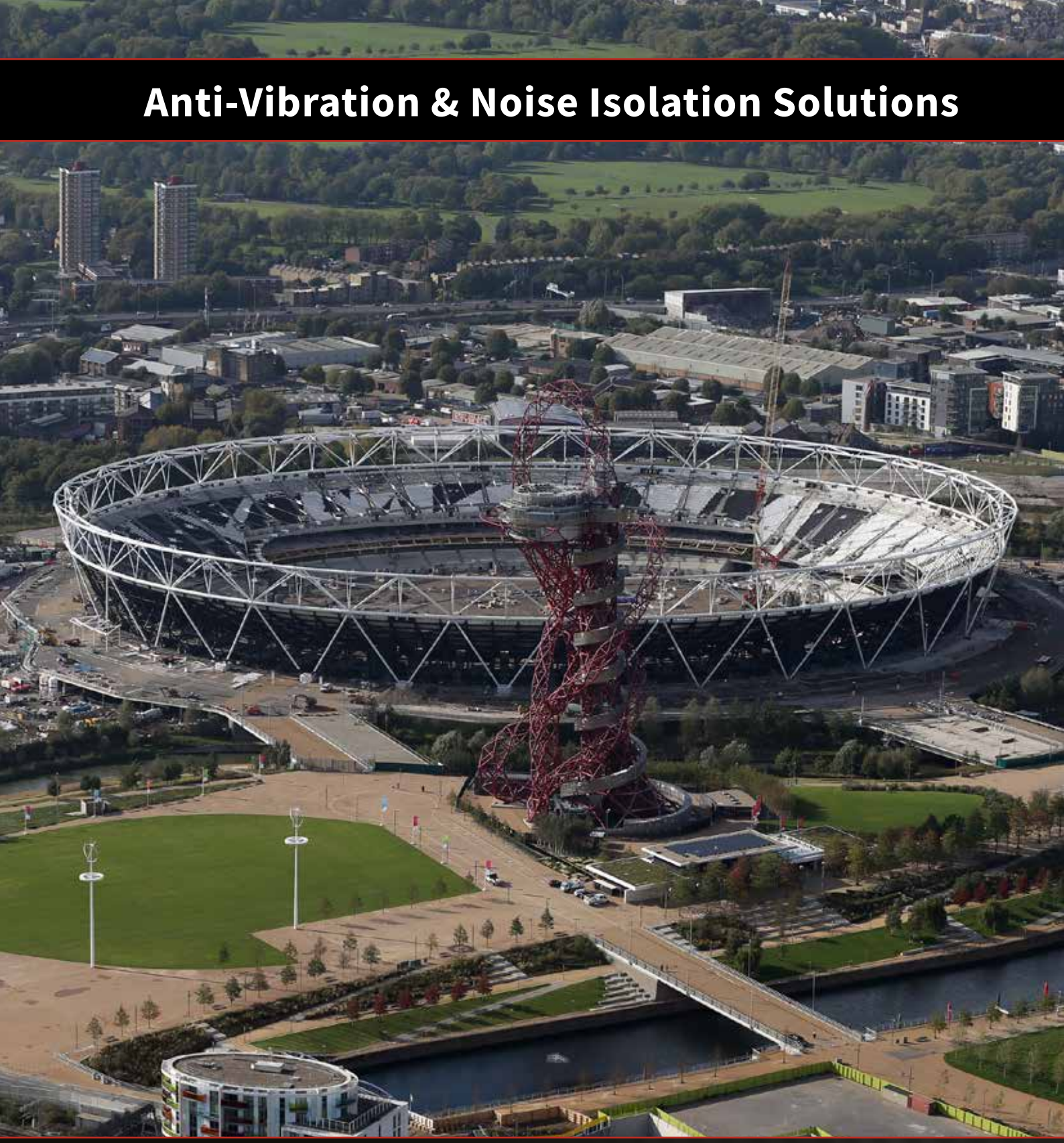
Anti-Vibration & Noise Isolation Solutions



TICO

LOAD BEARING SLIDING SUPPORT (SLIDING BEARINGS)

