

SENSO-JI TEMPLE

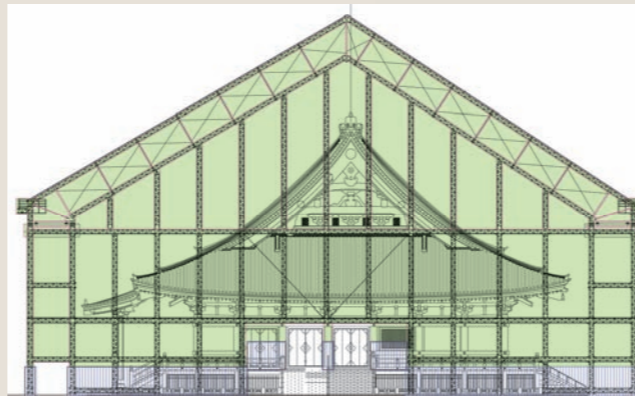
The outside repair project



Temporary roof trusses are being erected.

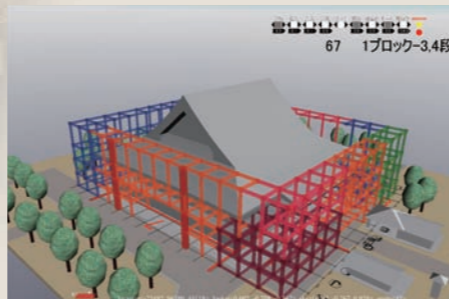
To safely and smoothly execute repair work of exterior finishes, the entire main building of the temple is covered with temporary roof without closing the approach to the temple.

- ◆ Sliding method is used to erect the roof trusses in a limited construction area.
- ◆ Lightweight trusses are used to construct a large space.

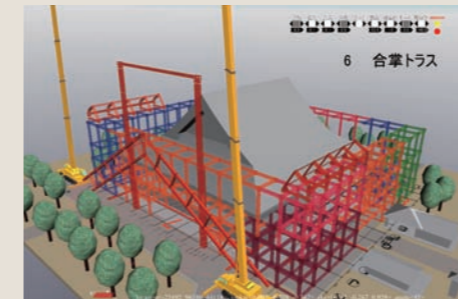


Erection processes.

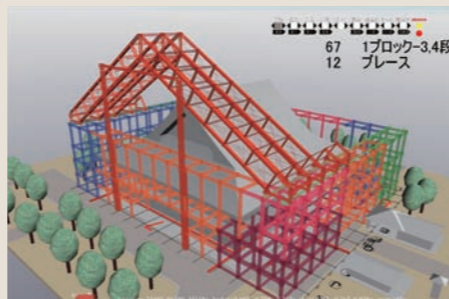
Three-dimensional CAD drawings are used to precisely visualize the erection processes.



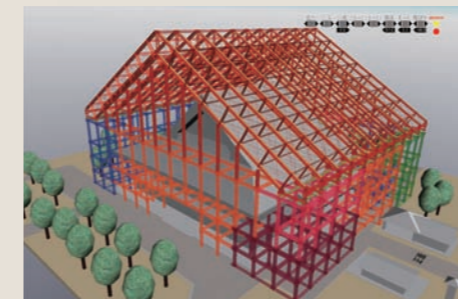
1 Exterior scaffolding is being erected.



2 The roof trusses are lifted up and then installed.



3 Minimum sliding truss units are assembled.



4 Erection of roof trusses has been completed.

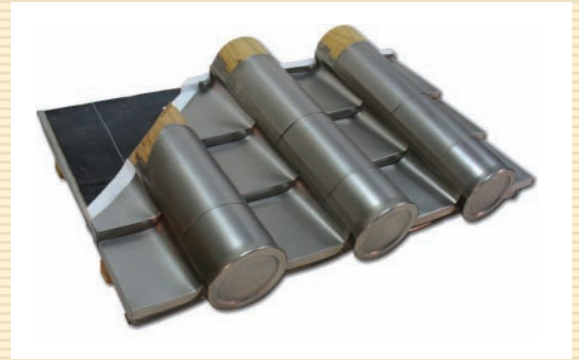
The roof tiles are replaced with titanium tiles.

