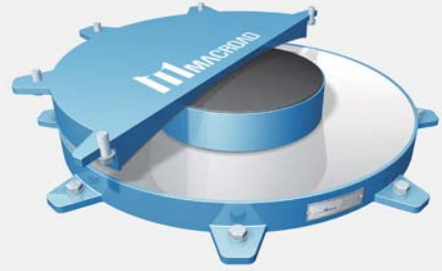
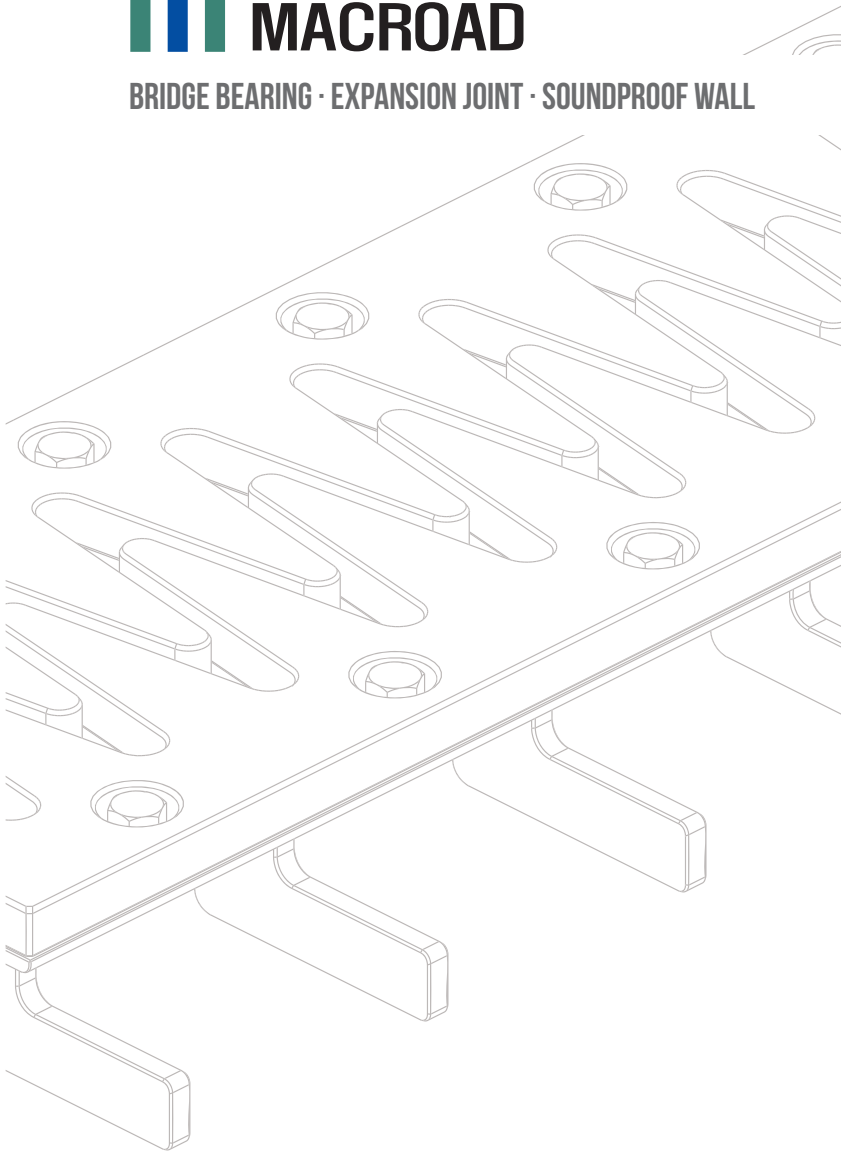


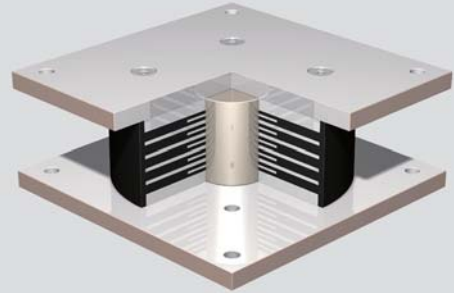
MACROAD

BRIDGE BEARING · EXPANSION JOINT · SOUNDPROOF WALL



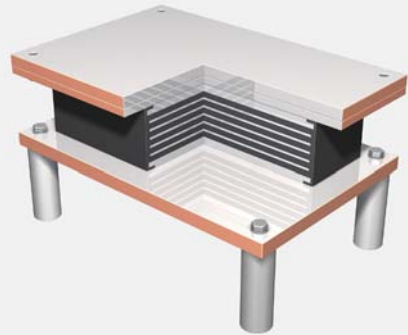
FIP

FRICITION ISOLATION PENDULUM



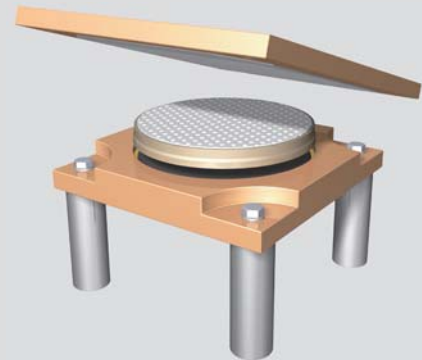
LRB

LEAD RUBBER BEARING



FRB

FUNCTIONAL RUBBER BEARING



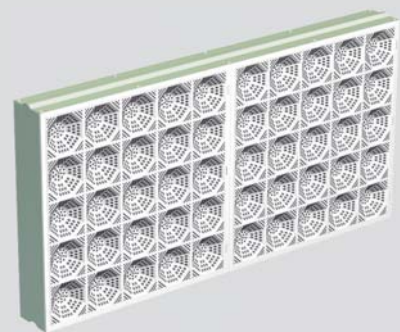
POT

POT BEARING



WMF

EXPANSION JOINT



MSA

SOUNDPROOF PANEL

Greeting

Macroad Co., Ltd. Loving nature and considering safety

Macroad Co., Ltd. has developed and produced key products for new construction and maintenance of bridges and roads based on outstanding technologies as holding new construction technologies, performance certificates and over 70 patents.

Especially, 'Seismic retrofit integrated elastic bridge bearing' and 'Expansion joint replacement method for preserving concrete' have been developed by ourselves and received favorably on economic efficiency, safety and workability by customers, and recently we have commercialized friction pendulum system through technical tie-up with FIP in Italy.

Our Macroad Company possesses the technology of noise absorption for development-oriented industrial societies.

And with new technology as our background, we are trying to make harmonious and comfortable living environment through our super-wave noise barrier that has the highest noise absorption ability domestically, Transparent noise barrier that can disjoin, High performance reflective noise barrier that uses the reflection of noise and frequency phase in reducing noise and combination sound-proof tunnel that looks like an art sculpture while functioning as effective sound absorber. Even if Macroad Co., Ltd has been established on a small but strong rock based on passion and technology and now joined to medium-sized enterprises, and all of company members are doing their best. We will do our best to be the world best company jumping across our country and work as a company which puts customers first, achieves quality management and responsibility management and gives hope and vision to everyone.

Thank you.

