Seismically Base Isolated Buildings

5th February, 2026

Building Research Institute, Japan

M.Seki

Key Aspects of Seismically Base Isolated Buildings

Mechanism:

The structure rests on specialized isolators (e.g., Rubber Bearings, Friction Pendulum Systems)

Benefits:

Protects both the structure and its contents,

Cost:

Typically adds about 3% to 5% to total construction costs

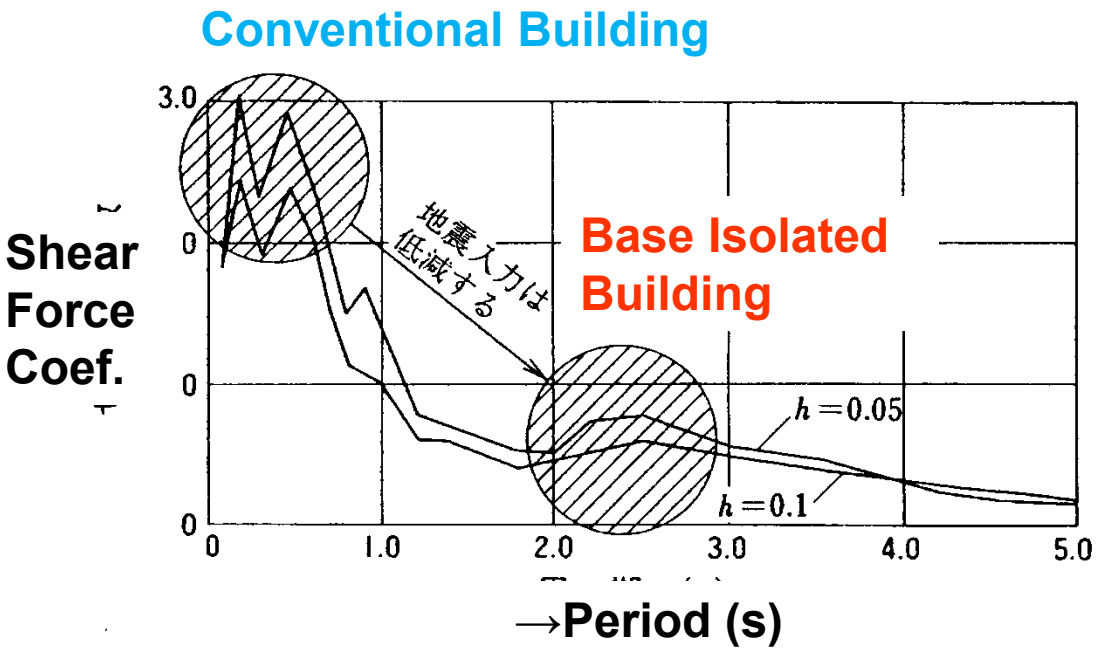
Durability of Isolators:

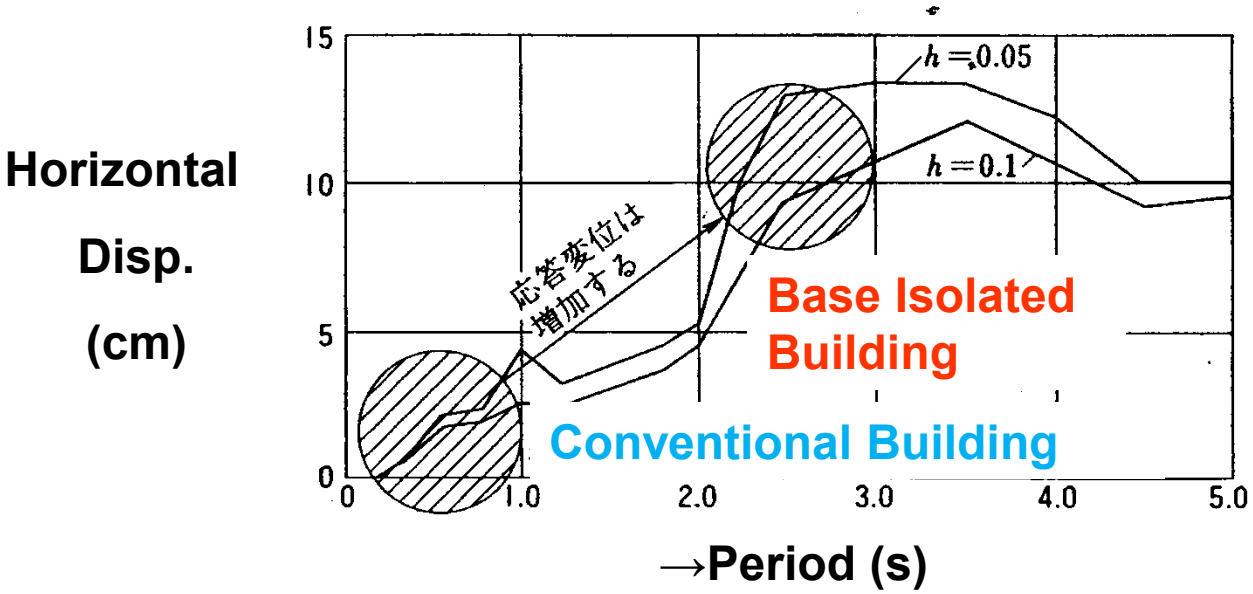
Equivalent to the superstructure of a building

Application examples:

Japan: more than 9000 buildings

Principle of Base Isolation

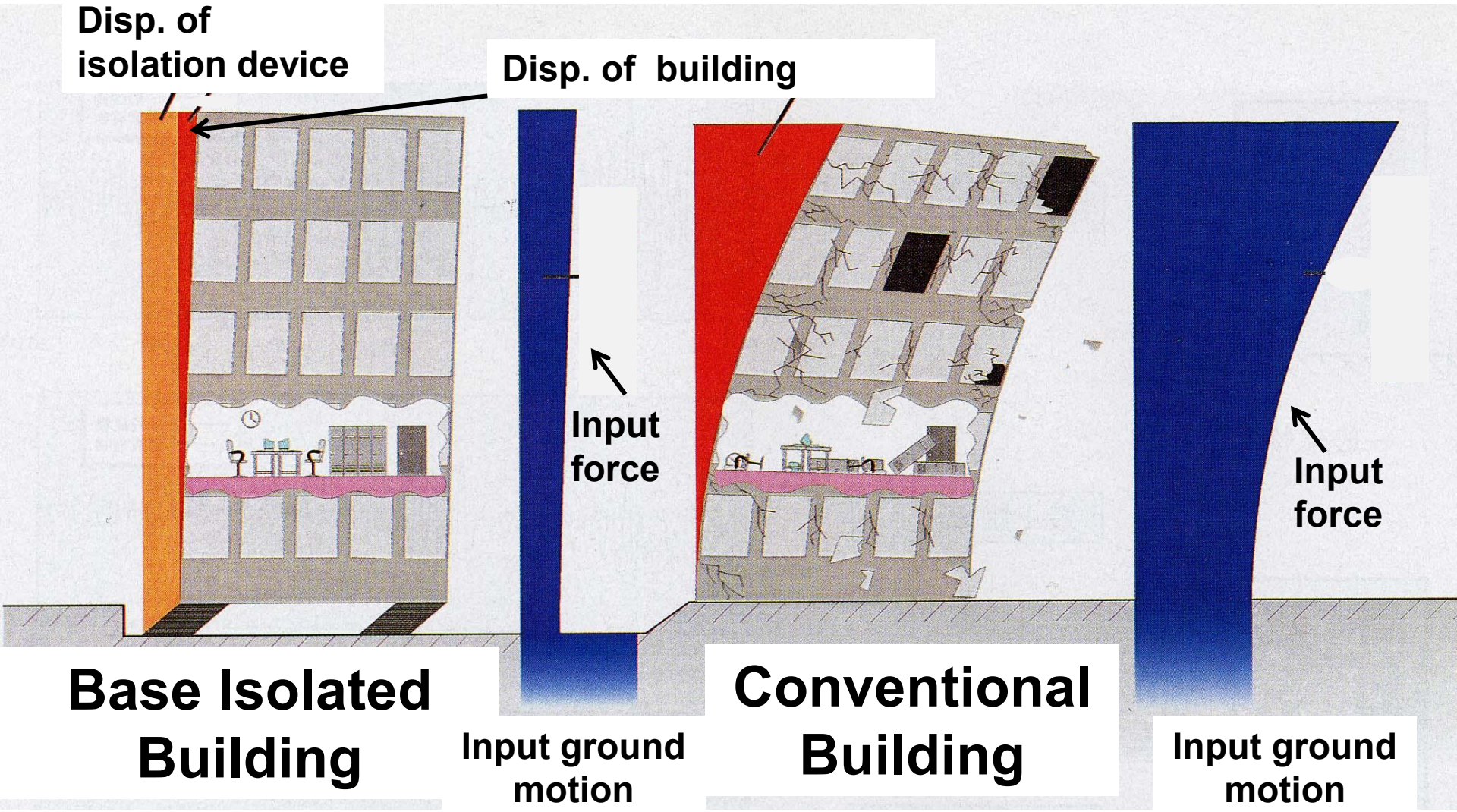




Response Spectrum

(El Centro NS, 1940, 0.1G)

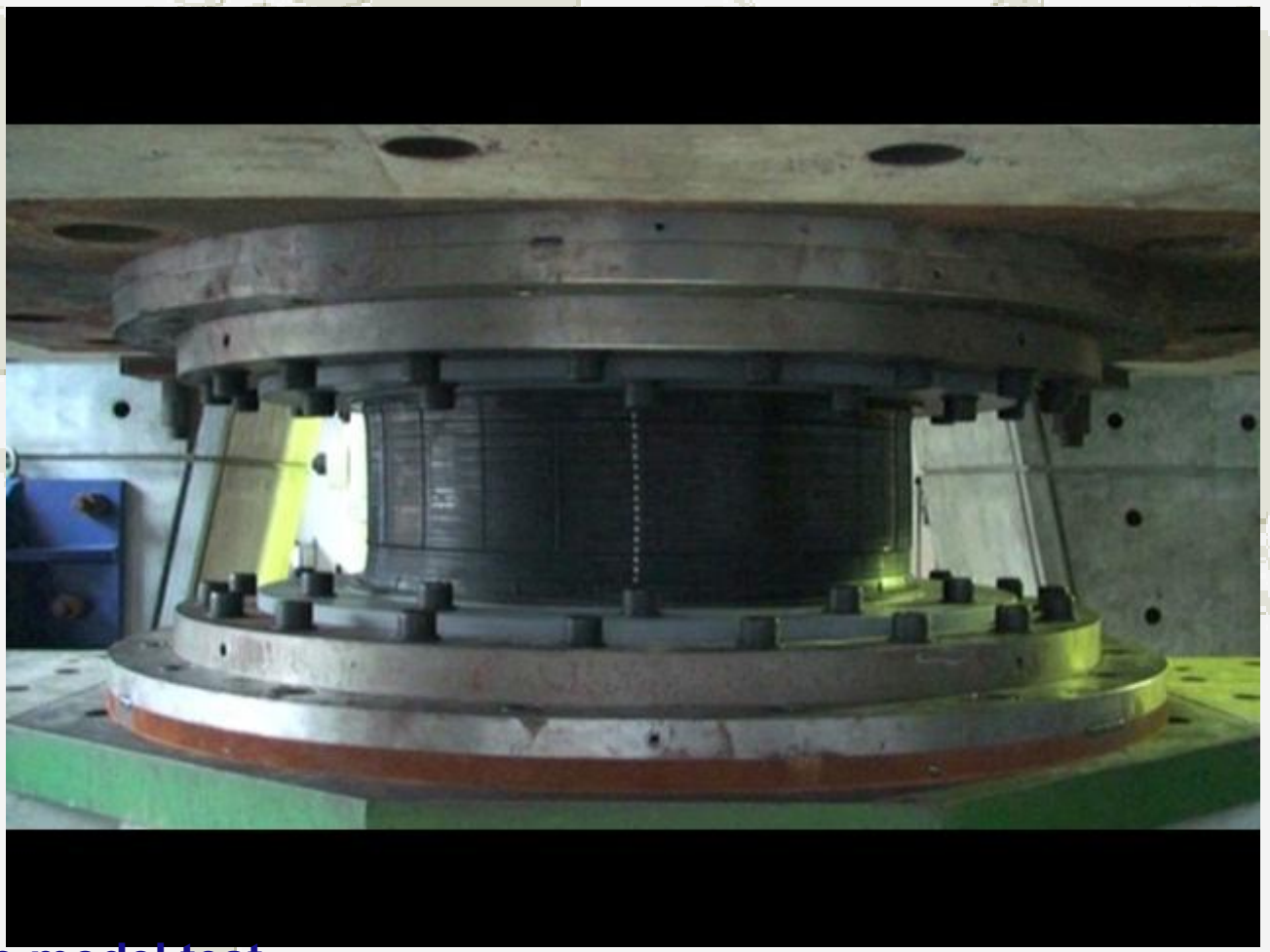
Principle of base isolation



Presented by BRIDGESTONE

Natural Rubber Bearing

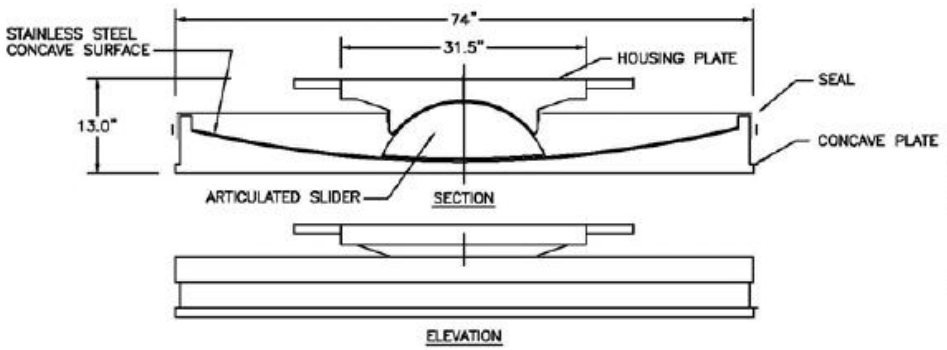
(After Nishi T.)