Features of titanium roof tiles

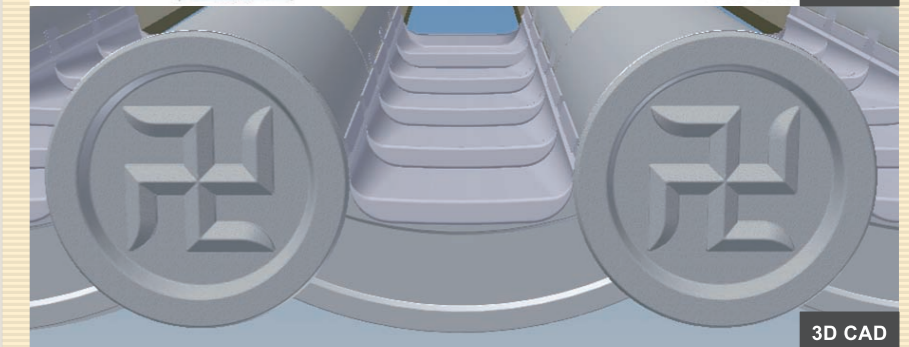
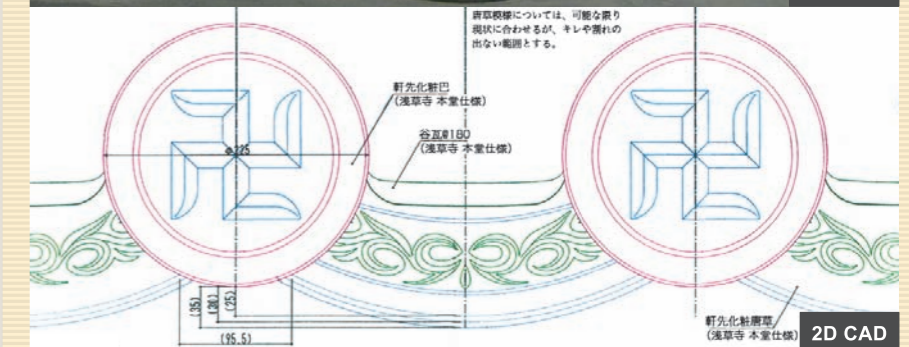
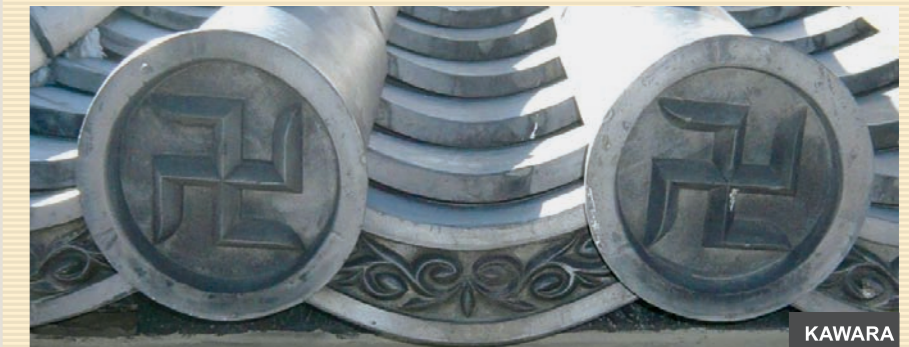
To reduce roof weight and improve earthquake resistance, the existing roof tiles are replaced with titanium tiles.

- Roof area : about 3,100 m² (One of the largest titanium tile roof)
- Titanium press-molded products are used.

Traditional titanium tiles are laid with parallel steps.



Tiles (eave-end tiles) were designed using three-dimensional CAD system



3D CAD

Decorative metal fittings are renovated and large doors are replaced.

- ◆ After on-site survey and surface treatment, decorative metal fittings are renovated by impressing gold foils, gold plating, and coated with black lacquer.
- ◆ Large steel doors at the entrance to the main building of the temple are replaced with aluminum doors to reduce weight and improve durability.



