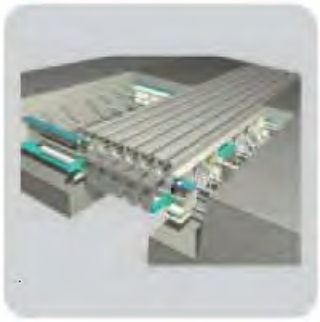
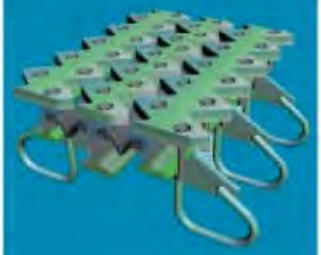
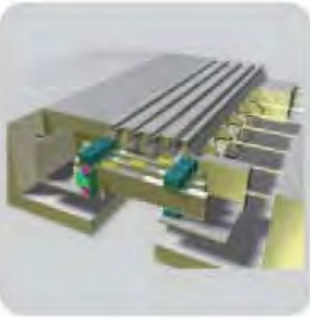



EBT INTERNATIONAL PTE LTD

Expansion Joints

About us

EBT is a professional products and solutions provider in the specialised fields of bridge devices, seismic isolation and vibration control. Our comprehensive range of products include bridge bearings, expansion joints, dampers, prestressing anchorages and other structure–related products cater for the construction industry.

Our recent focus of activities has been the provision of consultancy services in response to the increasing market demands. Apart from committed in R&D by ourselves and absorb advanced technology from Germany, we've also leveraged on our close collaboration in R&D activities with Shanghai Tongji University. Therefore, EBT has gained a reputation as the inventor of various patented products and solutions provider for sophisticated case studies.

Complete with a team of highly competent technicians and engineers, our delivery of a comprehensive and diligent customer support is never compromised. EBT has been constantly engaging a panel of both local and foreign experts for advice in further optimisation of our product's capabilities.

Today, EBT is one of the Asia's premier players in the highly competitive bridge, construction industry. Embrace with a clear company vision, we're now ready to propel forward and take on a much bigger role in the international arena.

Vision

EBT aims to be a world class preferred partner in the specialised fields of bridge devices, seismic isolation and vibration control.

Mission

To be the leading provider of products and solutions with enhanced priority in diligent customer support.

SSFB SERIES BRIDGE EXPANSION JOINTS

INTRODUCTION

The SSFB series expansion joints are featured by simple and reliable structure, long service life, convenient in installation and maintenance, with superior compression and expansion properties. The unit modulus for multi-joint is 80 mm, and the movement can be selected as per the integral multiple of 80 mm according to the actual need of the bridge. Single cell expansion joint can be classified into three types, including 40, 60 and 80. which use various anchoring bar to suitable for different installation recess of bridges.

The SSFB series expansion joint is suitable for various bridges, such as straight bridges, curved bridges, skew bridges and slope bridges.

For the structure of multi-cell joint, see the right figure.

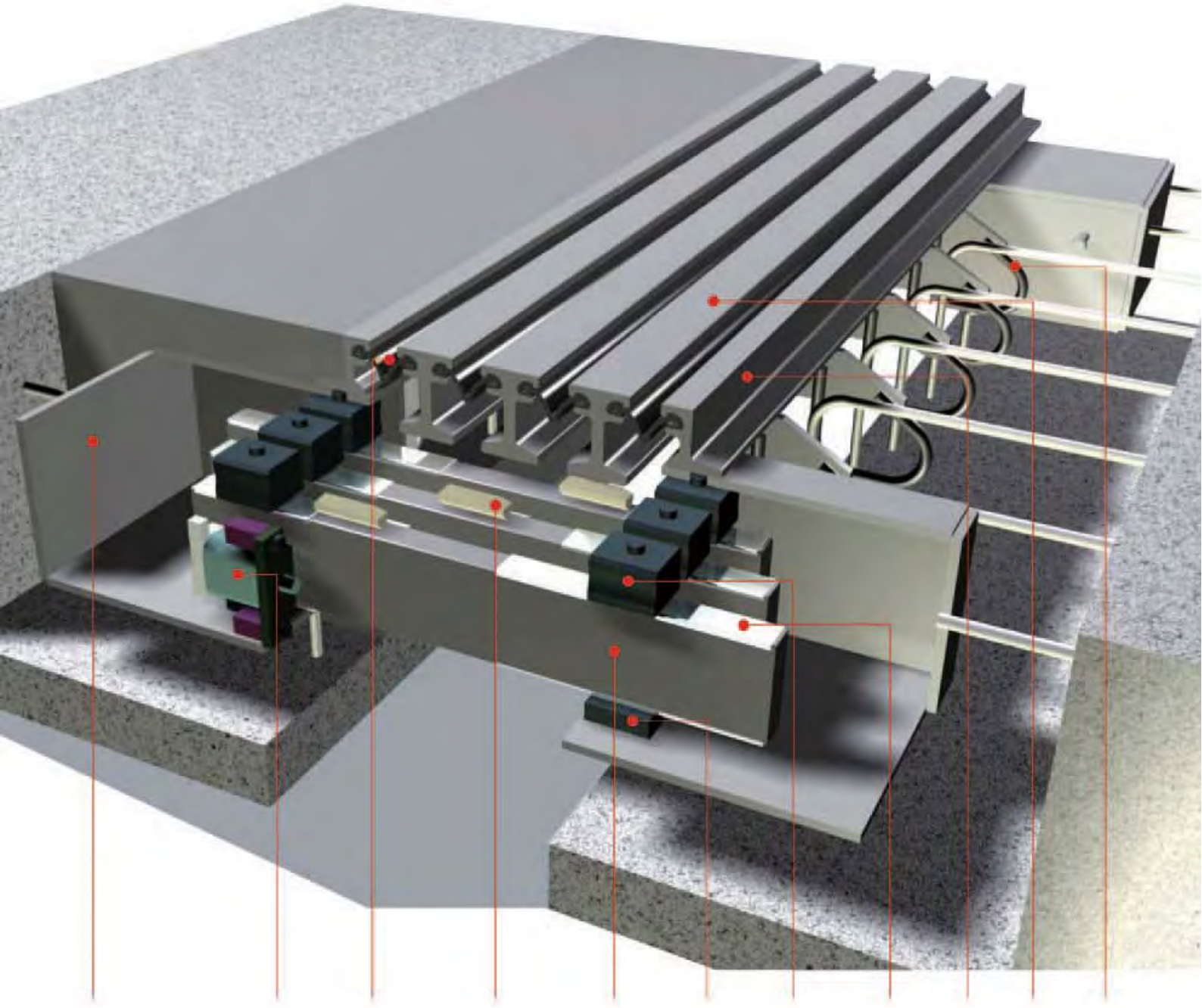
STRUCTURE CHARACTERISTICS

1. Section steel is integrally hot-rolled and the cavity of which is shaped by machining, thus it has good integral, effect, and high fatigue and impact resistance .Spigot are provided on the section steel to install the waterproof rubber band.

2. The control spring made of polymer materials has superior compressibility(compressive deformation rate is up to 80%)and resilience performance (after removing the pressure, it will restore immediately), high tensile strength, superior impact elasticity, and high longitudinal and transverse deformation performance. Meanwhile, the spring can buffer the impact and reduce the noise.

3. The load transfer system composed of compressive bearing, sliding bearing and the control spring can smoothly transfer the expansion force from the bridge to the joint to make each gap uniform while the resistance to displacement is minimized.

4. Water-proof rubber band made of chloroprene rubber is pressed into the cavity of section steel by special tool, so it has superior water-proof property and can adapt to the variation of structure.


Displacement control box
Control spring
Water–proof rubber stripe
Connecting piece of medial sill
Supporting sill
Sliding bearing
Pressing bearing
Stainless steel plate
Side sill
Medial sil
Anchor bar

SPECIFICATIONS AND MODEL

Model: SSFB-E §

- § — Different expansion joint types of the same movement. Currently classified as Type A,B and C expansion joints for displacement of 160mm or lower.
- E — Movement
- SS — Series code of expansion joint
- SSFB — Abbreviation of expansion joint in Chinese Pinyin

Specifications: SSFB series expansion joints are divided into 12 classes by the movement: 40mm、60mm、80mm、160mm、240mm、320mm、400mm、560mm、640mm、720mm and 80mm.

PERFORMANCE PARAMETERS

Applicable standard: JT/T 327-2004 Highway Bridge Expansion and Contractioninstallation, AASHTO – American Association of State Highway and Transport officialsand and BS5400 Standard

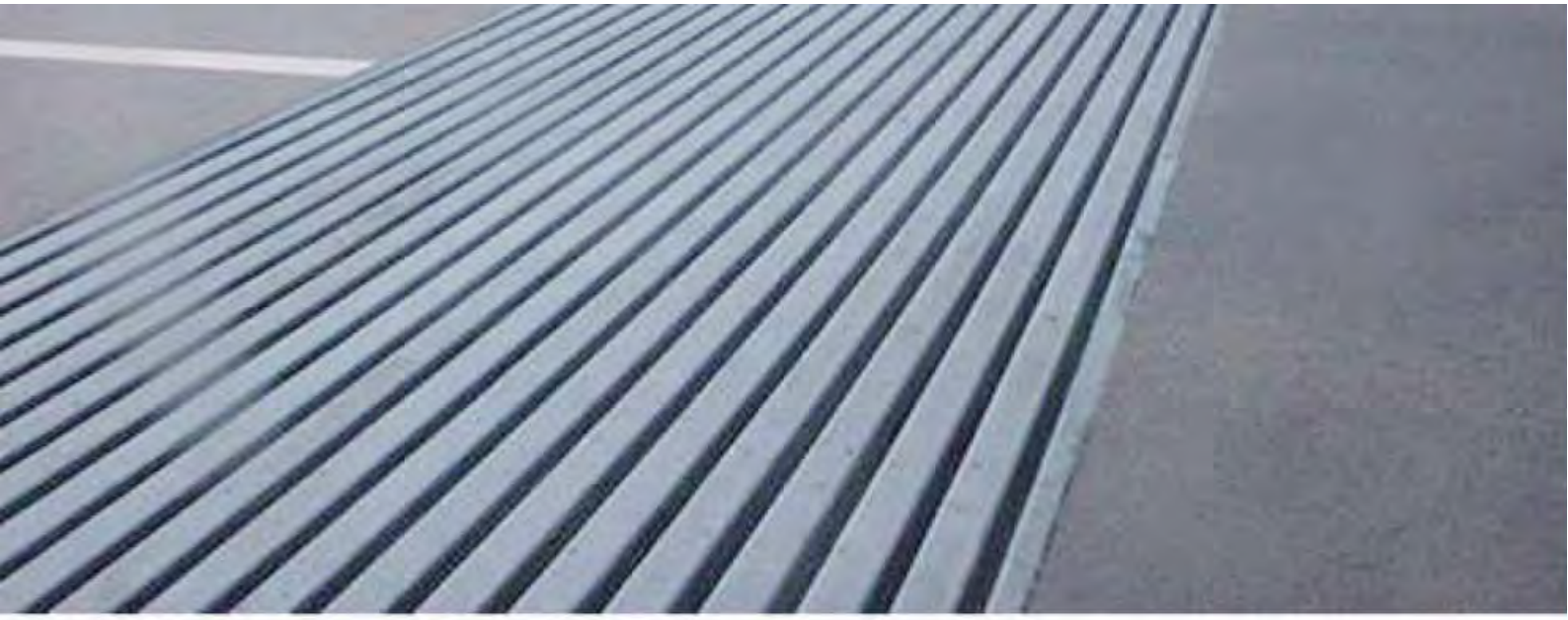
Design load: Class I highway load

Resistance to expansion: 4kN/m

Displacement: O~E mm (where, E means the movement of expansion joint of each class)

