


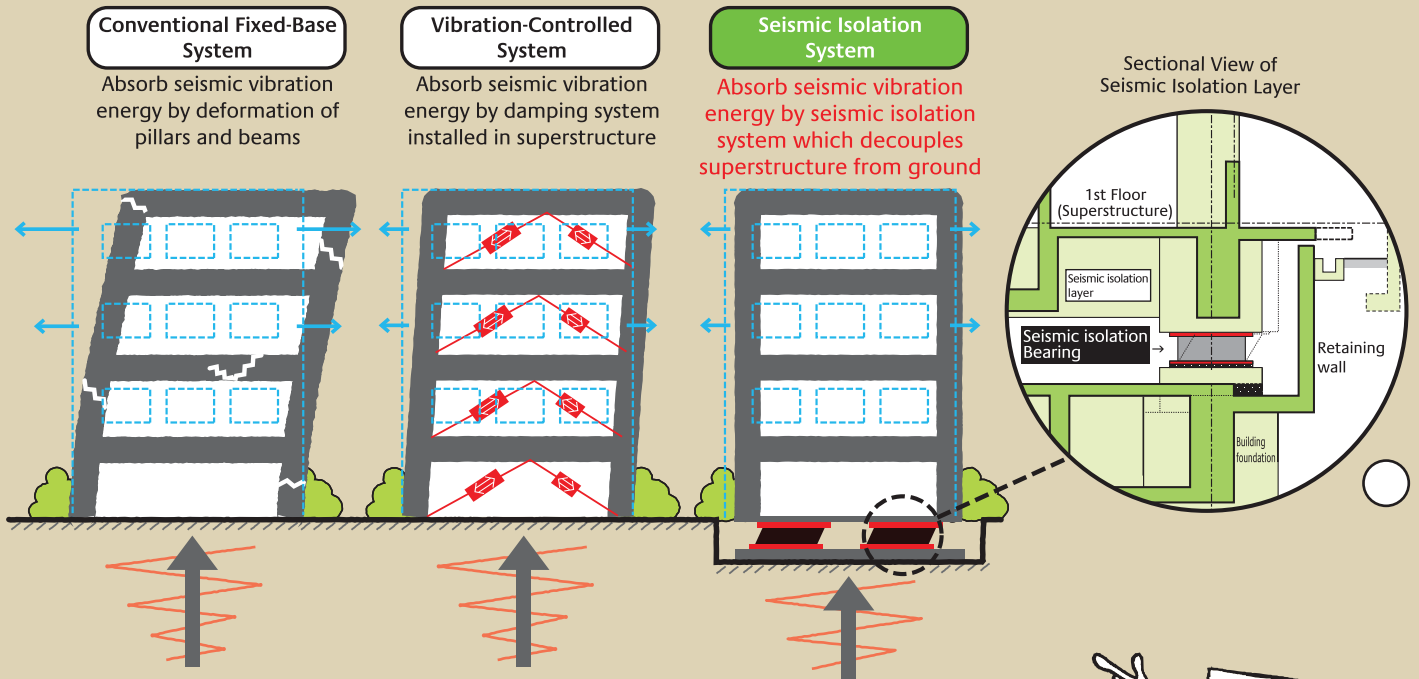
Technology which protects life and property.

