SEISMIC ISOLATION RETROFIT OF A MEDICAL COMPLEX BY INTEGRATING TWO LARGE-SCALE BUILDINGS

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1. INTRODUCTION

This paper discusses three key issues:

- Methodology of seismic isolation retrofit by integrating two buildings into one unit.
- Simulation of site-specific ground motions for a M8 subduction zone earthquake.
- Evaluation of performance and safety of the retrofitted buildings.

2. DESCRIPTION OF THE BUILDINGS OF HAMAMATSU MEDICAL CENTER

We applied seismic retrofit methodology to two large-scale buildings of Hamamatsu Medical Center, which are the first hospital retrofitted by the seismic isolation in Japan. The two buildings, named Building No.1 and No.2, were constructed based on the old building code before 1981.

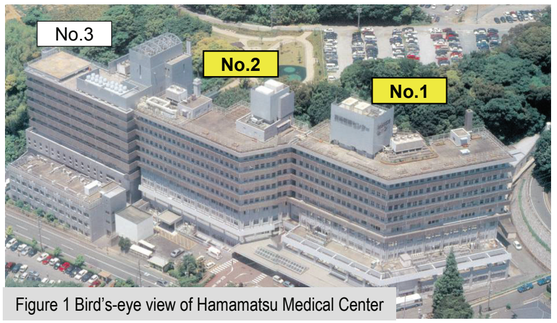

Figure 1 Bird's-eye view of Hamamatsu Medical Center

Table 1 Description of buildings

Building name	No.1	No.2
Year completed	1973	1975
Building area	2,035m^2	1,532m^2
Total floor area	12,915m^2	10,008m^2
Address	Hamamatsu City, Shizuoka Pref.	
Number of stories	nine-story on the ground and one-story on the underground level	
Structural type	Steel-reinforced concrete structure	
Eaves height	37.10m	
Structural system	Moment-resisting frames with shear wall	
Foundation type	Spread foundation	
Bearing stratum	Silty fine sand	

3. METHODOLOGY OF SEISMIC RETROFIT

3.1. Integration of The Two Buildings and Microtremor Measurements

The two buildings were integrated into one structural unit by connecting together at each floor by using post-tensioned cables through slabs. We confirmed that the integration worked well by comparing microtremors of the buildings before and after the integration.

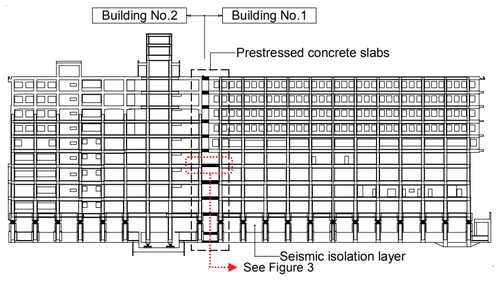

Figure 2 Framing elevation of No.1 and No.2

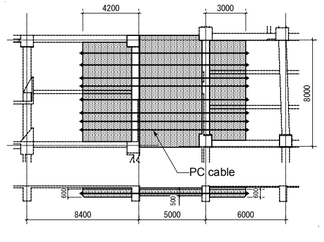

Figure 3 Plan (up) and section (down) of connecting slab

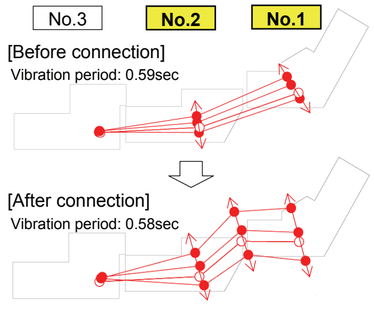

Figure 4 Predominant directions using microtremor before and after connecting No.1 and No.2

3.2. Seismic Isolation Retrofit

We adopted the temporary supporting method using post-tensioned units to install the devices safely and economically.

