

# SHAKING TABLE TESTS FOR AMPLIFICATION RATIO ESTIMATION OF ELECTRIC CABINET FOR NUCLEAR POWER PLANT UNDER SEISMIC LOADING

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## Introduction

In this study, the seismic behavior of the electric cabinet was analyzed considering the anchor standard and cracks in the concrete foundation, and a 3-axis shaking table test was conducted to evaluate the seismic performance. The dimensions of the anchor and the size of the concrete crack were determined by referring to the results of the field investigation of the nuclear power plant and the anchor test standard. The electric cabinet was manufactured with a steel frame to minimize experimental variables, and the steel frame was designed through numerical analysis to simulate the cabinet used in a nuclear power plant.

## Research Content

Table 1. Unit Under Test

Set No.	UUT No.	Concrete Foundation		Dimension of Electrical Cabinet model [mm]			
		Strength [MPa]	Crack		Length	Depth	Height
			Number of crack	Width [mm]			
1	1 (S2-1)	27	No crack	-	860	700	2,700
	2 (S2-3)		4	0.5			
2	3 (S1-3)		4	1.0			

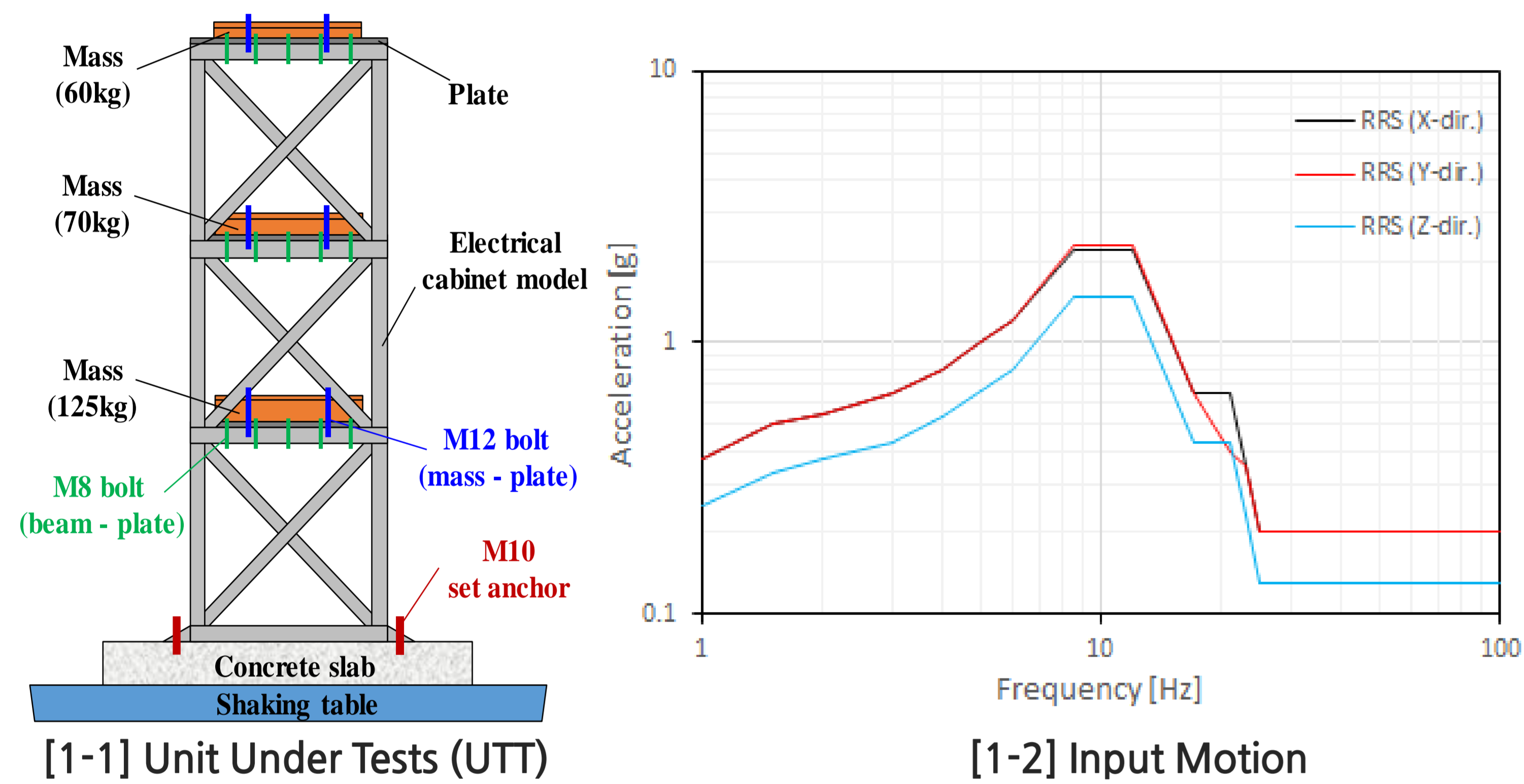


Fig 1. Model and Input Motion

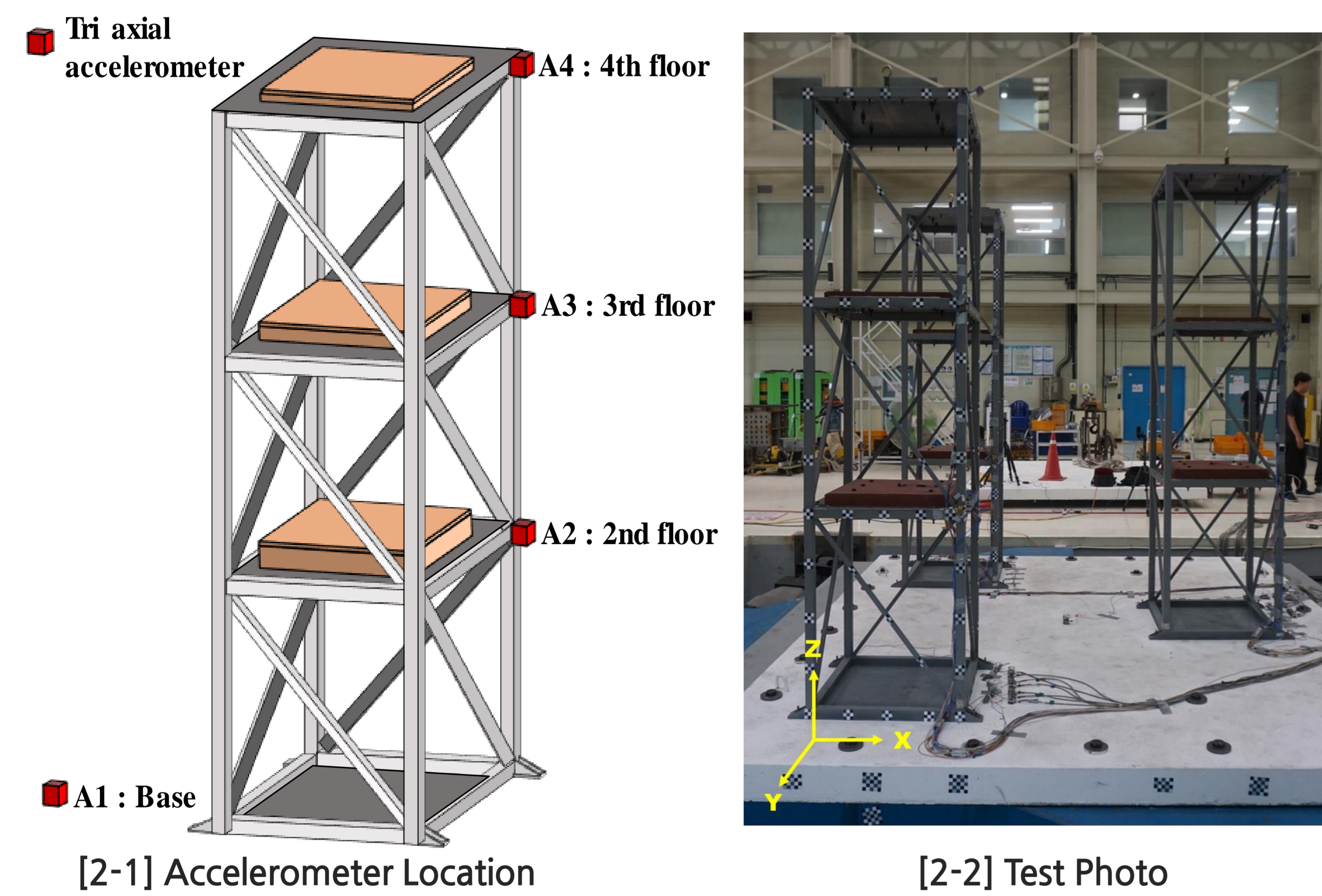


Fig 2. Location of the acceleration sensor

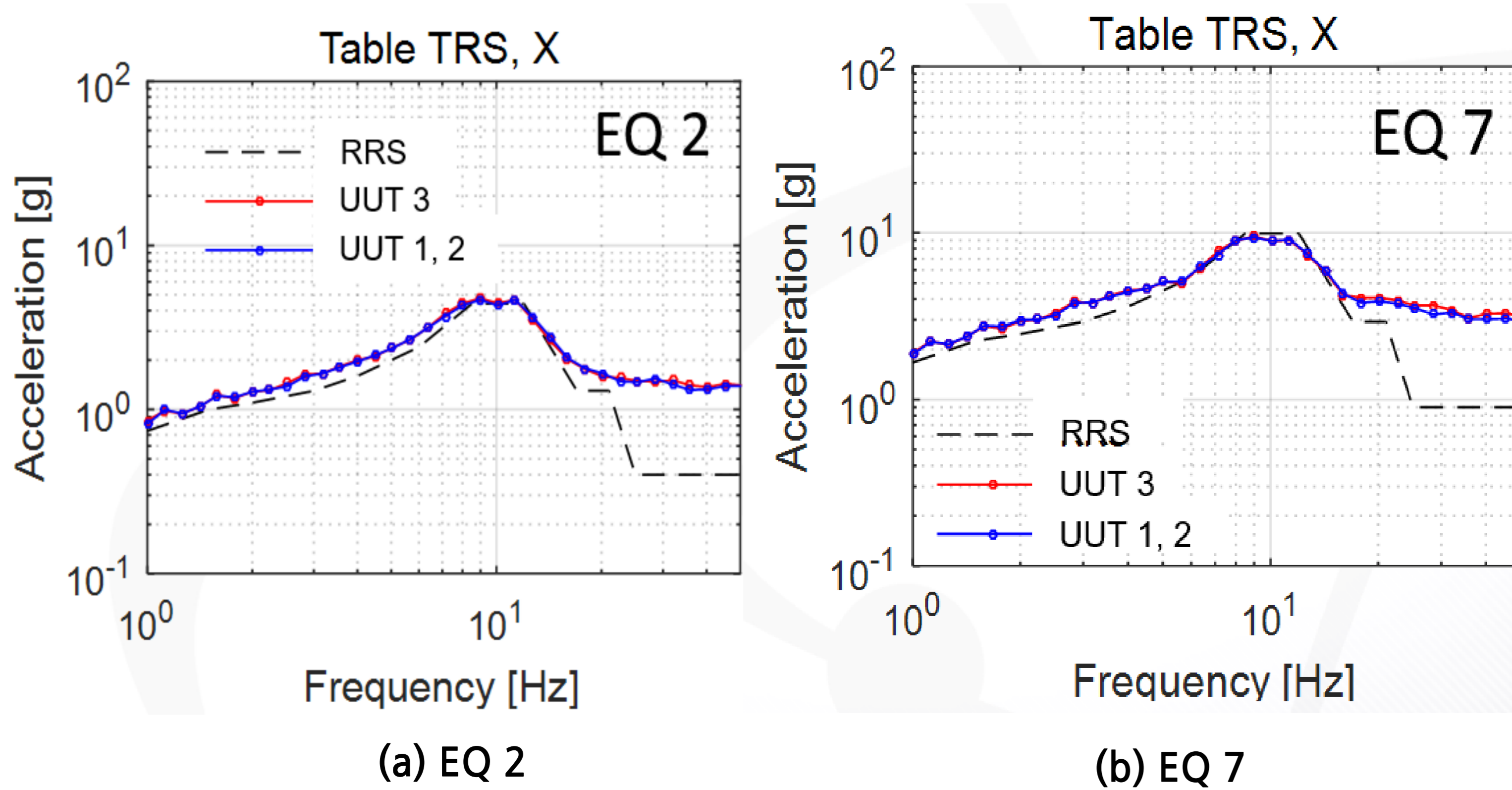


Fig 3. Comparison of TRS

Table 2. ZPA of Acceleration Response Spectrum

TEST ID	Dir.	ZPA of Response Spectrum (g)												
		TRS	FRS						TRS	FRS				
			Base	UUT1 (No crack)			UUT2 (0.5mm)			Base	UUT3 (1.0mm)			
