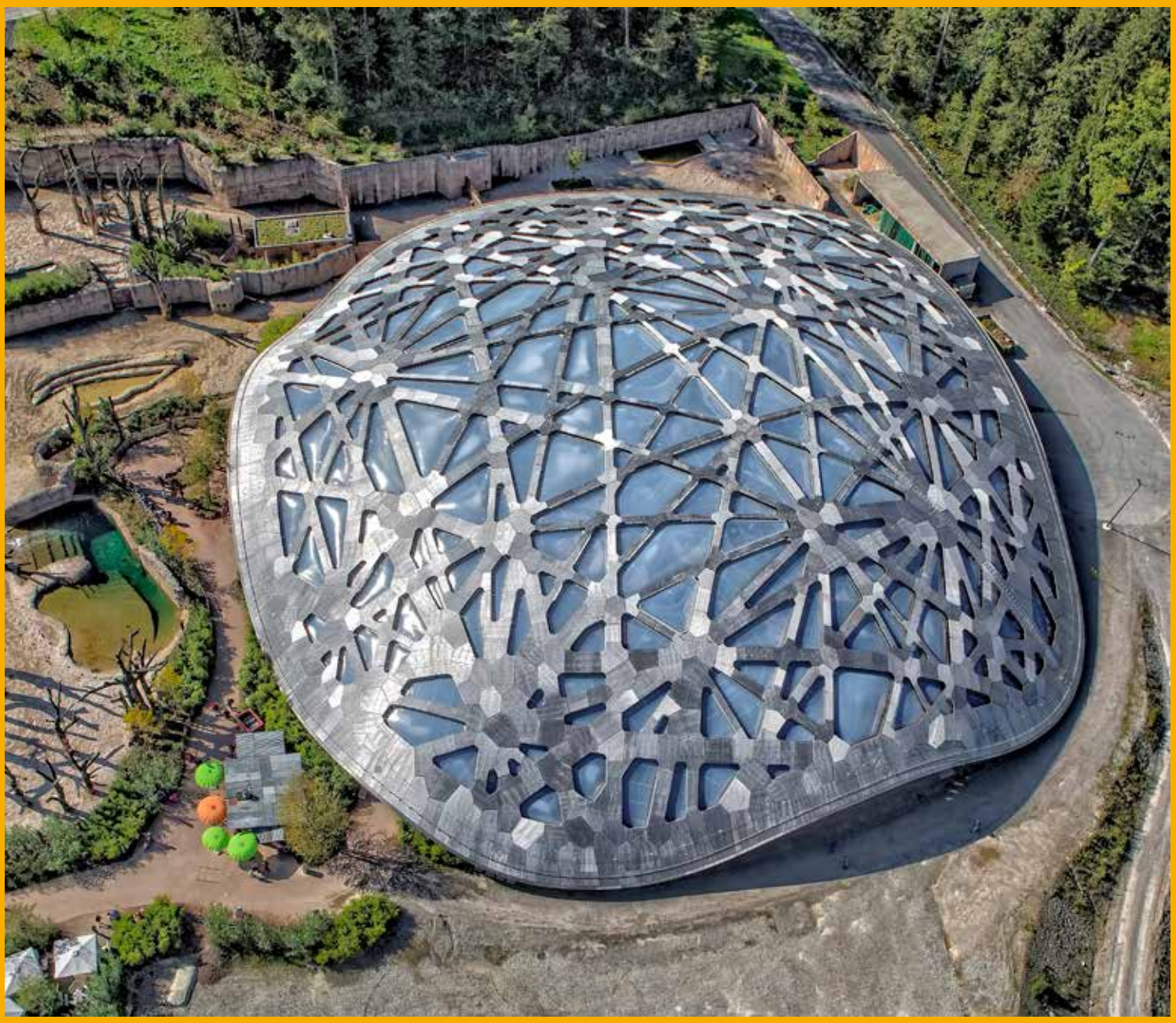


SIKA AT WORK

THE KAENG KRACHAN ELEPHANT HOUSE AT ZURICH ZOO

SIKA® SYSTEMS “FROM BASEMENT TO ROOF”