TICO - Sliding Bearings

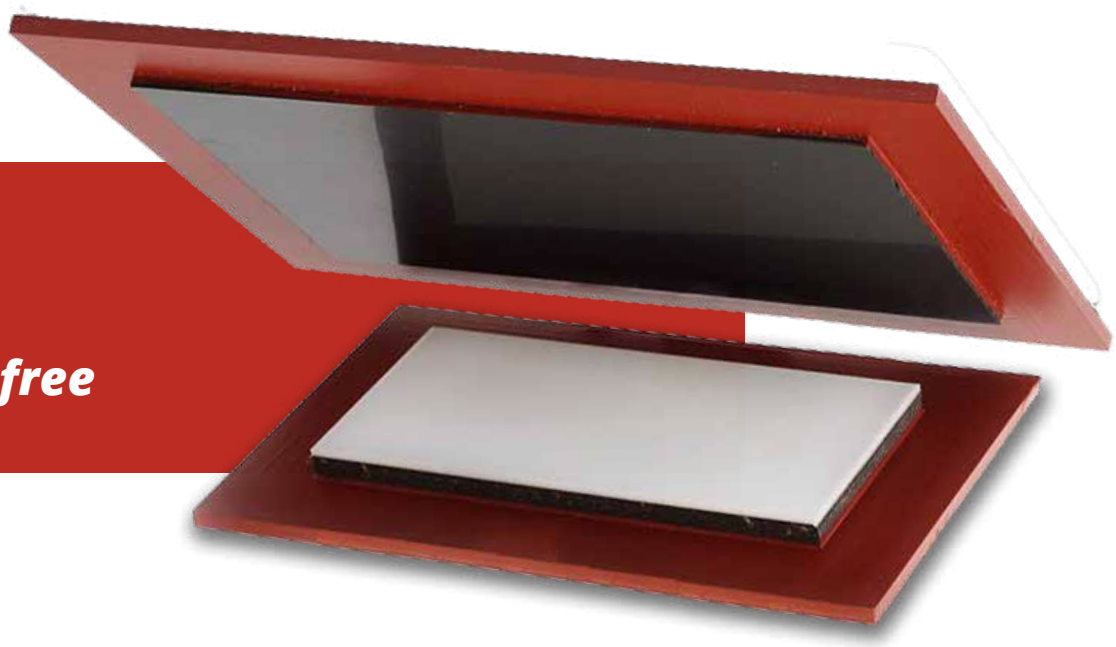
Allowable movements within a building structure can be accommodated by the range of TICO Resilient Seatings, but in some cases the movement required is much greater than those seatings are capable of accepting. TICO Sliding Bearings are the ideal answer to this problem, providing an economical load bearing sliding support with very low friction characteristics and virtually an unlimited degree of movement.

TICO Sliding Bearings are suitable for a wide range of applications to accommodate movement resulting from expansion, contraction or differential settlement. They may also be used to accommodate temporary requirements for movements during construction.

TICO Sliding Bearings are simple to install, require little space, have good thermal stability and are maintenance free. The excellent resistance of the materials to wear, abrasion, chemical attack and weathering ensures that they are durable and age resistant over many decades with an operational life expectancy in excess of the normal life of the structure.

TICO Sliding Bearings are custom designed to suit a wide range of structural loads and movements. TICO Sliding Bearings can also be designed to accommodate rotation as well as plane sliding motion by the incorporation of TICO Resilient Seating materials, these give the added benefit of noise and vibration attenuation between fixed and sliding structural members.

Simple to install and maintenance free



Components

TICO Sliding Bearings comprise two members, each with a low friction sliding surface. The upper member is usually TICO CV/S/NG - a molybdenum disulphide loaded self lubricating nylon with a bondable substrate - in contact with a lower member composed of highest quality virgin PTFE bonded to one of the TICO Resilient Seating materials (PTFE can be supplied glass filled on request).

The grade and thickness of the Resilient Seating substrate will depend on the load to be carried and the degree of rotation required (if any).

The nylon/PTFE interface has very low friction characteristics and is resistant to virtually all climatic conditions found in structural applications. With careful design, units can be provided to resist stress up to 15.5 MN/m^2 and virtually any degree of movement by sizing the upper and lower members appropriately relative to one another.

Components

There are a number of different sliding bearing components which can be used in different combinations to produce a wide variety of finished units with different properties.

Typical Upper Member component include:

- **TICO CV/S/NG** - a self lubricating molybdenum disulphide loaded nylon with a thin bonding substrate of rubber bonded cork. This is the most common upper member material and is typically 2.5 mm thick.

