-facing features to be robust. For example, inside the tiger exhibit, a fake 'temple column' also doubles as a scratching post. It's textured and impregnated with scents that attract the tigers. This piece was reinforced with extra steel and a higher-strength shotcrete mixture, because a 320 lb (145 kg) tiger can exert significant force with claws and bodyweight. Similarly, edges around pools and steps in the bear habitat were rounded and toughened to withstand digging and wear. Non-toxic sealers were applied over the cured shotcrete in water-contact areas to make them impermeable and easier to clean. These behind-the-scenes measures ensure the beautiful work remains safe and intact under animal use.

## INNOVATIONS & CHALLENGES OVERCOME

While much of the shotcrete placement used well-established techniques, the project did present some innovations and learning moments:

- **Hybrid Precast and In-Situ Method:** As mentioned, the team combined prefabricated GFRC pieces with in-place shotcrete. For instance, the intricate apsara dancer carvings on one wall were referenced from actual Angkor Wat carvings. These panels were set in position, and then concrete was shotcreted around them to embed them into the larger wall, blending edges seamlessly. This hybrid approach saved time on-site while still providing meticulously detailed results.
- **Precision Carving with Reference Grid:** To help sculptors hit their marks on proportion and scale, a laser grid and chalk lines were used on the cured base coat before adding details. For example, the Brahma head atop the gate was roughed out in shotcrete and then a grid was lightly etched on its surface. The sculptor, working with a reference drawing divided into corresponding grid squares, could then carve with confidence that the features (eyes, nose, etc.) were correctly placed.
- **Adapting to Weather:** Fresno summers are hot, 100 °F (38 °C) is common, which can cause shotcrete to cure too fast or crack. To mitigate this, major shotcrete placements were done in early morning or evening shifts. They also used misting and evaporation retardants on fresh work. During an extreme heat week, the crew erected shade tarps over active work zones.



*Guests walk down pathways where ancient stone motifs blend with natural landscape*



*A way finder welcomes guests to "Kingdoms of Asia"*

## CONCLUSION: A TRIUMPH OF THEME AND TECHNIQUE

Walking through "Kingdoms of Asia" today, it's easy to forget all the planning, effort, and cutting-edge shotcrete placement work. That's perhaps the best compliment to the project's success. It feels authentic and effortless, as if Angkor Wat truly sprang up in the middle of Fresno, as magical as it is educational. By melding cultural inspiration with shotcrete innovation, the team created an exhibit that engages on every level: Visually stunning, biologically enriching, and emotionally resonant.

This project is a showcase of what can be achieved with vision and skill. It demonstrates that shotcrete placement isn't just for bridges or pools or tunnels — it's also an artistic medium capable of delivering architectural art on a grand scale.



The Malayan tiger habitat includes a walkway on top of the temple ruins

## 2025 OUTSTANDING ARCHITECTURE PROJECT

*Project:*

**Fresno Chaffee Zoo: Kingdoms of Asia**

*Project Location:*

**Fresno, CA**

*Shotcrete Contractor Company:*

**COST of Wisconsin\***

*Architect Company:*

**CLR Design**

*Engineer Company:*

**Patrell Engineering**

*Materials Supplier Company:*

**Builders Concrete Inc. & Outback Concrete**

*Equipment Manufacturer Company:*

**REED Shotcrete Equipment\***

*General Contractor:*

**Bernards Bros**

*Owner:*

**Fresno Chaffee Zoo**

\*ASA Sustaining Corporate or Corporate Member



**Jared Stanwyck** is the Marketing Manager for COST of Wisconsin Inc., a family-owned theme and specialty construction company that started in 1957. Jared has experience in fabrication, project management, estimating, and operations, along with gunite and cast work in his previous role at Refractory Service, Inc. While his educational background is in Mechanical Engineering from Valparaiso University and Operations Management from University of Wisconsin, he loves being able to showcase the beautiful work COST's talented crews perform on a daily basis.



**John Hawkinson** holds dual master's degrees in architecture and urban planning from the University of Wisconsin–Milwaukee. He leads the Pre Construction team at COST of Wisconsin, Inc., bringing more than 25 years of zoo exhibit experience shaped by a deep appreciation for historic architecture and the outdoors. His expertise was utilized in the early stages of the "Kingdoms of Asia" project, where his background helped develop concepts and construction methodologies that supported the exhibit's thematic vision.