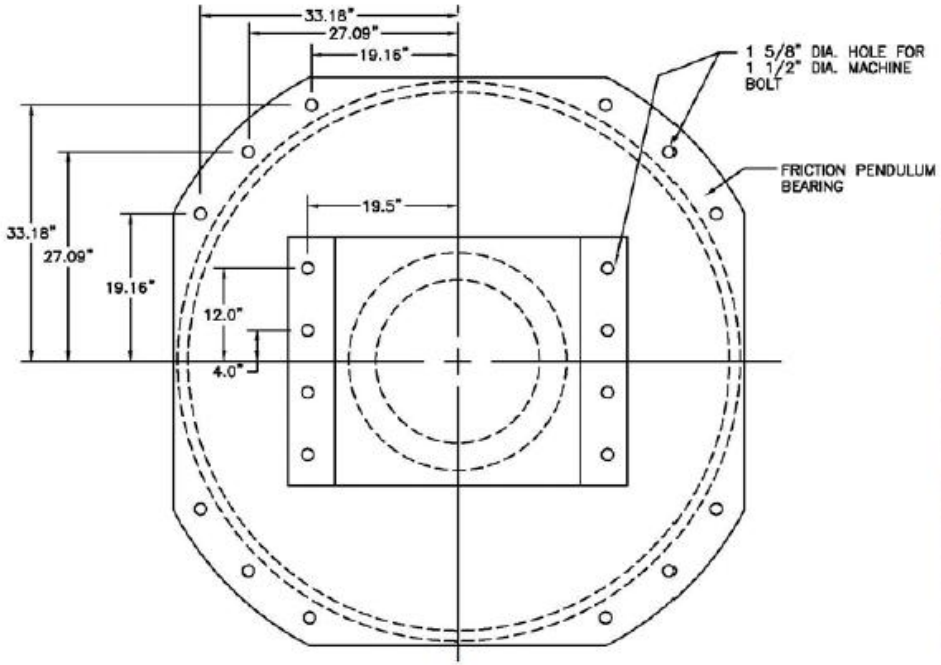


Full scale model test

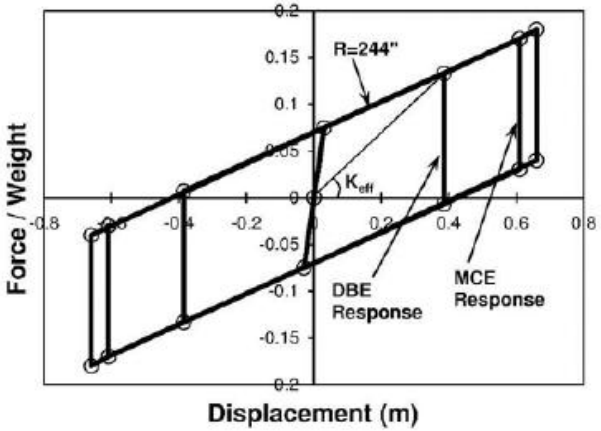
- Diameter：**1000 mm**
- Vertical load：**11,775 kN**
- Shear deformation：**±600 mm**（ Shear strain **300%**）

Friction Pendulum Isolator

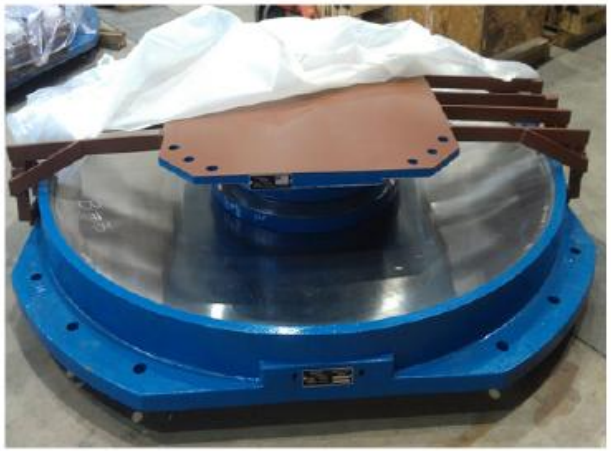




(a)



(c)



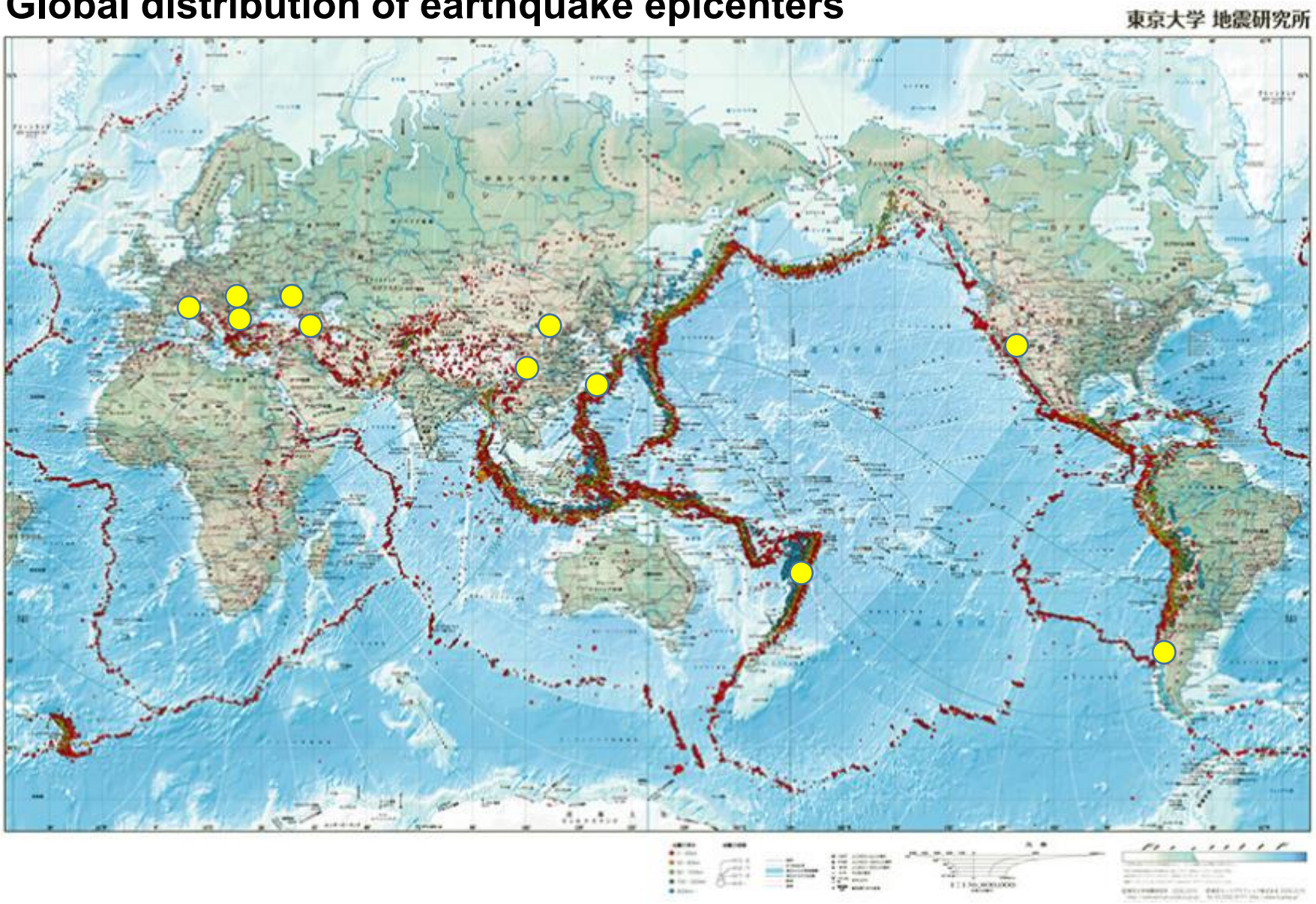
(b)