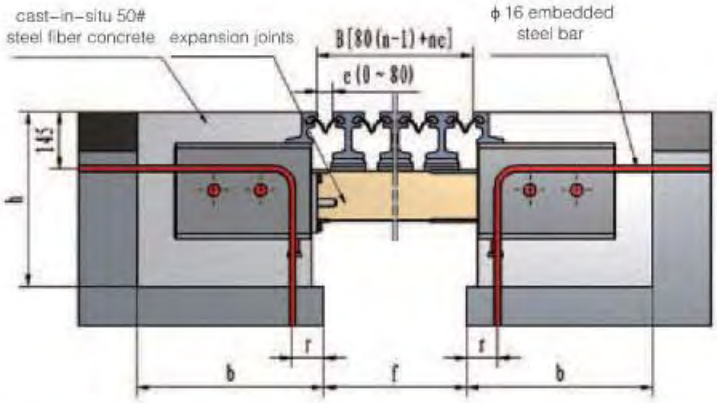
Plane turning angle: ±0.02 rad

Elevation turning angle: ±0.02 rad



INSTALLATION SIZE

The installation size for multi–cell joint for movement of more than 80 mm is as follows:



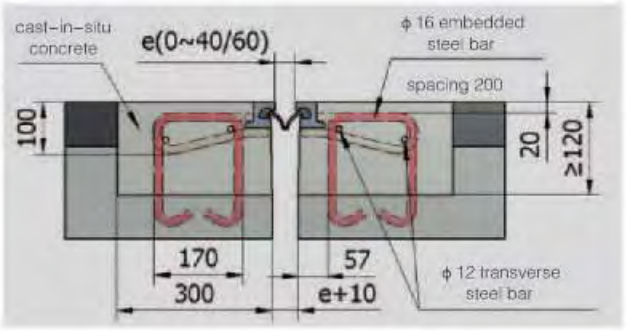
Model	Movement mm	No. of cell n	Gap of beam end f(mm)	Size of recess		
				Recess		Place of steel bar r(mm)
				h(mm)	b(mm)	
SSFB160A	160	2	160	400	350	60
SSFB160B	160	2	160	240	350	60
SSFB160C	160	2	160	200	350	60
SSFB240	240	3	280	420	440	60
SSFB320	320	4	400	450	525	70
SSFB400	400	5	520	470	690	70
SSFB480	480	6	640	470	780	90
SSFB560	560	7	760	500	870	90
SSFB640	640	8	880	500	960	90
SSFB720	720	9	1000	520	1050	90
SSFB800	800	10	1120	520	1140	90

Note:

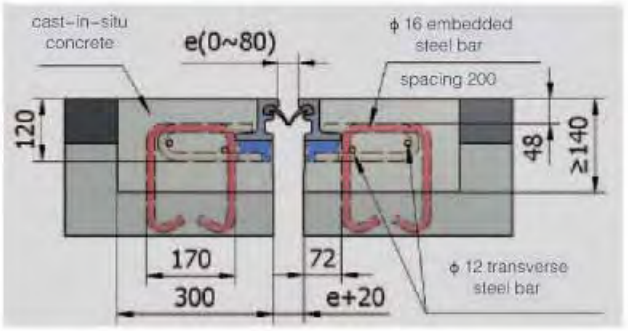
a. Value f in the table is the beam end gap corresponding to the medial temperature.

b. If an expansion joint is needed at sidewalk or railing, we can provide special design solution on request.

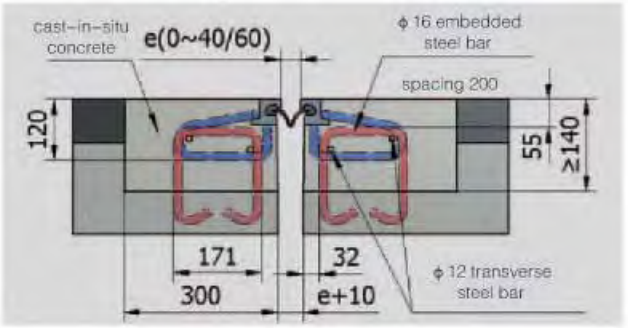
The single-cell joint with movement of less than 80mm consists of side sill, water-proof rubber band, anchor bar, etc. For structure and installation size of single-cell joint of each model, see the figure below.



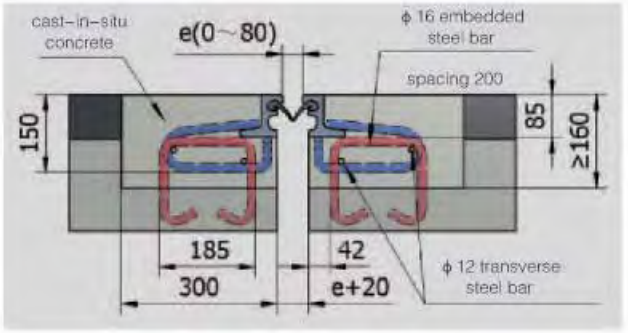
Installation diagram for SSFB40A/60A joint



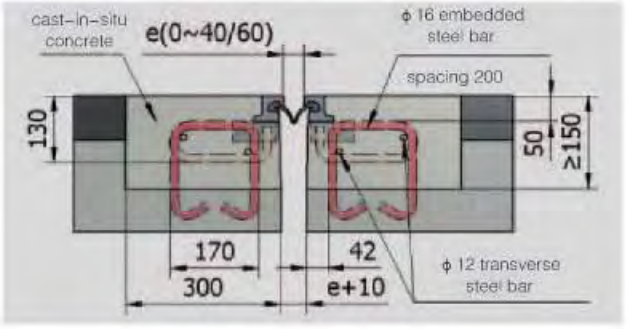
Installation diagram for SSFB80A joint



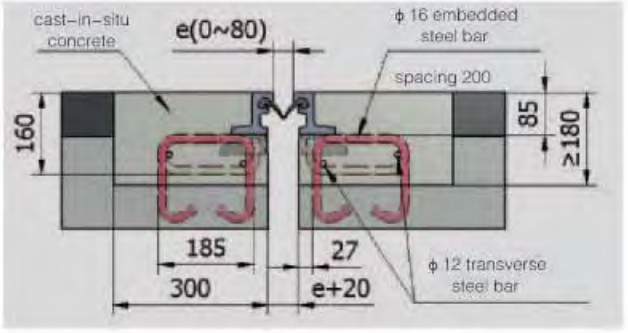
Installation diagram for SSFB40B/60B joint



Installation diagram for SSFB80B joint



Installation diagram for SSFB40C/60C joint



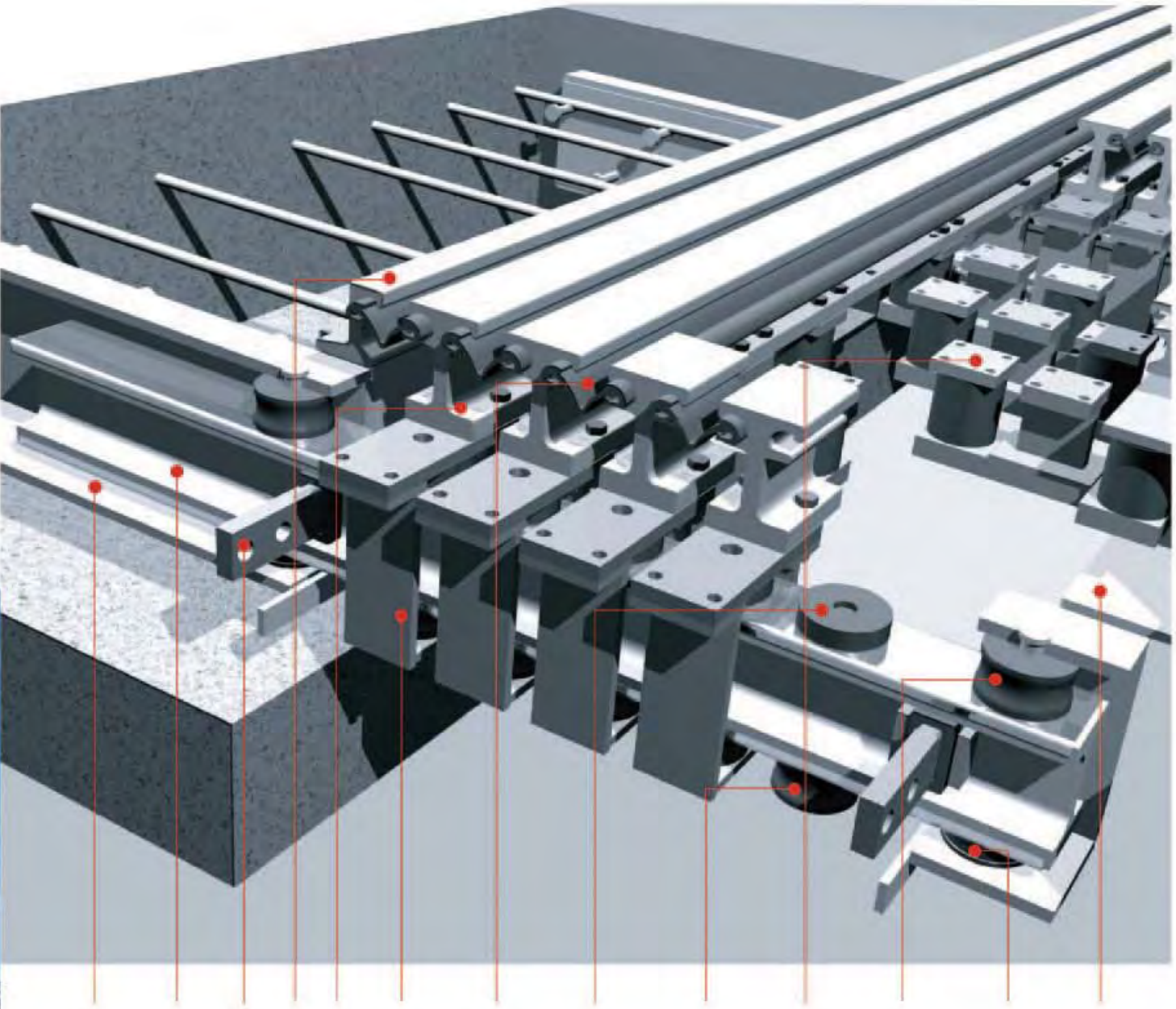
Installation diagram for SSFB80C joint

SSFC SERIES BRIDGE EXPANSION JOINTS

INTRODUCTION

SSFC series bridge expansion joint is a homemade product developed by our company through introducing, digesting and absorbing the patent technology of. Swiss when our company undertook major introduction, digestion and absorption (a coordinated process) projects during the national 8th five-year plan.

The SSFC series expansion joint is designed based on anti-fatigue principle of the dynamics and uses elastic bearing system and independent displacement control system. It has many advantages, such as small installation size, adaption to 3D displacement of bridges, long service life, comfort for driving, and convenient maintenance. This product has been used in various highway bridges, especially suitable for those bridges with extra large movement, such as suspension bridges, cable stayed bridges and continuous concrete.


Supporting box
Supporting sill
Guide block
Side sill
Medial sill
Supporting frame
Water–proof rubber stripe
Upper supporting of the medial sill
Lower supporting of the medial sill
Displaoement system
Upper supporting of the side sill
Lower supporting of the side sill
Displaoement box

TECHNICAL ADVANTAGES

● Good adaption to 3D movement of bridge

Using spherical bearing for bearing the supporting sill can effectively suit the 3D movement of the bridge due to temperature difference, load, shrinkage and creep of concrete, earthquake, wind force and settlement of pier or abutment. This structure is especially suitable for bridges designed based on floating system.

