Development of NS Space Truss system

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I.Prefabrication of Components

Bolt connection is adopted in this system in order to avoid site welding of steel pipes. Site welding requires a highly accurate set-up and skilled welders. In addition inspection is difficult. NS Space Truss system offers high accuracy and quality with reasonable cost by utilizing mass production techniques. For example, it takes less then a minute to automatically weld two end cones to a steel pipe in flat position. Because of accurate fit of the components, the system is easy to assemble on site.

II.Bearing Capacity of the Node (see the diagram with the same title)

Bearing capacity of the node depends on load distribution as well as on its configuration. ß-value represents load distribution. Mono-axial tests(ß=0) and bi-axial tests(ß≠0, see photo) were done to define bearing capacity ratio. E.T. and P.T. are the calculated curve for a ring on elastic theory and on plastic theory respectively. Plotted points ⊕ ⊙ X are the node test results and they are analogous to the calculated curve.

III.Buckling Load of Pipe Members (see the diagram with the same title)

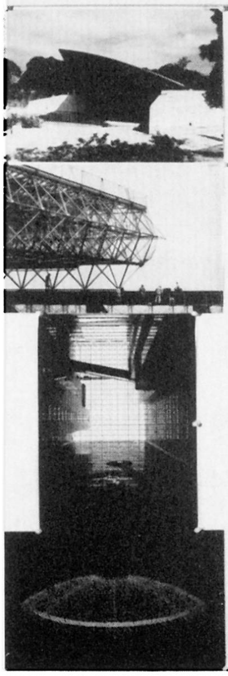
Pipe members and steel pipes of the same lot were loaded to failure. Normalized buckling loads and slenderness ratios are on the diagram. Buckling loads of steel pipes agree well with the value given by AISC spec. formula, and buckling loads of pipe members are larger because of the following reasons;

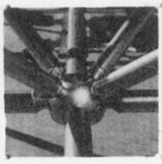
1)Actual pipe member length is approximately 90% of its nominal length which is the distance between the center of the two nodes on both ends.
2)Both ends of pipe members are not free to rotate but are slightly restrained.

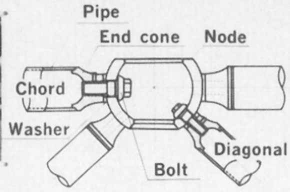
IV.Frame Tests (see the right side of the poster)

Three specimens were loaded to failure to find exactly the stiffness and bearing capacity of frames. Configuration of the three specimens were the same. Target ß-values(-1,0,1) were obtained by changing the location of loading points and supports. The load-displacement relations of specimens are shown on Results of Frame Test diagram with theoretical stiffness and loads, which were calculated on the assumption that joints are pin connections. Stiffness of the specimens agrees well with the theoretical one. Maximum load Px is approximately twice as large as Pa, and is larger than Pc. Stress redistribution was observed through strain measurement of pipe members. Pa is the load at which the axial force of the pipe member with the highest stress of all reaches the allowable axial force defined by AIJ-code;This is true also for Pc and the buckling axial force obtained in the previous tests.(see III)

DEVELOPMENT OF N.S. SPACE TRUSS SYSTEM







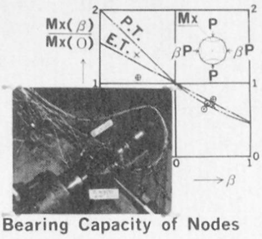
This system has following features;

1) easy application to wide-span structures
2) easy assembly on site
3) easy application to any structural shape
4) high structural reliability

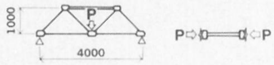
Spherical surfaces of nodes, bolts and washers enable members to be connected without eccentricity of internal forces.

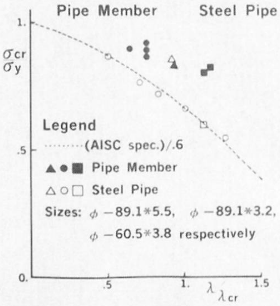
Bearing capacity of components and frames had been experimentally studied before design criteria were fixed.

Application of this system to a 200m—diameter dome is now under study.

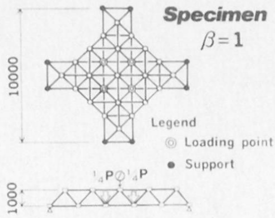


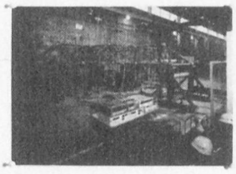
Bearing Capacity of Nodes

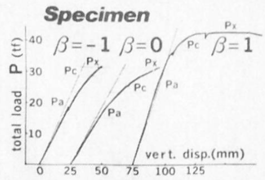




Buckling Load of Pipe Members







Results of Frame Test