- **STAINLESS STEEL** - highly polished or mirror polished stainless steel plates can be used to provide a low friction sliding surface in place of TICO CV/S/NG. These plates generally have higher coefficients of friction than CV/S/NG depending on the degree of polishing of the steel.

There are a wider variety of lower member components as these tend to be the principal load carrying part of the unit and can incorporate a variety of TICO resilient substrates. The principal lower member components employed are:

- **TICO CV/S/PT** - Highest quality virgin PTFE bonded to a thin bonding substrate of rubber bonded cork. This material is typically 3 mm thick.

- **TICO CV/M/PT** - Highest quality virgin PTFE bonded to a substrate of TICO CV/M/RS seating material.

- **TICO CV/CA/PT** - Highest quality virgin PTFE bonded to a substrate of TICO CV/CA/RS seating material.

- **TICO CV/PF/PT** - Highest quality PTFE, which can be supplied glass filled where required, bonded to a substrate of TICO CV/PF/RS seating material.

	CV/M/PT	CV/CA/PT	CV/PF/PT
Maximum Recommended Working Stress (KN/m^2)	1400	7000	15,500
Hardness of Resilient Substrate (IRHD)	55 ± 5°	76 ± 5°	93 ± 5°
Density of Resilient Substrate (kg/m^3)	1150	1150	1200

Components

Detailed physical properties of the TICO resilient substrates incorporated within TICO Sliding Bearing materials can be found in the literature for TICO Resilient Seatings.

When combined in a TICO Sliding Bearing, the upper and lower members form a sliding plane with a very low coefficient of friction. Due to the unique properties of PTFE and the nylon material, the coefficient of friction decreases with increasing applied stress, summarized in the following table.

Stress (KN/m^2)	700	1400	3500	7000
Coefficient of Friction	0.07	0.07	0.05	0.04

Normal operational temperature of a TICO Sliding Bearing is -40°C to +70°C.

The normal operational temperature of a TICO Sliding Bearing is -40 to +70°C. This is suitable for nearly all civil applications, however if the application requires excursions to temperatures outside of this range please contact our Technical Services Department for advice.

Design Considerations

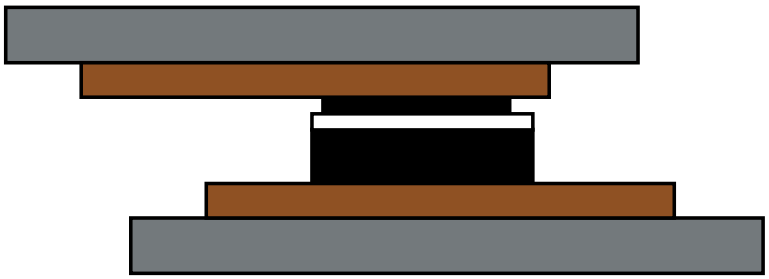
The design of a TICO Sliding Bearing depends on four principal factors:

- **Operating loads (dead loads and live loads)**
- **Degree and direction of movement required**
- **Available space to incorporate bearings**
- **Degree of rotation required (if any)**

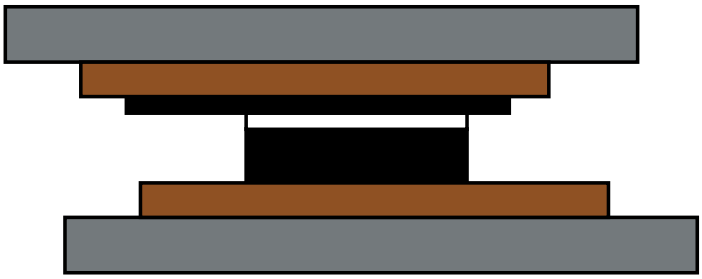
In essence the load determines the grade of lower member, and the movement defines the size and positioning of the upper member relative to the lower. The rotation to be accommodated, if any, will affect thickness (and possibly the grade) of lower resilient substrate. Constraints on available area can be a dominant factor in design, for instance if a bearing is required between two steel beams which run perpendicular to one another.

General design principles to be observed are that:

- **Lower Member** - is not over stressed under normal conditions in a manner that would cause both parts of the unit to become out of plane.
- **Upper Member** - should be larger than the lower member so that under all conditions up to the limit of movement, the lower member is always covered - a so called 'umbrella' effect. This will avoid surface contamination of the lower member with dirt or debris which can cause wear and reduced sliding performance, and ensures even load distribution on the lower member at all times.