● The structural dimensions are greatly reduced compared to other types of expansion joints to benefit the design of bridge structure

With an independent displacement control and load transfer system applied, the bearing box is designed with a relatively fixed end and a relatively movable end, the structural dimensions are smaller,and more space is provided to improve the anchoring design, thus effectively improving the anchoring performance between the expansion joints and the bridge and facilitating the bridge design.

● Independent movement control and load transfer system

The supporting sill that transfers impact load is parallel to the main movement direction. This design can avoid bearing other additional load. The independent movement control system has superior flexibility and adaption. If single gap cannot be contracted due to blockage, other cells are not affected and can be used still.

● Long service life

The whole system of SSFC series expansion joint is designed based on the anti-fatigue principle. All parts which bear impact force are connected by high-strength bolts with locking device, so as to avoid fatigue failure caused by welding stress and facilitate future maintenance and part replacement. The pre-pressed elastic bearing can effectively buffer and damp the impact load from the vehicles under any conditions and protect surrounding structures and supporting sill to prolong the service life of all parts.

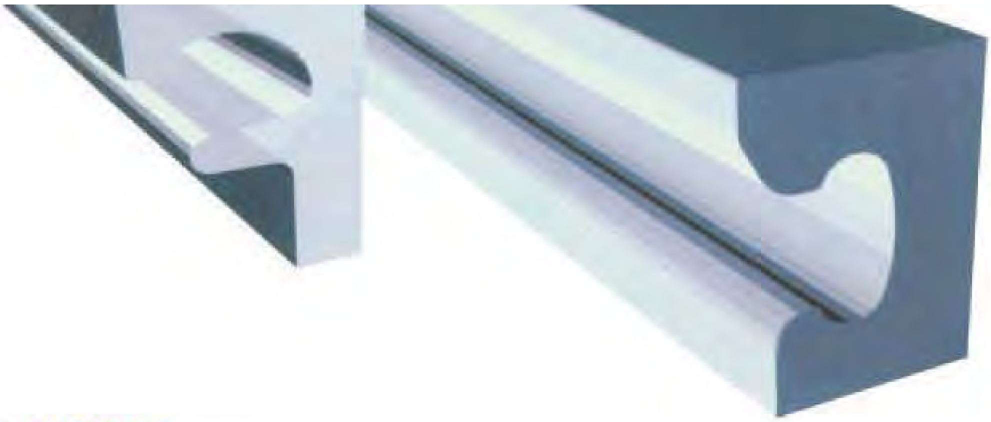
Moreover, SSFC series expansion joint adopt parallel sill structure to make the displacement of the bridge equal to the sliding distance of sliding device joint of, thus the service of life this joint is 30%~40% longer than that of joint with Oblique Structure.

● Earthquake resistance

Because of elastic system, the elastic elements have good damping function. In case of earthquake, the expansion joint will not be damaged for excessive rigidity between the girder body and the pier or abutment.

● Rigorous waterproof performance

Multi-point pre-pressed waterproofing measure is used for the water-proof rubber band of SSFC series expansion joint to completely prevent water from leaking onto the lower structure of the expansion joint like girder body.



WORKING PRINCIPLE

A relative movement between the girders or between girder and pier (abutment) cannot be avoided due to such factor as temperature difference, load, wind force, and shrinkage and creep of concrete. However, SSFC series expansion joint is constructed to suit this movement with superior performance.

●SPECIFICATIONS AND MODEL

Model: SSFC–E §

- § — Different expansion joint types of the same movement. Currently classified as Type A (movable in one direction) and B(movable in two direction)
- E — Movement
- SSFC — Series code of expansion joint
- SSFC–E — Abbreviation of expansion joint in Chinese Pinyin

Specifications: SSFC series expansion joints are divided into 24 classes by the movement: 160mm, 240mm, 320mm, 400mm, 480mm, 560mm, 640mm, 720mm, 800mm, ……2000mm.

●PERFORMANCE PARAMETERS

Applicable standard: JT/T 327–2004 Highway Bridge, Expansion and Contraction Installation
AASHTO – American Association of State Highway and Transport officialsand and BS5400 Standard

Design load: Class I highway load

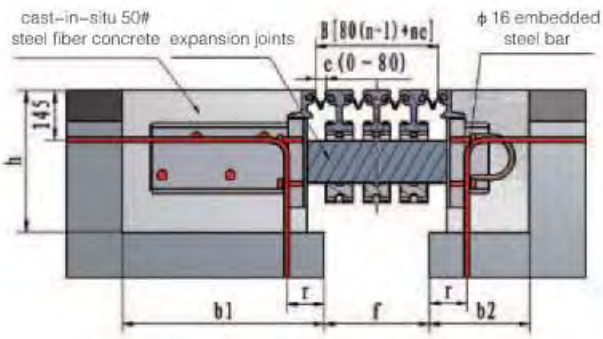
Resistance to expansion:4kN/m

Displacement:0~E mm (where, E means the movement of expansion joint of each class)

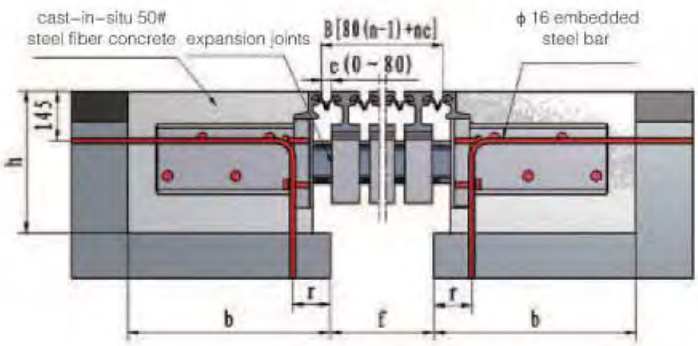
Plane turning angle: ± 0 06rad

Elevation turning angle: ± 0.06rad

●INSTALLATION SIZE



TypeA(movable in one direction)



TypeB(movable in two direction)

Model	Movement mm	No. of cell n	Gap of beam end f(mm)	Size of recess			
				Recess			Place of steel bar r(mm)
				h(mm)	b_1(mm)	b_2(mm)	
SSFC160	160	2	160	400	400	400	60
SSFC240	240	3	280	400	480	300	60
SSFC320	320	4	400	400	560	300	70
SSFC400	400	5	520	420	640	400	70
SSFC480	480	6	640	420	720	400	90
SSFC560	560	7	760	440	800	400	90
SSFC640	640	8	880	440	880	400	90
SSFC720	720	9	1000	480	960	400	90
SSFC800	800	10	1120	480	1040	400	90
SSFC880	880	11	1240	520	1120	400	90
SSFC960	960	12	1360	520	1200	400	90
SSFC1040	1040	13	1480	560	1280	400	90
SSFC1120	1120	14	1600	560	1360	400	90
SSFC1200	1200	15	1720	600	1400	400	90
SSFC1280	1280	16	1840	600	1520	400	90

Note:

a. Value f in the table is the beam end gap corresponding to the medial temperature.

b.If an expansion joint is needed at sidewalk or railing, we can provide special design solution on request.

c.For displacement over the above-mentioned value, we can provide special design solution on request.

d. In structure B,b=(b1+b2)/2.

●THE CUSTOMER SHOULD PROVIDE US WITH DETAILED INFORMATION ON DESIGN OF THE EXPANSION JOINT

① The cross section view of bridge at which the expansion joint is installed.

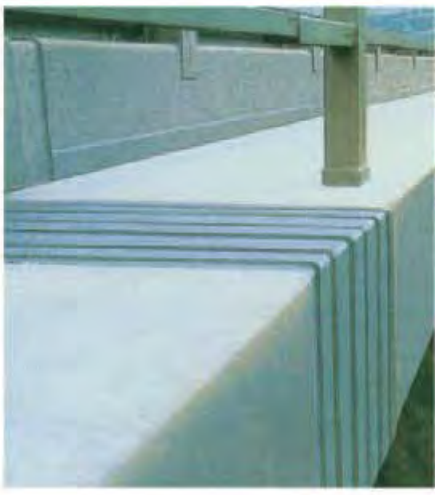
② The width of carriage way and the value of the transverse slope.

③ The included angle between the expansion joint and the direction of driving (the right front included angle).

④ The requirements for expansion joint at sidewalk or railing.

⑤ The approximate temperature range when installing, local daily mean Max.&Min.temperature, annual Max.& Min. temperature.

TYPE OF RAILING



BEJ SERIES BRIDGE EXPANSION JOINTS

BEJ expansion joint is a resin-bonded type which is domestically manufactured and developed by introducing the production and installation technology through cooperation between Britflex and our company.

BEJ expansion joint is a mechanical system composed of two section steel and a waterproof rubber stripe. The compound bonding the bridge and expansion joint is a patented product, this quickly cured and elastomeric compound is called "Britflex" resin.

Because the resin can firmly attach the expansion joint to the structure of bridge without any pre-embedded steel bar. The BEJ expansion join especially suitable for thin-wall girder and old joint transformation. The BEJ expansion joint has been widely used in the world, from the old London Tower Bridge to the modern bridge at the exit of the Tunnel across English Channel.

PERFORMANCE FEATURES

1.The connection between BEJ expansion joint and the girder body is bonding type, any alteration of bridge structure and embedded anchor bar are not needed.

2.The BEJ bonding resin can be quickly bonded and cured after installation, so that the traffic can be open to the public after three hours when the installation is finished.

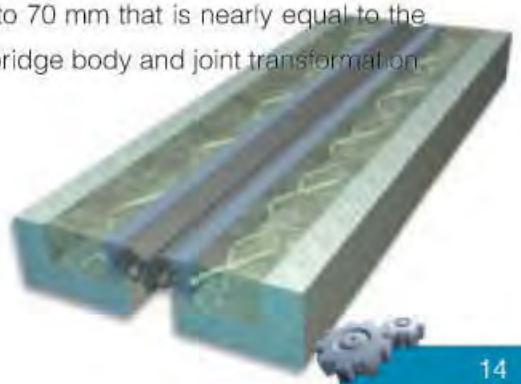
3.The BEJ bonding resin has high softening temperature and can not be softened in hot summer.

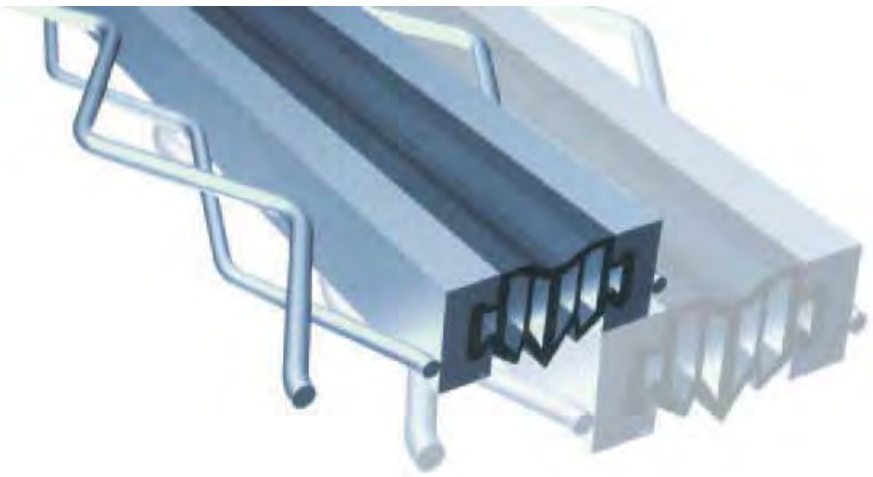
4.The BEJ bonding resin has high, wide bonding range and high bonding strength, so that the steel structure bridge and concrete bridge can be securely bonded with the expansion joint. The shear strength of the bonding area between the BEJ expansion joint and the concrete is greater than the strength of the concrete itself by test.