C.E.O. Eun Chul Choi

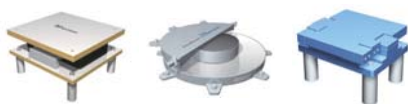
Eunchul, Choi

Company Information / Business area

Company Information

Name	Macroroad Co., Ltd.
CEO	Eun Chul Choi
Establishment	1 st July 2004
Sales	18,200,000,000 won (yr2016) (\$16,042,000)
Employees	73
Address	Headoffice Eoeun Bldg 5th Fl, Saemal-ro 125, Songpa-gu, Seoul, Korea 1 Facotry 188-11, Odu-ri, Bogae-myeon, Anseong-si, Gyeonggi-do, Korea 2 Factory 129-45, Sinnam-ro 365beon-gil, Namyang-eup, Hwaseong-si, Gyeonggi-do, Korea
Award	Award from knowledge Economy Minister Award from the Korean Intellectual Property Office Award from Small and Medium Business Administration Award from Seoul Regional National Tax service

Business area



Bridge bearing



Expansion joint



Soundproof wall

History

- 2004
 - 07 Company established
 - 08 Obtained constructing expertise license (the field of facilities maintenance)
 - 11 Rolled patent no.0427909 "CF-R (Concrete free finger joint replacing rail joint)"
 - 12 Obtained constructing expertise license (the field of Steel structure & Windows)

- 2005
 - 04 Registered in Venture Business (No. 051123031-1-00557)
 - 04 Rolled patent No.0484564 "A.R.B (Aseismatic-Strengthened Rubber bearing)"
 - 07 Selected as "Joint development consortium" held by the small & Medium Company Admin

- 2006
 - 04 Acquired the Certificate of ISO9001, ISO14001
 - 04 R&D center established
 - 10 Rolled patent no.0643015 "Spherical Bearing that can be maintained"

- 2007
 - 05 Participated at KINTEX "ROTREX international road show"
 - 06 Technical license agreement with Softelec in Japan
 - 07 Technical license agreement with Dongbang engineering
 - 07 Registered in "A+ MEMBERS" by Kibo Technology Fund
 - 08 Registered in "INNOBIZ Business(A-grade)" by the small & Medium Company Admin.
 - 12 Completed Anseong Factory

- 2008
 - 01 Received "Promising Company Accreditation" from Industrial Bank of Korea
 - 04 Registered "NeT (New Excellence Technology)" from Government with "CF-R" Obtained patent of "Air-Cleaner" and launched
 - 10 Won the prize of Minister by the Ministry of Knowledge Economy in the Entrepreneur Festival, Korea 2008
 - 12 Registered "Performance Certification" with A.R.B from the Public Procurement Service

- 2009
 - 03 Rolled patent no.0891464 "Replacement possible Soundproofing Wall"
 - 05 Won the prize of Commissioner by the intellectual property office
 - 06 Participated at COEX "International Environment show"
 - 07 Obtained patent of "Non-Point Pollution Source" and launched
 - 08 Participated at Songdo Convensia "Incheon International Environment show"
 - 09 Registered "New technology" with A.R.B from the Korean Land & House Corporation
 - 10 Won the prize of Commissioner by the small & Medium Company Admin. Registered "Excellent Product" with A.R.B from the Public Procurement Service

- 2010
 - 04 Selected as "an information-oriented company" by the small & medium Company Admin.
 - 08 Received the first order of Launching Girder equipment (Honam High-speed railroad)
 - 09 Registered "Industrial Design Firm" by Korea Institute of Design Promotion
 - 10 Completed Hwaseong Factory

- 2011 01 “Procurement Purchasing Agreement” for A.R.B. with Public Procurement Service
 01 “Manufacturing License Agreement & Royalty Agreement” with FIP INDUSTRIALE (Italy)
 03 Won the prize of Commissioner by Seoul Regional tax Office on the 45th day of taxpayer
 03 “Procurement Purchasing Agreement” for Safety barrier, Soundproof wall and Railings with Public Procurement Service
 07 Rolled Patent No.10-1051439 “Lead Rubber Bearing Improved seismic Isolate capability”
 08 “Aseismatic-strengthened Rubber Bearing (ARB)” KS Certification (KSA No.11-0465)
 11 Registered “High-performance Spherical Bearing” by KOREA RAIL NETWORK
- 2012 01 Rolled Patent No. 10-0291214 “Bumpy style Soundproofwall.”
 01 Rolled Patent No. 20-0228357 “Rotary transparent Soundproofwall.”
 04 Rolled Patent No. 10-1131389 “Non-point source system use no - woven fabrics”
 05 Rolled Patent No. 10-1152279 “Railway Spherical Bearing easily repaired”
 05 Established Product facilities of Soundproofwall in 2nd factory
 05 Rolled Patent No. 10-1152306 “Air cleaner for Public room”
 06 Passed to “SB4” Vehicle collision Test From Expressway & transportation Research Institute
- 2013 02 Registered “Performance Certification” with Superwave sound proof wall from the Public Procurement Service
 07 Rolled Patent no.10-1287510 Elastic rust-zero bridge bearing with using synthetic Public Procurement Service
 07 Rolled Patent no.10-1287439 Movable expansion joint
- 2014 01 Rolled Patent no.10-1355905 Road sign with Solar power
 07 Rolled Patent no.10-1423076 The external panel for bridges with magnetic nut locking device
- 2015 07 Acquire a performance certificate of “Railway Spherical Bearing easily repaired”
 07 Rolled Patent No.10-1538767 “frictional bridge bearing with closed friction surface”
- 2016 02 Obtain Hi-seoul brand
 03 Rolled Patent No.10-1604997 “e-co friendly soundproof tunnel system”
 09 Rolled Patent No.10-1630633 “expansion joint for bridge”
- 2017 07 Rolled Patent No.10-1762145 “repair-replacement method and device of expansion joint for bridge”
 08 Rolled Patent No.10-1768631 “non-skid expansion joint for bridge and its construction method ”



FIP

| Friction Isolation Pendulum |

General

Bridge bearing that ball bearing system supporting the superstructure does pendulum motion on the smooth friction surface with constant curvature

Engineering name is Self-centering seismic isolation system, of which product name is Friction Isolation Pendulum and defined as FIP using the initial letter



Friction Isolation Pendulum

Features

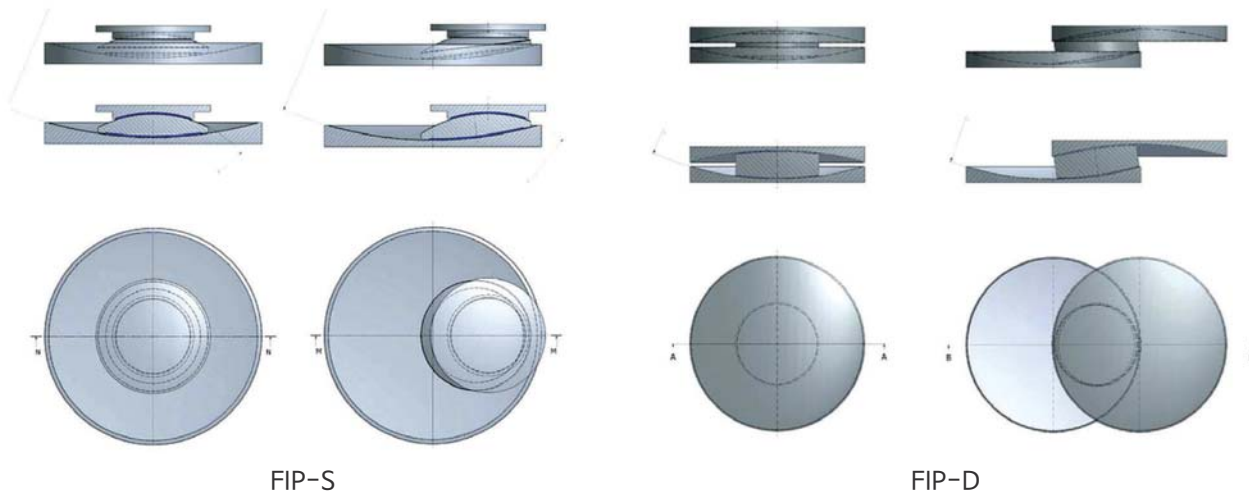
- Important concept for earthquake resistance design to minimize after shock and secondary damages by self-restoration of original structures after earthquake
- Bridge bearing based on plastic strain energy according to yield strength of the material reduces restoration capability more as the energy dissipation capability is higher
- AASHTO 1991, UBC1997 submitted constraints with regard to minimum value of restoring force and cycle after yielding
- Recently Eurocode8- Design of structures for earthquake resistance
- Part2: Bridges prEN 1998-2:2005 submitted constraints with regard to minimum value of restoring force and displacement in restoration