BUILDING TRUST

BASEMENT TO ROOF SOLUTIONS FOR ELEPHANT HOUSE AT ZURICH ZOO

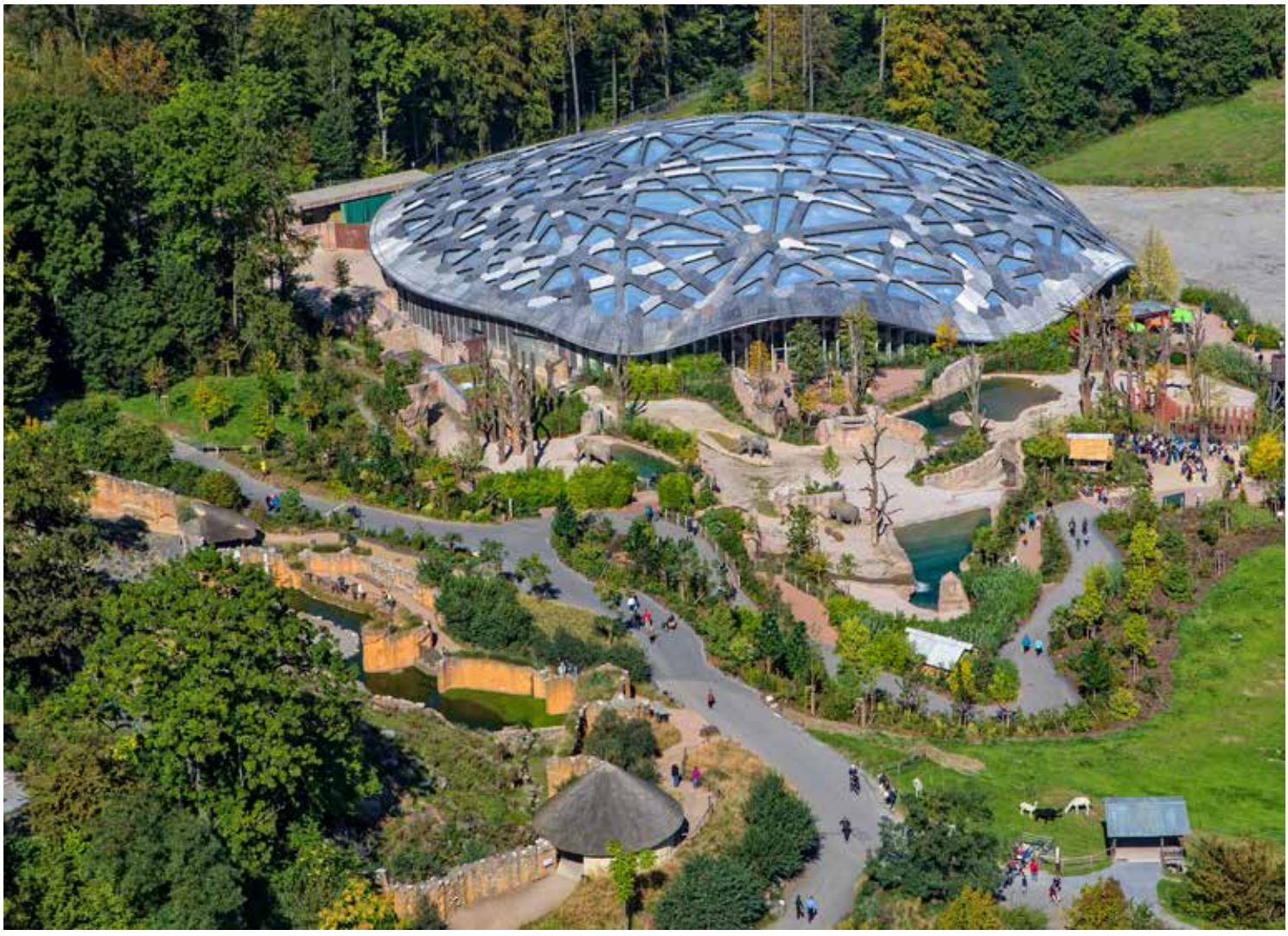
PROJECT DESCRIPTION

The Kaeng Krachan Elephant Park in Zurich Zoo is innovative in design and also in the way in which the elephants are looked after. The zoo's growing elephant family now has more than six times as much room as they did before, including a number of different pools and showers both indoors and outside, which they make active use of. Asian elephants are good swimmers, as they frequently cross stretches of water in the wild and often bathe in order to regulate their body temperature and look after their skin. Visitors can now also see the elephants when they are swimming from a special underwater viewpoint.