Figure 9. (a) Geometry of the proposed 4 second friction pendulum isolator for TPAC, (b) Physical model used for prototype testing, (c) Nonlinear isolator backbone curve

Taipei Performance Art Center

H.Darama, 16WCEE

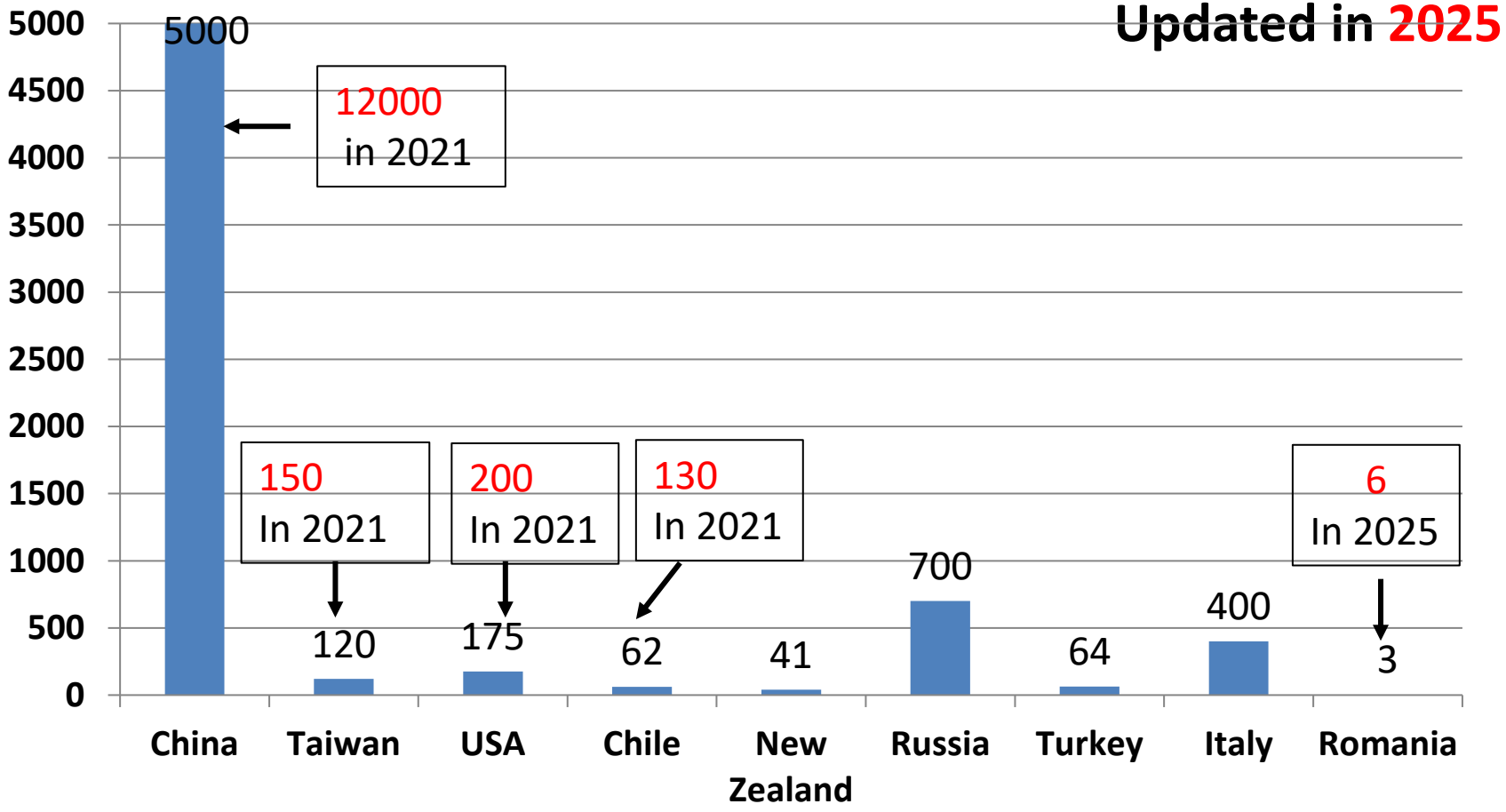
Global distribution of earthquake epicenters



https://www.eri.u-tokyo.ac.jp/gallery/2743/

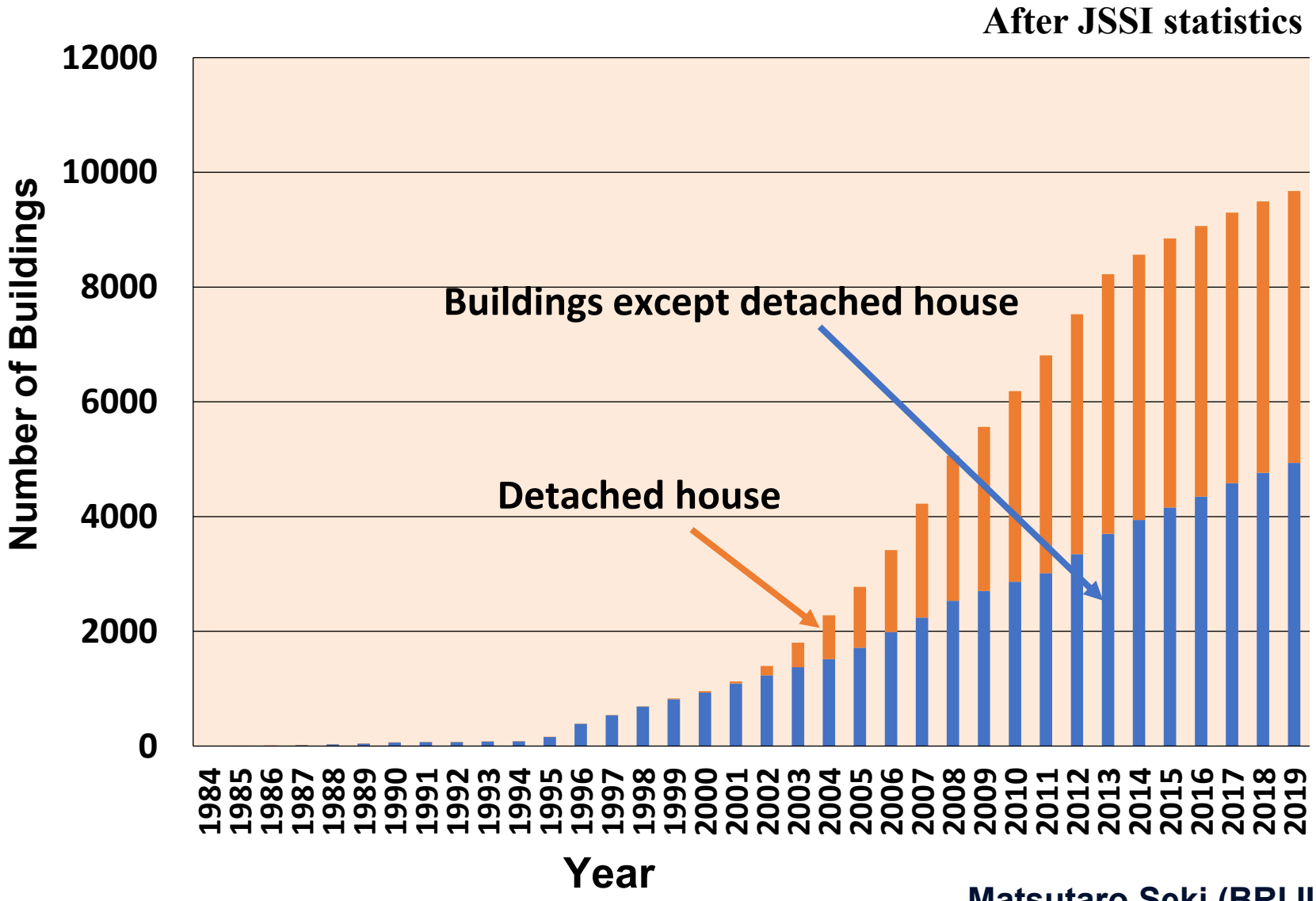
Number of seismic isolation buildings (except Japan)