5.The BEJ bonding resin has high elasticity and cannot be shrunk and cracked after bonded with different materials.

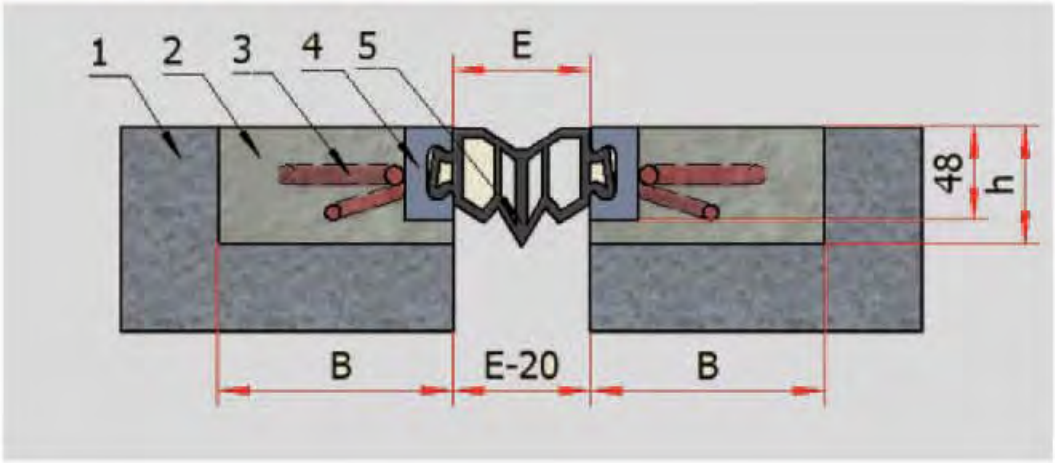
6.The BEJ bonding resin has high hardness and high wear resistance.

7.The BEJ expansion joints is compact in size, its installation depth is 60 to 70 mm that is nearly equal to the thickness of pavement of bridge deck. It is perfectly suitable for thin-wall bridge body and joint transformation.





SPECIFICATIONS AND MODEL



1–Girder; 2–BEJ Bonding resin; 3–Anchor bar; 4–Section steel; 5–Water–proof rubber band

Model	Movement		Size of single recess		Cap of expansion joints	Heighest temperature minimum gap	Lowest temperature maximum gap
	Horizontal	Vertical	B	h	E	Emin	Emax
BEJ3	35	±12	100	60	45	25	60
BEJ5	50	±15	120	60	55	30	80
BEJ8	80	±15	140	70	70	30	110
BEJ10	100	±15	160	70	90	40	140

Note:

1.The gap value E in the bable should be determined according to the actual average temperature of girder.To prevent the section steel of expansion joint from being suspended, the gap value shall be limited to E–20.

2.For the skew expansion joint, the movement can be increased 15mm.

TECHNICAL ADVANTAGES

● Onvenient bridge design

No embedded anchor bar is required for recess design, and no anti-cracking steel mesh is required for construction and placement. The structure is 60~70m in height and 100~160mm in width, which is especially suitable for thin-wall girder. The color of BEJ expansion joint can perfectly match the color of road surface.

● Convenient construction and high efficiency

The BEJ expansion can be bonded with no pre-embedded anchor bar used, thus greatly improving the construction efficiency. The resin mixture can be cured after three hours, and the road can be open to public when the strength of resin mixture reaches 90% the standard strength.

● BEJ expansion joint is environmentally friendly

The BEJ expansion joint will cause no affect to surrounding living or business activities. The BEJ expansion is compact in size and the noise is relatively small when vehicles passing. The resin mixture has high wear, shear and impact resistance, which is elastic and can absorbs noise generated by vehicles.

● Safe and comfortable driving

Since the BEJ expansion joint is compact in size, no noticeable feeling is produced when the vehicle is passing. In addition, the resin mixture is perfectly suit the variation of road surface so as to ensure the flatness of the road surface and enable safe and comfortable driving.

● Convenience of maintenance

The BEJ expansion joint has long service life and requires no maintenance or repair during operation, so that the maintenance cost is minimized. The expansion joint can be inspected or repaired without traffic interruption. In case of accidental damage to the expansion joint, the BEJ expansion joint can be replaced by sections or partially repaired and the road can be open to public in several hours.

INSTALLATION

● Requirements for recess:

The dimension of the recess shall be accurate, and the concrete base of which must be firmly and reliable, without any floating ash, mortar and water (if finding water, the recess shall be dried with flame before installation).

● Heating of resin:

There are two types of BEJ resin: basic resin and curable resin.

The basic resin and curable resin shall be heated respectively by the heating boiler. The heating process must be carried out carefully and evenly. When the temperature achieve the specified value, stop heating and insulate the resin.

INSTALLATION PROCEDURES

● Installation procedures

Positioning of steel sills is the important work that affects the entire quality of BEJ expansion joint and the steel sills shall be installed as follows:

① The steel sills shall be connected according to the road surface width, and the groove for welding shall be ground to flatness without 'dead corner'.

② The width between two steel sills shall be determined according to the actual gap between girder ends (The width shall be determined on the principle that a secure concrete foundation shall be provided at the bottom of the steel sill, otherwise the service life of expansion joint will be seriously influenced).

③ The steel sills shall be straightened with a secure concrete foundation provided at the bottom of the steel sill. Keep the steel sill straight as much as possible, in case of some sills cannot meet the requirement, arc section can be used for transition. The clearance of top of arc in transition area shall not more than 5mm/1.5m. If this value is exceeded, the joint width or the model shall be increased.

④ The elevation of steel sill is one of major factors that affect the driving comfort, and thus shall be the same as the road surface as far as possible. In case of incompliance, the difference of elevation shall be controlled within the specified range.

● Formwork:

Fill the gap between girder ends with PS plates to make formwork.The formwork must be continuous and tight, without any clearance.

● Mixing the two kinds of resin:

Pour the basic resin and curable resin heated to the specified temperature to two standard container and then pour them to other container to mix them by electric means until the color is the same.

● Priming the recess:

Apply a thin coat of mixed resin with brush to the bottom and walls of the cleaned recess. The BEJ resin mixture shall be cast two hours later after priming.

● Mixing and casting of BEJ resin mixture:

Pour the aggregate into the mixing boiler to heat with flame, and mix it during heating. Stop heating when the aggregate is heated to the specified temperature and pour in the heated mixture of resin and keep on mixing. When they are mixed evenly, pour the mixture to the recess and perform compaction. The BEJ resin mixture shall be cast by two steps. The top surface can be poured only after the basic layer is nearly cured.

● Installation of rubber stripe:

The strength of BEJ resin mixture will reach 90% the standard strength 3 hours later after the top layer is finished. In this case, remove the clip, and remove the PS plate and foreign materials between two steel sills. Install the rubber stripe into the cavity of steel sills to finish the BEJ expansion joint. The road can be open to public.

JZF NOISE REDUCTION TYPE EXPANSION JOINTS

INTRODUCTION

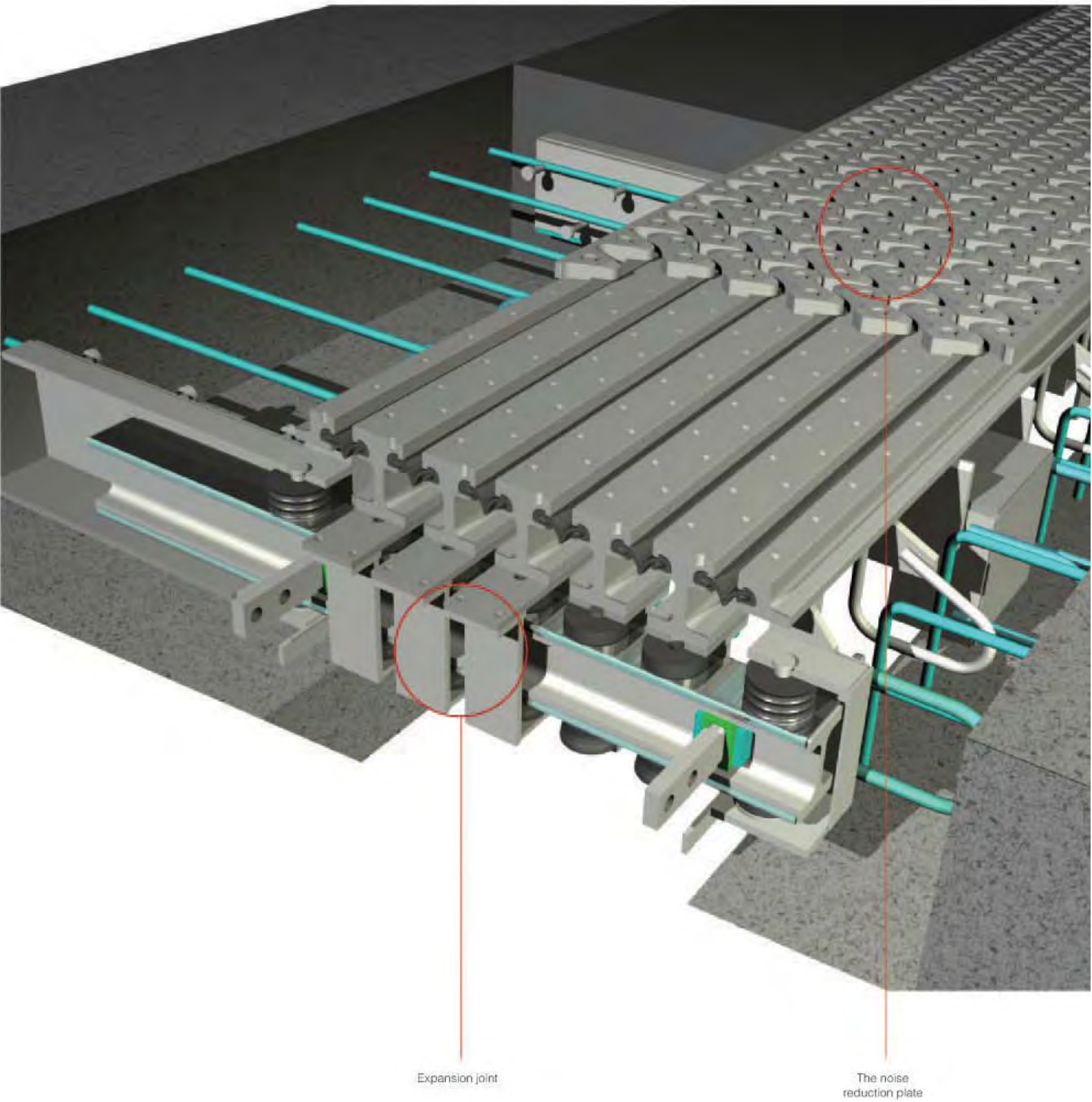
Noise reduction type expansion joint is an environmentally friendly type expansion joint developed by our company, which can reduce 70% noise when the vehicles pass over the expansion joints. This product is suitable for various bridges, such as straight bridges, curved bridges, skew bridges and bridges on slope, especially for urban flyover and viaduct whose design load is class I highway load. Moreover, it is characterized by strong interchangeability and ease of maintenance.

COMPOSITION

The noise reduction type expansion joint consists of two parts, namely expansion joint and the noise reduction plate. The noise reduction plate is connected to the section steel of standard expansion joint by bolts.