# Bridgestone Seismic Isolation Bearing

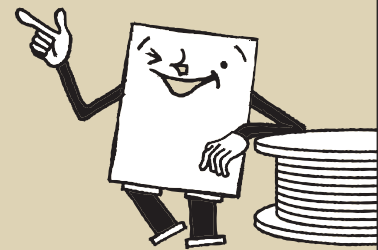


# Seismic Isolation Bearing (Seismic Isolator)

 **Seismic Isolation System** The latest technology proven in major earthquakes.



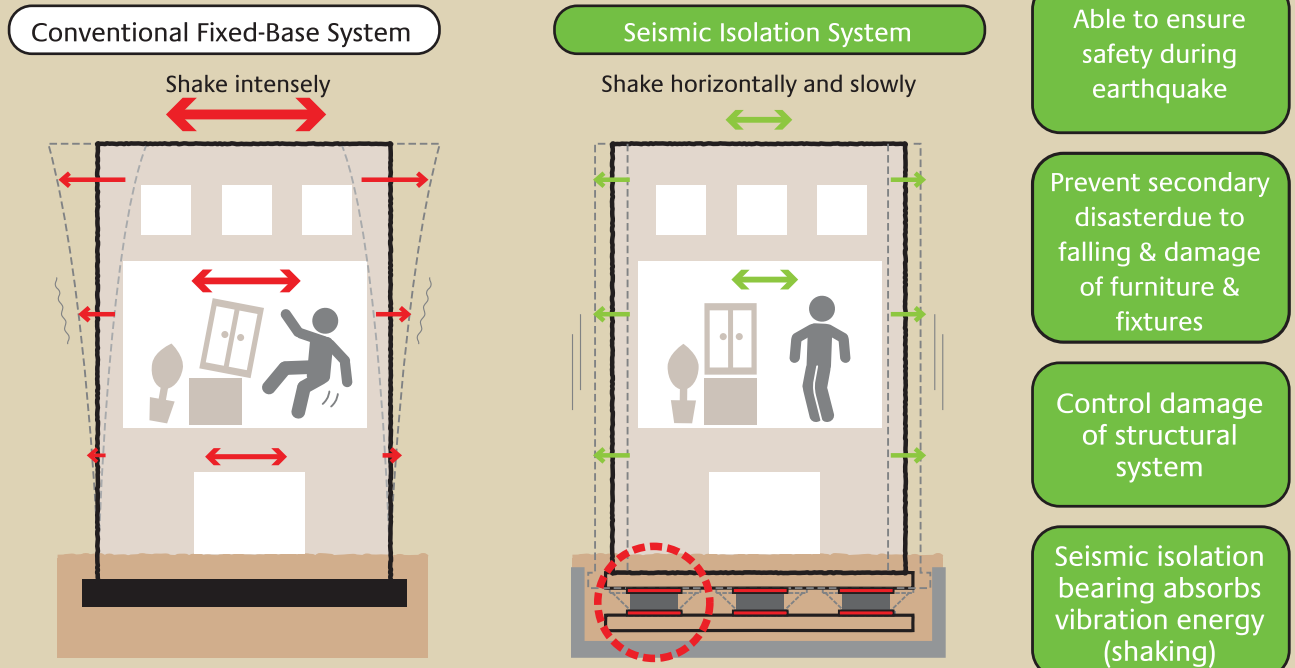
The concept of conventional fixed-base (or seismic-force resistant) and vibration-controlled system is absorbing seismic vibration energy transmitted to superstructures. On the other hand, seismic isolation system is designed to decouple the superstructure from the ground by seismic devices to prevent direct transmission of seismic vibration energy. Bridgestone seismic isolation bearing serves the most important function in the system.



## Merit of Seismic Isolation System

Seismic isolation system protects life, property, functionality, and liveability by controlling transmission of ground-shake to the superstructure.

Bridgestone aims at development of seismic isolation bearing to enable structure for continuity of human activities even after earthquake.





## Features of Seismic Isolation Bearing

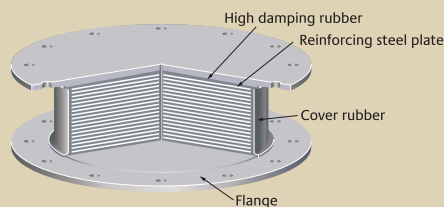
It demonstrates performance which has high stiffness in vertical direction but soft in horizontal direction by laminating thin rubber layer and reinforcing steel plate alternately. It is capable of supporting the building in vertical direction and absorbing the shaking of earthquake in horizontal direction.