As per April, 2016
Updated in 2025



Seismic Isolation Buildings in Japan

(9693 buildings in 2019)



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Seismic Isolation Buildings in Japan

Prada Aoyama

（Takenaka Corporation）

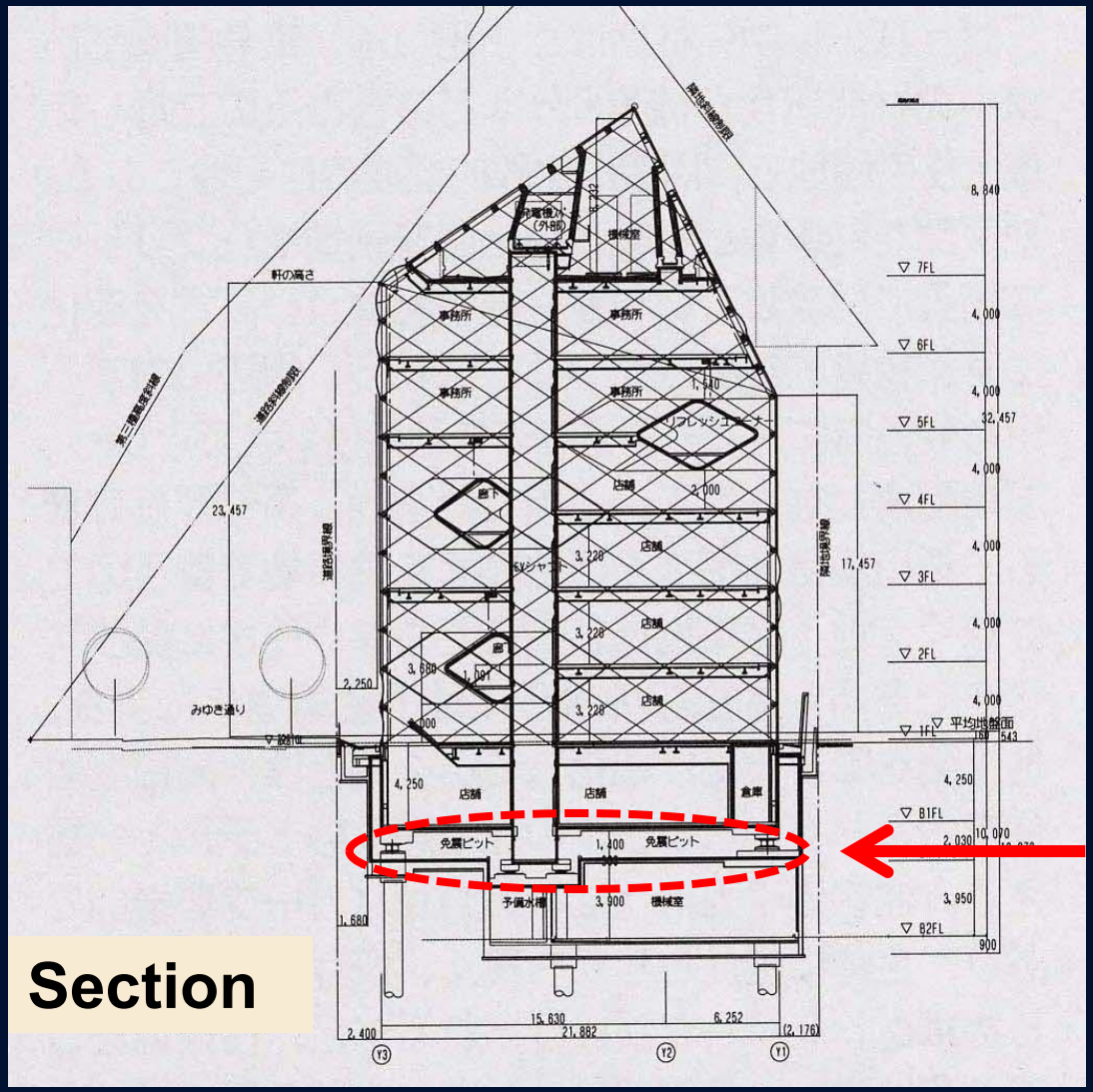
5th JSSI Award, 2004

MENSHIN,NO.5,2004.8

http://www.sawadalab.se.shibaura-it.ac.jp/kenken/kenken2005

Matsutaro Seki (BRI,IISEE)

