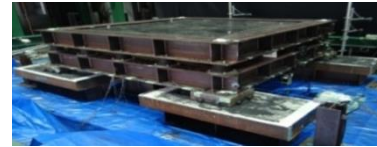
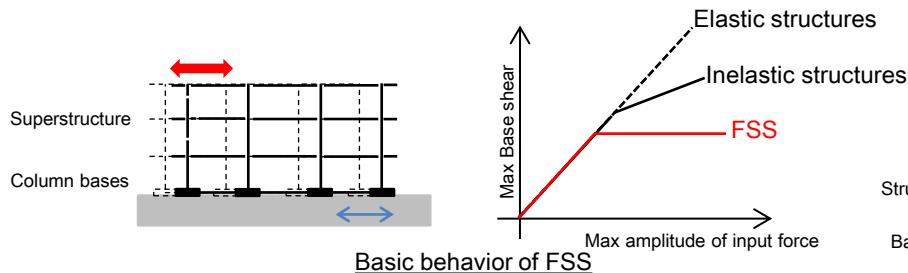


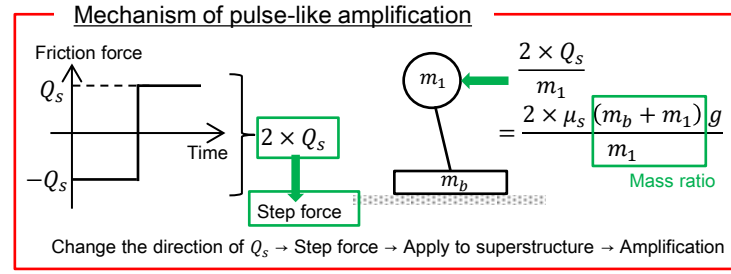
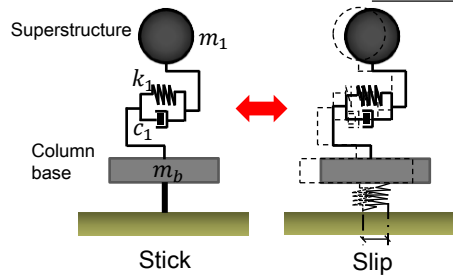
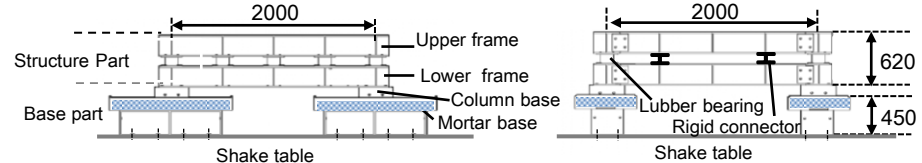
Shaking table test and performance evaluation of Free-Standing Structures

Background and Objectives: In recent earthquakes, strong ground motions far exceeded the design level were observed at many sites. One method to cap the seismic force applied to structures is to allow the structure to slide. Such structures are named 'Free standing structures (FSS).' The previous research revealed that the seismic force applied to the structures could be well controlled by adjusting the friction coefficient properly. This study aims to evaluate the performance of FSS with column base lubricated by graphite powders.

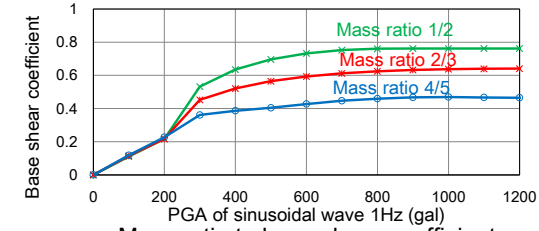
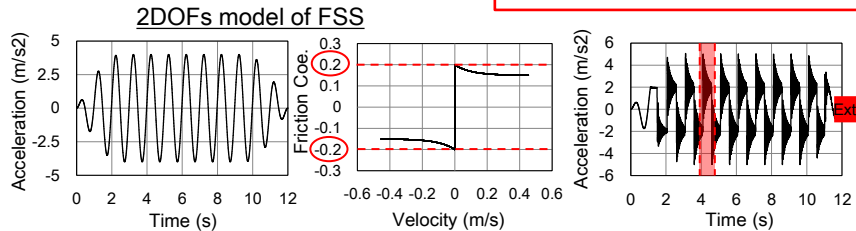
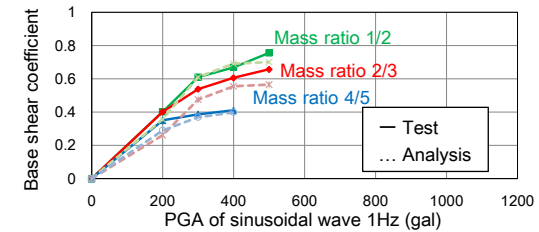
Methodology: Following characteristics of FSS are particularly evaluated using numerical simulations and shake table testing: (1) response acceleration; (2) friction coefficient; (3) base shear coefficient. The two specimens, rigid and flexible, are studied to evaluate the basic behavior and the influence of structural parameters. Moreover, a required base shear coefficient for FSS is quantified by simulation.



	Rigid	Flexible
Natural period	0.057 sec.	0.28 sec.
Damping	—	4%
Total weight	5065 kg	5015 kg
Mass ratio	1/2	1/2



Overview and properties of specimens



Time history of input motion Velocity to Friction coefficient Time history of response acceleration (Analysis)

Mass ratio to base shear coefficient (Top: Test Bottom: Analysis)

Conclusions: Pulse-like amplification and following damped oscillation were observed in the acceleration response after the sliding direction changed. The mechanism of amplification was explored and the mass ratio (superstructure mass over total mass) was identified as an influential factor in the amplification. From the numerical analyses, it was found that there was an upper limit for the acceleration response for each mass ratio.