| Friction Isolation Pendulum |



Shape

- Main components are upper/lower concave slide plates and a pendulum between them.
- Sliding material (UHMW-PE) applied to the friction surface between Concave slider Plates and Pendulum is a key factor for making FIP smaller



Test

- Quality assurance performance test : performance tester, performance test

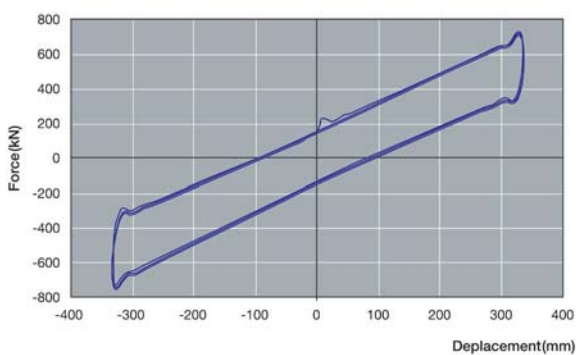


Performance test (1)

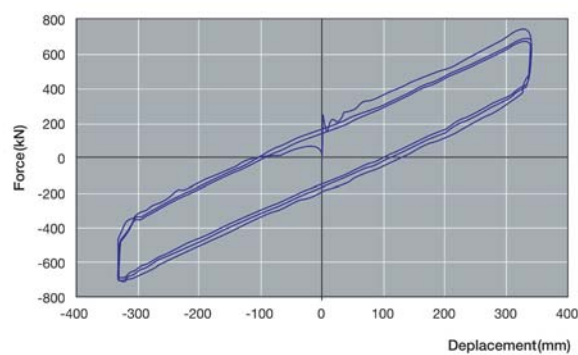


Performance test (2)

- Result of dynamic test on product size of FIP-D1000/1200(4202)



Test result (constant velocity)



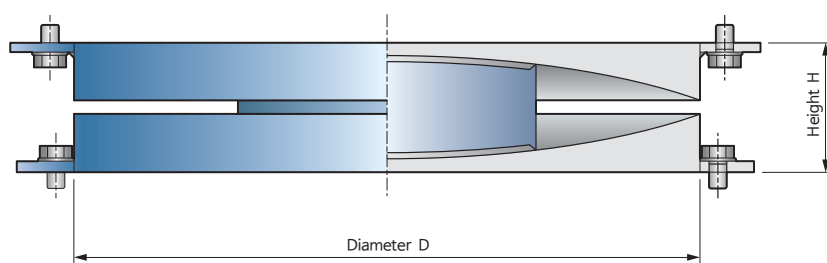
Test result (sinusoidal velocity)

FIP

| Friction Isolation Pendulum |

MACROAD

Specifications



Explanatory notes

Fzd	Maximum vertical load
R	Radius of curvature
D	Diameter of plane
H	Height of bridge bearing

Fzd (kN)	Deflection (mm)	FIP-D	R (mm)	D (mm)	H (mm)
900	±200	90/400(2535)	2535	400	84
1300		130/400(2535)		430	89
2600		260/400(2535)		485	120
3900		390/400(2535)		535	141
1300	±250	130/500(3125)	3125	490	94
2700		270/500(3125)		550	118
4000		400/500(3125)		595	140
1800	±300	180/600(3725)	3725	570	102
2750		275/600(3725)		600	119
4000		400/600(3725)		655	138
1800	±350	180/700(3715)	3715	620	112
2600		260/700(3715)		655	120
4000		400/700(3715)		705	147
1700	±400	170/800(3705)	3705	670	117
2600		260/800(3705)		700	129
4000		400/800(3705)		755	158

| Friction Isolation Pendulum |



Example of construction



Construction of large bridges



Geoga bridge



Construction of large buildings



Banpo bridge



Construction of large factories



Construction of building base



LRB

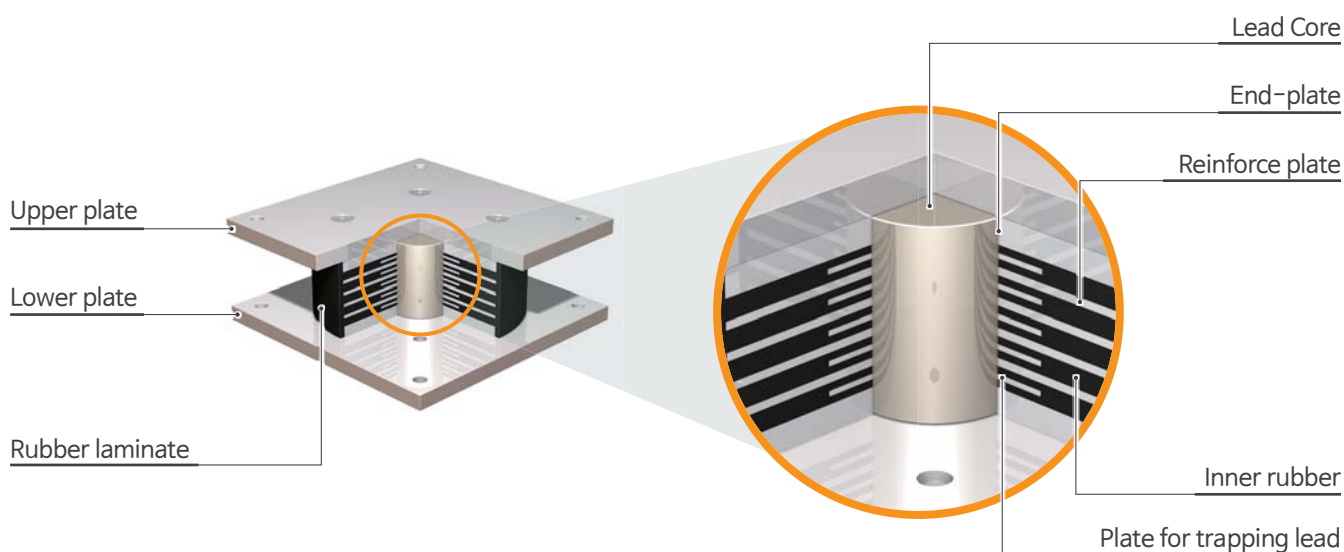
| Lead Rubber Bearing |

General

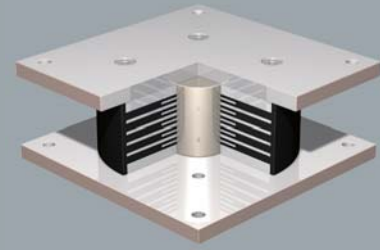
Lead Rubber Bearing(LRB) is a bridge bearing that inserts a lead core inside the bridge bearing to absorb and dissipate the horizontal energy generated during the earthquake, prevents the vertical force action and the bulging of lead in shear deformation by inserting lead prevention plate. also increases durability by control of peeling of elastic pad coating.