■ The inner rubber is protected from ultraviolet & ozone that cause deterioration of rubber by integrally moulded with cover rubber which excels in weather resistance during manufacturing process.

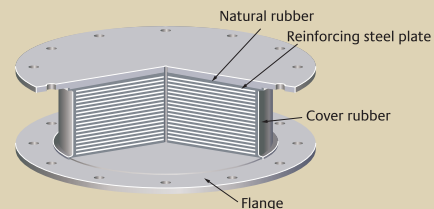
■ The inner rubber and reinforcing steel plates are strongly bonded using Bridgestone's long-established unique technology, allowing the isolator to deform drastically during massive earthquake without separation.

■ Bridgestone has more than 30 years of testing data for seismic isolation bearing, and our product line-up is top in industry. We always response to the requests of clients, as an all-embracing seismic isolation bearing manufacturer.

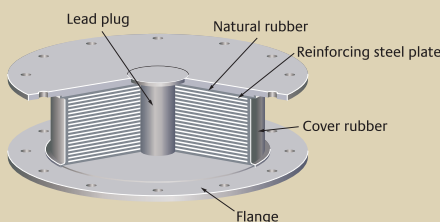
### HDR High Damping Rubber Isolator Series



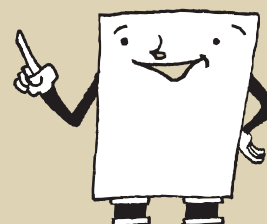
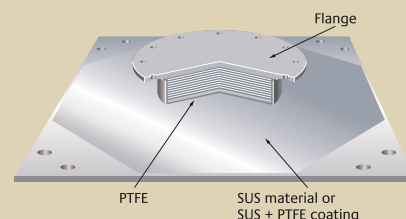
### NRB Natural Rubber Isolator Series



### LRB Lead plug Embedded Isolator Series



### Elastic Sliding Bearing



## Proven Example of Seismic Isolation Structure

In Tohoku University located at Aobayama, Sendai City of Miyagi Prefecture, there were test buildings jointly constructed by the university and Shimizu Corporation in 1986. Seismic isolation building and conventional fixed-base building were having the same superstructure design. At here, we would like to introduce observation record of The Tohoku-Pacific Earthquake occurred on March 11, 2011. ※Both buildings are 3-storey RC building, and 6 units of isolators of high damping rubber series are used in the seismic isolation building.

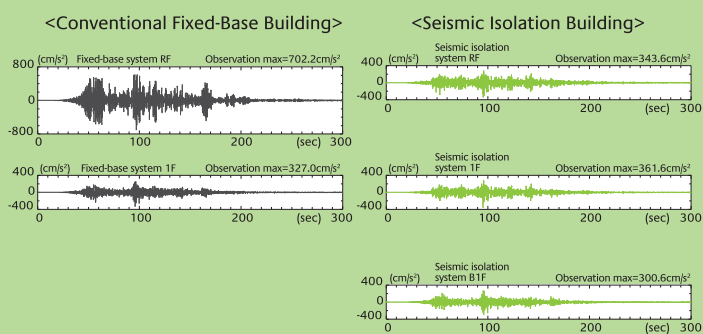
Conventional fixed-base building

Seismic isolation building



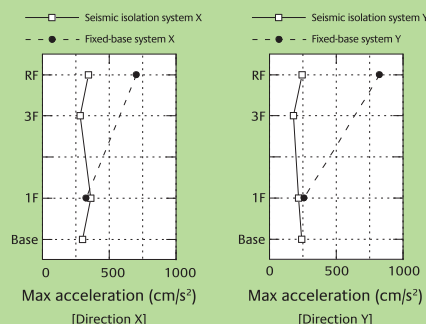
Tohoku University's seismic isolation test buildings.

