

International Institute of Seismology and Earthquake Engineering



Strong Motion Observation of BRI

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Outline

- Nationwide strong motion network for buildings started in 1957
- 74 stations with digital instruments in operation
- Aims to contribute to the improvement of seismic design technology for buildings
- Targets effect of surface geology, input earthquake motions to buildings and dynamic behavior of buildings during earthquakes



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Site location





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Recent Progress





Targets





Sensor Configuration





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Typical Sensor Configuration





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Example











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Effect of Surface Geology (Sendai #1)

Acceleration at hard and soft sites





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Effect of Surface Geology (Sendai #2)

Fourier spectra at hard and soft sites





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BRI Annex Outline

11 sensors in the annex building

- 4 in the main building
- 7 in the surrounding ground





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BRI Annex Sensor configuration in section





BRI Annex Sensor configuration in plan





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BRI Annex

Change of dynamic characteristics

- f₀ is falling with time
- f₀ show amplitudedependence
- h_0 is 2% to
- 3%





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Kushiro Government Office Bldg. Outline

9-story SRC building with steel braces





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Kushiro Government Office Bldg. Base isolation devices

- 64 Laminated rubber bearing
- 56 Lead Damper
- 32 Steel Damper







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Kushiro Government Office Bldg. Sensor configuration

3 sensors in the ground and 3 sensors in the building



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Origin time	2003/09/26 04:50
JMA Magnitude	8.0
Focal Depth	42 km
Casualties	2 Missing,
	>700 Injured
Damaged	12 Collapsed,
Houses	>500 Partially Destroyed

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NMWA Outline of building

 National Museum of Western Art (NMWA), Ueno park, Tokyo
RC/3F+B1F, Historic building (designed by Le Corbusier)

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NMWA Retrofitting work

- Seismic retrofitting in 1998 with preserving exterior
- Base isolation system with 49 highdamping rubber bearings

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NMWA Sensor configuration

GL, 2 sensors at B1F, 2 sensors at 1F and RF (6 in total)

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NMWA Strong motion records

101 strong motion data (2000-2008)
PGA: 0.942 m/s² (Feb. 16, 2005)

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NMWA Acceleration records

M5.4, *h*=45 km, February 16, 2005 Distance: 37 km, PGA: 0.942 m/s²

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NMWA Fourier spectral ratios (Feb. 16, 2005) Input loss and base isolation

1F/BF

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NMWA Fourier spectral ratios (Feb. 16, 2005) Building and overall

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NMWA Fourier spectral ratios (Feb. 16, 2005)

Torsional movement

1FE/1FW

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NMWA Natural frequency and damping ratio

 Assume SDOF
Identify *f* and *h* from input and resp.

NMWA Conclusions

- More than 100 records have been acquired
- Basic dynamic characteristics were discussed using a moderate record
 - Amplitude-dependency of natural frequencies was clearly observed
- Large damping effect was verified even in small amplitude range