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NUMERICAL SIMULATION OF CEILING COLLAPSE IN FULL-SCALE GYMNASIUM SPECIMEN USING ASI-GAUSS TECHNIQUE

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Many examples of ceiling collapse were observed in the 2011 Great East Japan earthquake and others in Japan. Numerical seismic simulation of ceiling collapse in the full-scale gymnasium specimen, which is tested at the E-Defense shaking table facility in 2014, is conducted in this research.

Numerical model consists of steel structural frames and suspended ceiling grid system as shown in Figure 1. All members are modeled by the linear Timoshenko beam elements. The ASI-Gauss technique, which is utilized to shift the numerical integration point adaptively to an appropriate position, is applied to the nonlinear finite element procedure for structurally discontinuous problems.

Tentative analytical result shows that insufficient attachment of ceiling joists, ceiling joist receivers and hanging bolts, due to poor execution of works, may trigger consecutive detachment of these elements and finally, resulting in ceiling falling-down, as shown in Figure 2. Analytical results are currently being compared with the experimental ones in detail to clarify the mechanism of ceiling collapse.

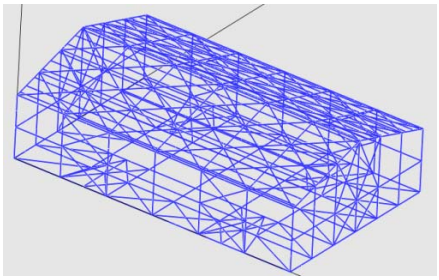

Figure 1: Model of gymnasium specimen

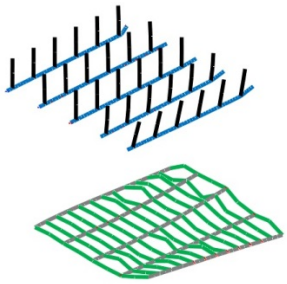

Figure 2: Simulation of ceiling collapse

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