### Observed Seismic Wave



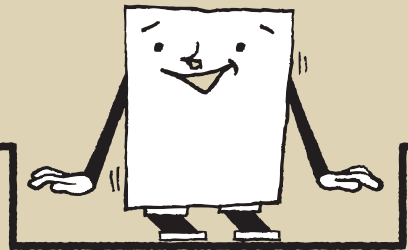
These graphs show seismic wave observed on basement, ground floor and roof floor of seismic isolation building and basement, ground floor and roof floor of conventional fixed-base building. Four strong shakes which were shaking massively for more than 120 seconds were observed.

### Distribution of Maximum Acceleration



The graphs show the distribution of maximum acceleration of both buildings. When compare maximum value on roof floor of seismic isolation building with roof floor of conventional fixed-base building, the shaking intensity had been reduced to 1/3 ~ 1/2.

Source : Shimizu Corporation



## Development

Bridgestone has accumulated R&D achievements over 30 years related to seismic isolation bearing and know-how of rubber for more than 80 years. Development/Manufacturing technology of seismic isolation bearing is established from 3 fields, which are material development technology represented by rubber compounding, design technology based on various tests and analysis, and then manufacturing technology that utilizes technique to predict rubber properties by heat accelerated aging test.



## Quality Control

Material researched & developed is produced by technology in Bridgestone domestic plant. We deal with wide range of sizes from small diameter until big diameter, and able to manufacture seismic isolation bearing up to maximum  $\varnothing$  1,800mm. We own the largest testing evaluation facility for seismic isolation bearing in Japan as well as the complete verification system too.

## Durability

Bridgestone's seismic isolation bearing has durability for more than 60 years\*, and it is certified by Minister of Land, Infrastructure and Transport. Inner rubber is integrally moulded with special cover rubber on surface, which can suppress the deterioration and improve the durability. This cover rubber is specially developed for seismic isolation and it has incorporated with over 80 years of Bridgestone's rubber technology.

※Note: Judge from heat acceleration aging test results.



## Cost / Asset Value

In seismic isolation building, cost is increased due to seismic isolation layer section. However, as the seismic force is reduced, the cost of work on superstructure can be reduced. In total, it is said that it is only few % higher in term of total construction cost generally. However, the total building cost is not only the initial cost. Seismic isolation building has more advantages when we consider the total cost in term of lifecycle cost which is overall running cost that includes safety, liveability, securing the asset and etc. during earthquake. Safety of building has very high impact on asset value and the asset value of seismic isolation building has been increasing recently.

## About Maintenance Management

Inspection is essential for seismic isolation system to function properly in future in order to maintain safety of building. (Refer to Article 8 and Article 12 in Japanese Construction Law) Inspection below is recommended.

Inspection at completion of construction: Execute when construction has completed.

Periodical inspection: Conduct every year periodically. This inspection is classified into 2 types:

- 1) Conduct inspection that includes measurement by specialist engineer. Generally it is conducted on 5th and 10th year, and every 10 years thereafter.
- 2) Conduct building patrol inspection mainly by visual check.  
Emergency inspection: Conduct immediately after disaster.  
Detailed inspection: If there is abnormality found during periodical inspection or emergency inspection, specialist engineer shall conduct detailed inspection.

※ Please refer to "Maintenance & Control Standard for Seismic Isolation Building (2014)" by The Japan Society of Seismic Isolation.







## Supply Records

Bridgestone's seismic isolation bearings are used in Japan as well as overseas. In Japan, it is widely used from Hokkaido until Okinawa in various applications, and it is rated as tough seismic isolation bearing which can withstand well even under severe condition.