Surface treatment after removal
Clear coating is applied after impressing gold foils on it

Measures against carbonation of concrete of building frames

- ◆ Measures are taken against deterioration of exterior walls that were severely damaged by exposure to the weather over the years. Protection of building frames from carbonation (applied to: Chidori gable and spalled concrete) by the Refrete method.



Existing paint films were examined by tensile test and the repainted.

- ◆ Repainting is done by making full use of the existing substrate without scaling off the existing paint films on the portions where the adhesion forces exceed the prescribed value.



Measuring method: pull-off method



Epoxy adhesive is used to bond the paint film surface, and the adhesive force of the paint film is measured with an adhesion tester.



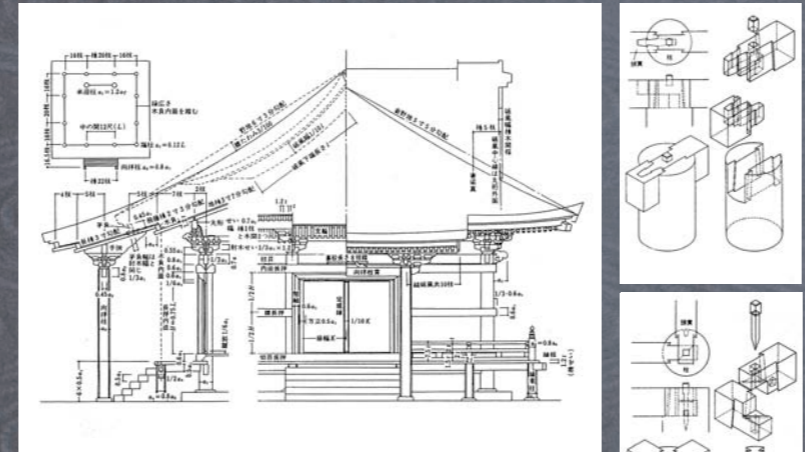
Scraping
Intermediate coating after puttying
Finish coating

Construction of temples and shrines by Shimizu Corporation

Passing on and creating traditional architecture
We propose the best technique by comprehensively considering the objectives of preservation and restoration, ease of use of buildings, preservation of design, type of building structure, conditions of the ground, construction technologies, and presence/absence of designated cultural heritages.

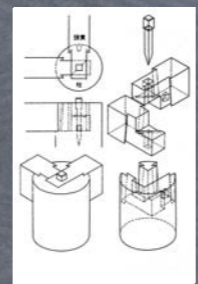
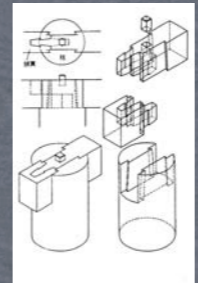
Begin with the learning of the wood of traditional architecture

Understanding of kiwari — a system for measuring out the wooden components to be used in architecture, and kigumi — wooded framework.



◆ Illustrated proportional value design collection "Shomei" (Doki-Shu and Sanken Shimendo)

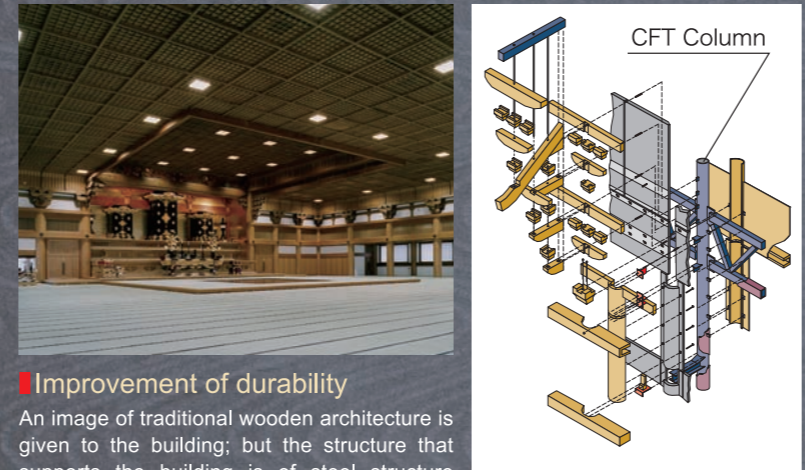
Shimizu carries on the tradition of kiwari as the starting point of the beauty of Japanese traditional architecture and follows the technology of kigumi as the beauty of carpentry.



