Structural Design of “Steel Pavilion”

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Abstract

In this paper we introduce a project of an office building of a steel fabricator adjacent to its own plant. (figure 1)

In order to realize the requests of the client who is also the fabricator, we adopted "Steel Pavilion" and "Voronoi Space" as design concepts.

1. Steel Pavilion

The steel fabricator has advanced steel fabrication technology and is actively working on the use of BIM technology. In order to demonstrate its technological capability, we challenged the steel structure of complicated shape.

2. Voronoi Space

The client requested to activate communication between employees working in different departments in the office. To solve this problem, we adopted the geometry of the Voronoi division as the spatial structure, so that each area had a three-dimensional and multi-faceted connection. (figure 2)

The size of this building is 92.4 m×21 m, and the height is about 13 m. All frames including footing beams are made of steel. The main structural frame of steel pipe placed on the boundary lines of the Voronoi space makes the architectural space attractive. Columns and girders are pin-jointed, and braces and steel plate shear walls are layouted as seismic elements.

There are three structural features.

1. "Steel plate shear wall" with buckling stiffening rib of Voronoi shape. (figure 3)
2. "Sandwich steel plate slab" which is a structural floor composed of steel plates.
3. "Cross-hatch braces" which are made to be seismic elements by crossing multiple narrow steel pipes.

By using these special structural elements, we realized "Steel Pavilion" which expresses the advanced steel manufacturing technology of the fabricator itself.

figure 1 Exterior perspective

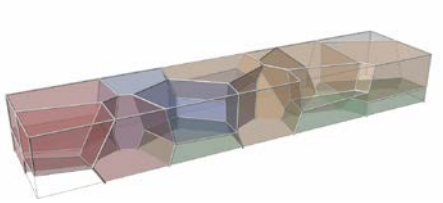

figure 2 Voronoi Space

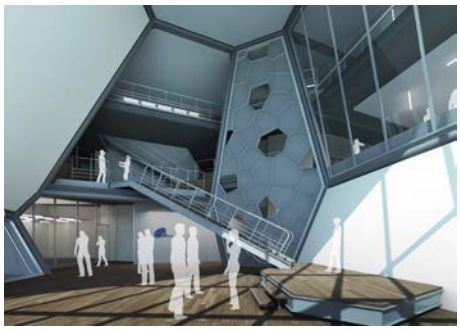

figure 3 Voronoi shaped wall

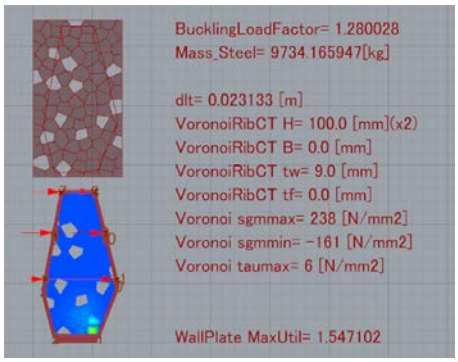

figure 4 Computational Design tool

For structural analysis of such special structures, we used data generated by a computational design tool. We devised a method to efficiently convert data from analysis tools, and verify structural performance of complex Voronoi shapes. (figure 4)