Lead Rubber Bearing



| Lead Rubber Bearing |

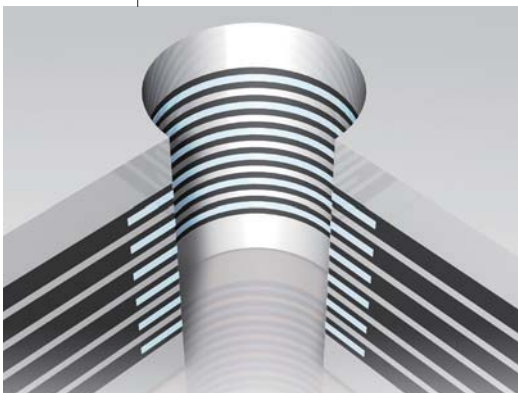
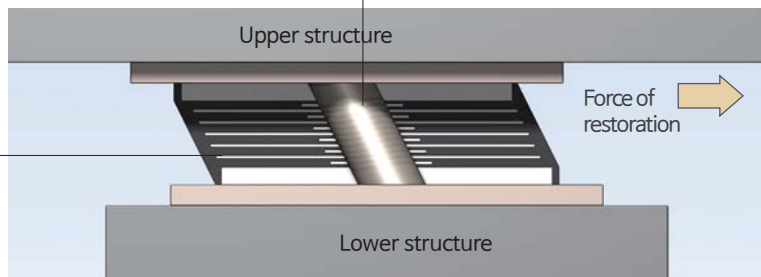


Features



Dissipate the earthquake energy [Lead core]

reduce seismic force and decrease displacement by inserting lead core in center of bridge bearing.
this product increases the usability of bridges and impose low longtime loading, because lead resistance to wind and braking loads with high rigidity.



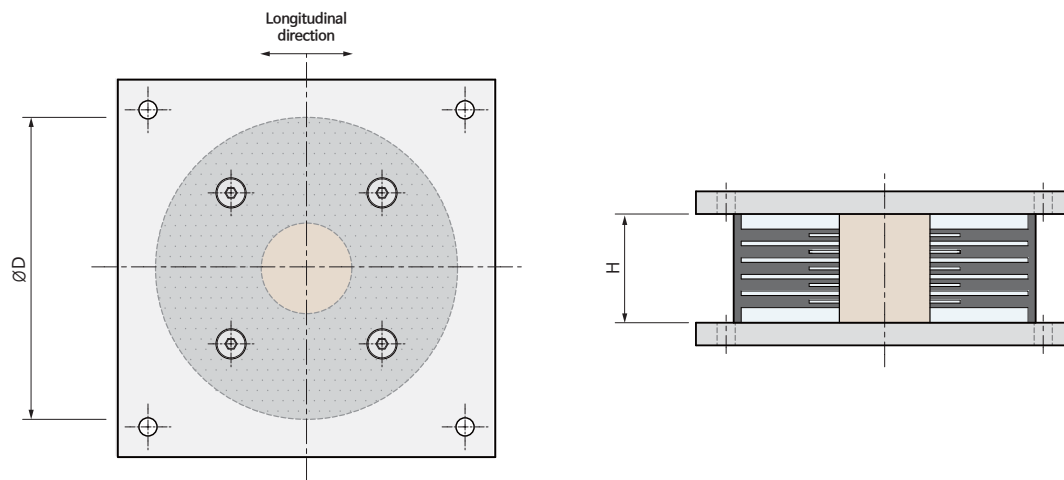
Prevent lead bulging

put a plate around the lead core, improve the seismic function by preventing the vertical force action and the bulging of lead during shear deformation.

LRB

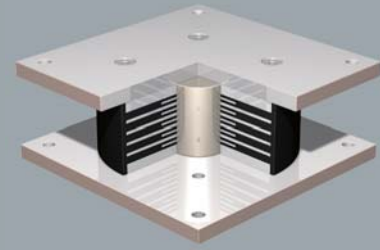
| Lead Rubber Bearing |

Specifications



Load (kN)	FRB Size (mm)		Elastic rubber layer		Modulus of rigidity (Mpa)
	ØD	H	Number of rubber layers	Thick-ness (mm)	
2500	600	62	3	42	0.7
		79	4	56	0.7
		96	5	70	0.7
		113	6	84	0.7
		130	7	98	0.7
		147	8	112	0.7
3000	650	65	3	45	0.7
		83	4	60	0.7
		101	5	75	0.7
		119	6	90	0.7
		137	7	105	0.7
3500	750	155	8	120	0.7
		68	3	48	0.7
		87	4	64	0.7
		106	5	80	0.7
		125	6	96	0.7
		144	7	112	0.7
4300	800	163	8	128	0.7
		95	4	72	0.7
		116	5	90	0.7
		137	6	108	0.7
		158	7	126	0.7
		179	8	144	0.7
5000	850	200	9	162	0.7
		97	4	72	0.7
		118	5	90	0.7
		139	6	108	0.7
		160	7	126	0.7
		181	8	144	0.7
6000	900	202	9	162	0.7
		101	4	76	0.7
		123	5	95	0.7
		145	6	114	0.7
		167	7	133	0.7
		189	8	152	0.7
		211	9	171	0.7

| Lead Rubber Bearing |



Example of construction



Seongsan bridge



Seogang bridge



Yeongjong grand bridge



Hangang iron bridge



Hangang bridge



Banghwa bridge



POT

| Pot Bearing |

General

Pot Bearing is composed of a rubber plate that accommodates vertical load and rotational deformation, and it make the expansion and contraction movement smoothly by skidding of PTFE and stainless steel.

