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**DOSHIN 3-DOF<sup>®</sup>**  
**EXPANSION JOINT**  
MODULAR TYPE

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## 1.0 INTRODUCTION

Doshin Modular Expansion Joint System is a mechanical device installed in between bridge decks. Its main function is to allow for smooth vehicular movement across expansion joint openings. This is achieved by employing the use of lamella beams which divides the expansion joint openings into smaller individual gaps. The lamella beams are connected by EPDM rubber that acts as a watertight seal that prevents debris and water from passing through bridge expansion joints openings and damaging the bridge deck and structures below.

## 2.0 ADVANTAGES

Doshin Modular Expansion Joints cater for expansion joints with movement range exceeding 80mm. The lamella beams work in series to accommodate the thermal expansion and contraction of bridge decks thus protecting it from damage.

The structural elements are made of superior and long lasting quality materials. All our products meet the stringent requirements of ISO 9001:2001 quality assurance requirements.

Doshin Modular Expansion Joints are highly durable, have no loose or moving steel parts thus totally eliminating it from damages due to frequent load changes. Lubricated PTFE, high-grade stainless steel, elastomeric components and plastics plays a part in enabling the movement of the Doshin Modular Expansion Joints.

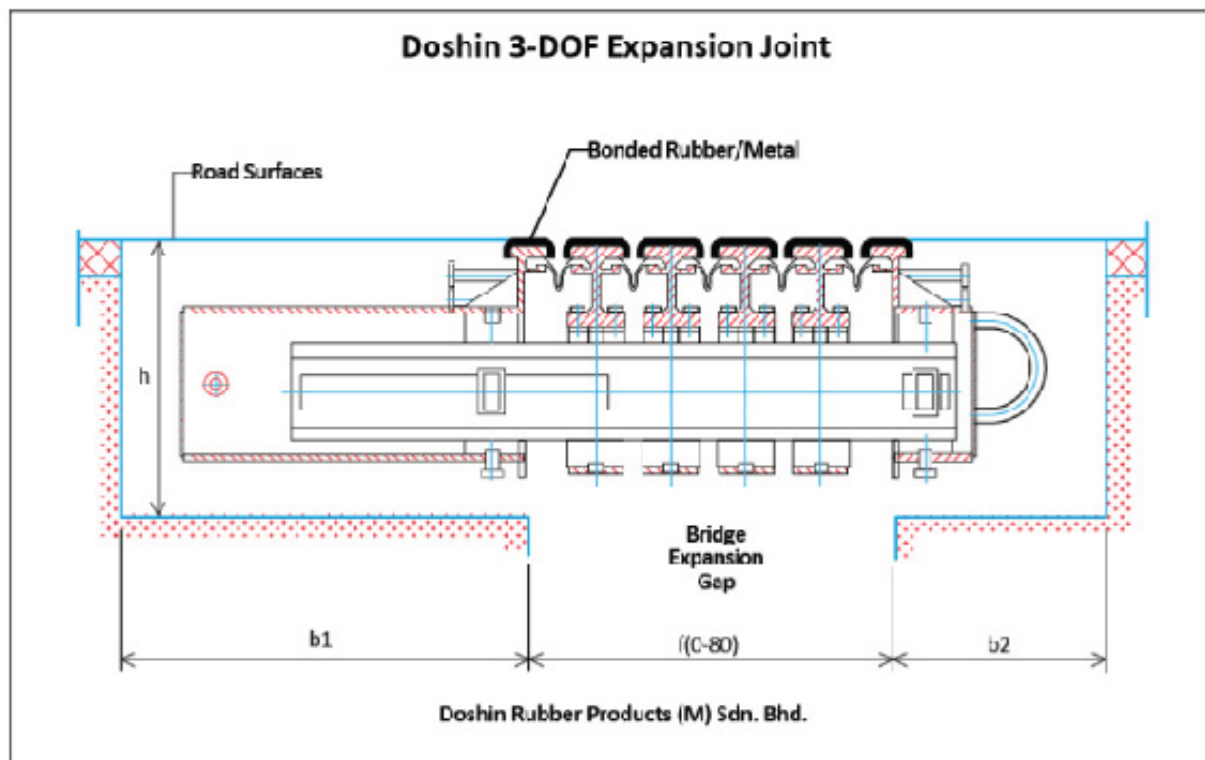


Doshin Modular Expansion Joint



Doshin Modular Expansion Joint

### 3.0 DESIGNATIONS OF TYPES



Type & Size	Max. range of movement (mm)	Recess Space (mm)			Joint Width (mm)				Weight (kg/m)
		$b_1$	$b_2$	$h$	$f_0$	$f_5$	$f_{65}$	$f_{80}$	
3-DOF 1	80	200	200	150	130	135	195	210	100
3-DOF 2	160	400	300	400	140	150	270	300	155
3-DOF 3	240	480	300	400	220	235	415	460	235
3-DOF 4	320	560	300	400	300	320	560	620	335
3-DOF 5	400	640	300	420	380	405	705	780	415
3-DOF 6	480	720	300	420	460	490	850	940	515
3-DOF 7	560	800	300	420	540	575	995	1100	595
3-DOF 8	640	880	300	440	620	660	1140	1260	695
3-DOF 9	720	960	300	460	700	745	1285	1420	785
3-DOF 10	800	1040	300	480	780	830	1480	1580	895

## 4.0 CHARACTERISTICS

### 4.1 MOVEMENTS

Doshin Modular Expansion Joints allow movement in all 3 directions ( $u_x$ ,  $u_y$ ,  $u_z$ ) and rotations about all 3 axes ( $f_x$ ,  $f_y$ ,  $f_z$ ).

