

GO BEYOND LIMITS

TAILOR MADE SOLUTION FOR SEISMIC PROTECTION



SEISMICDIVISION



DOSHIN RUBBER

TABLE OF CONTENTS



THE PIONEER IN RUBBER'S SOLUTIONS 4

From nature protection against earthquake 6

Well performing at large and small deformations

Long service life and no maintenance costs

Overloading? Not a problem for rubber

Different stiffness in different directions

Technological leader from rubber to components 8

Production

Material testing

Performance tests

Three times experts 10

From research to production, to a chain of Quality

The role of research

Total quality in production

The importance of an advanced design

Three ranges for every needs 12

Solutions for seismic isolation

Solutions for energy dissipation

Solutions for non-structural components

The benefits of proper protection from earthquake 14

Base isolation principles

Flexibility and energy absorption

Maintenance-free lifetime

Rubber and steel



SEISMICDIVISION



"Building a culture of prevention is not easy. While the costs of prevention have to be paid in the present, its benefits lie in a distant future. Moreover, the benefits are not tangible. THEY ARE THE DISASTERS THAT DID NOT HAPPEN"

UN Secretary-General Kofi Annan



"At Doshin we believe in pushing boundaries. Innovation, creativity, excellence and collaboration are the guiding forces for our work.

We believe the best results come from a dialogue with all stakeholders: we can provide optimised solutions to meet your specific needs and conditions."

Or Tan Teng



The pioneer in rubber's



DOSHIN RUBBER, established in 1978, is a pioneering manufacturer of laminated bridge bearings in Malaysia. With over 30 years of experience in providing rubber solutions for the civil engineering & construction industries, Doshin Rubber is today a subsidiary of **KOSSAN** group of companies, a public listed company at the Kuala Lumpur Stock Exchange (KLSE). In making **DOSHIN RUBBER** a one-stop centre for servicing the civil engineering & construction industries, a joint venture with Shibata of Japan was initiated in December 2000. The JV Company called Quality Profile Sdn. Bhd. is now manufacturing full range of marine fenders rubber product and accessories. With complete design, engineering, quality control, laboratory, and customer service departments, Doshin can provide an optimized solution to meet your specific needs.

solutions



Doshin Rubber products range

DOSHIN RUBBER is a leader in the design and production of rubber products.

DOSHIN RUBBER stands as a leader in the design and production of rubber products thanks to scientific research, engineering design, material and product constant development and full control of production technology. **DOSHIN RUBBER** combines state-of-the-art technology, experienced professionals and innovative products as a solution to clients' most difficult challenges.

Over the years Doshin Rubber has widened its product range that now includes:

- ➔ Marine Dock Fenders (Arch Fenders, Super Cone Fenders, Cell Fenders, D Fenders, Cylindrical Fenders, Pneumatic Fenders);
- ➔ High Damping Natural Rubber (HDNR) Bearings;
- ➔ Energy dissipation devices;
- ➔ Elastomeric Laminated Bridge Bearings, Elastomeric Rubber Bearings Pad, Elastomeric Bearing Strips;
- ➔ Bridge Expansion Joints;
- ➔ Finger Type Expansion Joints, Finger Joints;
- ➔ Rubber Panel, Trommel Panels, Liners, Lifter Bar, Screen Panel for Mill Lining and Mining Industry;
- ➔ Floating Slab Track (FST) Bearings, Lateral Bearings, Rubber Wedge for Rail Industry;
- ➔ Neoprene and EPDM Compression Seals, Neoprene Strip Seals, Rubber Waterstop.



From nature protection against earthquake

Natural rubber is extracted from latex produced by *Hevea brasiliensis* trees.

Natural rubber is highly elastic with excellent fatigue and longevity characteristics. It can be compounded to have high damping in addition to its elasticity. Rubber is ubiquitous in vibration control applications and its behavior **has clear benefits for anti-seismic protection.**

Natural rubber has been used for engineering applications for over 175 years.

The research in the area continues, but laminated natural rubber bearings are a proven technology with more than 60 years of use in non-seismic applications and over 30 years of high damping rubber bearings for seismic isolation.



Well performing at large and small deformations

Natural rubber can undergo **large deformations** with an inherent recentering capability unlike many other materials. The non-linear stress-strain behaviour of high damping natural rubber allows control of small deformations for example those due to wind.

This **"semi-intelligent"** property eliminates the need for having an additional system for restraining the movement of the structure due to wind loading while having a soft isolation system during the seismic event.



Long service life and no maintenance costs

Natural rubber bearings enjoy a **maintenance-free lifetime**. They are highly resistant to contamination (for instance from dust) and to the elements. In fact natural rubber can be moulded over steel plates and the connection system of the bearings to protect them from corrosion. Oxidation in natural rubber is only a surface effect.