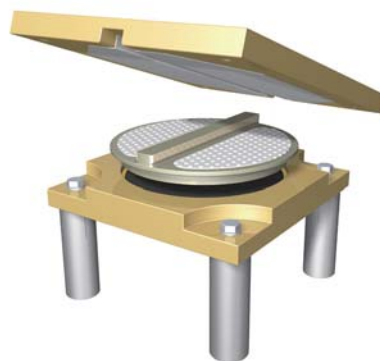


Pot Bearing

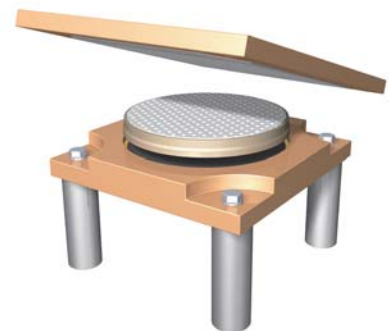
Pot Bearing Types



Fixed Pot Bearing

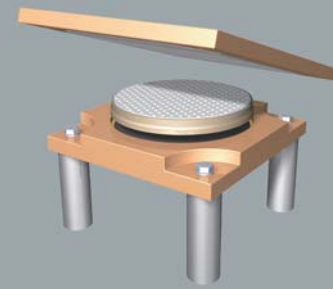


Sliding Guided Pot Bearing



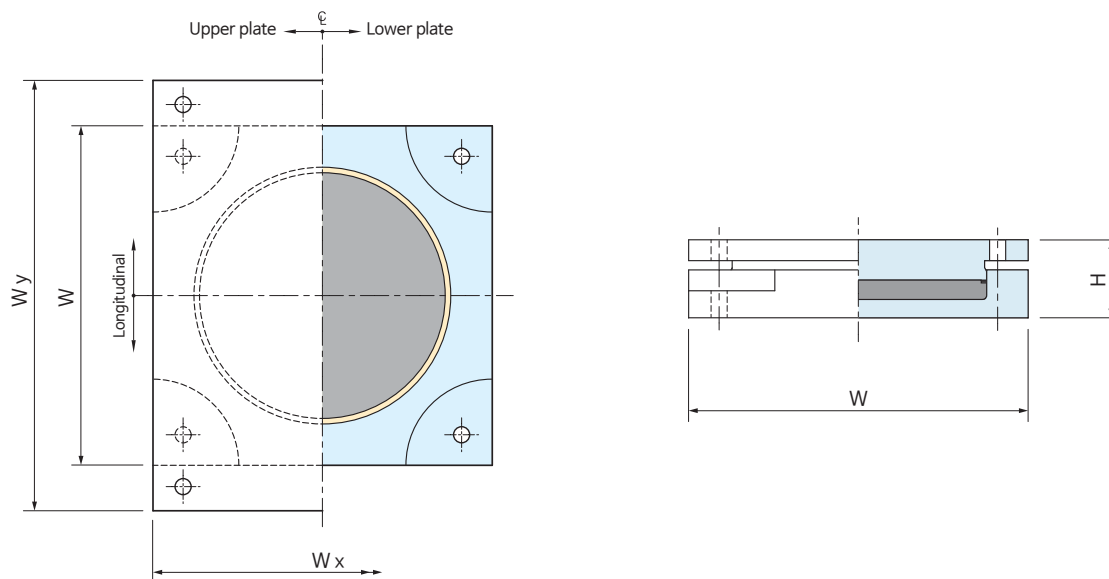
Free Sliding Pot Bearing

| Pot Bearing |



Specifications

Fixed pot bearings



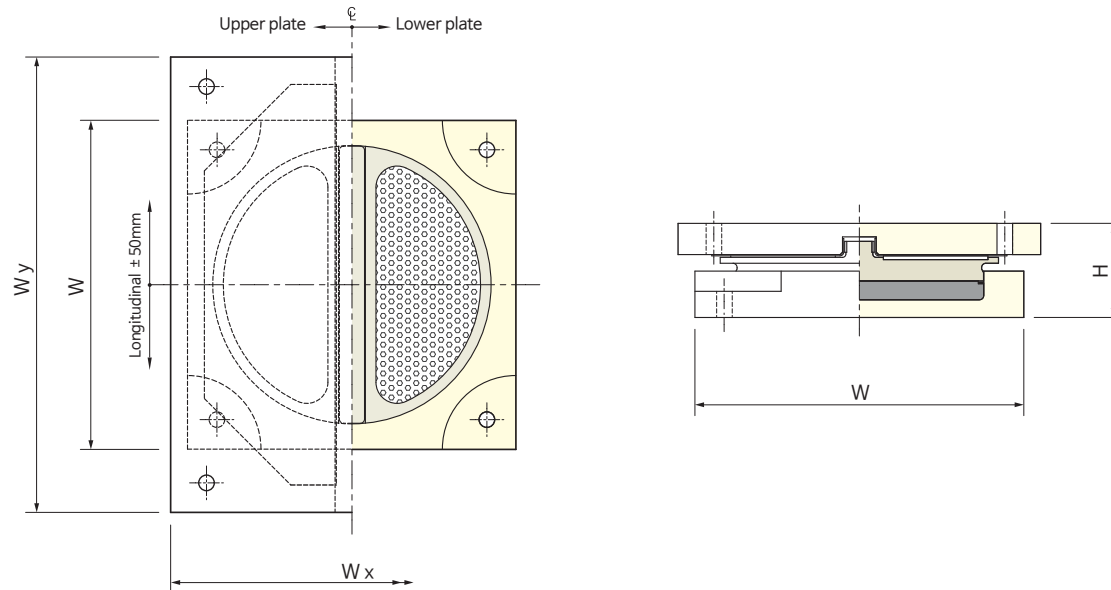
Vertical load [kN]	Horizontal load [kN]	W = Wx = Wy [mm]	H [mm]
1000	150	250	56
1250	188	280	56
1500	225	310	57
1750	263	330	57
2000	300	350	58
2250	338	370	58
2500	375	390	59
2750	413	410	59
3000	450	430	66
3500	525	470	66
4000	600	500	67
4500	675	530	68
5000	750	560	70
5500	825	580	72
6000	900	610	73
6500	975	630	75
7000	1050	660	76
7500	1125	680	77
8000	1200	700	83
8500	1275	720	86
9000	1350	740	86
9500	1425	760	88
10000	1500	780	88

POT

| Pot Bearing |

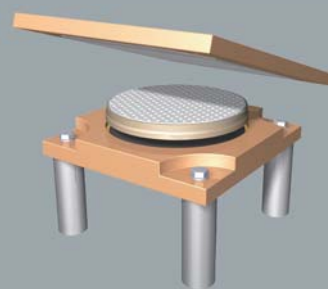
MACROAD

Sliding guided pot bearings

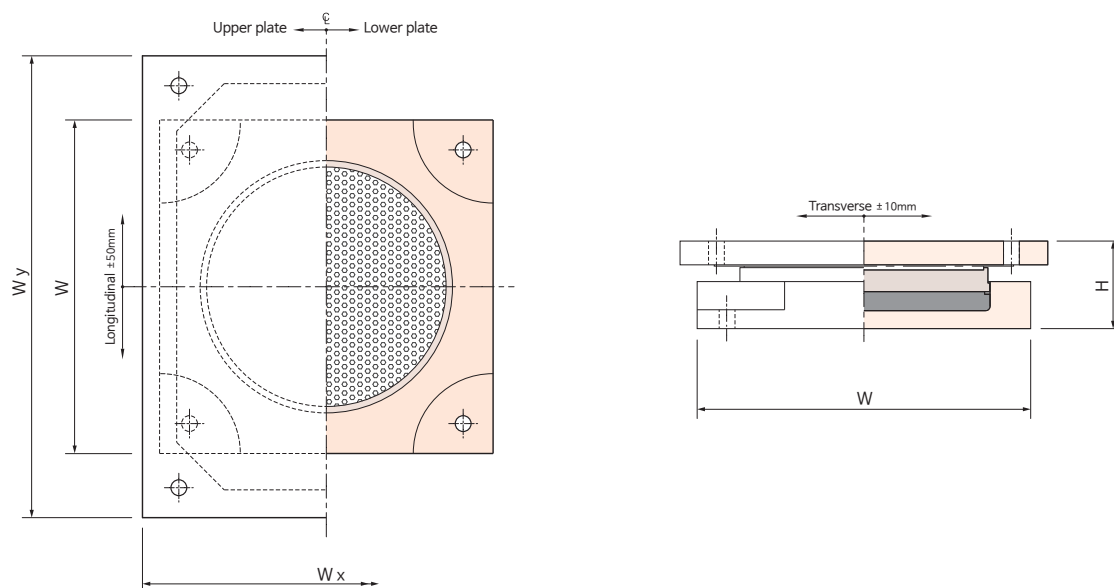


Vertical load [kN]	Horizontal load [kN]	W [mm]	H [mm]	Wy [mm]	Wx [mm]
1000	150	250	80	300	250
1250	188	280	80	330	280
1500	225	310	84	360	310
1750	263	330	85	380	330
2000	300	350	85	400	350
2250	338	370	85	420	370
2500	375	390	87	440	390
2750	413	410	87	460	410
3000	450	430	87	480	430
3500	525	470	95	520	470
4000	600	500	95	550	500
4500	675	530	102	580	530
5000	750	560	105	610	560
5500	825	580	105	630	580
6000	900	610	106	660	610
6500	975	630	110	680	630
7000	1050	660	111	710	660
7500	1125	680	112	730	680
8000	1200	700	114	750	700
8500	1275	720	115	770	720
9000	1350	740	115	790	740
9500	1425	760	119	810	760
10000	1500	780	121	830	780