Another husbandry innovation is that the animals are now cared for in "protected contact" at all times. This means that the keepers are no longer in the same room as the elephants, which gives the animals more freedom to develop their normal social structure and behaviour, plus this also ensures greater safety for the zoo's staff.

The centrepiece of the 11,000 m^2 elephant park is the unique 6,800 m^2 elephant house, an 80 m diameter facility with a multi-faceted timber roof structure weighing more than 1500 tons. This free-form, flat roof design requires no additional columns inside for support, plus in addition to weatherproofing and insulating the building, it also successfully uses the natural light provided by a total of 271 different shaped skylights to simulate the forest canopy of the elephants' natural habitat in Thailand.

This roof is supported by a fine architectural filigree concrete framework around the perimeter, but primarily the loads from the huge timber frame and shell are absorbed circumferentially by the structural foundations. These consist of a prestressed, free running concrete ring beam that transfers the load to the ground at three low points in the facade through specially piled foundations. The ring beam runs around the building for a total length of approx. 270 m, its cross-section is approximately 48 x 200 cm, however it is not rectangular, but adapted to the curvature of the structure.



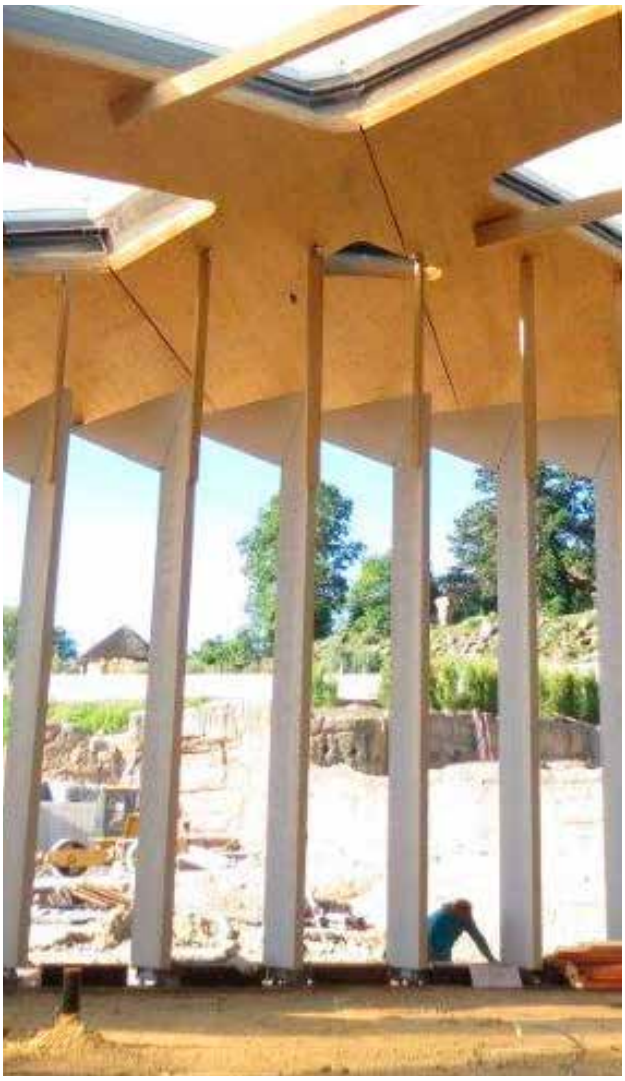
PROJECT REQUIREMENTS

Structural Foundations, Watertight Basements and Architectural Concrete Facades: – Initially on site the main excavation required slope stability, with sprayed concrete sides and pile walls being necessary prior to the main construction works.

For the structural foundations, including the prestressed ring beam, the highest specifications were set for the concrete with regards to strength development, self-compaction, low shrinkage and optimum installation within defined minimum time frames. A self-compacting mix and a maximum particle grading of 16 mm were stipulated due to the reinforcement density in the ring beam i.e. shear and torsion bars, with dense flange reinforcement around both axes, plus up to five prestressing 2 cable ducts in the same cross-section. A "low shrinkage" specification was also demanded for the structural concrete and the floor slabs of the building in order to minimize deformation and cracking.

