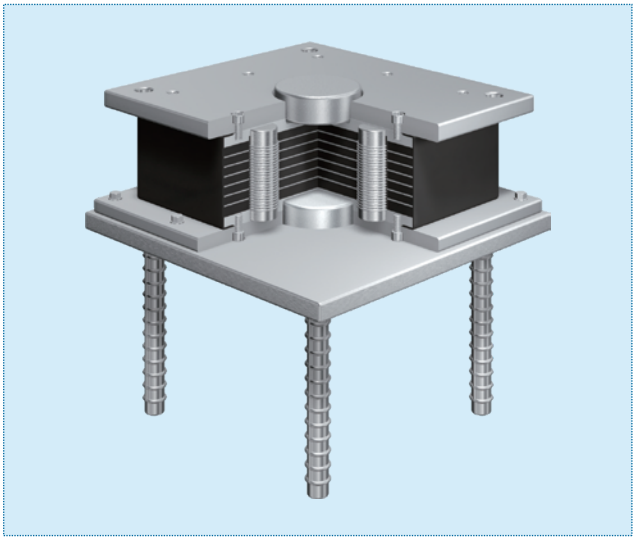
SPR Spring Confined Pb Rubber Bearing

Compared to conventional bearings, damping performance of SPR is greatly enhanced!

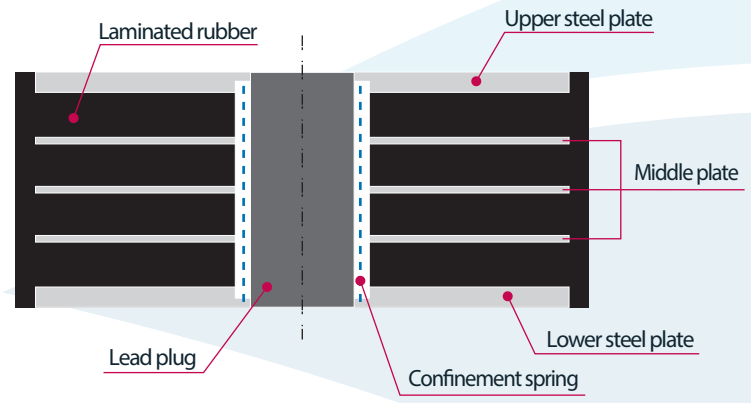
The bearing is down-sized and optimized to achieve cost reduction of an entire bridge project.



The SPR is a new seismic isolation bearing consisting of laminated natural rubber with lead plugs confined by springs. The SPR laminated structure transfers the shear deformations to the lead plugs to dissipate energy from the earthquake.

The confinement springs are vulcanized to the rubber layers to improve durability against repeated loading and stabilize the damping.
The SPR can be used for concrete or steel bridges and new or retrofit projects.

Structure



Material Specification	• Inner rubber : Natural rubber • Covering rubber : Integrated with Inner rubber • Middle steel plate : SS400 • Upper and lower plate : SM490 • Lead plug : Purity 99.99%
Physical Property of Inner Rubber	• Shear modulus : G12 • Elongation at break : over 550% • Tensile strength : over 12 N/mm^2

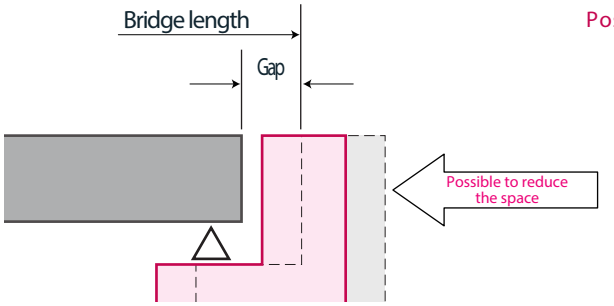
Characteristics

Joint gap reduction

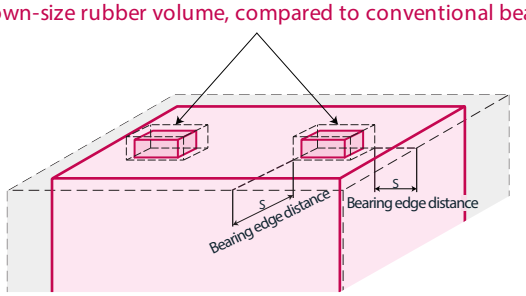
Because of the higher damping performances of the SPR, the superstructure's horizontal movement during an earthquake will be reduced. Therefore the expansion joint and gap dimensions can be minimized, achieving cost reduction.

Smaller section of substructure

Due to smaller seismic displacements, the bearing dimensions can be reduced compared to conventional isolators. As a result, the size of the substructure could be reduced achieving remarkable cost savings.