◆ Typical joints in the middle of the Muromachi period

Expression of traditional wooden architecture with steel structure

Improvement of earthquake resistance and durability by combining traditional and advanced technologies



Improvement of durability

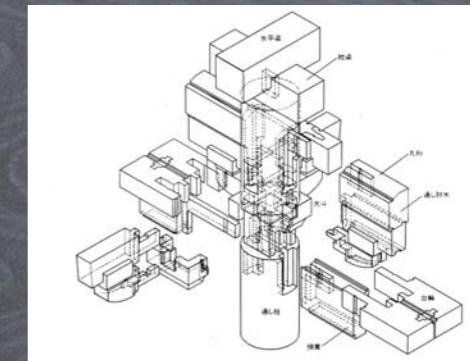
An image of traditional wooden architecture is given to the building; but the structure that supports the building is of steel structure (using CFT columns) to emphasize the importance of earthquake resistance of the building. Taking a hint from the modifiability of traditional architecture, a system that facilitates the maintenance and replacement of structural members is established.

Improvement of earthquake resistance

Earthquake waveforms are assumed and a vibration analysis is carried out to study the safety of the building.

New efforts in the area of traditional architecture

Commitment to wooden structure by traditional construction methods

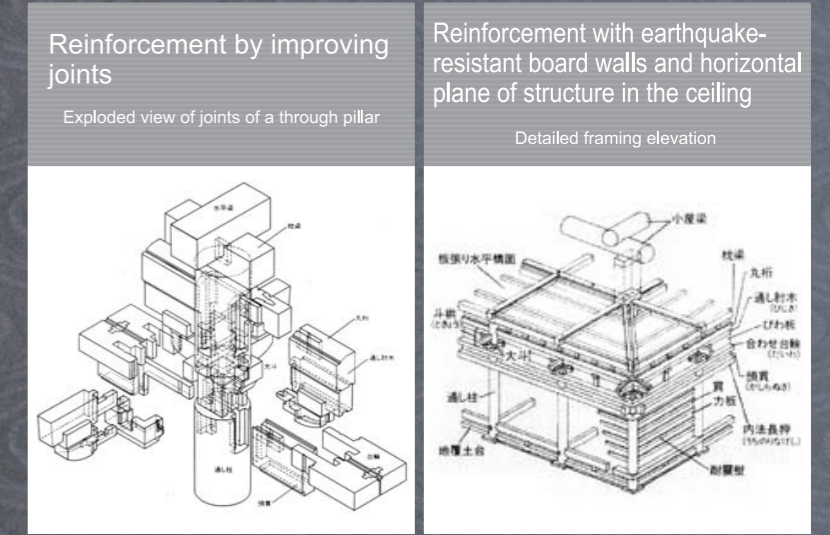


A large space is realized with unprecedented structural frames in which four interior columns are laid out in a ten-foot-square interior space. Connections and joints are structurally engineered and their strength is demonstrated by a full-scale test.

◆ Illustration of joints (exploded view)

Combination of traditional and the cutting-edge technologies

Technologies of renovating and structurally reinforcing traditional wooden structures



Reinforcement by improving joints
Exploded view of joints of a through pillar

Reinforcement with earthquake-resistant board walls and horizontal plane of structure in the ceiling
Detailed framing elevation

We protect temples and shrines from earthquakes while preserving traditional design by bringing together our wooden architecture technologies that took a long time to cultivate.

Today's Work, Tomorrow's Heritage

More Information

SHIMIZU CORPORATION Shrine, Temple & Residence Dept.
TEL:03-5441-0720 <http://www.shimz.co.jp/shazi/>