

Structural Design of Beam String Structure in a low space

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Abstract

This paper explains the design of the Beam String Structure in the cafeteria of Teikyo University.

The Beam String Structure is often applied to high places such as gymnasiums, but in this design we adopted the Beam String Structure in a low place, a height of about 5 meters. Because we planned a Beam String Structure in a human-scale space like the cafeteria, we designed it considering the details that are not usually noticed, such as paying attention to the size of the members. The span of the Beam String Structure is 32 meters, and the spacing between the Beam String Structure is 4.2 meters. The Beam (upper material) is H-shaped steel: H-390 × 300 × 10 × 16, the String (the lower material) is spiral rope: 2-30φ, and the Strut is steel pipe: φ76.3 × 5.2. The Strut is placed in 2 places, trisecting the 32 meters long beam. The depth is 2.0 meters and the depth span ratio is 0.06, which makes this flat for a Beam String Structure. It is about 4 meters high from the floor level to the bottom of the beam.

We used ingenuity, such as below, so that the Strut and the String does not give a sense of oppression to the space.

- Planned appropriate beam spacing and restrained the size of the Beam String Structure
- Reduced the depth of the Beam String Structure and made it flat
- The joint of the Strut and the String minimized the joint by not clamping the String and reduced the presence of the Strut and String
- Arranged the Strut on the bisector of the String to make the Strut stable even with a single material, by making the tension of the String on both ends equal and reducing the sliding power

Through these ideas, we were able to make a comfortable place with human scale, by making the ceiling feel more higher, and making the people realize the brightness and the good view.

In addition, this paper also explains the following items:

- Influence of flattening the Beam String Structure
- Effects of the Beam String Structure due to difference in Strut number
- Benefits of not binding the Strut and String etc.