The majority of the facilities utility services and plant rooms, together with some of the animal stalls, are built below, or partially below ground, which required them to be designed and built as watertight structures. This is to prevent any ground water penetration and equally to prevent and contamination of the ground water by animal excretions or waste water from the daily activities and cleaning regimes in the facility.

The sustainable construction approach for this project also required that rainwater from the roof was collected and stored for use in the facility; reinforced concrete holding tanks for this purpose were therefore designed in such a way as to also function as an integral part of the structure and so had be absolutely watertight.

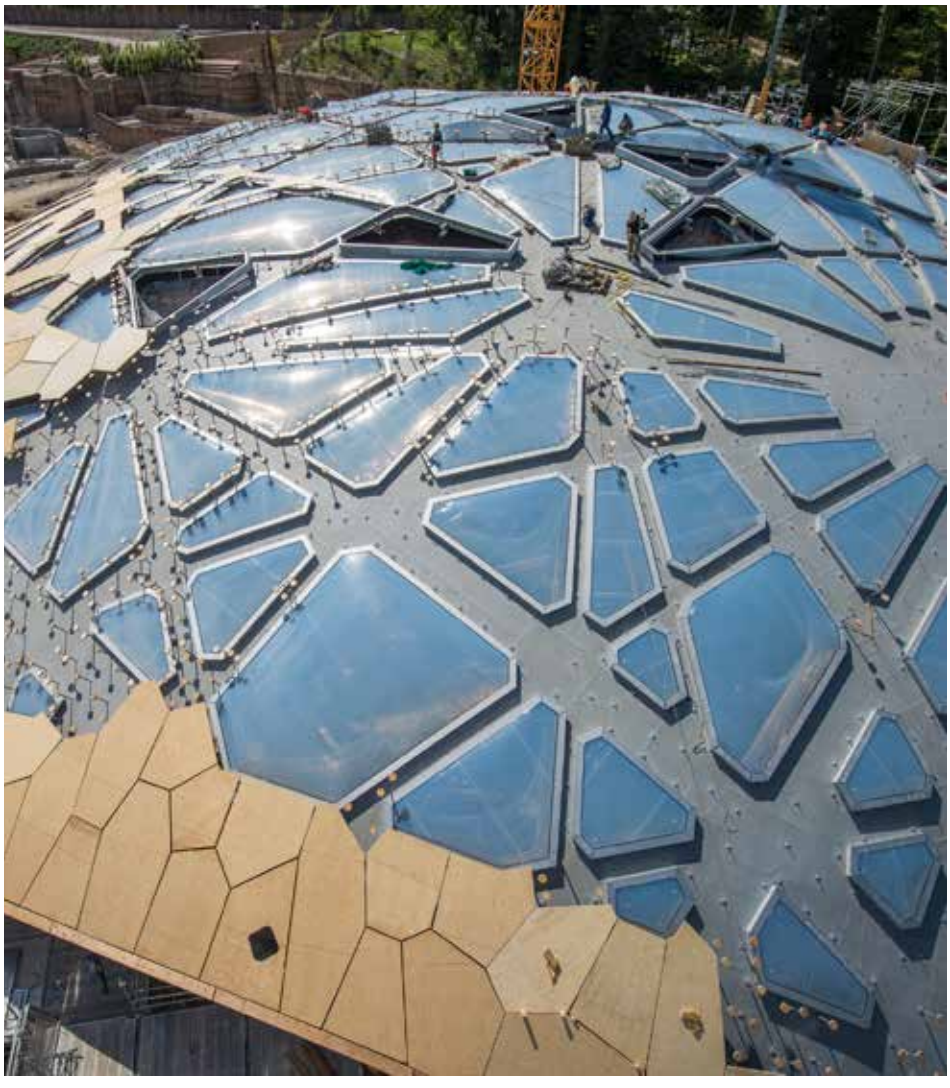


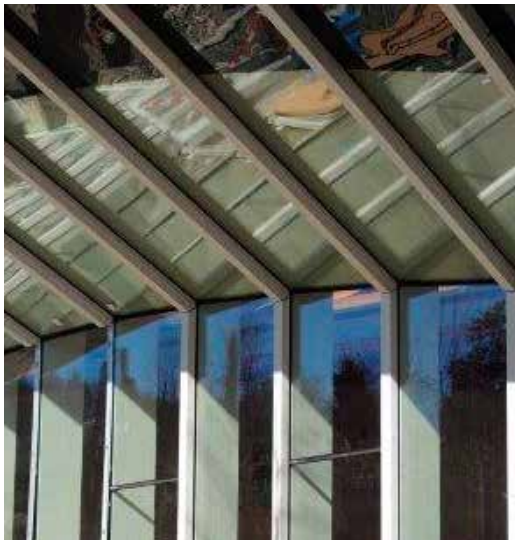
Structural Glazing: Elastic, movement accommodating, but airtight, bedding for the glazing was necessary to prevent stress and unwanted constraints on the glass panels. The Engineers therefore checked materials for their suitability by carrying out compatibility and adhesive tensile strength tests.

Roof Waterproofing: – The roof itself is unique, but a well proven and secure system was essential for the roof waterproofing, including around the 271 roof lights, each with a different shape. All of the necessary upstands, support platforms and approximately 1,500 corner sections had to be constructed by hand due to the variable angles for which standard profiles were not available.

To meet the architect's aesthetic requirements and also to create a safe working level for cleaning and maintenance, a continuous timber platform was designed to span the roof 50 cm above the waterproofing membrane; this structure is set on 5,615 supports that also needed to be waterproofed with the membrane system.

Flooring, Containment Lining & Waterproofing: – Mechanically and chemically resistant flooring that is also easy to clean and very durable was required in many areas. The animal husbandry and management area of the elephant house accommodates the feeding and holding stalls, together with the veterinary and medical treatment / operating rooms, plus the facilities utility service controls and plant rooms. These high-tech and hygienic areas all demanded a top-quality finish for efficient running of the facility and for the good of the elephants.





SIKA SOLUTIONS