				2층	3층	4층	2층	3층			4층	2층	3층	4층
EQ1	X	0.65	1.45	1.64	2.12	1.16	1.5	1.69	0.66	1.73	1.85	2.61		
	Y	0.62	1.24	1.91	2.33	1.09	1.28	1.7	0.63	1.29	1.8	2.36		
	Z	0.59	0.69	0.71	0.72	0.77	0.69	0.67	0.57	0.65	0.9	0.95		
EQ2	X	1.39	3.44	3.83	4.55	2.84	2.96	3.78	1.44	2.88	3.62	4.32		
	Y	1.29	2.96	4.42	5.1	2.37	2.89	3.3	1.33	2.68	4.19	4.75		
	Z	1.22	1.83	2.58	2.19	1.42	1.62	1.49	1.16	1.24	1.42	2.71		
EQ3	X	1.76	3.47	4.44	6.48	3.24	3.69	4.33	1.82	3.05	3.97	4.59		
	Y	1.64	3.5	5.19	6.08	3.35	3.42	6.53	1.75	2.72	4.27	4.9		
	Z	1.63	1.94	3.53	3.81	1.84	1.9	2.75	2.56	1.84	2.48	2.53		
EQ4	X	1.97	7.17	8.09	12.75	3.16	4.19	5.27	2.25	3.88	5.16	7.16		
	Y	2.03	5.87	10.42	10.41	3.09	4.48	7.07	2.09	3.15	5.38	8.01		
	Z	1.91	9.08	7.11	8.39	1.98	2.94	4	1.8	1.98	2.82	5.99		