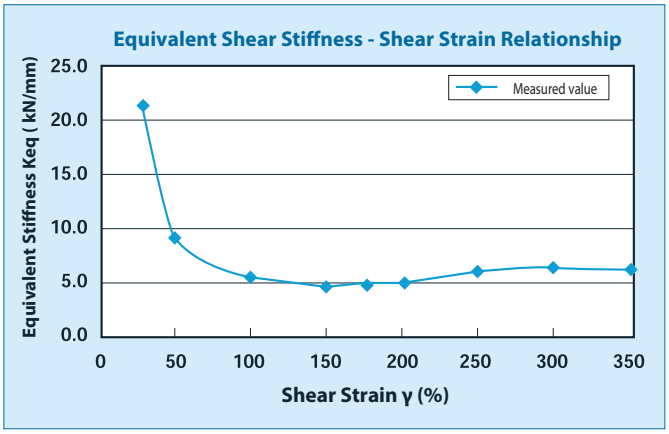


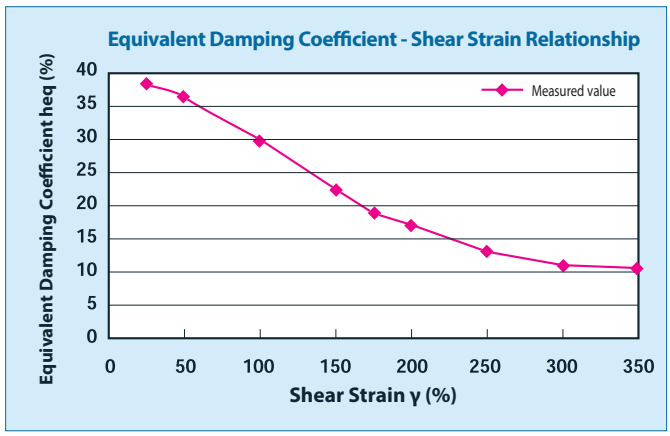
Possibility to down-size rubber volume, compared to conventional bearings

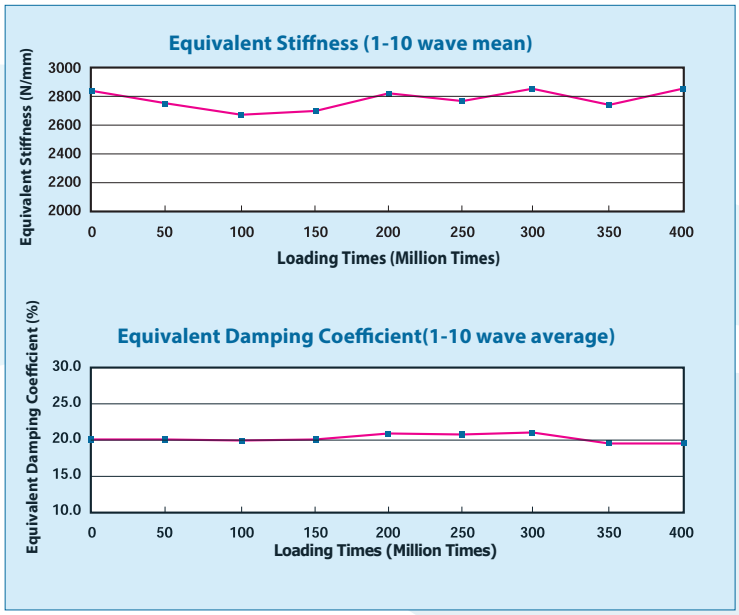


Performance

SPR performance is verified by several performance tests and severe durability tests.







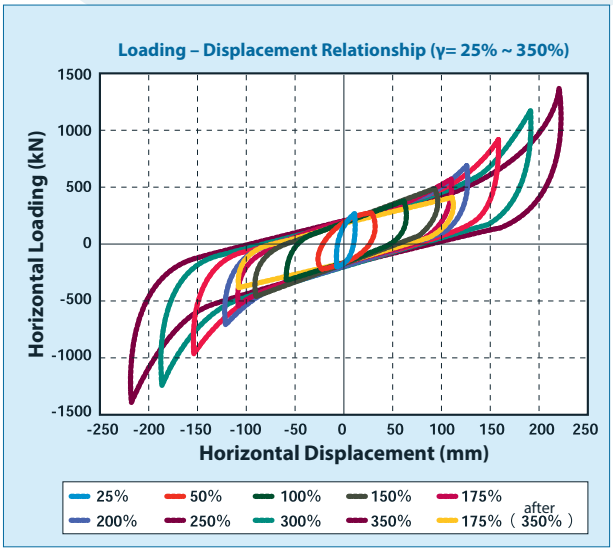
Measured value (for Shear strain 175%)

Loading times (million times)	Equivalent stiffness (N/mm)	Equivalent damping constant (%)
	1-10 wave mean	1-10 wave mean
0	2839	20.0
50	2738	20.0
100	2652	19.6
150	2682	20.1
200	2832	21.1
250	2761	21.0
300	2867	21.3
350	2733	19.3
400	2864	19.4

Ratio

Loading times (million times)	Equivalent stiffness ratio	Equivalent damping constant
	1-10 wave mean	1-10 wave mean
0	1.00	1.00
50	0.96	1.00
100	0.93	0.98
150	0.95	1.00
200	1.00	1.06
250	0.97	1.05
300	1.01	1.07
350	0.96	0.97
400	1.01	0.97

Both stiffness and damping were stable after 400 million cycle test.



Kawakin Core-Tech Co., Ltd.

Head Office : 2-2-7, Kawaguchi, Kawaguchi-city, Saitama, 332-0015, JAPAN
TEL: +81-48-259-1117 FAX: +81-48-259-1137
Email: info@kawakinkk.co.jp
Branch/Plant : Ibaraki / Tokyo / Osaka / Sendai / Sapporo / Vietnam

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