For large components such as structural bearings or dock fenders historical data has confirmed that there is no concern in exposing the component to atmospheric conditions.





Overloading? Not a problem for rubber

Natural rubber is capable of **coping with** overloading unlike metallic materials and therefore would forgive occasional **over stressing** where as metals would either fracture or undergo irreversible plastic deformation. The forgiving nature of this material adds to its ability to provide a **maintenance free life**.



Different stiffness in different directions

The **incompressibility** of natural rubber is often exploited in designing components with **different stiffnesses** in different directions i.e. with anisotropic behaviour. Natural rubber bearings can be designed in a compact **anisotropic multipurpose** component for example combining vibration isolation with seismic isolation, or bridge bearings with seismic isolation.





Technological leader from rubber to components

The **quality** of our products is the result of a careful control of the **entire production chain**, from raw materials to delivery to final components. We strictly control the entire manufacturing process, thanks to our experience combined with a comprehensive range of testing facilities and **modern manufacturing technologies**.



Production Facilities

Auto Clave Press



PRODUCTION



Fender Mould

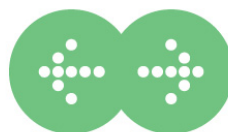


Compound Sheetting

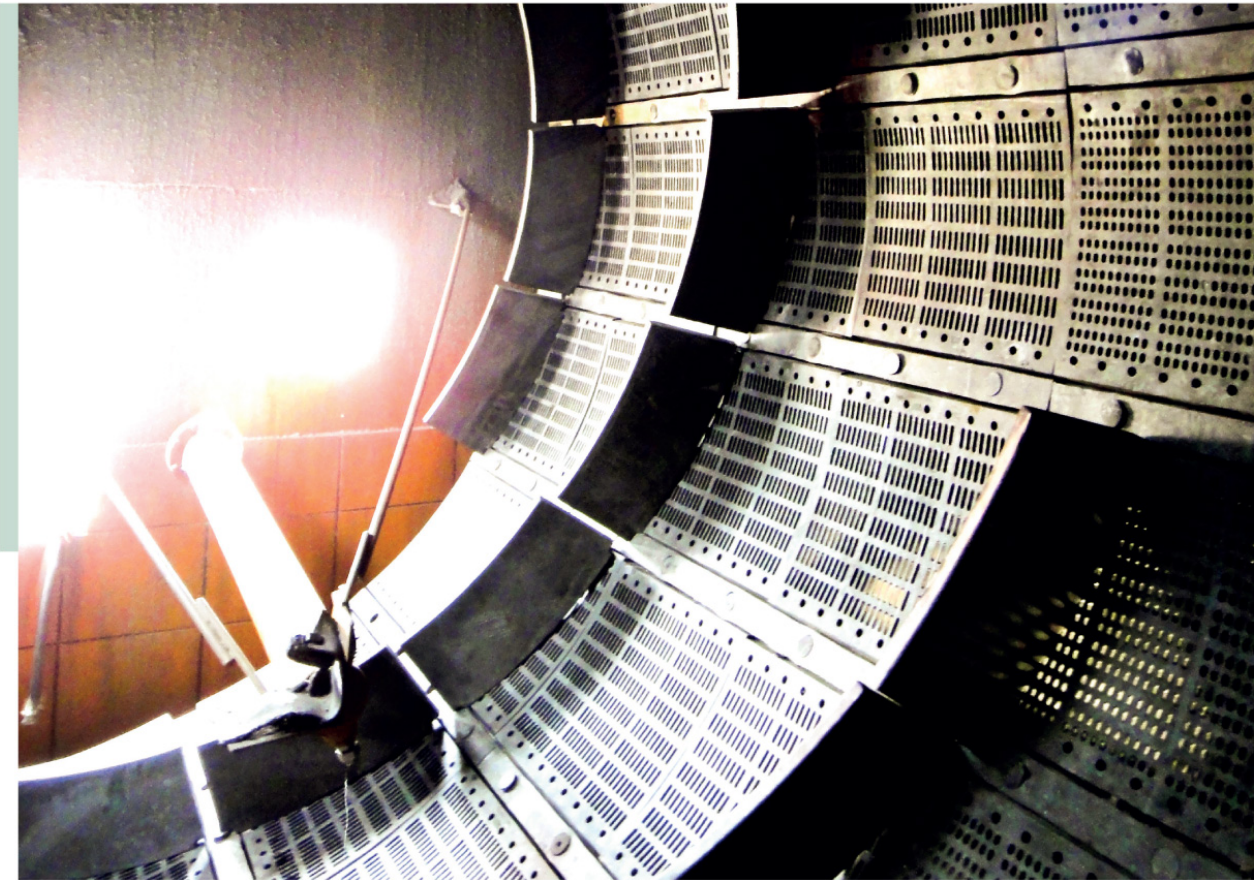
Our production plants relies on **advanced technological** solutions for the production of rubber components, from the processing of raw material to finished products.