### Base Seismic Isolation Seismic isolation devices are installed at the base of buildings



#### High Rise Building

Island Tower Skyscraper (Fukuoka)

**Design:** Takenaka Corporation and Tsukasa Architectural Design Office JV

**Construction:** Takenaka Corporation and Matsumoto Group JV



#### Communication Facility

NTT Docomo Shikoku

**Design:** NTT Facilities

**Construction:** Taisei Corporation



#### School

Hokuriku Gakuen

**Design:** Kajima Corporation

**Construction:** Kajima Corporation



#### Hospital

Showa University Koto Toyosu Hospital

**Design:** AXS STATOW Inc.

**Construction:** Taisei Corporation

### Mid-Storey Seismic Isolation

Seismic isolation devices are installed at middle floor (between pillars)



#### Company's House

Company's House

Amitie Shin Osaka

**Design:** Shimizu Corporation

**Construction:** Shimizu Corporation



#### Government Office Building

Kotoku Ward Office

**Design:** Takenaka Corporation

**Construction:** Takenaka Corporation

### Retrofit

Use construction method stated above to reinforce existing building



#### Important Cultural Property

Osaka City Central Public Hall

**Design:** Osaka City, Sakakura, Hirata, Aoyama, Shinnisetsu JV

**Construction:** Shimizu, Nishimatsu, Daitetsu JV

### Examples of other applications

- Office building
- Research facility
- Computer centre
- Art gallery, museum
- Old folks home facility
- Factory (precision devices, chemical related)
- Warehouse (high-class items storage)
- Government office (public office, court etc.)
- Disaster prevention facility (police station, fire station)



#### High Rise Building

Capital Mark Tower

**Design:** Nikken Housing System, AXS STATOW Inc.

**Construction:** Kajima Corporation



#### Hospital

Osaka General Hospital of West Japan Railway Co..

**Design:** JR West Japan Consultants Company

**Construction:** Obayashi, Daitetsu, Okumura JV



#### Important Cultural Property

Tokyo Station Marunouchi Station Building

**Design:** East Japan Railway Company Tokyo Construction Office, Tokyo Electrical Construction & System Integration Office, JR East Design Corporation, JR East Consultants Company

**Construction:** Tokyo Station Marunouchi Station Building Preservation & Restoration JV Company

## ○ Bridgestone Sales & Support Organization

Bridgestone has sold seismic isolation bearing for more than 30 years up to date, and we have achieved accumulated supply records of about 54,000 units until end of 2014. We believe this is the track record of trust from our clients on our company's persistent research & development on rubber.

Currently, we have setup dealers throughout whole Japan in order to response our customers' needs promptly, and formed a strong support organization so that the products are effectively used.

For example, when we study design of seismic isolation structure, we provide technical follow-up support by technical staff, provide LAP<sup>2</sup>+<sup>※</sup> free of charge, and then after delivery, we also expand long term aftersales service for inspection & maintenance, to provide supports including maintenance of products so that they can perform as expectation when earthquake happens.

※Seismic Isolation Devices Allocation Planning Support System

## ○ Introducing Seismic Isolation Simulation Vehicle

As seismic isolation bearing manufacturer, Bridgestone is the first to introduce<sup>※</sup> seismic isolation simulation vehicle that simulates shaking of mansion with seismic isolation system and conventional fixed-base system, so that everyone can understand the effect of seismic isolation system better. Experiencing difference of each shaking allows real feeling on safety of seismic isolation system. Seismic isolation simulation vehicle tours around every area so that more people can understand the safety of seismic isolation system.

※First seismic isolation bearing manufacturer in introducing seismic isolation simulation vehicle among the member companies of JSSI (The Japan Society of Seismic Isolation)



## ○ Seismic Isolation Channel

Bridgestone has launched special website "Seismic Isolation Channel" for people who are interested in seismic isolation to understand the mechanism easily. In this site, we have prepared the comments from people staying in seismic isolation mansion, so that everyone can really feel the usefulness of seismic isolation system. We plan to expand the content step by step in future.



<http://www.menshin-channel.com>

●Specification and parameter may vary. Please enquire our company or any group's subsidiary when want to use it.

●Content of catalogue is as on April 2015.

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More information on seismic isolation <http://www.menshin-channel.com/index.html>

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