HISISM

ANTISEISMIC DEVICES

Temburong Bridge
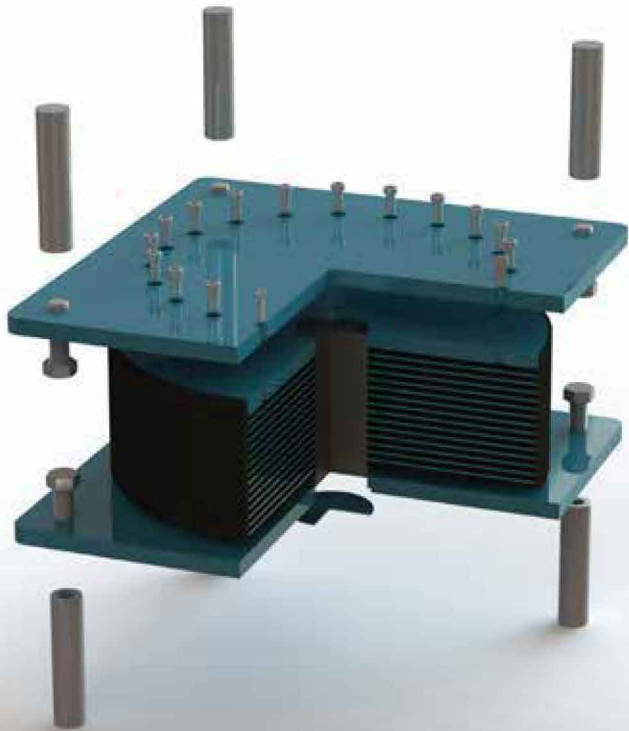*Brunei*

Dependable Joining Technology

The high amounts of energy dissipation solution.

In these isolators the re-centering capacity is given by the rubber elasticity and the energy dissipation is given by the lead core that is stressed over the yield limit.

They are a combination of a rubber bearing and a single or multiple lead cores.

A rubber bearing is an alternation of rubber and steel layers providing a very high vertical stiffness and a low horizontal stiffness, hence providing a large vertical bearing capacity and a large horizontal displacement capacity.

The lead core, as a consequence of the horizontal displacement of the bearing, is subjected to yield. One peculiar property of the lead is that after several yield cycles it can re-crystalize and get back to the initial properties. So in principle they could sustain an unlimited number of yield cycles.

Main Field

Bridges and building located in medium and high level earthquake areas

INSTALLATION

Requires trained team

DURABILITY

> 60 years

MAINTENANCE

Corrosion protection after 15 years

COST

AVERAGE

VERTICAL LOAD

HORIZONTAL DISPLACEMENT

RE-CENTERING CAPACITY

DAMPING

FIRE RESISTANCE

They are using the mass spring system:
• The spring is represented by the elasticity of the rubber
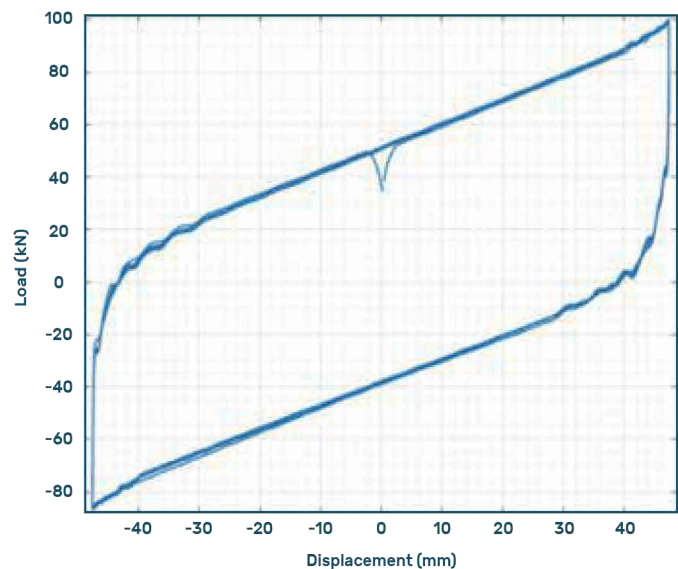• The energy dissipation is provided by the lead core
Their mathematical model can be expressed in function of two parameters only:
• The Rubber stiffness K_d
• The characteristic strength = the yield force of the lead core Q_d
The mathematical model of the LRB is represented in the following graph:
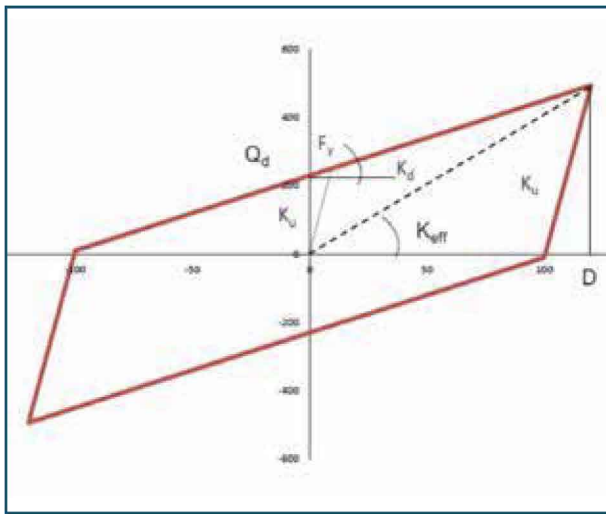
LRB Mathematical model