Continuous investment in machinery and equipments allows **DOSHIN RUBBER** to rely on innovative tools, some of which are **UNIQUE IN THE WORLD**, like the 1500 tons hydraulic press in an autoclave of 3000 mm diameter.

DOSHIN laboratory's testing equipment makes up one of the most comprehensive test facilities in the world. Our laboratories are equipped to carry out testing on materials and devices according to most international Standards: tensile properties test, hardness test, **hot air heat aging test** (up to 300°C), compression set test, ozone resistance test (up to 400 pphm), **moisture content test**, quadruple shear test imaging analysis (for dirt particles/contamination detection), ISO/DIN abrasion resistance test, **low temperature brittleness test** (up to -70 °C), density/SG test, rheology test, flame retardant test fluid/oil immersion test.



MATERIAL
TESTING



PERFORMANCE TEST

DOSHIN RUBBER takes special care in the **performance test** on final products; dynamic spring rate test (automotive parts), durability/endurance/life test (Automotive parts), bond failure test (Rubber-Metal Bonded). Two test rigs are available for static testing of isolators. The most recent test rig, with a capacity of 50000 kN vertical load, 5000 kN shear load and +/- 1000 mm shear displacement, is one of the **most powerful** in the world.

Tests can be carried out according to **International Standards** (EG, ISO Standards, E.C. Standards).

Doshin antiseismic devices are **CE marked**.



➤ Test rig for isolators testing (50000 kN compressive load, 5000 kN shear load, +/- 1000 mm displacement)



➤ Compressive load test (20.000 kN, shear force 2000 kN)



Three times experts



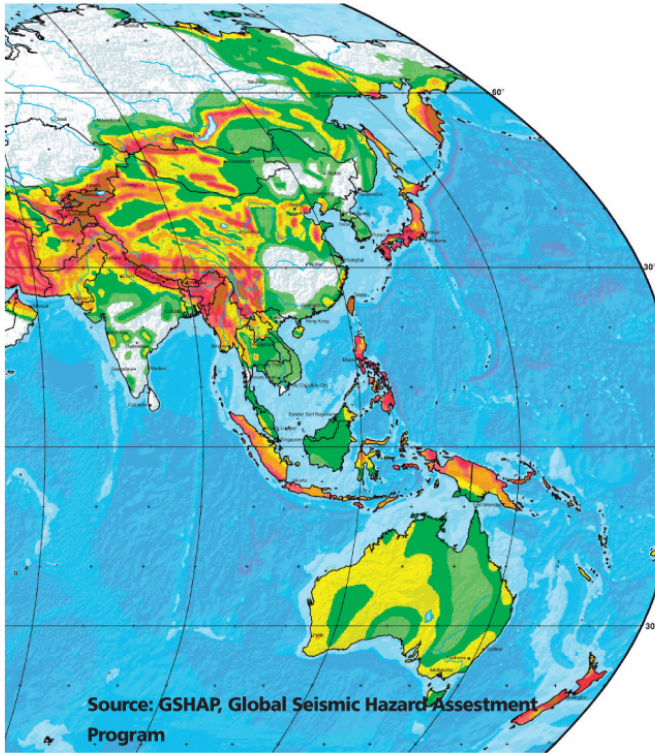
**Doshin
Rubber**
experience
in novel
antiseismic
components

From research to production, to a chain of Quality

The design, manufacturing and quality control of the bearings has been based on well established research findings published over the last three decades.

The methods adopted by Doshin are in line with the requirements of national and international standards covering anti-seismic devices, e.g. European Union [EN15129:2009 and EN1337-5:2005], Japan [JIS K 6410:2010], USA [AASHTO: 2010] and International Standards [ISO 22762:2010].





The role of research

DOSHIN is continually following research findings in material development, design of new and novel anti-seismic components, and new methods of manufacture for optimizing the properties of the component enabling it to offer a wide technical support for its after sale service.

Total quality in production

All bearings are manufactured under strict quality control procedures. The preprototype bearings are dismantled and checked for uniformity of the quality throughout the bearing. The prototype bearings are tested for performance according to the requirements

of International Standards required by the clients. Doshin welcomes the impartial monitoring of its quality procedure by any accredited body and would be willing to consider procedures requested by the client. All raw and processed material are tested according to International Standards required by the clients.

The importance of an advanced design

Thanks to collaboration with leading consulting engineering firms specialized in the design of structures with novel antiseismic components, **DOSHIN RUBBER** is able to provide solutions tailored to all types of civil and industrial structures, from transportation infrastructure (bridges, viaducts) to ordinary buildings, strategic structures (such as hospitals and emergency centers) and industrial facilities.