Prada Aoyama（Takenaka Corporation）

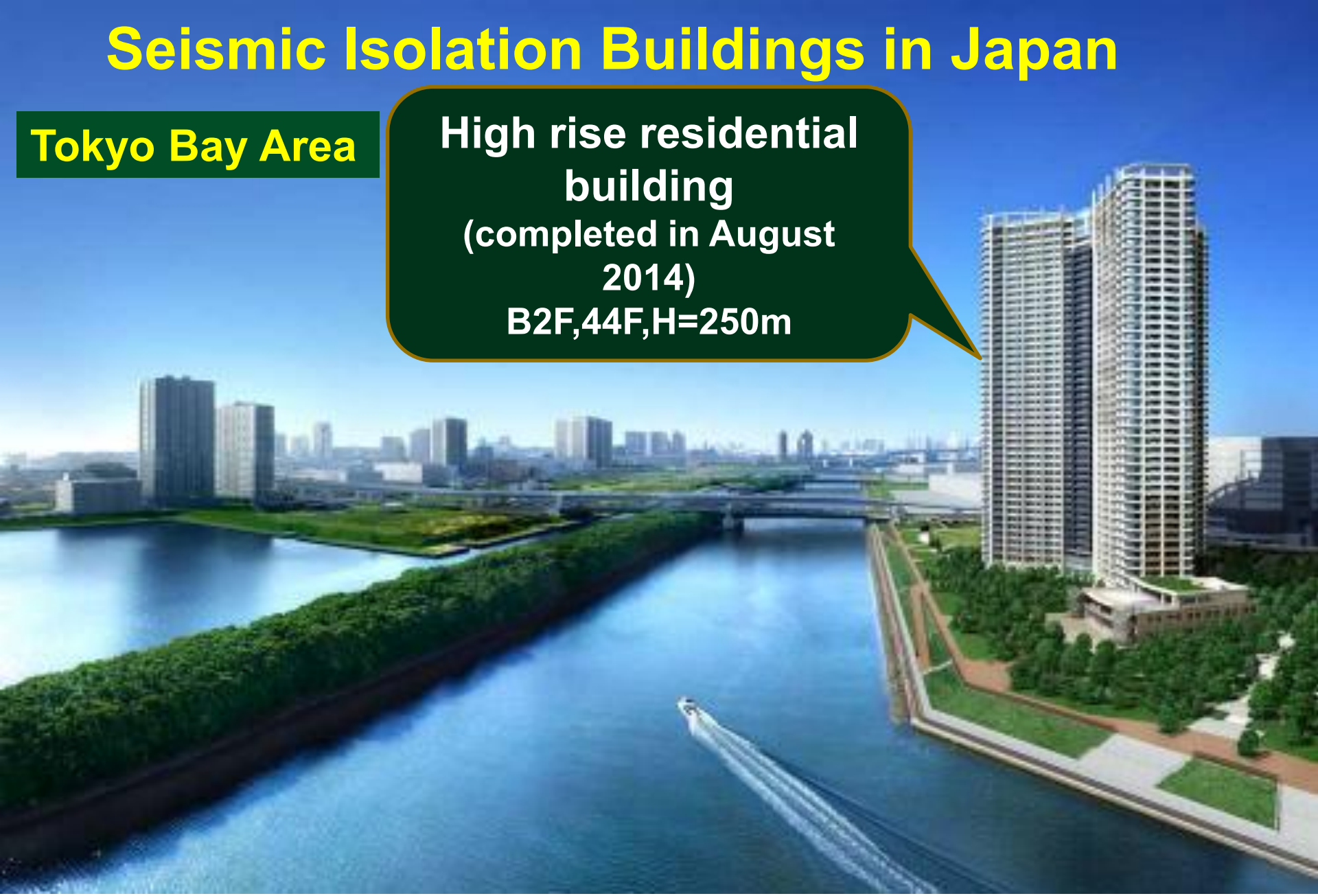


陶朱隱園（Tao Zhu Yin Yuan） Taiwam

Residential Building

Outside View

Seismic Isolation Buildings in Japan



http://kenplatz.nikkeibp.co.jp/article/building/news/20130911/631735/?P=1

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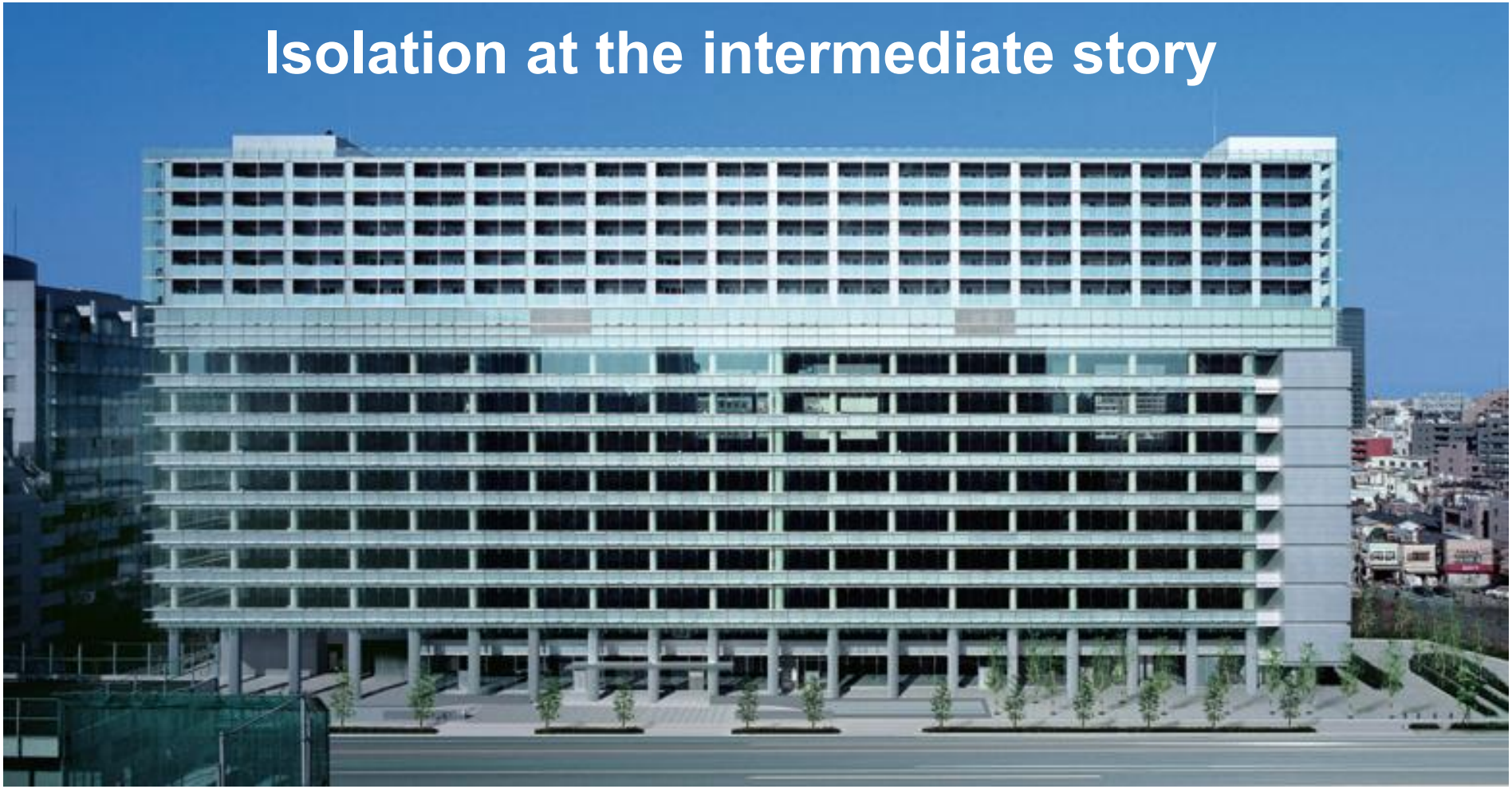
Seismic Isolation Buildings in Japan