LRB real load – deflection plot from testing

The relevant parameters of the mathematical model are the following:
• Q_d Characteristic strength = $A_{lead} \times \tau_{lead}$ where:
• A_{lead} is the area of the lead core
• τ_{lead} is the yield shear stress of the lead, normally 10 MPa
• K_u is the elastic stiffness = $G_{lead} \times A_{lead} / h_r$ where:
• G_{lead} is the shear modulus of the lead, normally 130 GPa
• h_r is the net rubber thickness of the LRB
• F_y is the yield force = $Q_d + K_d \times h_r / G_{lead}$
• D_y is the displacement corresponding to the yield force = $\tau_{lead} \times h_r / G_{lead}$
• K_d is the post-elastic stiffness, equal to the stiffness of the rubber only
• D is the design displacement
• K_{eff} is the effective stiffness = $(Q_d + K_d \times D)/D$
• ξ is the equivalent viscous damping

$$\xi = \frac{EDC}{2\pi K_{eff} D^2} = \frac{4Q_d(D - D_y)}{2\pi K_{eff} D^2}$$

• EDC is the energy dissipated per cycle

Dimensions Table
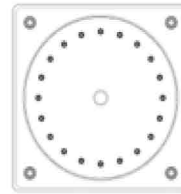# HILEAD LRB

They are identified by the following Mark
HLRI
S for soft
N for normal,
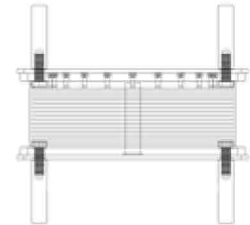**H** for hard.
350 Diameter of rubber (mm)
77/105 Rubber thickness
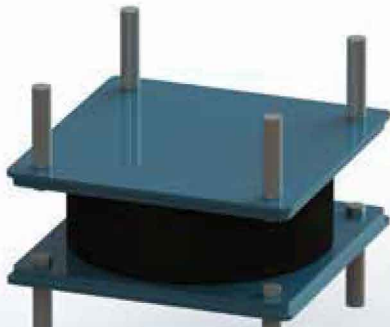/ Lead core diameter (mm)

Plan　　　　*Section*

	DESIGN DISPLACEMENT d=150	Rubber Diameter	Lead Diameter	Total Height	Rubber Thickness	Mounting Plate Dimension	Horizontal Stiffness of isolator	Horizontal Stiffness of lead	Horizontal Stiffness of rubber	Vertical Load ULS	Seismic Vertical Load	Damping
	Types	mm	mm	mm	mm	mm	kN/mm	kN/mm	kN/mm	kN	kN	
NORMAL	HLRIN-350-77/115	350	115	247	77	400X400	1.65	17.54	1.00	2400	1440	30%
	HLRIN-400-77/130	400	130	247	77	450X450	2.14	22.41	1.31	3100	1860	30%
	HLRIN-450-80/145	450	145	244	80	500X500	2.64	26.83	1.60	3900	2340	30%
	HLRIN-500-72/160	500	160	224	72	550X550	3.54	36.30	2.20	4900	2940	30%
	HLRIN-550-80/180	550	180	252	80	600X600	3.98	41.35	2.39	5900	3540	30%
	HLRIN-600-80/195	600	195	252	80	650X650	4.71	44.53	2.84	7000	4200	30%
	HLRIN-650-77/210	650	210	243	77	700X700	5.64	58.48	3.47	8200	4920	30%
	HLRIN-700-72/230	700	230	232	72	750X750	7.06	75.02	4.29	9600	5760	30%
	HLRIN-750-75/245	750	245	229	75	800X800	7.88	81.72	4.74	11000	6600	30%
	HLRIN-800-75/260	800	260	229	75	850X850	8.93	92.03	5.39	12500	7500	30%

Dimensions and performances are given for guidance only.
Any dimension up to 1500 mm diameter and 1000 mm displacement can be designed, tested and manufactured