Wrong

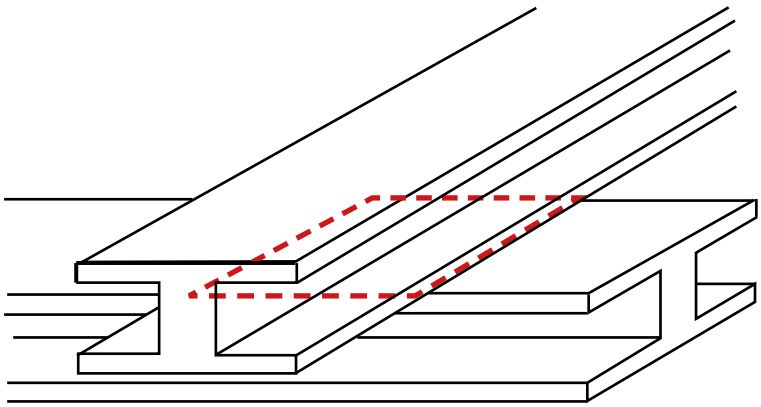


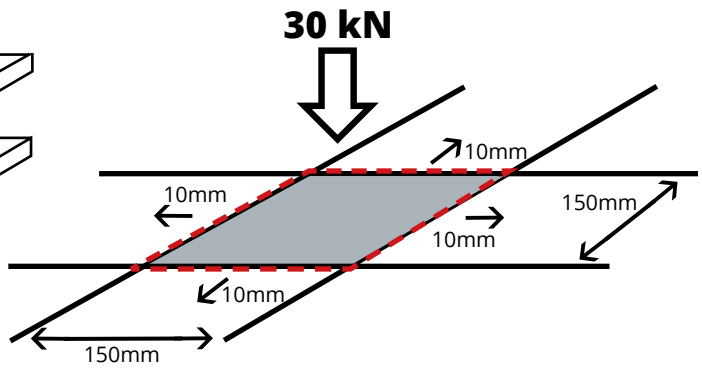
Correct

Design Considerations

Example:

A sliding bearing is required to support a 30 kN load and provide a horizontal movement of ±10 mm in two horizontal directions indicated in the diagram below. There is no rotational requirement but due to restrictions on area the overall unit must be no larger than 150 x 150 mm.





Maximum bearing area restricted to contact area between two steel beams.

As the area is restricted it is convenient to begin with the upper member, picking a convenient size such as 140 x 140 mm which fits into the available area with a small tolerance either side of the pad. The upper member is selected as standard CV/S/NG material 2.5 mm thick.

To provide a movement range of +/- 10 mm, the size of the lower member needs to be at least 20 mm smaller in each plan dimension than the upper. To allow for site positioning errors and a small safety factor, we would recommend adding a small tolerance of 20mm to the overall movement range, [a large bearing or a greater overall movement should have a greater tolerance]. Overall the lower member would thus be 100 x 100 mm.

Using the plan dimensions for the lower member and the applied load, the generated stress on the pad is calculated.

$$\text{Pad Stress (KN/m}^2\text{)} = \frac{\textbf{Applied Load (kN)}}{\textbf{Lower Member Area (m}^2\textbf{)}}$$

$$= \frac{\textbf{30}}{\textbf{0.1 x 0.1}}$$

(Area of pad 100 x 100mm)

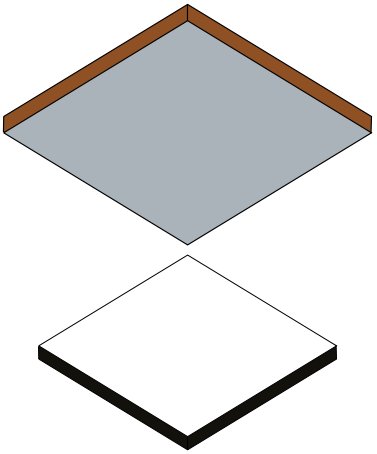
$$= \textbf{3000 kN/m}^2$$

Design Considerations

An appropriate material for this level of stress is TICO CV/CA/PT. As no rotation is required we select a general thickness of 8 mm to minimize the impact of unit height on the construction.