WORKING PRINCIPLE

When the vehicle passes over the gaps between two section steels, the tire impact the section steel directly and thus the noise is generated. The noise reduction plate with special shape changes the way of entry of tire into the expansion joint, namely changing the way of entry from straight line to diagonal line, so that the impacting force is reduced and the noise is reduced effectively. The practice shows that the noise reduction joint can reduce 70% the noise when the vehicle passes.


Expansion joint
The noise reduction plate

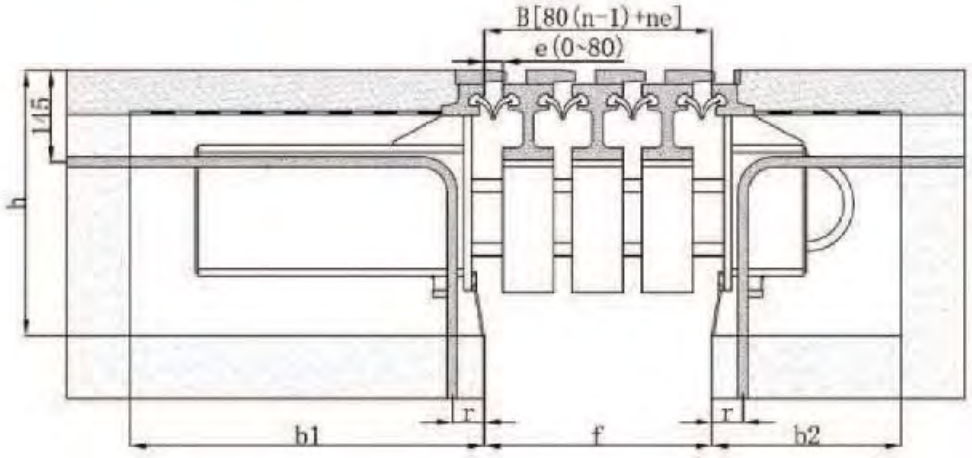
SPECIFICATIONS AND MODEL

Model: JZF-E

- Movement
- Abbreviation of noise reduction type expansion joint in Chinese Pinyin

Specifications: JZF series expansion joints are divided into 15 classes by the movement: 160mm, 240mm, 320mm, 400mm, 480mm, 560mm, 640mm, 720mm, 800mm, ……1280mm.

INSTALLATION SIZE



Model	Movement mm	No. of cell n	Gap of beam end f(mm)	Size of recess			
				Recess			Place of steel bar r(mm)
				h(mm)	b_1(mm)	b_2(mm)	
JZF160	160	2	160	420	400	400	60
JZF240	240	3	280	420	480	300	60
JZF320	320	4	400	420	560	300	70
JZF400	400	5	520	440	640	400	70
JZF480	480	6	640	440	720	400	90
JZF560	560	7	760	460	800	400	90
JZF640	640	8	880	460	880	400	90
JZF720	720	9	1000	500	960	400	90
JZF800	800	10	1120	500	1040	400	90
JZF880	880	11	1240	540	1120	400	90
JZF960	960	12	1360	540	1200	400	90
JZF1040	1040	13	1480	580	1280	400	90
JZF1120	1120	14	1600	580	1360	400	90
JZF1200	1200	15	1720	620	1440	400	90
JZF1280	1280	16	1840	620	1520	400	90

SCF SERIES FINGER TYPE EXPANSION JOINTS

INTRODUCTION

SCF series finger type expansion joint is our patented products specially designed for thick-wall girder, which is suitable for steel bridges and concrete bridges.

Multi-way waterproofing measures are used to have superior waterproofing performance. Structure with rigidity and flexibility are adopted to realize smooth and comfortable driving. Weather-resistant materials are used to guarantee service life of up to 50 years. Automatic slag-removing function can make the joint to expand and contract freely.

COMPOSITION

The SCF series expansion joint mainly consists of large tooth plate, small tooth plate, stainless steel plate, rubber plate, lower plate, bolt and water-proof ointment.

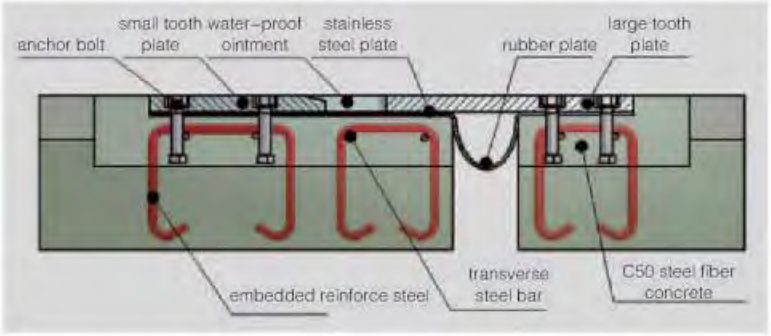
SPECIFICATIONS AND MODEL

The design movement of SCF series expansion joint is 0 to 1000mm(SCF40~SCF1000). For different bridges of the same displacement, the gap of girder end may be different, so the size of joint in the longitudinal direction of the bridge may be different. Therefore, the detailed dimensions of expansion joint shall be designed according to the actual condition of the gap of girder end.

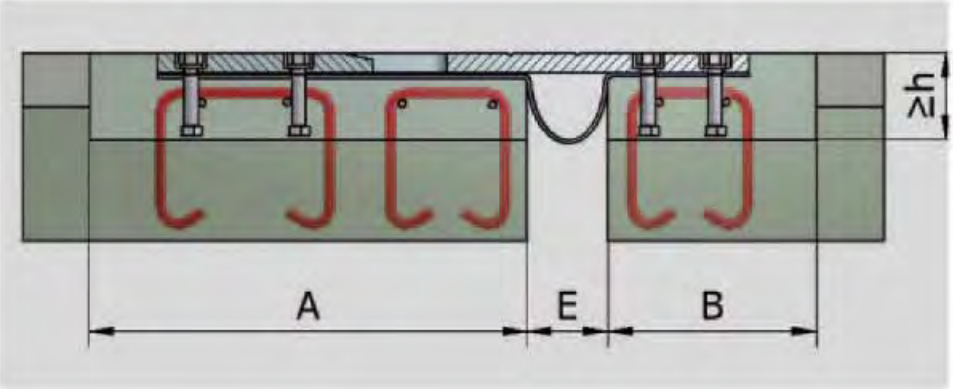
Model: SCF-E

- Movement
- Abbreviation of expansion joint in Chinese Pinyin

Specifications: SCF series expansion joints are divided into 25 classes by the movement: 40mm、60mm、80mm、400mm……1000mm.



INSTALLATION SIZE



Model	Movement	h	B	A	E
SCF40	40	120	300	315	70
SCF80	80	120	300	395	90
SCF120	120	120	300	475	110
SCF160	160	120	300	555	130
SCF200	200	150	350	635	150
SCF240	240	150	350	715	170
SCF280	280	150	350	795	190
SCF320	320	150	350	875	210
SCF360	360	150	400	955	240
SCF400	400	180	400	1035	260
SCF440	440	180	400	1115	280
SCF480	480	180	400	1195	300
SCF520	520	180	450	1275	320
SCF560	560	180	450	1355	350
SCF600	600	210	450	1435	370
SCF640	640	210	450	1515	390
SCF680	680	210	500	1595	410
SCF720	720	210	500	1675	430
SCF760	760	210	500	1755	450
SCF800	800	240	500	1835	480
SCF840	840	240	550	1915	500
SCF880	880	240	550	1995	520
SCF920	920	240	550	2075	540
SCF960	960	240	550	2155	560
SCF1000	1000	270	550	2235	580

Note:Value f in the table is the gap of beam at medial temperature. If the gap is quite different from the value listed in the table, special design is required.

TSSF Series Rail Viaduct Expansion Joint

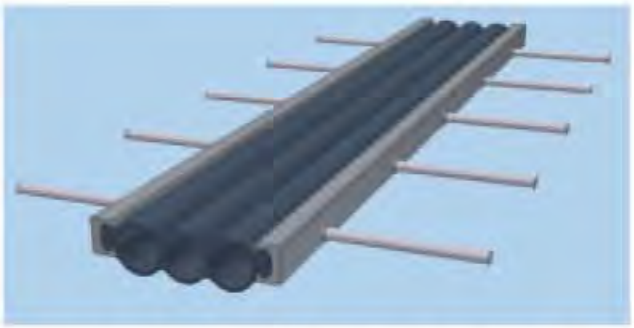
INTRODUCTION

Rail Viaduct Expansion Joint is an important connection component between bridge girder end and other girder end, it plays a vital role in the aspect of bridge expansion and water-proof performance, its quality and water-proof performance will directly affect durability of whole bridge.

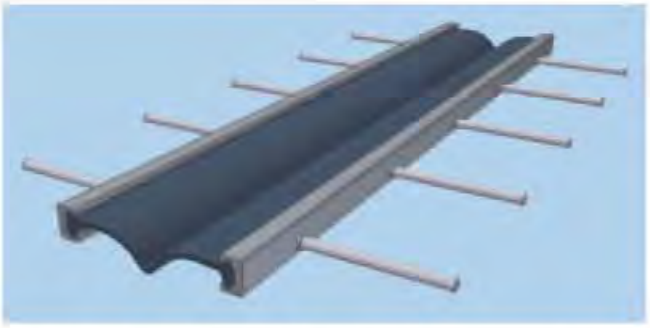
TSSF Series Rail Viaduct Expansion Joint is designed with consideration of its various of capability on different special requirements which include load, durability and water-proofing.

The TSSF Series is suitable for rail viaduct project which displacement of no more than 160mm. It is divided into four level: ± 15mm, ± 30mm, ± 50mm, ± 80mm。

According to different environmental conditions, our TSSF Series is divided into ballast-less weathering steel expansion joint and ballast weathering steel expansion joint. The type of ballast-less weathering steel expansion joint is divided into straight line and curve, its main components including weathering steel, anchorage steel and water-proof rubber band, the structure schematic diagram is as follows for your reference:

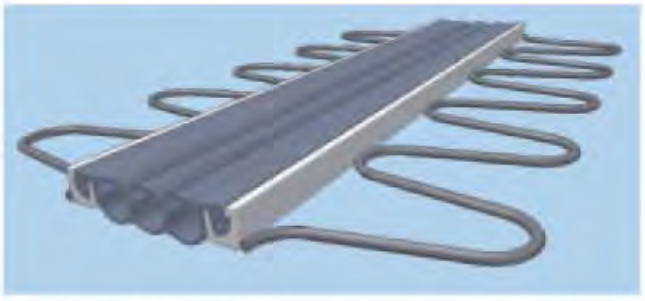


Picture 1 Ballast-less straight line girder weathering steel expansion joint

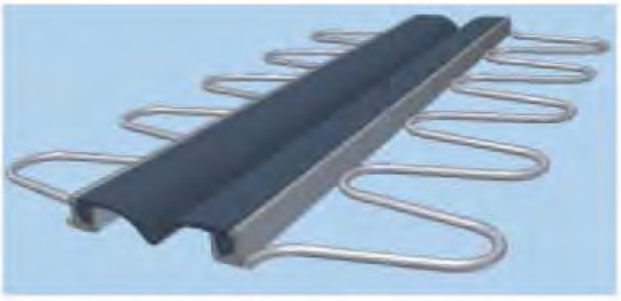


Picture 2 Ballast-less curve girder weathering steel expansion joint

Its main components including shaped steel, corrugated steel bar, water-proof rubber band, baffle plate, side baffle plate, its structure schematic diagram is as follows for your reference:



Picture 3 Ballast straight line girder weathering steel expansion joint



Picture 4 Ballast curve girder weathering steel expansion joint

Main technical performance:

3.1 Block up the two side of shaped steel and water-proof rubber stripe, fill in the water fully, 24 hours, without leakage.