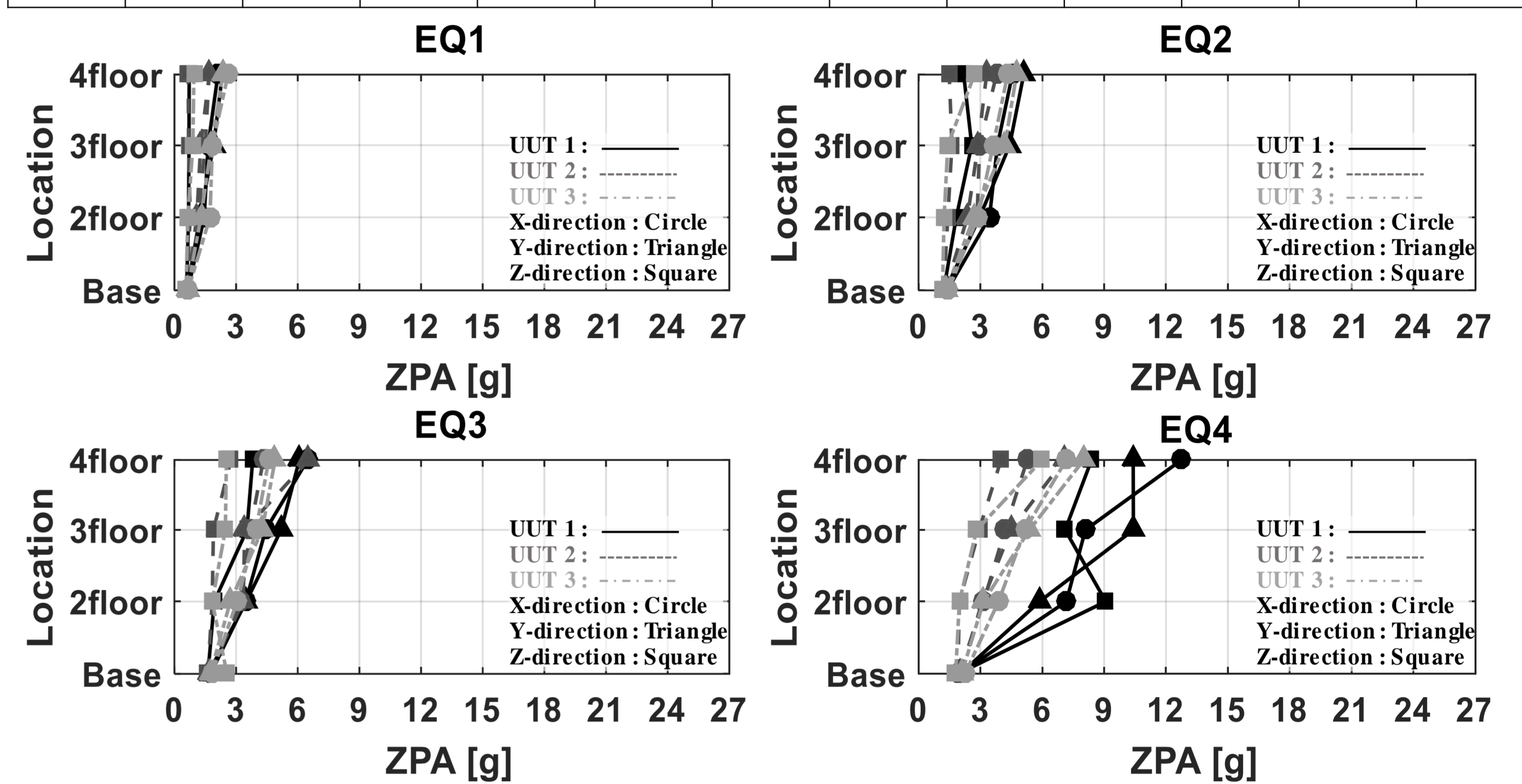


Fig 4. ZPA of Acceleration Response Spectrum (45.25Hz)

