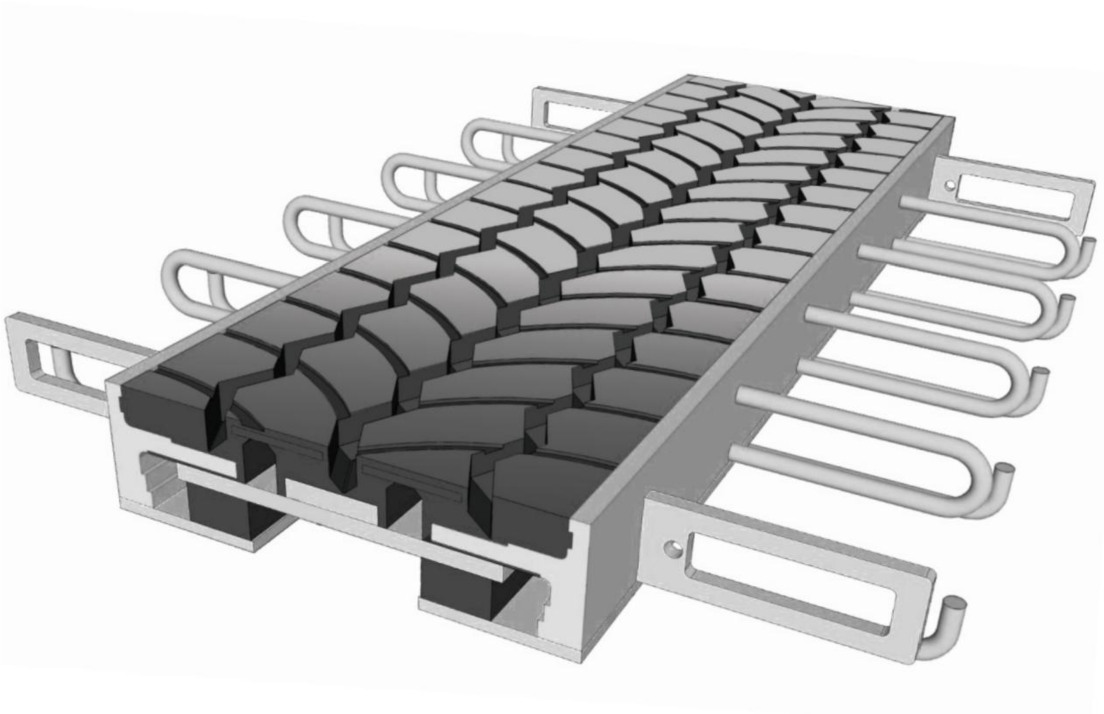
IEC mat Expansion Joint

IEC has supplied MAT Expansion Joint in numerous urban viaducts or flyovers in China, the picture reveals mat joint installed in flyover at Jiaomei Taihai Industrial park, Zhangzhou, Fujian,China in 2022

design principle

According to Europearn standard EOTA EAD 120110-00-0107, a mat expansion joint is comprised of an elastomeric element, such as a rubber mat, which includes a bridging plate and an accessory anchorage system. The surface of the mat is designed to be flush with the running surface of the bridge, ensuring smooth vehicle transitions while efficiently carrying traffic loads. The joint accommodates structural movements primarily through deformation of the mat, including compression, elongation, or shear. This design is particularly effective in absorbing and dispersing the forces exerted by traffic and environmental changes, ensuring the long-term performance and durability of the expansion joint.

IEC's mat expansion joints are engineered using high-performance rubber elastomers reinforced with metallic components. The rubber provides flexibility and resilience, allowing the joint to absorb deformations up to 200mm. Meanwhile, the embedded steel reinforcements are designed to withstand significant vertical loads, ensuring structural stability and load-bearing capacity. Each mat joint is manufactured in 1-meter sections, facilitating easier future replacement and maintenance without extensive disruption to the bridge structure. This modular design offers practical benefits, including reduced installation time and enhanced durability in high-traffic areas.