3.2 The clamping force between shaped steel and box model water-proof rubber stripe is no less than 5 kN/m, when the expansion range could up to 3 times, keep load 15 minutes, shaped steel and band model water-proof rubber stripe will not shedding.

3.3 The height difference between two shaped steels in the same cross section could no more than 1mm after assemble expansion joint.

3.4 The gap between two shaped steels is even after assembling expansion joint, the tolerance of gap width is no more than 2mm.

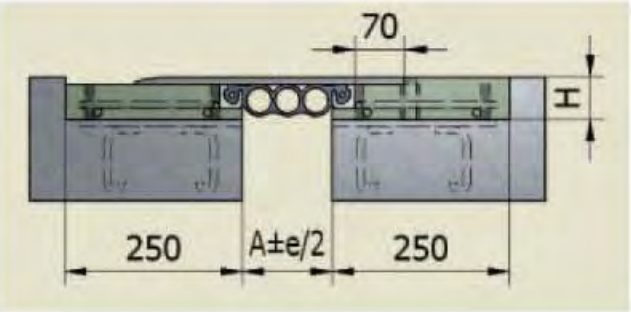
3.5 The displacement is divided into four level: ±15mm, ±30mm, ±50mm, ±80mm

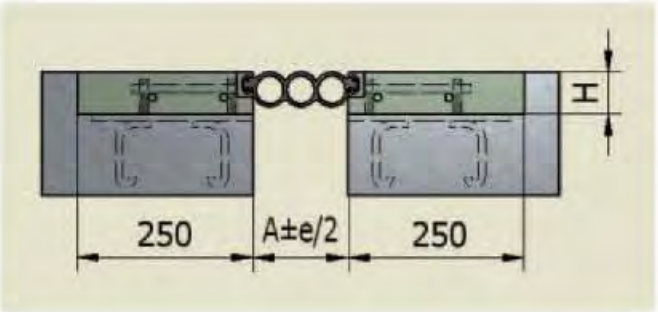
Selection table for standard girder span expansion joint:

Code number	Standard girder span(m)	Specification	Depth of installation
1	12	TSSF-30	≥50mm
2	16	TSSF-60	≥50mm
3	20	TSSF-60	≥50mm
4	24	TSSF-60	≥50mm
5	32	TSSF-60	≥50mm
6	≥32	Customize	≥50mm

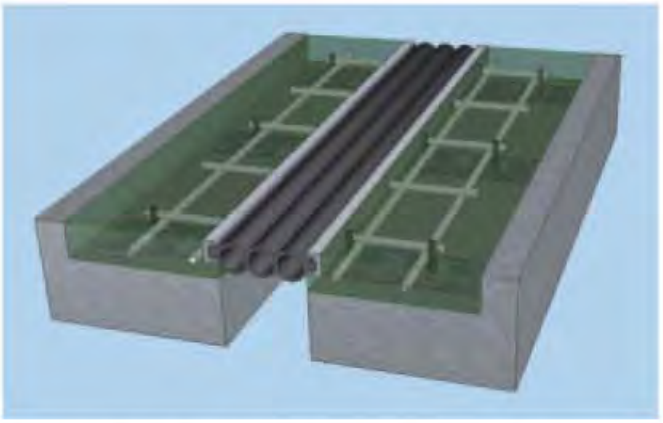
For curve bridge, consideration of curve rate radius and other factor in girder end gap, when satisfied with installation requirement, the above mentioned specification could be applicable, when the girder end gap have wide range change, the above specification could not meet the requirement, we will use water-proof rubber band to install after compression; when compression water-proof rubber band still could not satisfied with installation requirement, we will use curve type water-proof to satisfied with installation requirement.

Specification and installation dimension

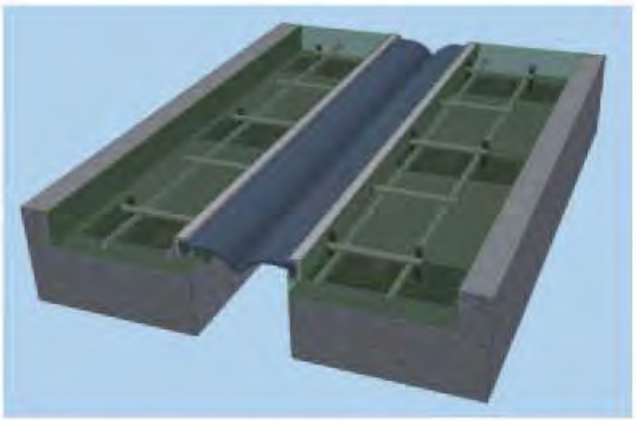




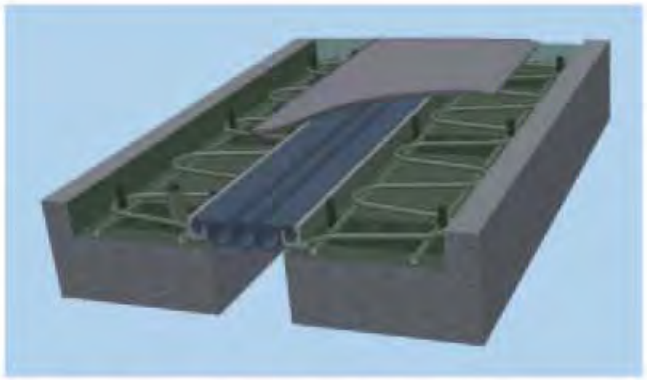
Code number	Specification	Maximum displacee(mm)	Depth of installation H(mm)	Median temperature, Girder gap A(mm)
1	TSSF-30	30	≥50	60
2	TSSF-60	60	≥50	100
3	TSSF-100	100	≥50	100
4	TSSF-160	160	≥50	150



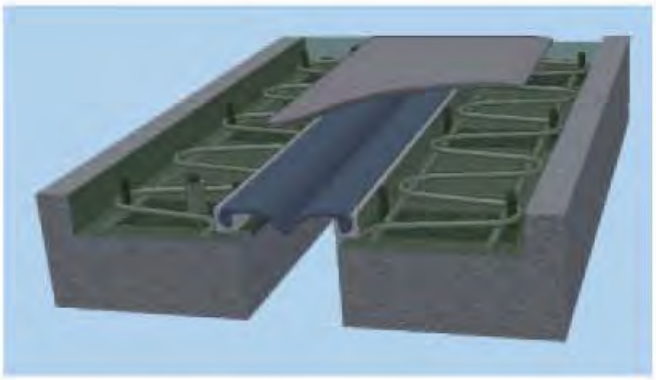
Ballast-less straight line weathering steel expansion joint



Ballast-less curve weathering steel expansion joint

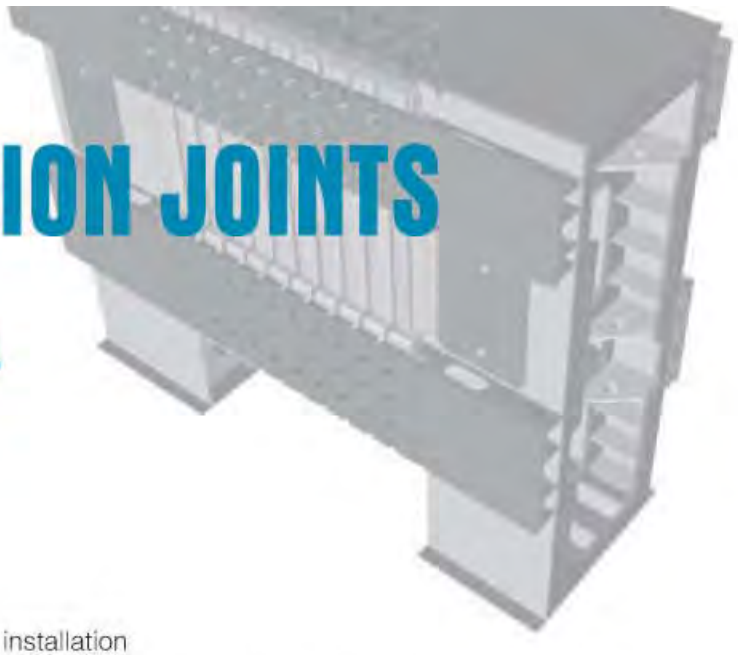


Ballast straight line weathering steel expansion joint



Ballast curve weathering steel expansion joint

SPECIAL EXPANSION JOINTS



GDF SERIES MODULAR RAIL GIRDER EXPANSION JOINT

STRUCTURE CHARACTERISTICS

1. Bolted parts of expansion joint facilitating repair and installation

Expansion joints of any type require maintenance and service due to various factors during operation. The design of the expansion joints has taken this point into account, and the parts of expansion joint facilitate repair and service after service of many years.

2. Independent movement control and load transfer system

The transverse sill that transfers impact load is parallel to the movement direction. This design can avoid baring other additional load. The independent movement control system is suitable for any application conditions. If single unit clearance cannot be contracted due to blockage, other joints are not affected and can be used still.

3. Spherical bearing for bearing the transverse sill of expansion joint

Use of spherical bearing for bearing the transverse sill can effectively suit the 3D movement of the girder body.

4. Design of expansion joint based on elastic bearing system

The pre-pressed elastic bearing can effectively buffer and damp the impact load from the vehicles under any conditions. Therefore, the surrounding structures and bearing transverse sill can be effectively protected, and the service life of all parts is guaranteed while the driving noise is significantly reduced.

5. The medial sill for bearing load is formed by injection, and damage will be produced due to fatigue if welded medial sill is used.

6. This structure solution can realize extra large displacement of expansion joint, and can meet the requirements for large turning angles.

7. A noise reduction plate is set in the passing face and guide face, and vehicle can pass the expansion joint smoothly, significantly reducing the noise of driving and the impact to the expansion joint and girder. The test shows that the expansion joint with noise reduction plate can reduce noise by 70% when the vehicle passes the expansion joint.