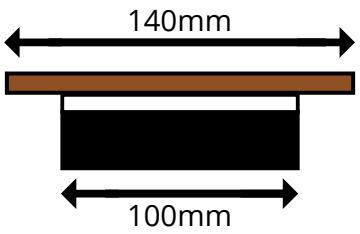
The complete specification for this TICO Sliding Bearing is thus as follows:

- **Upper Member** - TICO CV/S/NG 140 x 140 x 2.5mm thick
- **Lower Member** - TICO CV/CA/PT 100 x 100 x 8mm thick



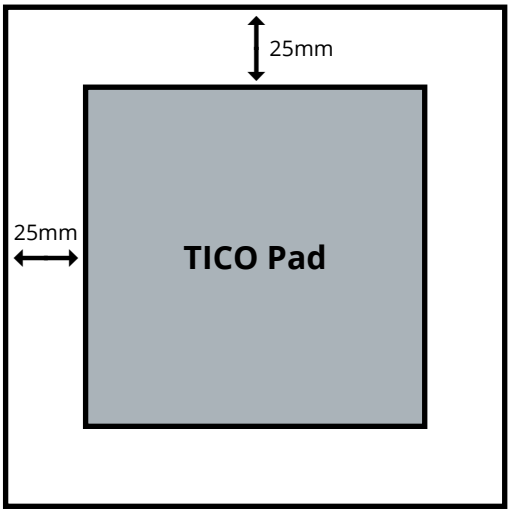
Note that other materials could have been selected for the lower member. In general there is often more than one solution for a given bearing unless there are a combination of restrictions e.g. height, rotation, area and damping requirements.

It is possible to use a sliding member in an 'upside down' position although some method of protecting the bearing surfaces from dirt and debris then needs to be employed. In general the surface of the smaller member should not be significantly harder then the surface of the upper member as under load the softer member can become indented resulting in 'stick-slip' movement.



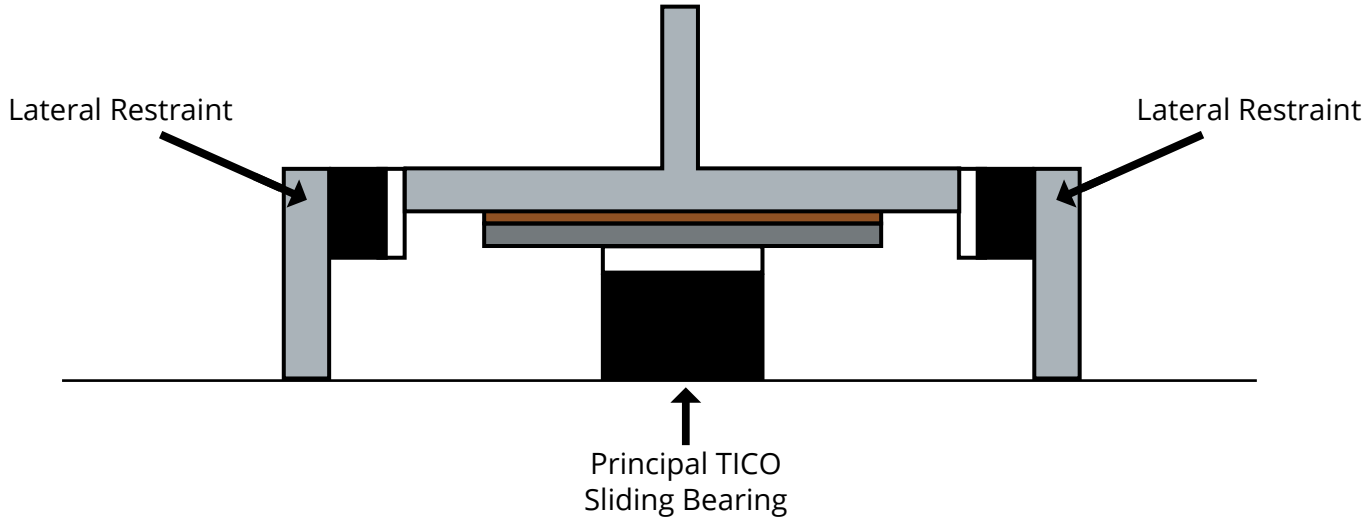
TICO Sliding Bearings can be supplied prepared for direct bonding on site, however it is often convenient to have the materials pre-bonded to steel backing plates which are more simply welded to steel structures. In these cases, due allowances must be made at the design stage for the size of the backing plates which should have minimum edge clearance of 25mm with respect to the relevant TICO part to allow for heat dissipation during welding which might otherwise affect the materials or their bond to the steel.