Dimensions Table
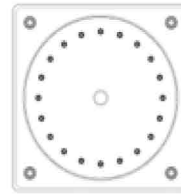# HILEAD LRB

They are identified by the following Mark
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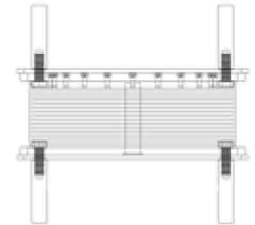**N** for normal,
H for hard.
350 Diameter of rubber (mm)
77/105 Rubber thickness
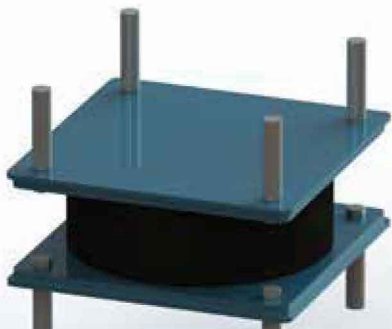/ Lead core diameter (mm)

Plan   *Section*

DESIGN DISPLACEMENT d=200	Rubber Diameter	Lead Diameter	Total Height	Rubber Thickness	Mounting Plate Dimension	Horizontal Stiffness of isolator	Horizontal Stiffness of lead	Horizontal Stiffness of rubber	Vertical Load ULS	Seismic Vertical Load	Damping
Types	mm	mm	mm	mm	mm	kN/mm	kN/mm	kN/mm	kN	kN	
HLRIN-350-105/115	350	115	299	105	400X400	1.23	12.86	0.74	2400	1440	30%
HLRIN-400-105/130	400	130	299	105	450X450	1.60	16.43	0.96	3100	1860	30%
HLRIN-450-104/145	450	145	286	104	500X500	2.02	20.64	1.23	3900	2340	30%
HLRIN-500-99/160	500	160	269	99	550X550	2.61	26.40	1.60	4900	2940	30%
HLRIN-550-100/180	550	180	284	100	600X600	3.18	33.08	1.91	5900	3540	30%
HLRIN-600-100/195	600	195	284	100	650X650	3.77	38.82	2.28	7000	4200	30%
HLRIN-650-99/210	650	210	277	99	700X700	4.43	45.48	2.70	8200	4920	30%
HLRIN-700-96/230	700	230	268	96	750X750	5.30	56.26	3.22	9600	5760	30%
HLRIN-750-98/245	750	245	264	98	800X800	5.98	62.54	3.62	11000	6600	30%
HLRIN-800-98/260	800	260	264	98	850X850	6.78	70.43	4.13	12500	7500	30%

(Left side label: NORMAL)

Dimensions and performances are given for guidance only.
Any dimension up to 1500 mm diameter and 1000 mm displacement can be designed, tested and manufactured

Standard

Normally HISLIDE Sliding Pendulum Isolators are designed, manufactured and tested in accordance with EN 15129 and CE marked with supervision of the Notified Body ICECON that executes the regular audit visits as foreseen by the EN standard.

Quality Assurance

The whole production of CECO-HIRUN is subjected to a quality assurance program in accordance with ISO 9000 certified by CQC, member of the International Mutual Acknowledgment Body IQNET.
In addition the production of the Sliding Pendulum Isolators is subjected to a specific quality assurance program in accordance with EN 15129 Annex ZA for the CE marking with the supervision of the Notified Body ICECON. (The relevant certificates are shown on the side)

Sliding Materials

CECO-HIRUN developed outstanding sliding materials:
- HI-3 mainly for use in spherical bearings
- HI-M and HI-H for use in sliding pendulum isolators.
- Here below a comparison table of the most commonly used sliding materials

For the sliding pendulum isolators a dynamic friction from 3 to 9%, according to the Engineers's requirements, can be granted

SLIDING MATERIAL PROPERTY	PTFE	HI-3	HI-M	HI-H
Compressive strength	90 MPa	180 MPa	270 MPa	180 MPa
Heat resistance (long term)	48°C	90°C	120°C	90°C
Heat resistance (short term)	80°C	120°C	180°C	180°C
Wear resistance	10,000 m	50,000 m	50,000 m	10,000 m
Static friction	<3%	<3%	<6%	<10%
Dynamic friction	<3%	<3%	2,5%	6 10%

Corrosion protection

The corrosion protection of structural steel is normally performed in accordance with EN ISO 12944.

The working life of the protective coating system on the bearing can be assumed to be fulfilled with a protective system designed for the durability "high" of more than 15 years in accordance with EN ISO 12944-5:2007, 5.5 for corrosivity category C5-I (I=industrial) for inland locations and C5-M (M=marine) for sea side locations.

Surfaces in contact with concrete need no corrosion protection, however a layer of 50 μm of the first pack is applied in order to prevent oxidation during the storage before the installation. A return of at least 50 mm is applied.