Structural Foundations, Watertight Basements and Architectural Concrete Facades: – All of the concrete for the specialist structural and watertight performance demands of the elephant house was produced using Sika ViscoCrete® admixture technology, including the ring beam to accommodate the roof loads and support the entire main building. The main excavation also required slope stability, with sprayed concrete sides and pile walls, once again Sika® ViscoCrete® admixtures were used, here in combination with and Sigunit® sprayed concrete accelerators for optimum performance and rapid completion of the sprayed concrete walls between the piles. The sprayed concrete was applied by the Sika® Sprinter mobile spray machine.

The fine filigree reinforced concrete support structure for the architectural facades was also made possible using the latest generation Sika® ViscoCrete® technology, in order to achieve the optimum concrete flow, compaction and ultimate strengths.

The watertight areas and structures used Sika's engineered waterproofing solutions to seal and accommodate the required movement capabilities in all of the joints, including the Sikadur®-Combiflex® system. Sika® Control technology was also used in the concrete to prevent shrinkage cracking in the floor slabs.

SikaGrout® technology was used to fix and seal the roof supports into the structure

Structural Glazing: As a result of the Engineers testing of the different materials proposed, Sikasil® structural glazing adhesives and sealants were used for structural bonding of the overhead glazing in adapted profiles, plus sealing and UV-resistant bonding of the insulated glazing for the edge seals.

Roof Waterproofing: – The roof was produced and waterproofed with a Sika® Sarnafil® roofing system, fully bonded to the Duripanel boards, thus allowing joints in this substructure to be fully and securely bridged.

The base of each platform support was enclosed in a maintenance-free Sarnafil® T fitting that was specially developed for the project by Sika.

Flooring, Containment Lining & Waterproofing: – Fast-curing, sprayed Sikalastic® polyurea technology was selected as the ideal solution to waterproof and provide highly impact and chemically resistant linings on the exposed concrete surfaces. This system was used throughout the elephant house and for protection of the water retaining and holding tanks, including the waste-water containment and treatment facilities. Sikafloor® resin systems were applied on all of the trafficked and exposed floors in the visitor entry and access corridors.