| Pot Bearing |



Free sliding pot bearings



Vertical load [kN]	Horizontal load [kN]	W [mm]	H [mm]	Wy [mm]	Wx [mm]
1000	150	250	73	300	250
1250	188	280	73	330	280
1500	225	310	73	360	310
1750	263	330	73	380	330
2000	300	350	77	400	350
2250	338	370	78	420	370
2500	375	390	79	440	390
2750	413	410	79	460	410
3000	450	430	79	480	430
3500	525	470	84	520	470
4000	600	500	85	550	500
4500	675	530	86	580	530
5000	750	560	88	610	560
5500	825	580	89	630	580
6000	900	610	90	660	610
6500	975	630	91	680	630
7000	1050	660	92	710	660
7500	1125	680	93	730	680
8000	1200	700	98	750	700
8500	1275	720	98	770	720
9000	1350	740	100	790	740
9500	1425	760	102	810	760
10000	1500	780	102	830	780



MACROAD

FRB

| Functional Rubber Bearing |

General

There is no 'roll over' and 'roll out' phenomenon of elastic pad, it maximizes the seismic effect of Functional Rubber Bearing. It is a one-piece elastic pad suitable for the steel bridge and long-span bridge through the integration of the upper and lower steel plates.



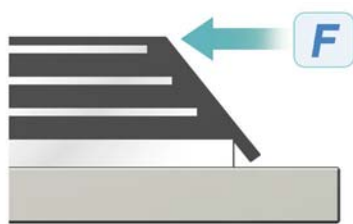
Functional Rubber Bearing



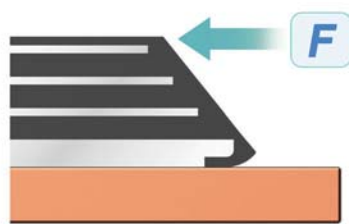
| Functional Rubber Bearing |



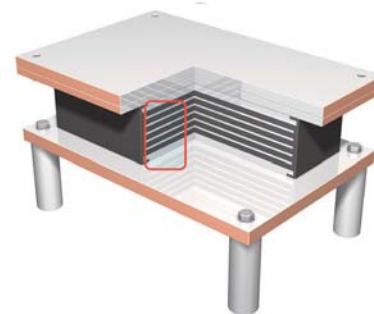
Features



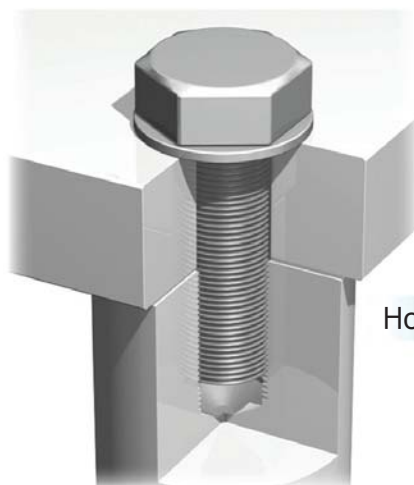
The existing product



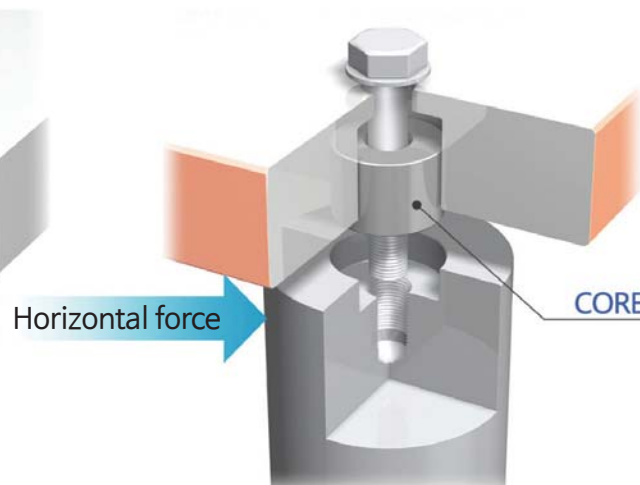
Developed product



In order to improve exfoliation of elastic pads, the raised spots are formed on the end plates, so it can prevent exposure of the end plates even if coating is exfoliated or exfoliation occurs, and consequently it improves durability of bridge bearing and extends the lifespan of the bridge.



[The existing product]



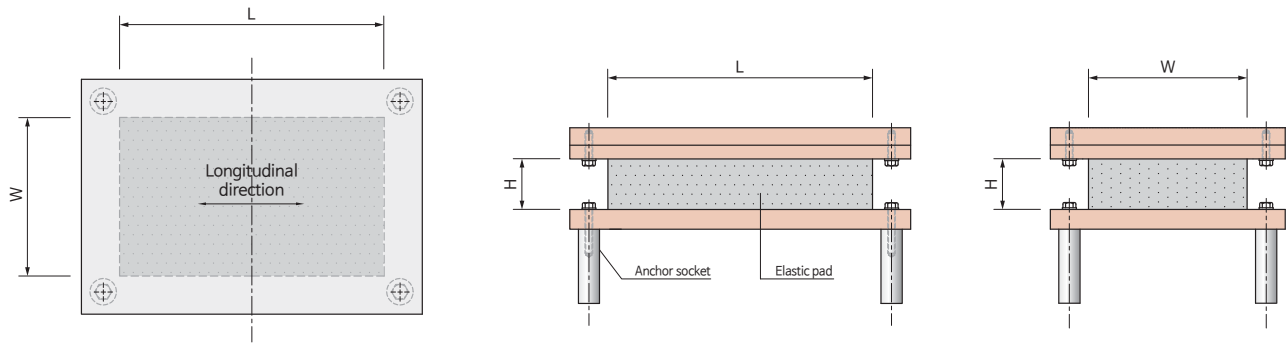
[Improved product]

The size of bolt can be made smaller than the existing bolt by application of core anchors and the horizontal force can be controlled by extension of socket diameter. It also has an advantage to minimize number of bolts.