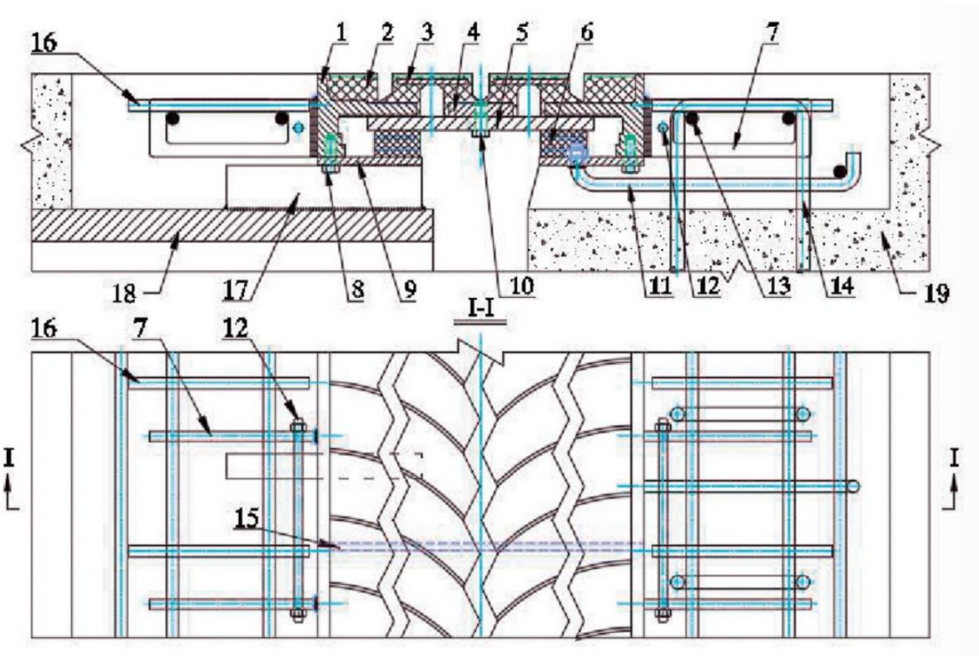


An 3D view of IEC mat expansion joint, E-flex series

To anchor the mat expansion joint securely to the bridge deck, IEC employs a robust system that combines steel plates and loops. These components are welded to the side vulcanized steel plates of the joint, which are then fixed to the bridge deck's reinforcing rebar. This method provides a highly secure connection, ensuring that the joint remains stable under the stresses of heavy traffic and varying environmental conditions. Such anchorage systems are commonly utilized in modular expansion joints and have proven effective in maintaining long-term structural integrity.

This approach not only enhances the lifespan of the joint but also ensures ease of replacement and maintenance, making IEC's mat expansion joints a reliable and efficient solution for modern bridge infrastructure. Additionally, the combination of rubber's flexibility and steel's strength results in a highly versatile joint capable of withstanding both vertical and horizontal movements, ensuring optimal performance under dynamic load conditions.

mat joints produced at IEC



1. Lateral steel beam
2. High-strength rubber
3. Reinforced steel plate
4. Reinforced steel plate

5. Support bearing
6. High-damping vibration-absorbing rubber bearing
7. Anchoring steel plate
8. fixing bolt
9. bearing bottom steel plate
10. fixing bolt
11. Anchoring rebar
12. tightening rod
13. reinforcing rebar mesh
14. Pre--embedded rebar
15. Segment end locking joint
16. reinforcing rebar mesh
17. Support block
18. Steel-beam blockout
19. Concrete-beam blockout

Materials

(1) Elastomeric Mat:

- The primary component of the joint, made from high-performance rubber elastomers reinforced with steel. This allows the joint to absorb movements through compression, elongation, and shear forces.
- The rubber mat also includes a **bridging plate**, which is flush with the bridge surface, ensuring smooth transitions for vehicles over the joint.

(2) **Steel Reinforcements**:

- Embedded within the rubber mat to provide structural strength. These reinforcements ensure the mat can bear significant vertical loads, making it suitable for high-traffic areas.
- The steel reinforcement is designed to work in combination with the rubber to provide both strength and flexibility, ensuring durability under heavy loads.

(3) **Anchorage System**:

- The mat is securely anchored to the bridge deck using a system of **steel plates and loops**, which are welded to the side steel plates of the joint. These plates are then fixed to the bridge deck's reinforcing rebar.
- This robust anchorage system ensures that the joint remains stable under heavy traffic and varying environmental conditions.