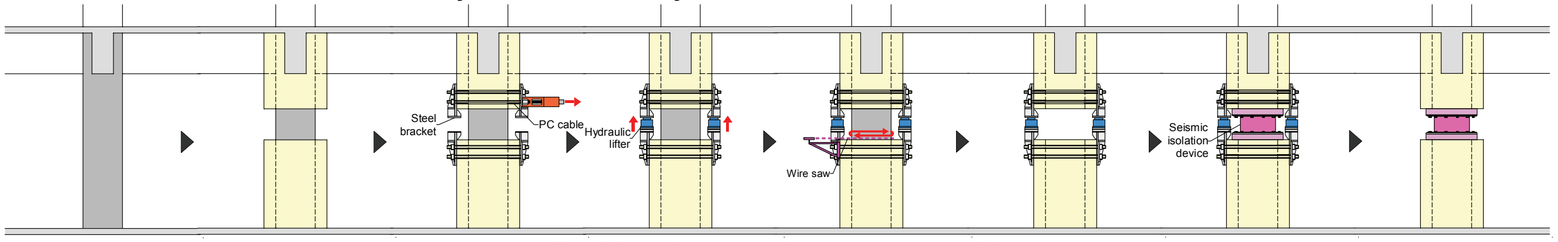

Figure 5 Construction process by the temporary supporting method

4. SIMULATION OF SITE-SPECIFIC STRONG GROUND MOTION

In the seismic design phase, we simulated the broadband input earthquake ground motions for a hypothetical M8-class earthquake in the vicinity of the site, using a hybrid method.

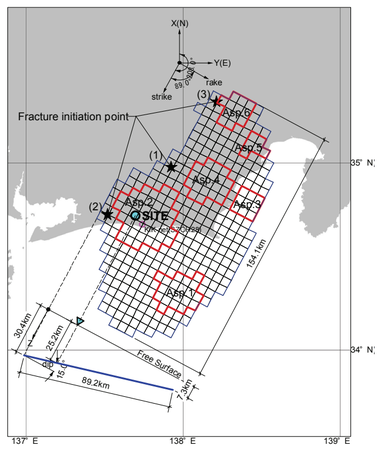

Figure 6 Seismic fault model used for theoretical method

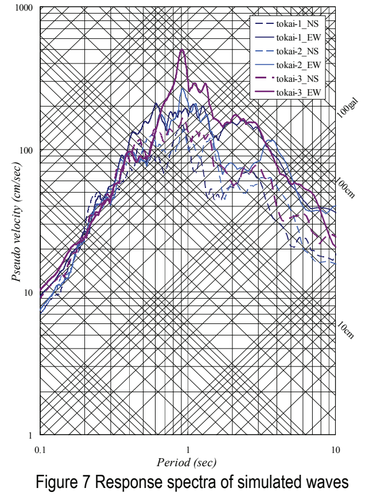

Figure 7 Response spectra of simulated waves

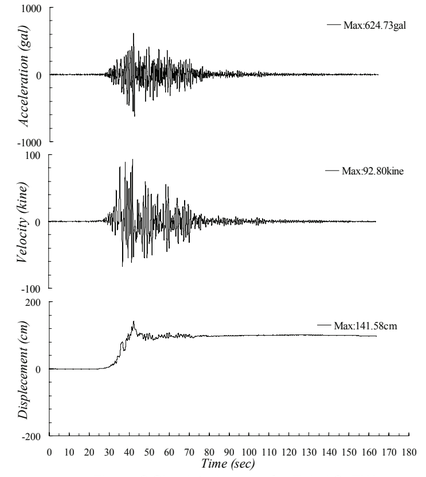

Figure 8 Simulated waves for Tokai-3_EW

5. EVALUATION OF SEISMIC PERFORMANCE OF THE BUILDING

We confirmed the safety and functionary of the medical center by evaluating the seismic performance of the buildings, based on the time history seismic response analysis.

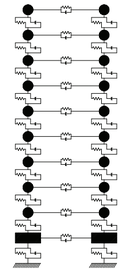

Figure 9 seismic response analysis model

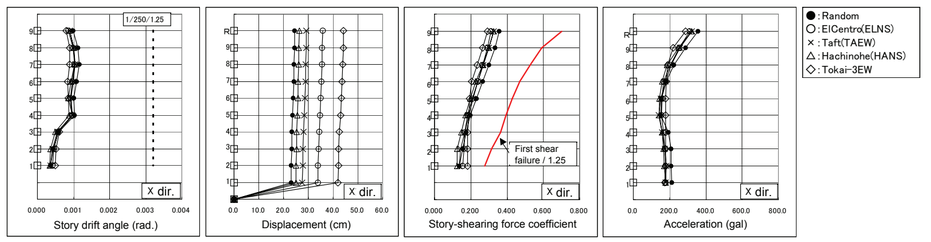

Figure 10 Time history response analysis results of the upper structure and the seismic isolation layer (stiffness of seismic isolation layer: hard case)