Large movements in the bridge's transverse direction ( $u_y$ ) and vertical direction ( $u_z$ ) of both the lamella beams and the cross beams are made possible due to the consistent elasticity of the support system.

### 4.2 PRINCIPLE OF ELASTICITY

Highly advanced spring and damping system is incorporated in the modular expansion joint design due to its ability to reduce dynamic stresses thus protecting the joints and structural elements from excessive damage due to traffic movement.

### 4.2 MOVEMENT CAPACITY

The maximum movement capacity in all 3 directions ( $u_x$ ,  $u_y$ ,  $u_z$ ) of Doshin Modular Expansion Joints, and the angle permitted between the movement direction and its joint axis, are presented in the table below.

Type	Number of Gaps	Max. Longitudinal Movement (mm)	Max. Transverse Movement
			Standard Design (mm)
3-DOF 1	1	± 40	± 12
3-DOF 2	2	± 80	± 12
3-DOF 3	3	± 120	± 12
3-DOF 4	4	± 160	± 12
3-DOF 5	5	± 200	± 12
3-DOF 6	6	± 240	± 12
3-DOF 7	7	± 280	± 12
3-DOF 8	8	± 320	± 12
3-DOF 9	9	± 360	± 12
3-DOF 10	10	± 400	± 12

Standard Design: Standard joint with limited transverse movement capacity  
 Special Design: Available upon request

## 5.0 QUALITY

### 5.1 PROOF OF QUALITY

Doshin Modular Expansion Joints are durable, long lasting and can withstand heavy traffic conditions for years without showing any signs of damage due to overuse. It has been successfully used for decades internationally.

### 5.2 PARTS AND CORROSION PROTECTION

Principal components of Doshin Modular Expansion Joints and their material designation:-

- S355 steel lamella and cross beams
- EPDM or CR sealing profiles
- Rubber control and sliding springs from elastomeric material
- Sliding bearings from special elastomeric material and PTFE
- Special sliding material used for joints in highly stressed situations

The following standard corrosion protection is used for all exposed steel components:-

- SA 2.5 sandblasting
- 50µm zinc metal spray galvanizing
- two 40µm layers of top coat

### 5.3 PRODUCT TESTING

An independent laboratory will test the dynamic performance indicators of the system as a whole, such as spring characteristics and damping effects for movement capability in all three axes.

All the components used in Doshin Modular Expansion Joints have been thoroughly tested for durability.

## 6.0 DESIGN DETAILS

### 6.1 RECESS SPACE

The designer should determine the size of the recess space during the initial planning stage.

Measurements should be taken again and verified before assembly of the Doshin Modular Expansion Joint commences.

### 6.2 SUPPORT SYSTEM

Every lamella beam is supported on each joist beam via a joist frame (see cross-section A-A) which can move on elastically pre-stressed sliding components along the joist beam. The joist beam is similarly supported at the entrance to the joist box, allowing the joist beam to slide into and out of the joist box. The entire system is thus elastically fixed and free to move.

## 7.0 BRIDGE CONNECTION

### 7.1 REINFORCEMENT BAR ARRANGEMENT

The connection reinforcement is to be designed according to the rules of reinforced concrete construction. The anchor loops on the edge profile are normally attached perpendicular to the expansion joint. As a result, the structure's reinforcement should be placed parallel to the anchor loops. Additional reinforcement should be provided underneath the joist boxes due to the higher loads arising here.

## 8.0 ASSEMBLY, INSTALLATION AND MAINTENANCE

### 8.1 ASSEMBLY AND INSTALLATION AT SITE

The Doshin Modular Expansion Joint is assembled into a completely working unit in the factory. It is then transported to site. Before installation, the expansion joint width needs to be checked and verified first. Using a crane the expansion joint is then gently lowered into the recess area and secured in place by welding. Once welding work has been completed, formwork is fitted on the edge profiles and braced against the joint edges. High-strength concrete is carefully poured into the recess space. It is then compacted and levelled, and treated to prevent shrinkage. Utmost care should be taken to ensure that no concrete is allowed to get into the joint boxes.

### 8.2 MAINTENANCE

It is recommended that an annual inspection of the joint be carried out for the Engineers to identify and repair any possible damage. The Engineers should also look out for signs of corrosion and the water tightness integrity of the EPDM rubber.

## 9.0 CUSTOMER SUPPORT

Our product specialists will be pleased to entertain all of your product inquiries and advise you in the selection of the optimal solution for your project, and to provide you with quotation. For more information, please get in touch with us at: 603-3290 5619 / 603-3290 5621.



## 10.0 PROJECT REFERENCE

### 10.1 PENANG FIRST BRIDGE



Doshin Modular Expansion Joint: 70 meters



### 10.2 SULTAN ABDUL HALIM MUADZAM SHAH BRIDGE (PENANG SECOND BRIDGE)



Doshin Modular Expansion Joint: 366 meters



### 10.3 BAYAN LEPAS EXPRESSWAY



Doshin Modular Expansion Joint: 40 meters



### 10.4 PULAU SEKATI, TERENGGANU



Doshin Modular Expansion Joint: 40 meters





## 11.0 OTHERS EXPANSION JOINTS AND SEALS

### 11.1 TYPES OF JOINTS

1. Elastomer Expansion Joints
2. Modular Expansion Joints (DOF)
3. Finger Joints (DFJ)
4. Compression Seals



movements up to 330mm



**UPTURN WITH SKEW JOINTS**




**MODULAR JOINTS**




**FINGER JOINTS**



**COMPRESSION SEALS**



**GO BEYOND LIMITS**  
**MAKE DREAMS REALITY**



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