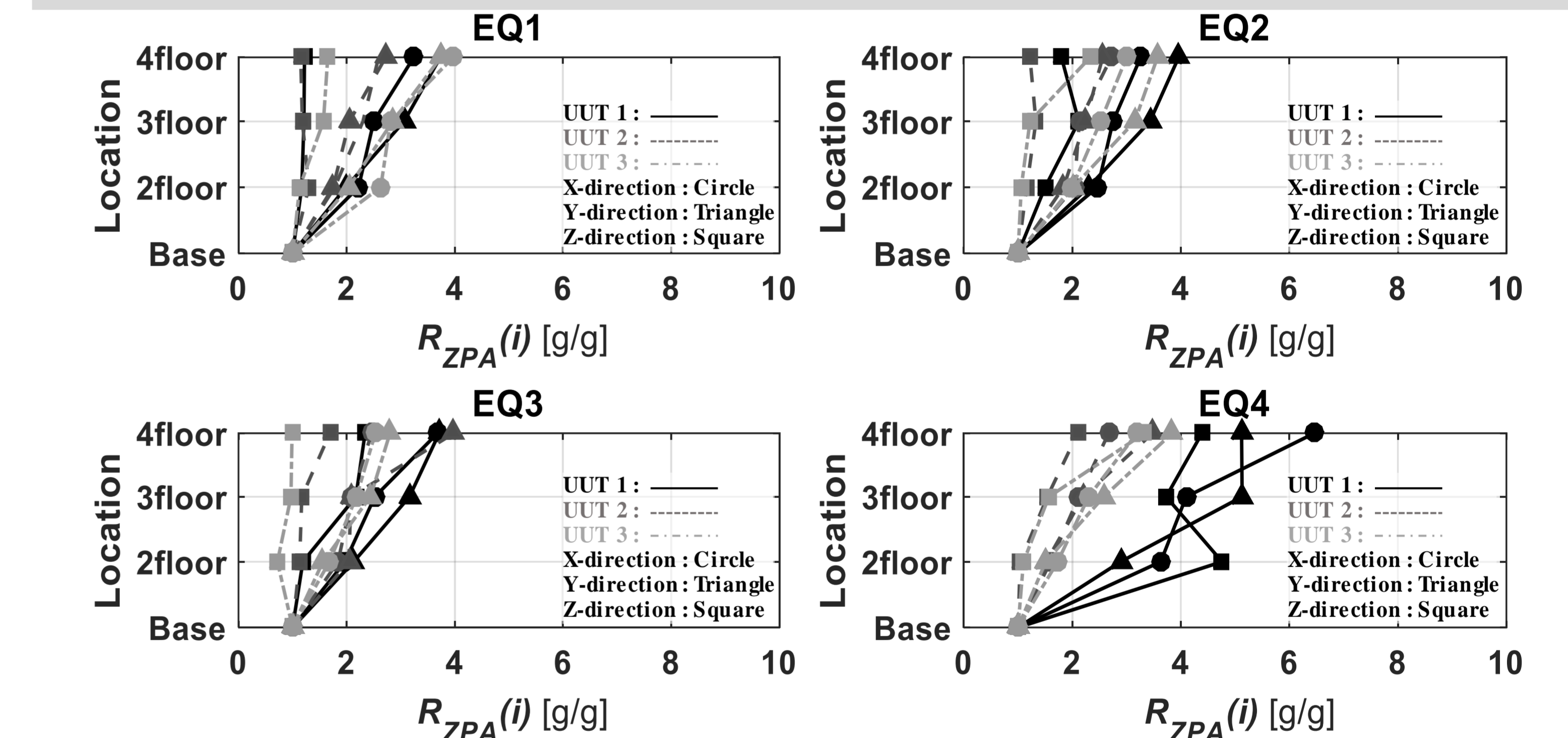


Fig 5. Ratio of Acceleration Response Spectrum

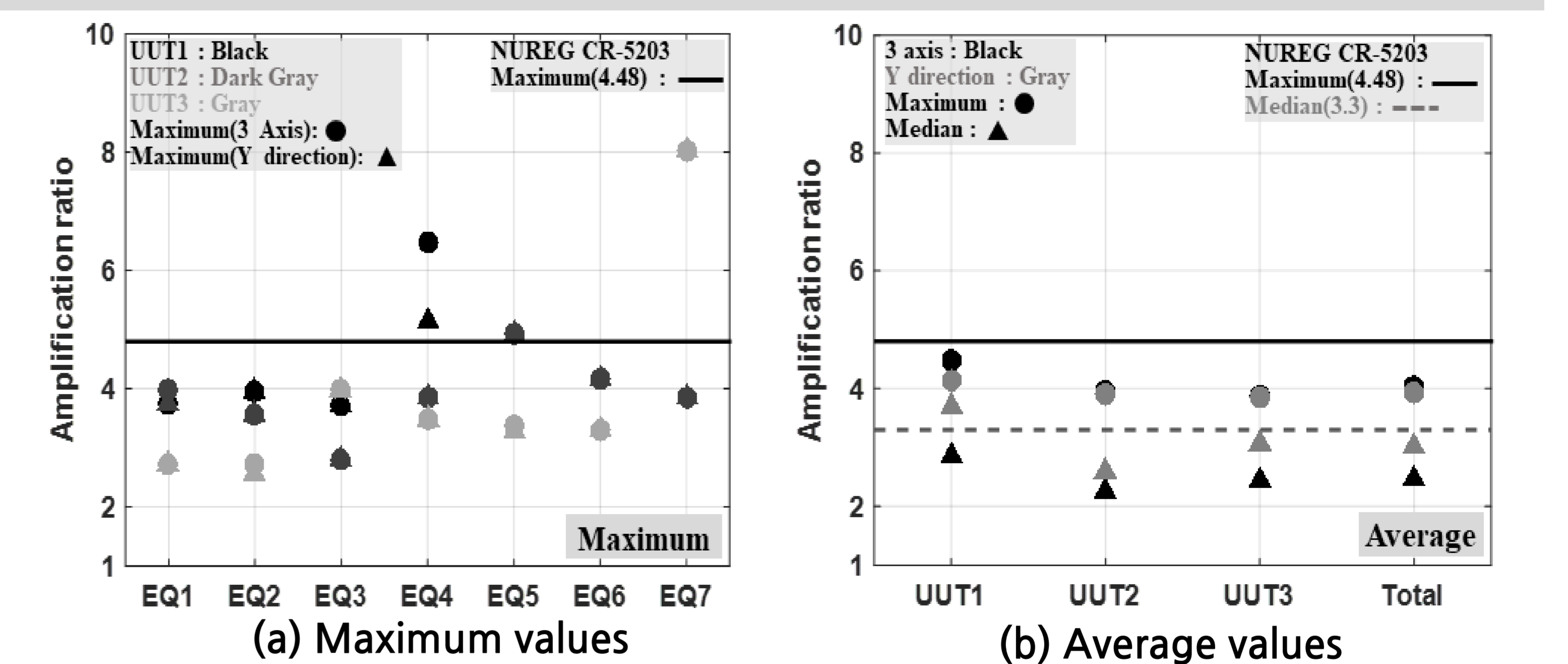


Fig 6. Amplification Ratio of Electrical Cabinets

## Conclusion

The estimation of the amplification of electric cabinets for nuclear power plants subjected to seismic loads can be one of the safety evaluations of nuclear power plants. In this paper, seismic analysis was performed for electric cabinets for nuclear power plants through shaking table test. For accurate analysis, cracks in the concrete foundation were considered. As a result of the analysis, the  $R_{ZPA}(i)$  value of the cracked UUT is smaller than that of the non-cracked UUT. Depending on the  $R_{ZPA}(i)$  value, it is possible to determine whether or not the support is damaged.

## Acknowledgment

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