Solutions for every



**The right
product
for every
constructive
solution**

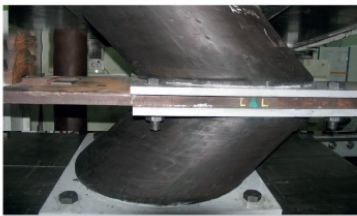


DOSHIN RUBBER has developed, after an important path of research and development and a thorough and detailed series of tests in the laboratory and in the field, a full range of products and technological solutions for seismic isolation and energy dissipation.

In relation to the type of structure to be protected, the solutions DOSHIN RUBBER are able to ensure the best results in terms of protection from earthquakes; the raw materials used, together with the technological solutions choices, also guarantee a long useful life of our products, the total absence of maintenance costs and reliability are among the highest in the world.

Our product range has already been successfully applied in many applications around the world; our research and development department and our ability to develop solutions specifically designed for the application requirements of our customers, allow us to be the right partner for our clients, whatever their needs for seismic and vibration protection.

need



Solutions for seismic isolation

DOSHIN RUBBER offers a full range of devices for seismic isolation of structures and components, including advanced, cost-effective systems for the protection of lightweight structures, electrical, medical and manufacturing process equipment as well as artworks..

Solutions for energy dissipation

DOSHIN RUBBER can provide passive devices for energy dissipation and damage control in building structures. Doshin's energy dissipation devices absorb energy from earthquakes or wind and can be installed in either newly constructed or retrofitted buildings.

Solutions for non-structural components

Continuous investments in research allows **DOSHIN** to offer a set of innovative, rubber-based, systems for damage reduction in architectural elements (infills, panels etc.), building utility systems and building contents.

Solutions for vibration

Solutions for vibration control of structures and components to traffic and environmental induced excitations



The benefits of proper protection from earthquake

Base isolation offers important advantages over conventional protection methods because it reduces the earthquake forces transmitted into a structure. Thus it protects not only the structure itself but also the contents and secondary structural features.

Base isolation reduces the economic impact of the

earthquake, allowing things to return to a normal life.

One of the most important and effective protection methods is seismic isolation at the base of the buildings: **DOSHIN RUBBER** offers products and technological solutions for **base isolation**.

Base isolation principles

Seismic (or base) isolation is a design technique that reduces the **force demand on structures** by isolating them from the damaging effect of the ground motion.

It functions primarily by **lengthening the period of the structure**. This approach contrasts with conventional design schemes that rely on inelastic actions of various structural elements to dissipate earthquake energy. It provides a level of performance well beyond the normal code requirements with potential for substantial life-cycle cost reduction.



Flexibility and energy absorption

Isolation is achieved with specially designed bearings placed between the building and its foundations that provide **flexibility** and **energy absorption capability** while supporting the weight of the structure. These bearings can be replaced if such need arises.

DOSHIN RUBBER High Damping Rubber Bearings (HDRB) form a simple and economical isolation system. The damping needed to limit the displacement of the structure and reduce the response at the isolation frequency is incorporated into the rubber compound, so that there is generally no need for auxiliary dissipation devices.

Maintenance-free lifetime

Natural rubber bearings enjoy a **maintenance-free lifetime**. They are highly resistant to contamination (for instance from dust) and to the elements. In fact natural rubber can be moulded over steel plates and the connection system of the bearings to protect them from corrosion. Oxidation in natural rubber is **only a surface effect**. For large components such as structural bearings or dock fenders historical data has confirmed that there is no concern in exposing the component to atmospheric conditions.



Rubber and steel

DOSHIN RUBBER'S HDRB consists of alternative layers of rubber and steel, made of specially formulated **high damping** rubber compound. The steel plates can greatly increase the vertical stiffness of the bearing: a ratio of around 800:1 between vertical and horizontal stiffness is typical. The plates enable the bearing to support the vertical load even under a large shear displacement. The bearing supports the design vertical load even with a shear deformation sufficient to produce **no overlap** between the top and bottom bearing endplates. A strong bond between the rubber and steel is critically important to the correct functioning of the bearing.

DOSHIN RUBBER can provide perfect bonding between rubber and steel. The rubber is specially formulated to give the damping required. The use of **high damping** rubber avoids the need for auxiliary dampers such as viscous or elasto-plastic steel dampers in the isolation system. **DOSHIN RUBBER** offers three different rubber compounds as standard:

- **soft compound**, with a low dynamic shear modulus (0,6 MPa)
- **normal compound**, with a medium dynamic shear modulus (0,9 MPa)
- **hard compound**, with a high dynamic shear modulus (1,3 MPa).

DOSHIN RUBBER CAN
DEVELOP ALTERNATIVE RUBBER
COMPOUNDS TO SATISFY
DIFFERENT DESIGN
REQUIREMENTS AND CAN
DESIGN SEISMIC ISOLATORS
TO ALL INTERNATIONAL
STANDARDS.



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