PERFORMANCE PARAMETERS

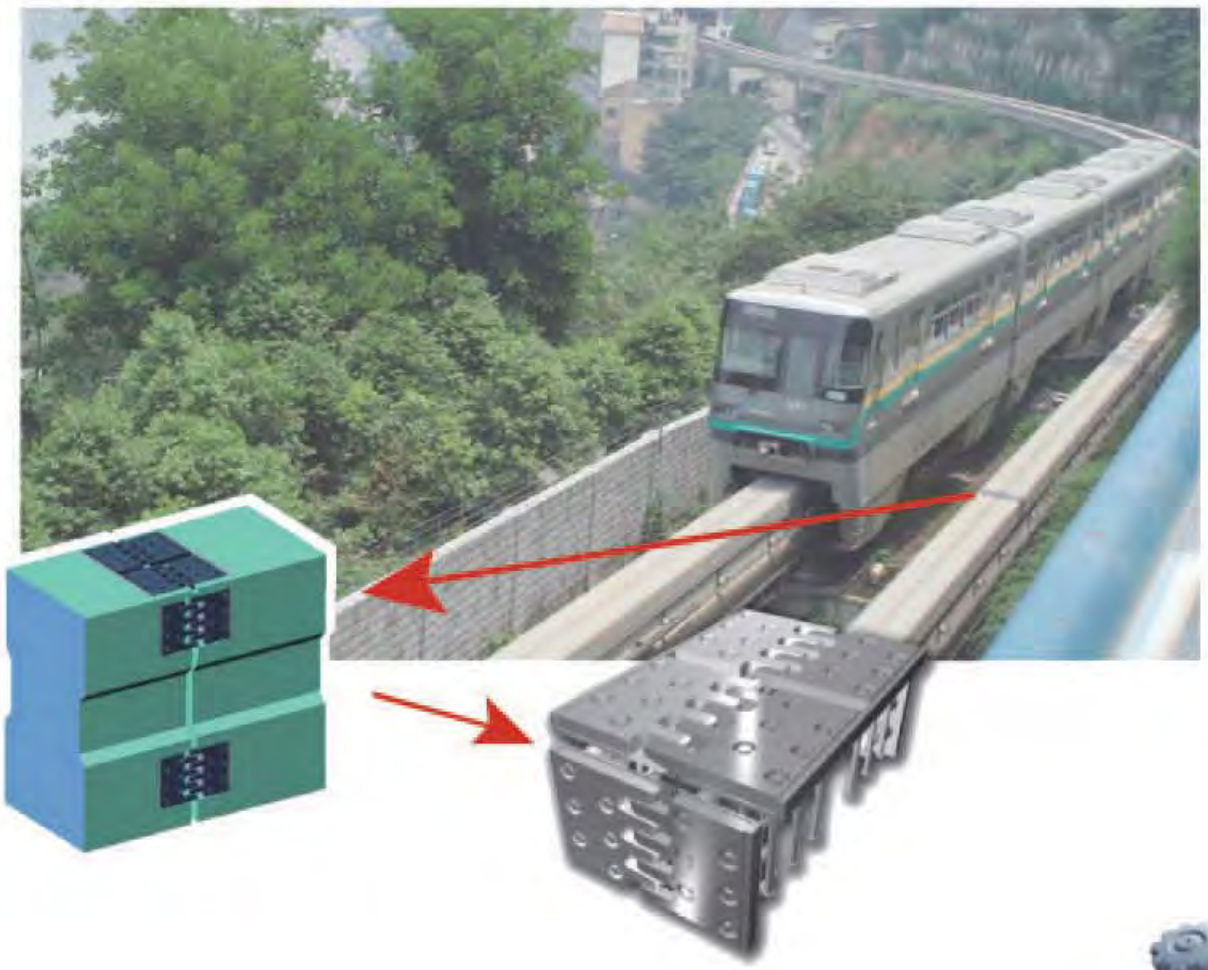
1) Vertical turning angle: ±0.06rad
2) Horizontal turning angle: ±0.06rad
3) Max. displacement: 600mm
4) Max axle weight at design load: 110kN
5) Axle weight at load for fatigue verification: 90kN
6) Horizontal load of the vehicle: 27.5kN
7) Traction and braking force of the vehicle: 16.5kN
8) Design driving speed: Max driving speed: 75km/h
9) Design reference temperature: 20℃. temperature change range of system: −10℃~+60℃

PC RAIL GIRDER FINGER-TYPE EXPANSION JOINT

PC rail girder finger–type expansion joint is a newly developed product with simple structure, good appearance and long service life, which is suitable for urban light rail traffic construction. The product is successfully used in the urban light rail traffic construction in Chongqing and is well received by customers.

SPECIFICATIONS

Displacement of expansion joint:30 ~ 160mm
Max. design axle load: 110kN
Axle load for fatigue verification: 90kN
Horizontal load of the vehicle: 27 5kN
Design driving speed: Max. driving speed:75km/h



CALCULATION OF BRIDGE MOVEMENT

Since the bridge structure is exposed to the complex weather for a long period, the movement is determined by the factors as follows:

1 atmospheric temperature, 2 shrinkage of concrete, 3 creep due to pre-stress, and 4 rotation of beam end caused by variable load.

● Movement due to change of temperature △Lt(mm)

Calculation formula for movement the temperature is fixed during installation:

a. $\triangle Lt=aL(Tmax-Tmin)$

Calculation formula for movement when the temperature is within a range of (T1,T2)during installation:

b. $\triangle Lt=\triangle Lt^{+}+\triangle Lt^{-}$

$\triangle Lt^{+}=aL(Tmax-T1)$

$\triangle Lt^{-}=aL(T2-Tmin)$

Where ,is the thermal expansion coefficient (=1010^{-6}/℃ for concrete,=1210^{-6}/℃ for steel structure), L is the length of bridge beam(mm),Tmax is the local highest average daily temperature, Tmin is the local lowest average daily temperature, $\triangle Lt^{+}$ is the expansion value(mm)due to increase of temperature from T1 to Tmax, and $\triangle Lt^{-}$ is the expansion value(mm)due to drop of temperature from T2 to Tmin.

Generally, it is more reasonable to use formula b to calculate the expansion joint when the expansion joint is installed under certain installation temperature range.

● Movement due to shrinkage of concrete △Ls(mm)

Generally, the formula for movement △Ls is:

$\triangle Ls=\varepsilon \infty \beta L$

Where, $\varepsilon \infty$ is the concrete shrinkage coefficient($\varepsilon \infty$ is equal to a temperature reduction at 20℃,and use 20×10^{-5}),is the concrete shrinkage reduction coefficient, which relates to duration from the time when the bridge is finished to that when the expansion joint has been completely installed, and L is the length(mm) of expansion bridge beam.

● Movement due to creep of the bridge caused by pre-stress or other loads △Lc(mm)

△Lc can be calculated by using the following formula:

$\triangle Lc=(\sigma \rho/Ec)\ \phi \infty \beta L$

Where, $\sigma \rho$ is the average axial stress of the bridge section caused by some loads, such as pre-stress, Ec is the elastic modulus of concrete, $\phi \infty$ is the creep coefficient of pre-stressed concrete(use 2.0 generally), β is the concrete shrinkage reduction coefficient, and L is the length(mm) of expansion bridge beam.

● Movement due to rotation of beam end caused by variable loads R(mm)

Ronly relates to length of the expansion bridge beam L(mm)

$R=4\times10^{-5}$ L for pre-stressed concrete bridges,

$R=6\times10^{-5}$ L for steel bridges

The basic movement of the bridge is the sum of the formulas above.

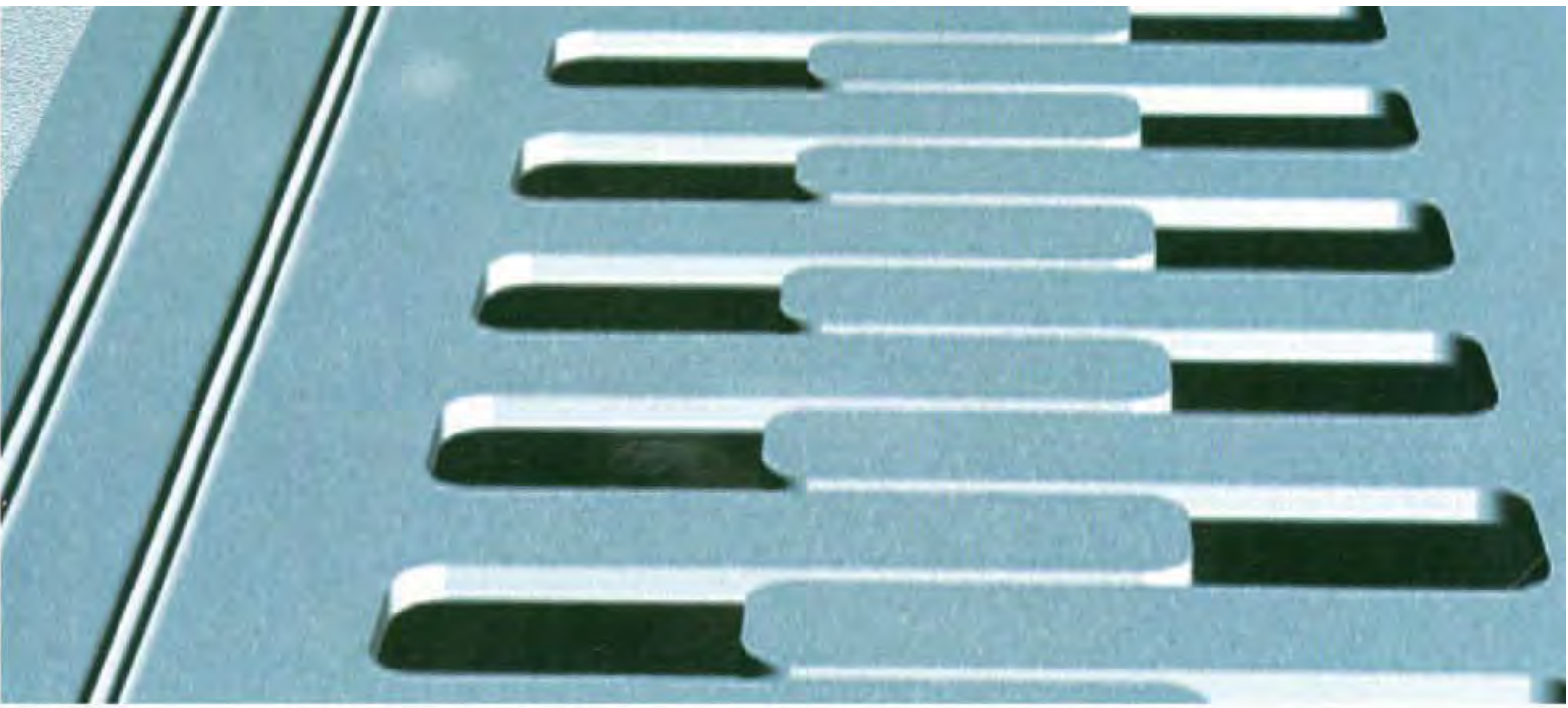
$\triangle L0=\triangle Lt+\triangle Ls+\triangle Lc+R$

It should be noted that, for different types of bridge structures, the movement only relates to some factors above, Only the temperature change, the variable loads for the steel structure and the concrete shrinkage movement for reinforced concrete bridge are considered only. For pre-stressed concrete bridge, all the possible factors mentioned shall be considered.

The basic movement of bridge can be calculated through the formula above. But for design movement, it can be obtained by given certain allowance (30% the basic movement)based on the resulting basic movement.

The design movement is: $\triangle L=1.3\ \triangle L0$

Generally or in the phase of preliminary design, the movement of several types of bridge in different regions can be obtained from Table 7. For bridges of flexible system, such as cable stayed bridges and suspension bridges. Use 1.5×10^{-3}multiplying by the expansion length of the beam as the movement, and the beam length and movement are both in mm.



Region	Bridge type	Basic movement	Allowance(30% the basic movement)	Design movement
East China	Reinforced concrete bridge	40.6 × 10–4L	1.54 × 10–4L	6.15 × 10–4L
	Pre–stressed concrete bridge	6.66 × 10–4L	2.00 × 10–4L	8.66 × 10–4L
	Steel structure bridge	6.57 × 10–4L	2.27 × 10–4L	8.84 × 10–4L
South China	Reinforced concrete bridge	5.40 × 10–4L	1.62 × 10–4L	7.20 × 10–4L
	Pre–stressed concrete bridge	7.45 × 10–4L	2.24 × 10–4L	9.69 × 10–4L
	Steel structure bridge	8.52 × 10–4L	2.56 × 10–4L	11.08 × 10–4L
North China	Reinforced concrete bridge	6.50 × 10–4L	1.95 × 10–4L	8.45 × 10–4L
	Pre–stressed concrete bridge	8.55 × 10–4L	2.57 × 10–4L	11.12 × 10–4L
	Steel structure bridge	9.84 × 10–4L	2.95 × 10–4L	12.79 × 10–4L
Southwest China	Reinforced concrete bridge	4.52 × 10–4L	1.36 × 10–4L	5.88 × 10–4L
	Pre–stressed concrete bridge	6.57 × 10–4L	1.97 × 10–4L	8.54 × 10–4L
	Steel structure bridge	7.46 × 10–4L	2.24 × 10–4L	9.70 × 10–4L
Northwest china	Reinforced concrete bridge	6.21 × 10–4L	1.86 × 10–4L	8.07 × 10–4L
	Pre–stressed concrete bridge	8.26 × 10–4L	2.48 × 10–4L	10.74 × 10–4L
	Steel structure bridge	9.49 × 10–4L	2.85 × 10–4L	12.34 × 10–4L
Northeast China	Reinforced concrete bridge	8.36 × 10–4L	2.51 × 10–4L	10.87 × 10–4L
	Pre–stressed concrete bridge	10.41 × 10–4L	3.12 × 10–4L	13.53 × 10–4L
	Steel structure bridge	12.07 × 10–4L	3.62 × 10–4L	15.69 × 10–4L

Note:The expansion beam length and movement are both in mm.