If requested, Tiflex will bond all TICO materials to steel backing plates under strictly controlled conditions of temperature and pressure to ensure the strongest possible bond, prior to the delivery of bearings to site.

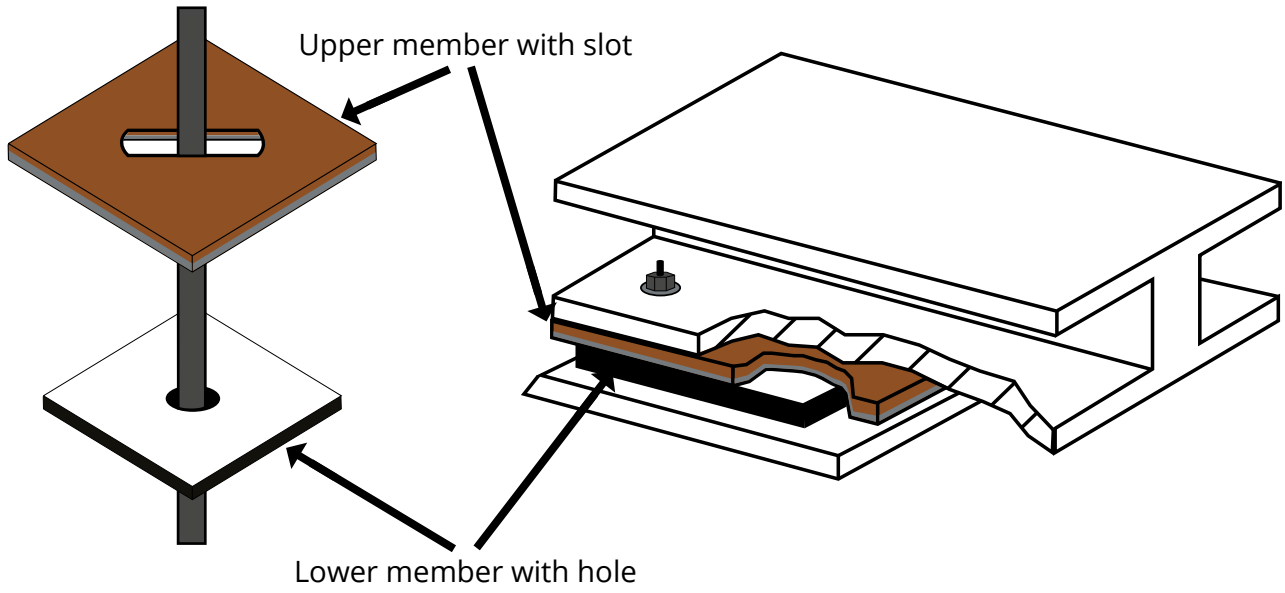


Design Considerations

To enable the control of movement in one direction only it maybe considered necessary to employ a side guide in the design. To reduce unwanted friction these guide stops can be faced with TICO Sliding Bearing materials such as in the diagram below.