FRB

| Functional Rubber Bearing |

Specifications



Load (kN)	FRB Size (mm)			Elastic rubber layer		Modulus of rigidity (Mpa)
	W	L	H	Number of rubber layers	Thick-ness (mm)	
2000	400	600	62	3	42	0.7
			79	4	56	0.7
			96	5	70	0.7
			113	6	84	0.7
			130	7	98	0.7
			147	8	112	0.7
2500	450	600	65	3	45	0.7
			83	4	60	0.7
			101	5	75	0.7
			119	6	90	0.7
			137	7	105	0.7
			155	8	120	0.7
3000	500	600	68	3	48	0.7
			87	4	64	0.7
			106	5	80	0.7
			125	6	96	0.7
			144	7	112	0.7
			163	8	128	0.7
3500	600	600	95	4	72	0.7
			116	5	90	0.7
			137	6	108	0.7
			158	7	126	0.7
			179	8	144	0.7
			200	9	162	0.7
4300	600	700	97	4	72	0.7
			118	5	90	0.7
			139	6	108	0.7
			160	7	126	0.7
			181	8	144	0.7
			202	9	162	0.7
5000	700	700	101	4	76	0.7
			123	5	95	0.7
			145	6	114	0.7
			167	7	133	0.7
			189	8	152	0.7
			211	9	171	0.7

| Functional Rubber Bearing |



Example of construction



Yungnyeong 1 bridge



OSaeng 1 bridge



Gaheung 1 bridge



Samcheonpo bridge



Yongsan bridge



Gwangjin bridge



WMF

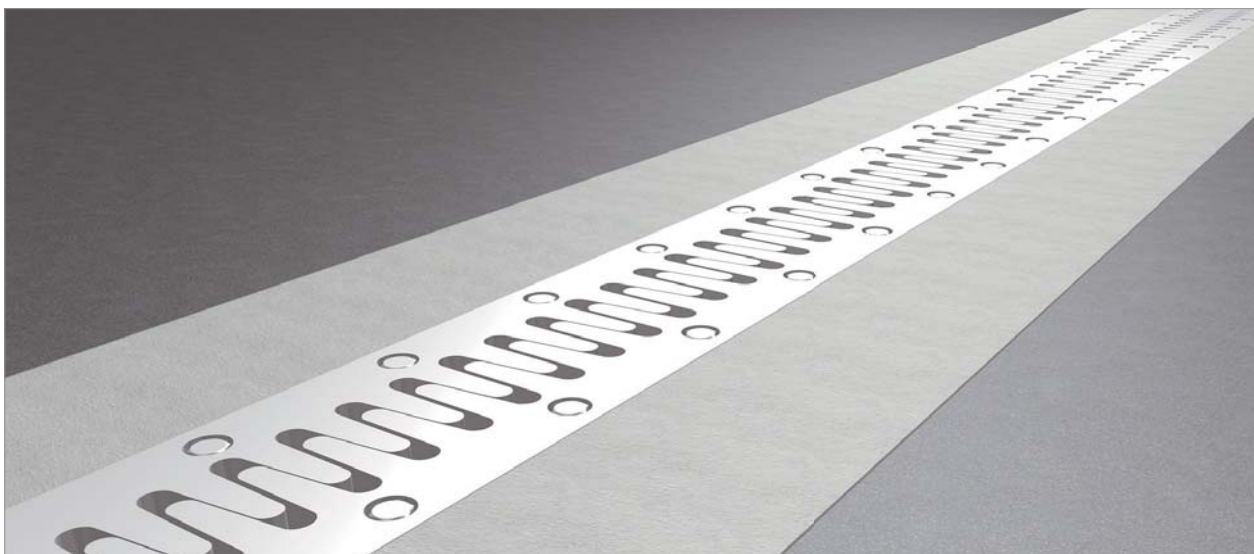
| Waterproof Membrane Finger Joint |

General

The method to get bridge surface waterproof treatmentsame as rail type of expansion joint unit by composing finger plate at the upper part (bridge surface) and waterproofing materialsupport plate at the lower part, and assembling and installing porous waterproof seal in between them is called Waterproof Membrane Finger Joint (WMF)



Waterproof Membrane Finger Joint



| Waterproof Membrane Finger Joint |



Problems of the existing finger joint

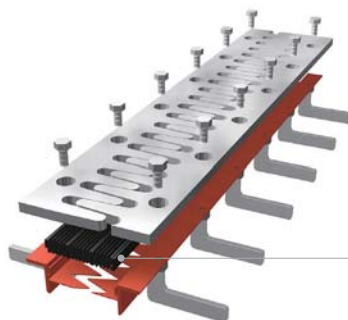
- Damage to waterproofing sheet and loss of waterproofing function by accumulation load of foreign substances flowing in through finger gap and accumulated
- Corrosion of waterproofing sheet and shortening service life of the bridge due to chemical reaction caused by foreign substances
- No repair method for damaged waterproofing material
- Periodic removal of foreign substances is required
- Increase of construction cost and maintenance cost because of extra installation of rainwater pipe

Features of Waterproof Membrane Finger Joint

- No extra drain facilities are required same a rail joint.
- Unlike the existing finger joint, no extra maintenance is required because no foreign substances flow in through the gaps
- Easy to install and maintain it because finger plate and waterproofing material support plate are divided to be assembled
- Service life of the bridge is enhanced because the problem of damage to waterproofing material due to accumulation of foreign substances
- Applicable to all sizes regardless of expansion size
- Material with strong corrosion resistance is applied to expansion member support plate at the lower part



Details of product dissembling



Details of product assembling



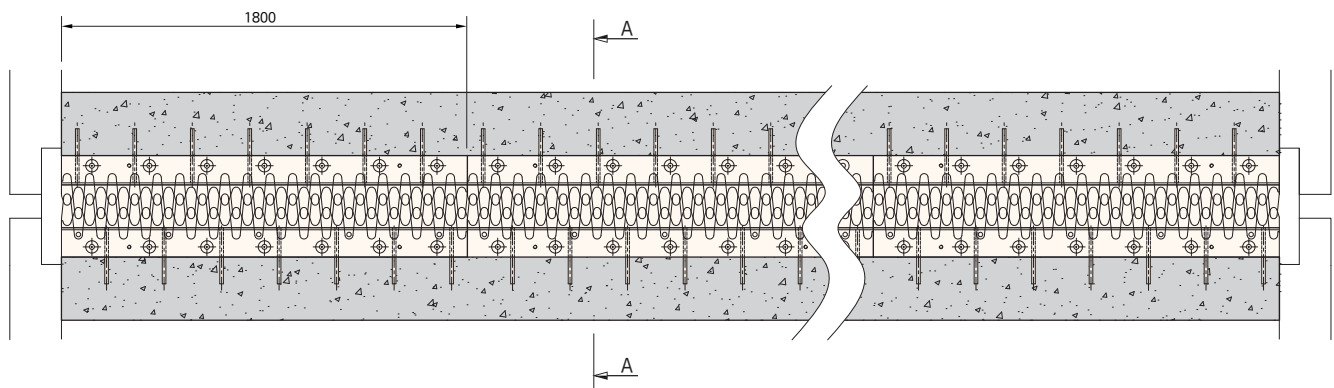
Waterproof rubber seal

WMF

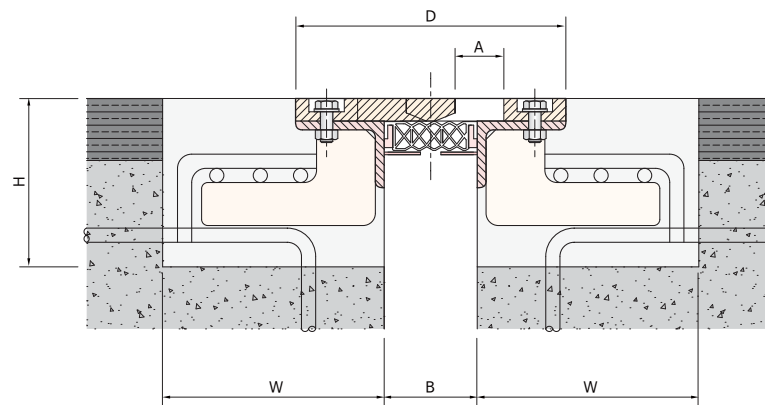
| Waterproof Membrane Finger Joint |

Shape and specifications of waterproof membrane finger joint

Ground plan



Sectional view



Specifications

(unit : mm)