EXAMPLE 1 OF SELECTION OF EXPANSION JOINT MODEL AND CALCULATION OF GAP WIDTH

For a pre-stressed continuous bridge with a concrete box section, the expansion beam length is L=200m, the local highest average daily temperature is Tmax=35℃,the local lowest average daily temperature is Tmin=-5℃, the linear expansion coefficient of concrete is $a=10\times10^{-6}$,the shrinkage movement is $\varepsilon\infty=20\times10^{-5}$,creep coefficient is $\phi\infty=2.0$,the elasticity modulus is $Ec=3.5\times10^{4}$ MPa, the shrinkage and creep reduction coefficient of concrete is =0.3,the sectional average axial stress due to pre-stress is $\sigma\rho=0.7$MPa,and the temperature range during installation is 10~15℃.

The expansion of girder due to temperature change at 10℃ during installation $\triangle Lt^{+}$:

$\triangle Lt^{+}=aL(Tmax-T1)=10\times10^{-6}\times200\times10^{3}\times(35-10)=50mm$

The contraction of girder due to temperature change at 15℃ during installation $\triangle Lt^{-}$:

$\triangle Lt=aL(T2-Tmin)=10\times10^{-6}\times200\times10^{3}\times(15+5)=40mm$

The contraction of girder due to concrete shrinkage $\triangle Ls$:

$\triangle Ls=\varepsilon\infty\beta L=20\times10^{-5}\times0.3\times200\times10^{3}=12mm$

The contraction of girder due to concrete creep $\triangle Lc$:

$\triangle Lc=(\sigma\rho/Ec)\ \phi\infty\beta L=(7.0/3.5\times10^{4}\times2.0\times0.3\times200\times10^{3})=24mm$

Movement due to Rotation of beam end caused by variable loads R:

$R=4\times10^{-5}L=4\times10^{-5}\times200\times10^{3}=8mm$

From the above description, the expansion of girder is 50mm, and the contraction is 40+12+24+8=84mm, The basic movement is 50+84=134mm, with 30% allowance considered, the design movement is $1.3\times134=174.2$mm, The design closing amount of expansion joint is $1.3\times50=65$mm,and the design opening amount is $1.3\times84=109.2$mm.

Therefore, SSFB240 expansion joint can be used. The allowance is 240-134=106mm,In this case, the gap width for installation and positioning of expansion joint is 50+106/2=103mm.

EXAMPLE 2 OF SELECTION OF EXPANSION JOINT MODEL AND CALCULATION OF GAP WIDTH

For a steel structure bridge with a box section, the beam length is L=800m, the local highest average daily temperature is Tmax=35℃,the local lowest average daily temperature is Tmin=−10℃,the liner expansion coefficient of material is=12×10^{-6} ,and the temperature range during installation is 15~20℃.

Fir a steel structure bridge, the highest and lowest effective temperature is increased or reduced by 10℃ respectively on the level of the local highest and lowest average daily temperature.

The expansion of girder due to temperature change at 15℃ during installation $\triangle Lt^{+}$:

$\triangle Lt^{+}=aL(Tmax+10-T1)=12\times10^{-6}\times800\times10\times(35+10-15)=288mm$

The contraction of girder due to temperature change at 20℃ during installation $\triangle Lt^{-}$:

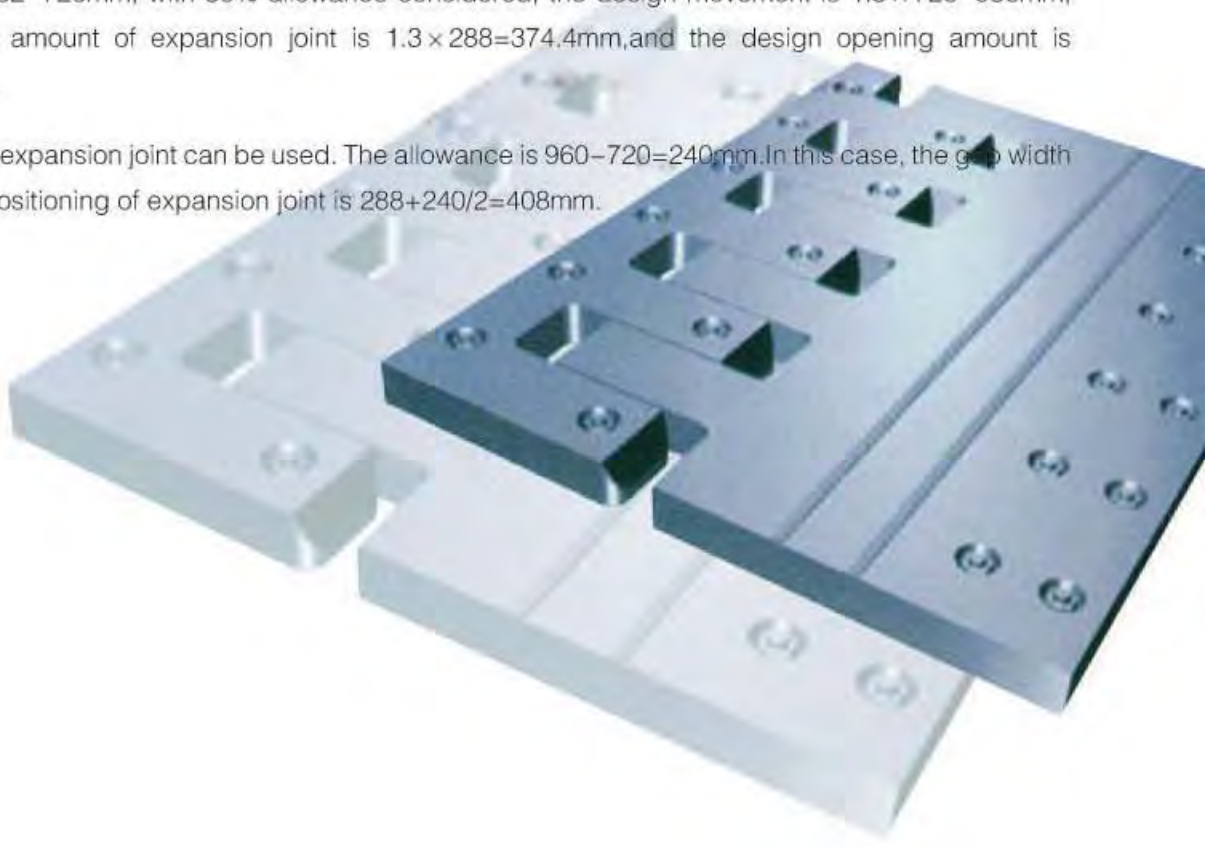
$\triangle Lt^{-}=aL(T2-Tmin+10)=12\times10^{-6}\times800\times10^{3}\times(20+10+10)=384mm$

Movement due to Rotation of beam end caused by variable loads R:

$R=6\times10^{-5}L=6\times10^{-5}\times800\times10^{3}=48mm$

From the above description, the expansion of girder is 288mm,and the movement is 384+48=432mm.The basic movement is 288+432=720mm, with 30% allowance considered, the design movement is $1.3\times720=936mm$, The design closing amount of expansion joint is $1.3\times288=374.4mm$,and the design opening amount is $1.3\times432=561.6mm$.

Therefore, SSFC960 expansion joint can be used. The allowance is 960−720=240mm.In this case, the gap width for installation and positioning of expansion joint is 288+240/2=408mm.



INSTALLATION AND MAINTENANCE OF EXPANSION JOINT

INSTALLATION

The quality of installation of expansion joint directly affects the stability and comfort of driving and the service life of the expansion joint. Since the installation of expansion joint is very important, the installation works are generally carried out by our professional installation team or under the guidance of our experts.

● Preparations before installation:

1. Fabricate the groove and pre-embed the steel bars. The construction unit shall fabricate the groove and steel bars according to the installation size of the selected expansion joint model, and protect the beam end groove against entrance of foreign materials.
2. Check whether all installation conditions are met. Installation conditions include finish works done, and materials, equipment and personnel provided.

● Process flow of installation:

Recess cutting → Removal of foreign materials in the recess → Arrangement of pre-embedded steel bars → Laying of expansion Joint → Leveling and positioning of expansion joint →Welding and strengthening → Set Formwork for concreting → Concreting → Curing of concrete → Installation of water-proof rubber stripe

● Key Quality Control Points:

1. Locate the center line of beam end before line drawing, and draw lines according to the corresponding size of the installation drawing of expansion joint.
2. Before laying the expansion joint, adjust the gap between steel sills of expansion joint according to the temperature during installation, and ensure that no foreign material exists in the gap.
3. Level the expansion joint so that the top face of the expansion joint is 1~2mm lower than the elevation of the road surface for asphalt roads, and is equal to the elevation of the road surface for concrete roads.
4. The steel bars of the girder shall be securely welded to the anchor bars of the expansion joint as far as possible. Welding shall not be applied to the steel sills of the expansion joint to avoid deformation of steel sills.
5.After the expansion joint is correctly anchored, formworks shall be made according to the dimensions of expansion joint and the pre-fabricated recess, For small displacement or shallow recess. the formworks shall be polystyrene sheets. For large displacement or deep recess, the formworks shall be steel or wooden sheets. The formwork shall be tight to prevent mortar from entering the displacement box or the gap between beam ends. No suspended concrete due to entrance of mortar is allowed at the bottom of the bearing box.
6. When concreting, the concrete must be strictly in accordance with the design class and mix ratio of mixture, and shall be vibrated fully to keep compacted. The top surface of concrete should not be lower and 2mm higher than that of side sill. The elevation of concrete top shall be equal to that of road surface. The concrete shall be tight with no gap to ensure that the driving is stable and comfortable.
7. The concrete shall not be open to public until it is cured to ensure the service life of the expansion joint.

MAINTENANCE

1. Remove the foreign materials, such as sand and chip, in the rubber stripe at regular intervals, so as to prevent from damaging the rubber stripe. In case of damage, replace the rubber stripe in time.

2. Check the flatness of the surface under which the expansion joint is installed at regular intervals. If the flatness is poor or noticeable rigid impact is produced when a vehicle passes over it, the sliding bearing, pressing bearing or concrete at the bottom the bearing box may be damaged. In this case, the fault shall be removed as soon as possible; otherwise the expansion joint is seriously damaged soon, and the expansion joint cannot be restored through maintenance.

3. Check each expansion joint for evenness at regular intervals. In case of excessive gap, the displacement spring may be damaged, and shall be replaced as soon as possible.

4. Check the steel sills for rust during replacement of rubber band, and remove rust and apply coating if necessary.

Contact us

EBT INTERNATIONAL PTE LTD

10 Anson Road#10-11
International Plaza
Singapore 079903
Tel:+65 6220 5658
Fax:+65 6348 2109
E-mail:info@ebt-international.com
Website:www.ebt-international.com