Proposal of new roof support considering seismic performance.

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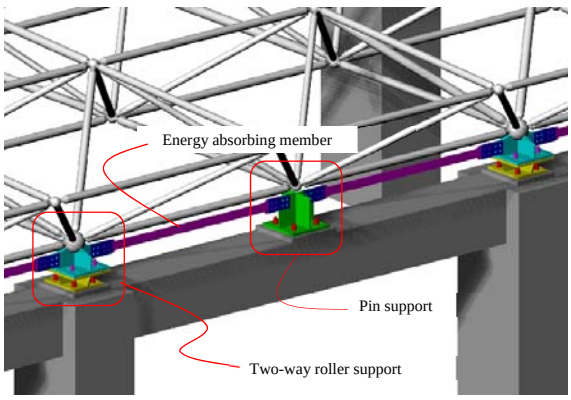
Abstract (to be presented in the session of WG 8)

The steel roofs of gymnasiums or factories are generally supported by reinforced concrete structure. In this type of structures, pin supports or roller supports are installed at the base of steel roofs and atop of reinforced concrete structure. In 2011 Tohoku earthquake and in 2016 Kumamoto earthquake, the damages around the supports were reported. Therefore, the present paper proposes a new support to refrain from the damage due to strong earthquake. And the seismic performance of the model with new supports are discussed through the dynamic response analysis.

The 3D model shown in Fig.1 is new supports proposed to refrain from the damage resulting from an earthquake. In this model, there are two types of supports. The one on atop of column is called “two-way roller support” which can be moved tow-way direction. And one on atop od beam is called “pin support” which can’t be moved. The two-way roller and pin support are connected by a steel plate called “energy absorbing member”. The dead load due to steel roof is imposed on the two-way roller supports and horizontal load due to earthquake is imposed on the pin support through the energy absorbing member. If the earthquake becomes more excessive, the energy absorbing members will yield fast and the stress generated at the steel members of roof can be restrained.

The structure shown in Fig.2 is a numerical model adopted new supports. In this model, The roof is composed with steel structure and the substructure is composed with reinforced concrete. This type of model is commonly used in school gymnasia and factories. The span of the model is 26m, length in the longitudinal direction is 39m, column height of reinforced concrete structure is 10m, and the model is designed using structural design code in Japan.

Seismic performance in the span direction is discussed in the present paper by elasto-plastic dynamic response analysis. Through the results obtained based on elasto-plastic dynamic response analysis, ductility factor μ of the energy absorbing members, amount of horizontal displacement between column and support, the stress of the steel members of roof are investigated and proved the applicability of this supports.



“Pin support” is not connected with the steel members of roof.

Fig.1: new supports

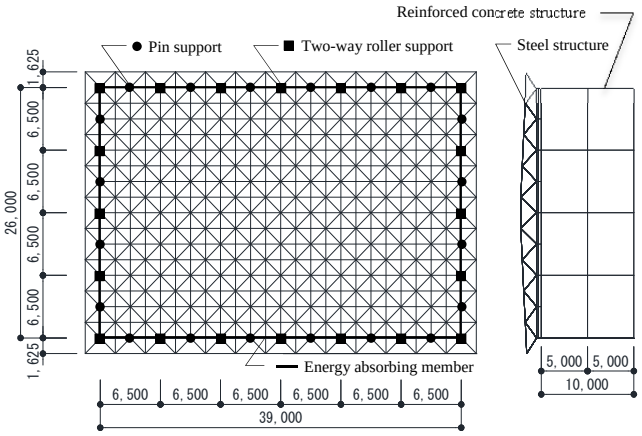


Fig.2: Analytical model