In alternative paint will conform to the Project specifications, as specified by the purchaser

Fire resistance

HISLIDE Isolators are fire resistant and don't require special precautions to protect them from the fire. After a fire event an inspection is recommended and, depending on the fire intensity, the sliding material may need to be replaced

Fixings

The HISLIDE Sliding Pendulum isolators are provided with fixings made with bolts or dowels according to the type of structure. The fixing are connected to the Isolator in such a way to allow the easy replacement if necessary.

Fuses

In case of use of the HISLIDE Isolators in railway bridges it is recommended the use of mechanical fuses in order to grant the fixity of the bridge under service condition. In case of a strong earthquake the fuses will be sheared of and the isolators can start their antiseismic function

References

Asan Cheonan Expressway
South Korea

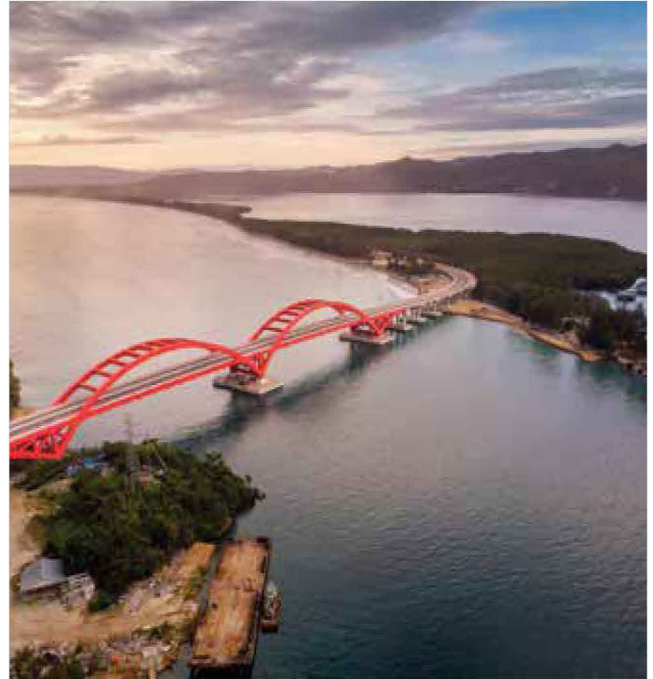**Bursa Hospital**
Turkey

Dintai Building
Taiwan

Green Museum
Taiwan

References

Cibubur LRT
Jakarta, Indonesia

Holtekamp bridge
Turkey

Kerch bridge
*Russia, Crimea*

Casaclima
Rimini, Italy

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CECO has long list of approvals, appreciation letters and satisfactory perfomance repotrs issued from various goverment agencies, many Indian & International cunsultants those who are working in India.
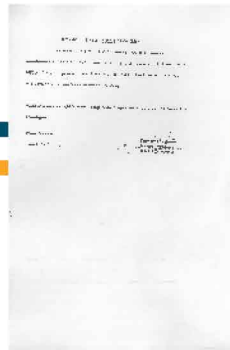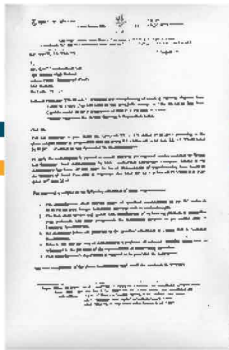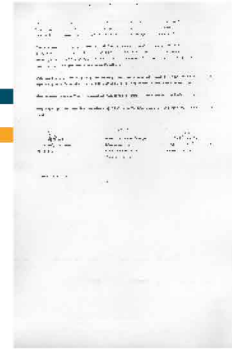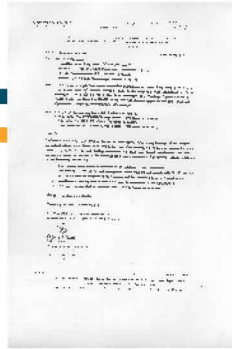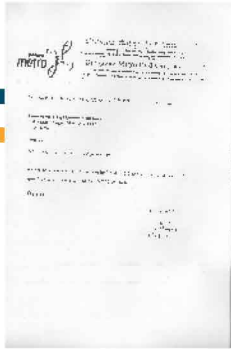
QUALITY CERTIFICATIONS

Hirun International and its partners cooperate with important international institutions in order to guarantee the test performances and the advanced research on materials and products
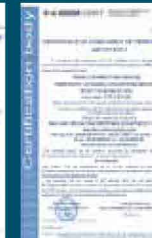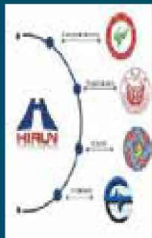
QUALITY

EUROPEAN CERTIFICATION - CE MARK

EUROPEAN CERTIFICATION - ETA

HIRUN INTERNATIONAL is actively working with its partner to obtain the European Technical Assessment for all its advanced products like special sliding materials, post tensioning kit, expansion joints

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