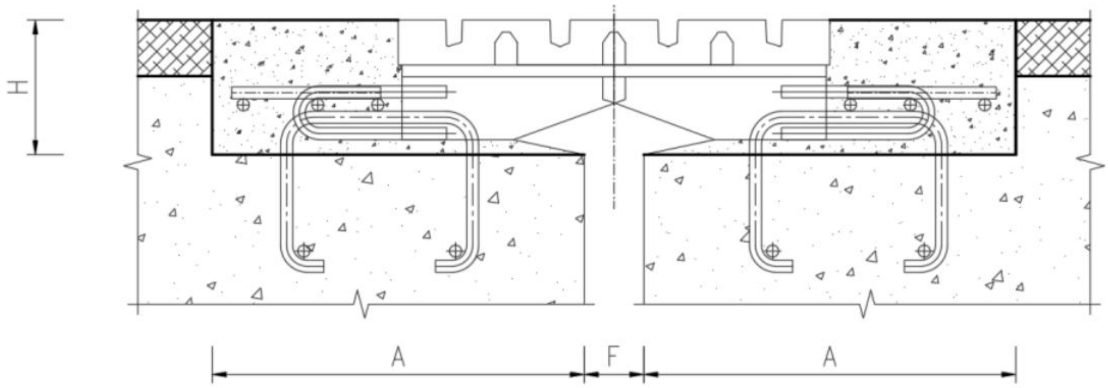
Performance requirement of of Elastomer properties (Chloroprene Rubber)

Properties	ASTM Test	Norm
Hardness (Shore A Durometer)	ASTM	63±5

	D2240-04	
Tensile Strength, Min. （Mpa）	ASTM D412	20
Ultimate elongation at break,min %	ASTM D412	550
Oven aging, 96h at 70℃		
Hardness, type A durometer, points change	ASTM D573	-5 ~ +10
Tensile strength, loss, max %	ASTM D573	15
Elongation, loss, max %	ASTM D573	20
Oil Swell 168 h@23℃		
Max. Volum change (%)	ASTM D471	-10
Max. hardness change (%)	ASTM D471	-10
Ozone resistance (50pphm, 20% strain, 40℃ at 96h)	ASTM D1149	no crack
Compression set (aged 24h@70℃), max %	ASTM D395	25
Brittleness -40℃	ASTM D746	-40℃
peeling strength between rubber and steel shim,N/mm		12

items		unit	Elastomer in the high-damping rubber bearing	Elastomer body-expansion and contraction	Elastomer surfacing layer -contact with traffic
hardness		IRHD	60±5	60±5	63±5
tensile strength		MPa	≥18	≥18	≥18
elongation at break		%	≥650	≥550	≥550
Fragile temperature		℃	≤-40	≤-40	≤-40
permanent deformation in compression (23℃，24h, 25%)			≤60	≤20	≤20
Ozone resistance (50 pppm, 20% elongation, 40℃x 96h)			No crack	No crack	No crack
change in oven aging, 96h at 70℃	Tensile strength loss, max	%	≤15	15≤	15≤
	Elongation loss, max	%	≤20	≤20	≤20
	Hardness	IRHD	-5～+10	-5～+10	-5～+10
peeling strength (rubber-steel)		N/mm	≥10	≥12	≥12
change in Oil Swell 168 h@23℃	Volum	%	<+40	<+15	<+15
	hardness	IRHD	<-25	<-20	<-10

Technical data



Section view

model	movement (mm)			beam gap(mm)	Block-out size(mm)
	longitudinal		transversal		
	expansion	contraction			A
E-FLEX80	45	35	±24	100±10	450
E-FLEX120	70	50	±36	140±10	450
E-FLEX160	90	70	±48	180±10	500
E-FLEX200	110	90	±60	250±10	500

Merits of IEC Mat Expansion Joint:

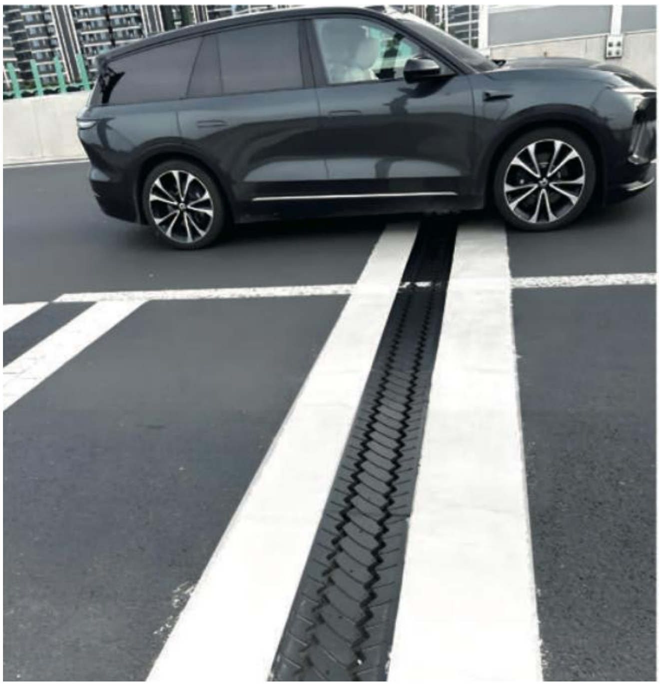
- **Combination of Strength and Flexibility:**
  IEC mat expansion joints are designed to harness the benefits of both steel and rubber, combining the robust load-bearing capacity of steel plates with the flexibility of rubber. The steel reinforcements provide structural strength, while the elastomeric rubber absorbs deformations caused by traffic and environmental changes, ensuring the joint can withstand significant stress without compromising performance. This synergy between materials enhances the durability and longevity of the joint under heavy loads.
- **Superior Driving Comfort:**
  The mat expansion joint features rubber-to-rubber contact when vehicles pass over the joint, significantly reducing the impact felt by the vehicle. This design minimizes vibrations and shocks, providing smoother driving conditions, particularly in high-traffic areas. The flexibility of the rubber effectively absorbs the energy generated by moving vehicles, improving overall driving comfort and reducing wear and tear on both the bridge and the vehicles themselves.
- **Enhanced Safety with Anti-Slip Surface:**
  To further improve driving safety, the surface of the mat joint is engineered with an anti-slip design. This feature provides increased traction, especially in wet or slippery conditions, helping prevent accidents caused by reduced tire grip. The

anti-slip surface enhances the joint’s functionality and ensures safer driving experiences for all vehicles, even in adverse weather conditions.

- **Accommodates Multi-Directional Movements:**
  One of the key advantages of IEC’s mat expansion joint is its ability to handle movements in both horizontal and vertical directions. The joint’s flexibility allows it to accommodate structural shifts caused by thermal expansion, contraction, and the dynamic forces of traffic, ensuring seamless operation under a variety of load conditions. This capability makes the joint ideal for bridges that experience significant movement or deformation due to traffic loads and environmental changes.
- **Waterproof and Replaceable Design:**
  The joints are connected by durable rods that ensure structural continuity and waterproofing, protecting the underlying bridge structure from water ingress. This waterproof feature is crucial for preventing damage caused by moisture and ensuring the long-term integrity of the bridge. Additionally, the modular design of the mat joint allows for practical replaceability, making future repairs or replacements more efficient and less disruptive to traffic. This design helps extend the lifespan of the joint while reducing maintenance costs.

Installation and maintenance

Consult IEC engineers for more information.



A car is passing through mat joint which IEC has supplied and installed at viaduct in Taiwanese Industrial Park, Zhangzhou, Fujian Province, China

Suitable applications

Mat expansion joints are ideal for accommodating structural movements in bridges and other infrastructure subjected to dynamic loads and environmental variations. These joints are made from elastomeric materials, such as neoprene or blends of rubber compounds, offering durability, flexibility, and resistance to weathering. Below are specific applications where mat expansion joints are most suitable:

- **Road and Highway Bridges**

  Accommodates thermal expansion and contraction, vehicular loads, and vibrations.Suitable for short to medium-span bridges where movements are moderate.

- **Pedestrian Bridges**

  Provides smooth transitions for pedestrian traffic with minimal maintenance.Ensures slip resistance and comfort for walkers.

- **Parking Structures**

  Handles structural movements caused by temperature changes and load fluctuations.Resistant to oils, chemicals, and weather exposure.

- **Urban Rail and Light Rail Bridges**

  Absorbs vibrations and dynamic loads caused by trains.Prevents noise transfer and wear at expansion joint interfaces.

- **Flyovers and Elevated Roads**

  Provides continuity of the driving surface while accommodating horizontal and vertical movements. Offers protection against joint sealing material degradation from traffic loads.

- **Low-Movement Structures**

  Effective for bridges with minimal displacement or expansion due to thermal variations. Economical and durable for less demanding applications.

- **Extreme Weather Conditions**

  Suitable for regions with significant temperature fluctuations, such as deserts or cold climates. The elastomeric material remains functional over a wide range of temperatures.

- **Structures Requiring Low Noise Levels**

  Ideal for urban areas or residential neighborhoods where noise from vehicular movement must be minimized.