

Proposal of Plate Structures Consisting of Intersecting Tensegrity Truss Units and Grasp of Structural Characteristics of the Plates

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Abstract

This paper is about the systems composited with "Intersecting Tensegrity Truss (ITT)" unit which is consisted of two pyramidal frameworks (compression member, DT in Figure 1), a center tension member (HS in Figure 1) and exterior tension members (DS, HT in Figure 1). Because the two opposing pyramidal units are rotated by 45 degrees and connected intersecting each other in the center using the HS member, this unit has the distinctive advantage that the introduction of tensile force of the ITT unit can be easily performed by shortening the length of the center screw (HS).

In this paper, the authors are going to propose a plate-type structure based on the features of ITT by connecting multiple ITT units.

Firstly plate models of ITT having area 9,900x9,900mm were designed. Using these models, the influence and behaviors of the structure systems at additional load by the introduction of tension was examined. The structural performances of the plate structure systems were figured out and the applicability of the proposed model was experimentally examined using a scale-down beam-type model.

Several findings obtained as a result of examination in this paper can be summarized as follows;

- When tensile force of strings does not disappear by introducing proper pretension, it has constant rigidity.
- When tensile force of strings disappears, it was confirmed that there is no sudden instability phenomenon, although the stiffness of the frame structure decreased and even after the tension disappeared, it shifted to a new load resistance mechanism.

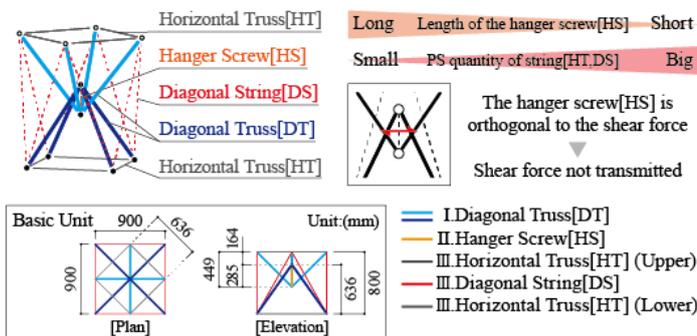


Figure 1 : Basic System ITT Unit

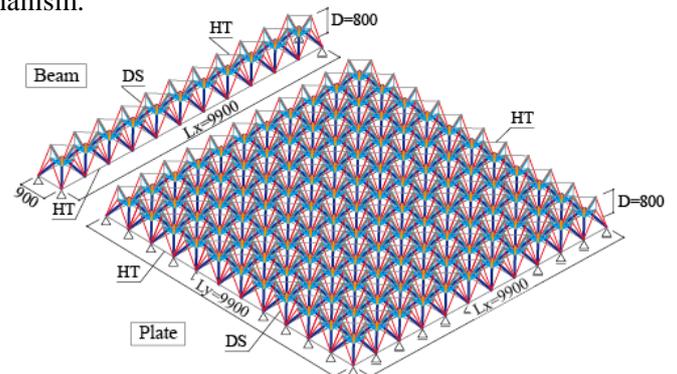


Figure 2 : Analysis Model Diagram of Proposed Frame

References

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- [2] Juna Lee, et. al, "A Development of Intersecting Tensegrity System and Analysis of Structural Features for Forming Space", Journal of the Korea Association for Spatial Structures, Vol.14, No.4, pp.55-54, 2014