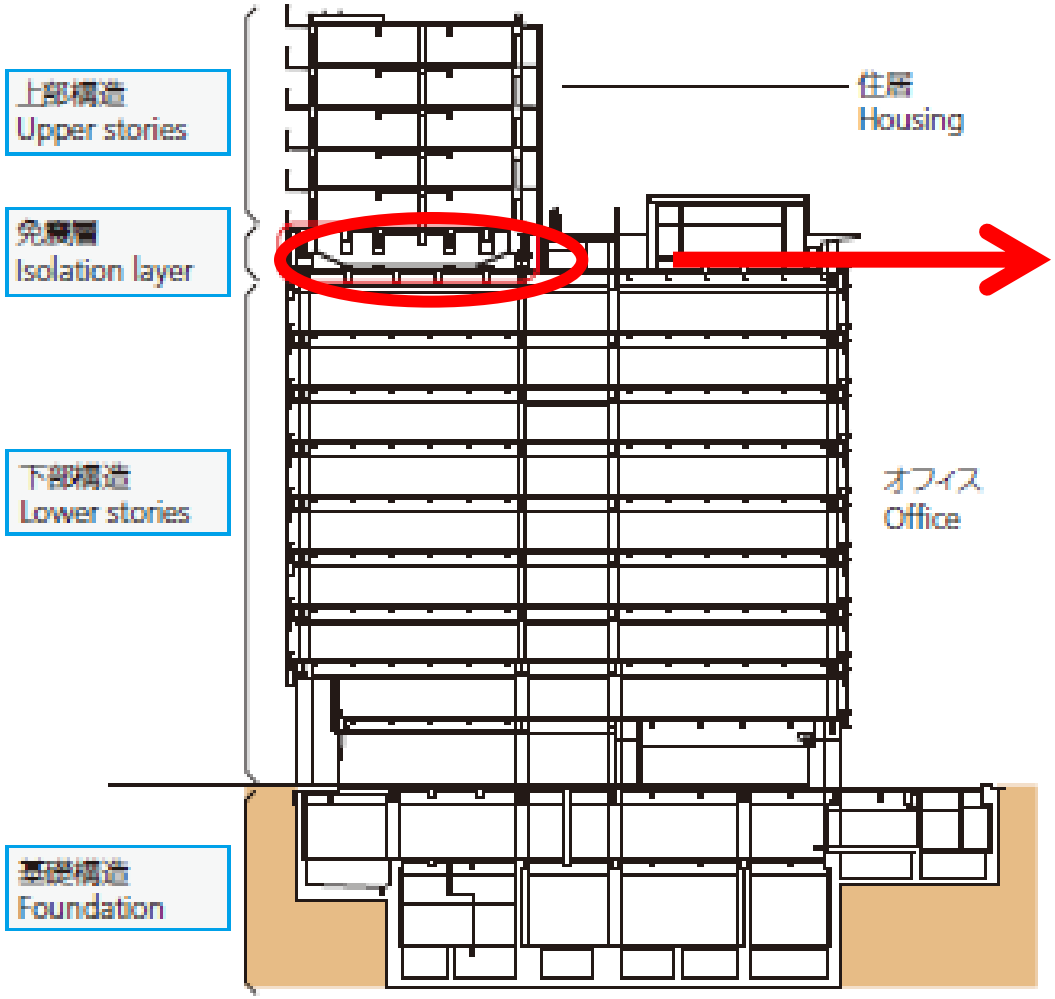


Completed in 2000, 14F, B2F, Isolation level is between 9F and 10F
Office（1-9F, Steel structure）、Residence（10F-14F、RC structure）

http://www.nikken.co.jp/ja/archives/20013.html

Isolation at the intermediate story

http://www.nikken.co.jp/ja/archives/20013.html



Isolation story
（Natural rubber bearing
+ Lead damper）

Seismic Isolation Buildings in Japan

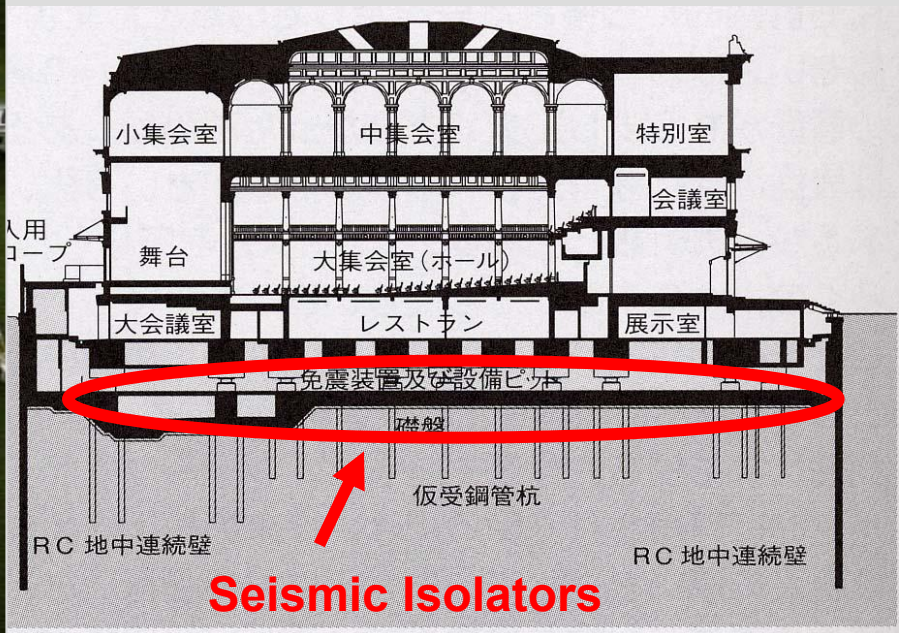
Osaka City Hall (Retrofitted building)

（Osaka City, Tokyo Kenchiku Institute Co., Shimiz Corporation）

【 Original Building: 1918,　Retrofitted: 2002】

Exterior View

(Brick Masonry + Steel frame)



section

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Los Angeles City Hall, Los Angeles, California(USA)

S+BW(External), 26F
H=138m, The highest base isolated building in USA
A=83,000m^{2,}
W≒1,100,000KN
Original construction:1928
Damaged in 1994
Northridge Earthquake
Retrofitted: 1999-2001

(Photo; SIE, Inc.)

Los Angeles City Hall, Los Angeles, California(USA)

HDRB:416 Friction bearing:90(900-1300mmΦ,
Viscous damper:52(±580mm capacity)
RC shear walls are newly installed in upper storey.
12 Viscous dampers at 24F-26F tower.

(Photo; SIE Inc.)