MODEL NO.	Expansion	A	B	D	Block Out	
					W	H
WMF 50	50	30	50	220	250	250
WMF 80	80	45	60	270	300	250
WMF 100	100	55	85	345	300	250
WMF 150	150	80	125	465	300	250
WMF 200	200	105	150	590	300	300
WMF 250	250	130	175	635	300	300
WMF 300	300	155	200	700	300	300
WMF 350	350	180	225	805	350	300
WMF 400	400	205	250	920	400	300
WMF 450	450	230	275	975	450	300
WMF 500	500	255	300	1060	500	300
WMF 550	550	280	325	1165	550	300
WMF 600	600	305	350	1240	600	300

| Waterproof Membrane Finger Joint |



Example of construction



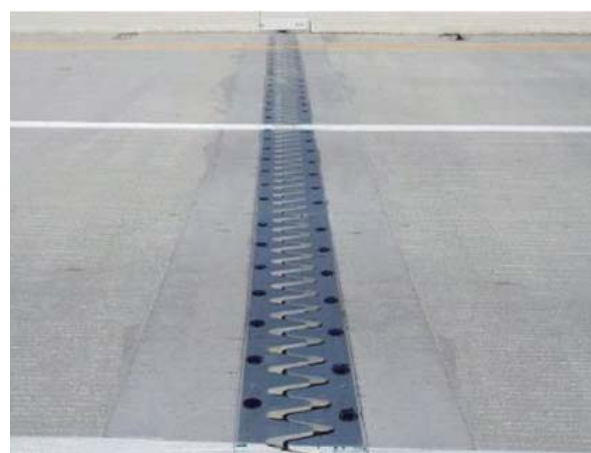
Seochang bridge



Pyeongtaek bridge



Sinchon bridge



Junju-kwang yang express way

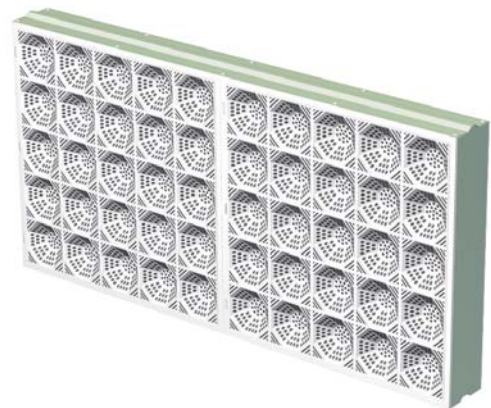


MSA

| SUPER WAVE SOUND ABSORPTION | SOUNDPROOF PANEL

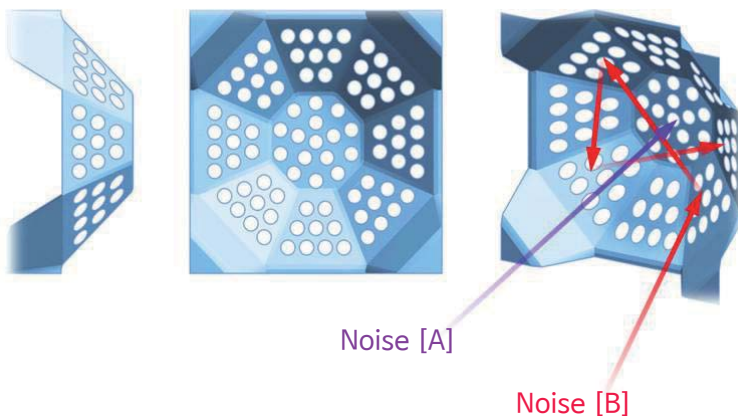
General

Super wave sound absorption soundproof panel maximizes the noise reduction effect by inducing sound absorption, reflection, diffraction and interference through numerous conical grooves with the most ideal shape from various noise sources.



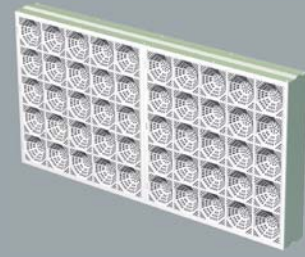
Super wave sound absorption soundproof panel

Structure of soundproof panel



- Ideal structure to maximize sound absorption and noise reduction performance of soundproof panelz
- Reduces noise by make reflected sound interfere with each other with conical shape
- It is resistant to horizontal load in conical shape.

| SUPER WAVE SOUND ABSORPTION | SOUNDPROOF PANELS



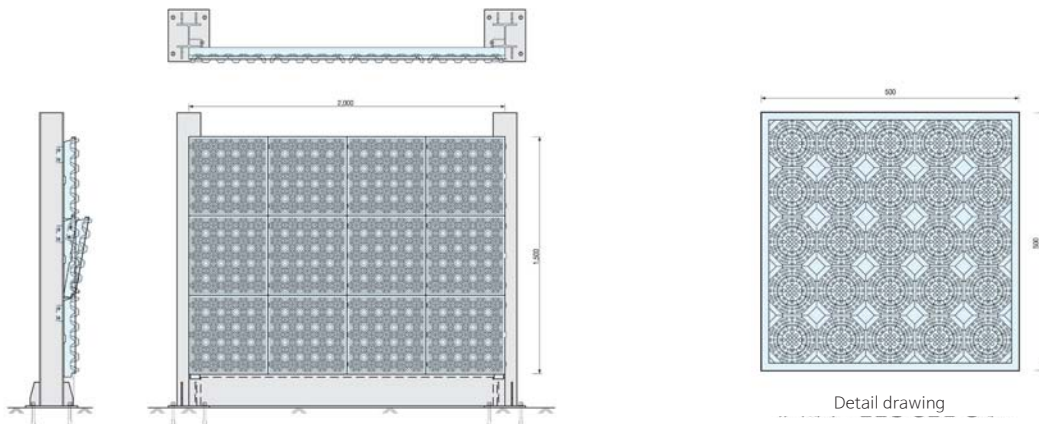
Features and Advantages

- For a damaged soundproof panel, easy of partial maintenance from the front side consisting of 4 blocks without dismantlement of the soundproof wall
- Natural purification by rain and possible to maintain the beauty of view by simple water cleaning fine due to excellent corrosion proof and surface roughness
- Structurally stable by improvement of load resistance and durability performance
- Even sound absorptive effect on diffused reflection noise without directivity toward noise
(Advantageous for road, railroad site)

Example of installation



Basic block diagram



Product sizes and materials

Size	Width	Height	Thickness of panel
	1995/2995/3995mm (Manufacture of non-standard product)	500mm	95/120mm
Material	Front panel	Back panel	Sound absorptive material
	Synthetic resin (A.S.A)/Galvanized steel (0.6~0.8T)/Aluminum (1.0T)	Galvanized steel (1.6T)/Synthetic resin	Polyester/Glass wool



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