SIKA® SYSTEMS FROM "BASEMENT TO ROOF"

THE PROJECT PARTICIPANTS

Owner: Zoo Zürich AG
Lead Architects: Markus Schietsch Architekten GmbH, Zurich
Structural Engineer: Zoo Zürich AG
Contractor: Zoo Zürich AG

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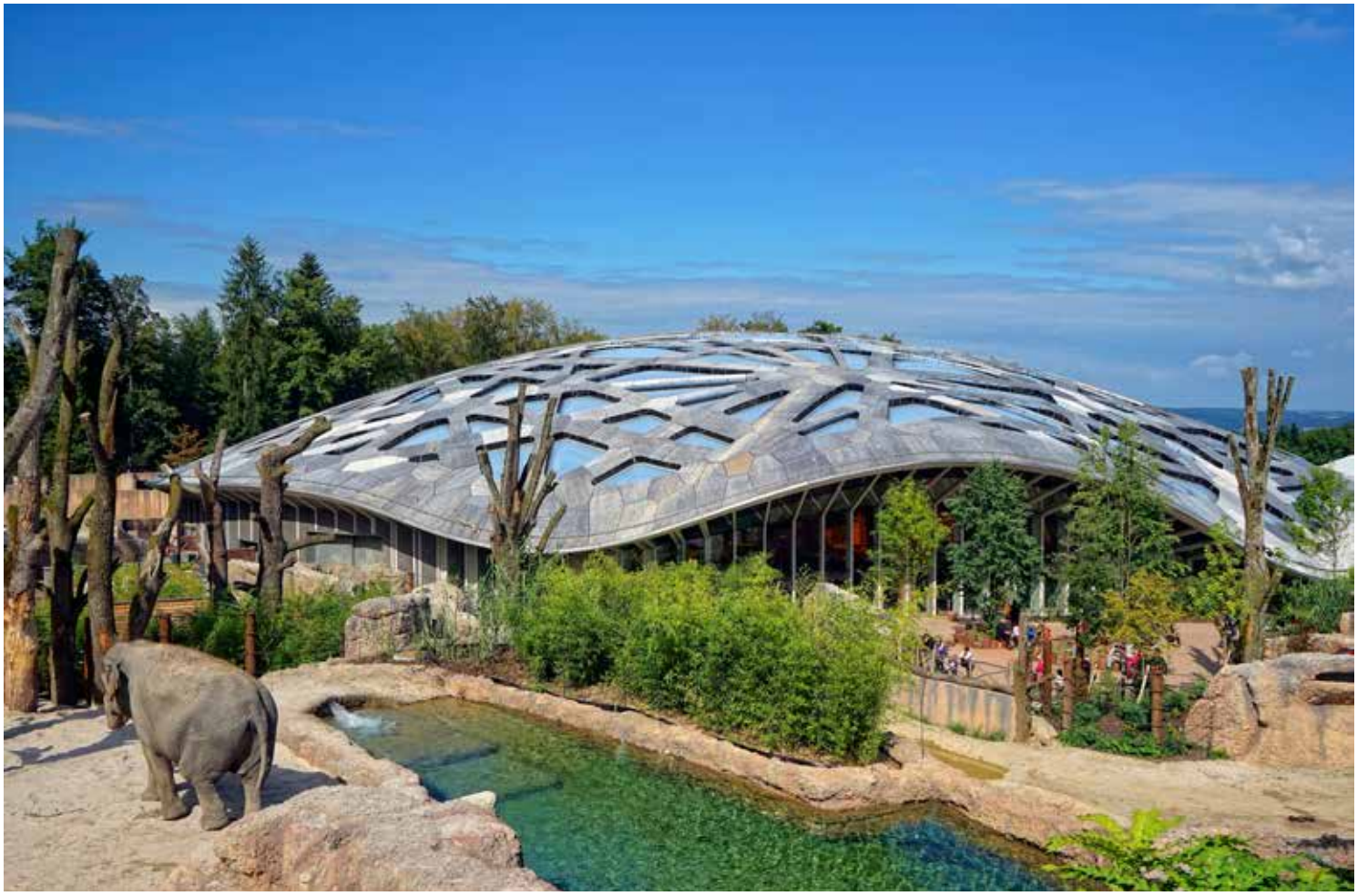

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