The Chapel Building, Rikkyo University, Tokyo

Brick Masonry Building

Outside View

Inside View

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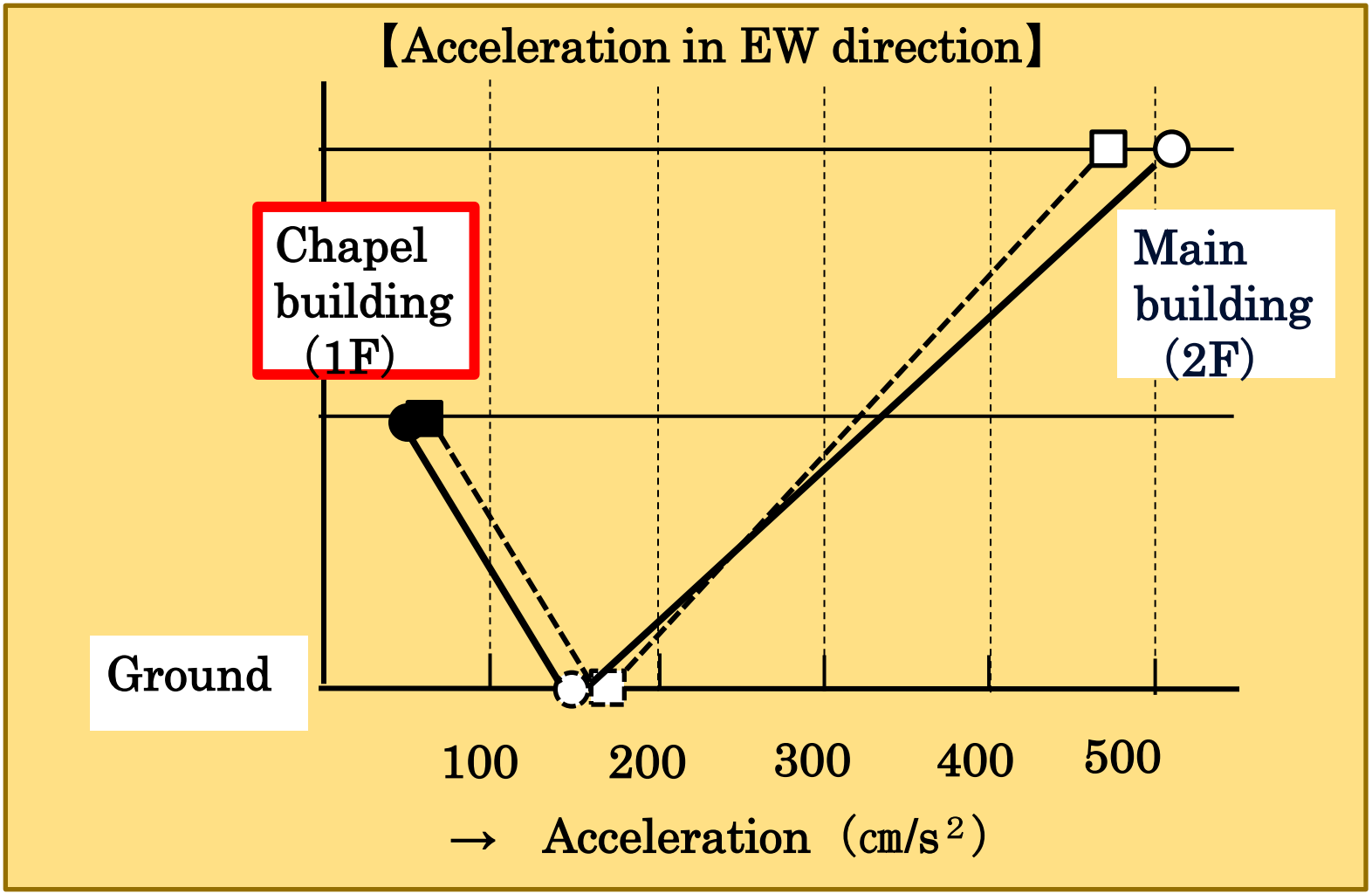
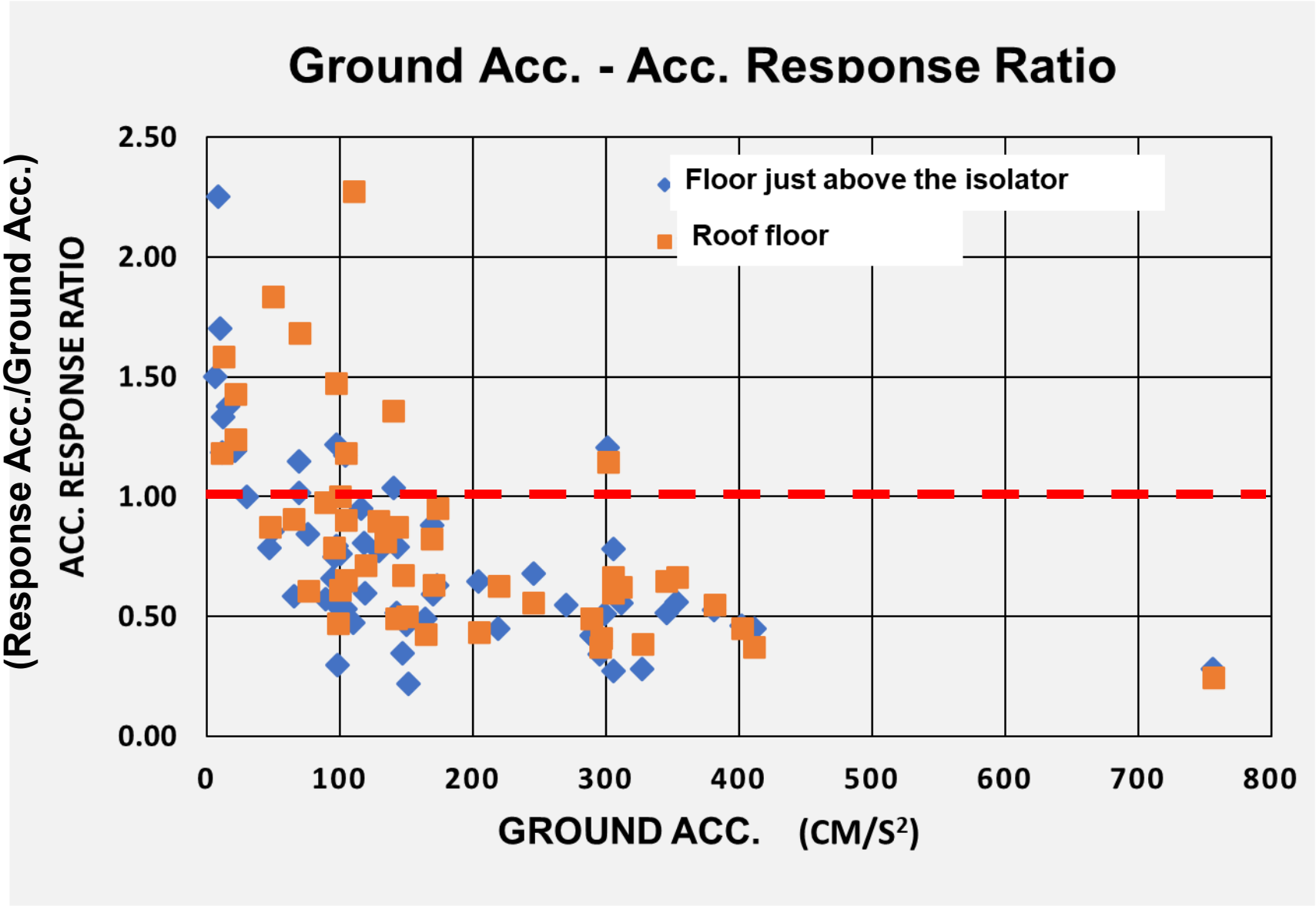
March.11, 2011 Earthquake in Japan



Observed Acceleration in Chapel building and Main building



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Conclusions

- **Seismic isolation technology is a feasible method to reduce significantly seismic risk.**
- **Therefore, this technology not only improves the safety of the building, but also allows for more freedom and flexibility in expanding a variety of building designs.**
- **However, this is a still new and innovative technology, then, the engineers shall pay much attention to the structural design, the quality of Isolators and of construction work.**

Thank you
for your attention