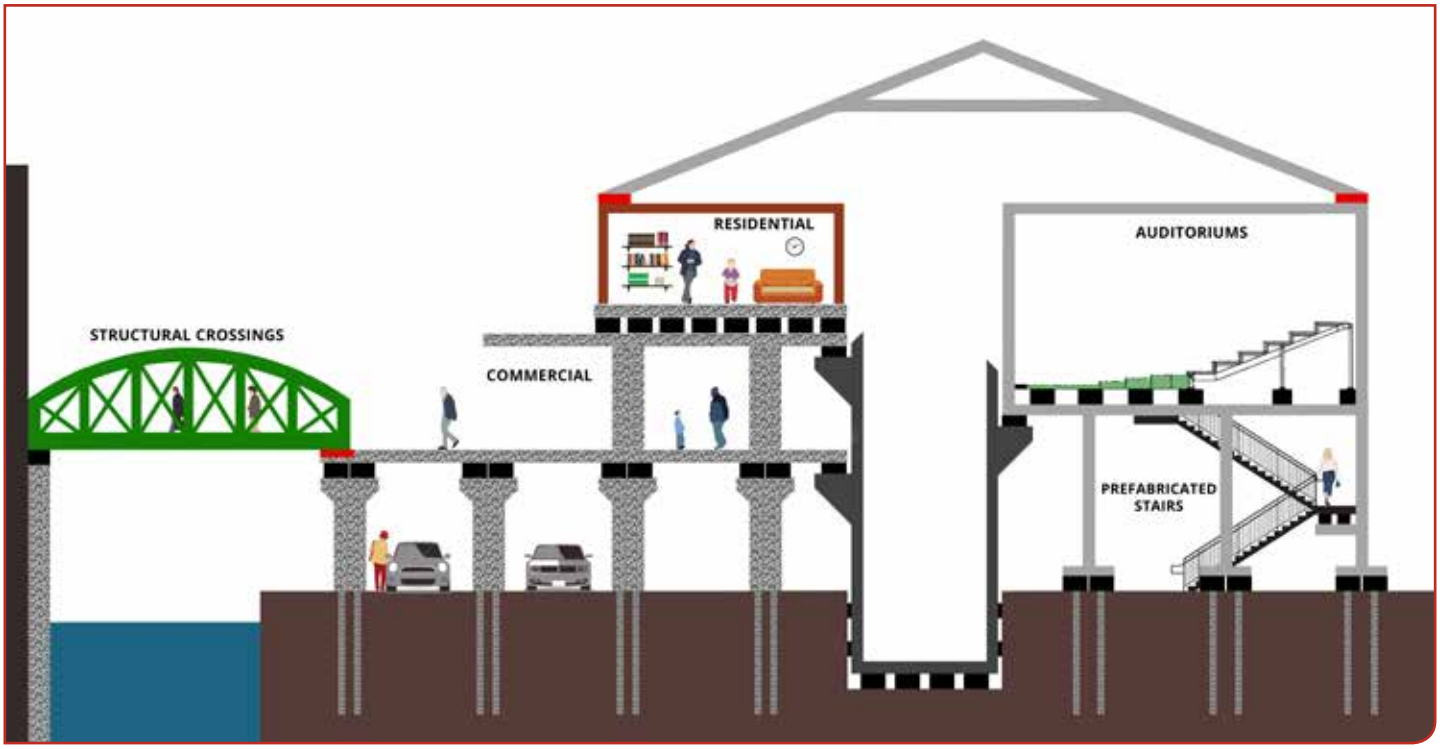
Alternatively, bolts or dowels may be used for directional stability. In this case holes must be drilled into the upper and lower members to allow the bolts or dowels to pass through. At least one set of these holes must be slotted to allow for the necessary movement to be accommodated.



Tiflex recognises that in these applications there is often more than one solution to a given problem and that design criteria can occasionally be more complicated than those described here. Our Technical Services Department is pleased to provide assistance in the specification of TICO Sliding Bearings at any stage in the design process, and to review customers own specifications in light of project requirements. Please contact us with as much detail of your application as possible including, where available, loads, required movements, rotation and available space.

Typical Sliding Bearing Applications

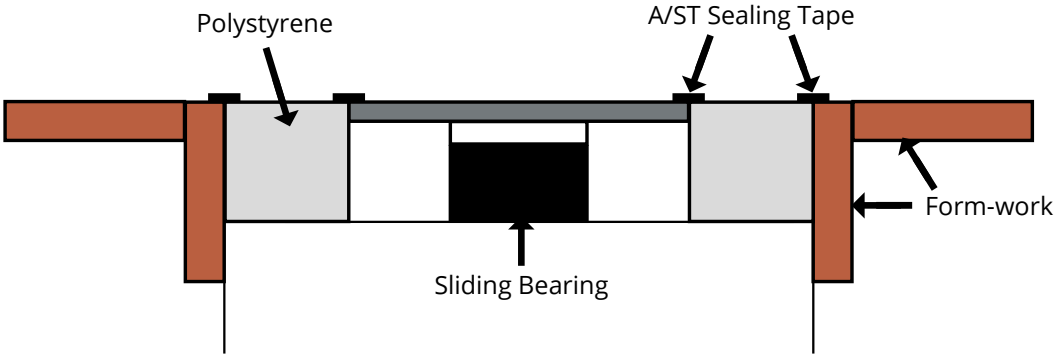
Bearings highlighted in red



Unless supplied with steel backing plates, or if one member is polished stainless steel, both members of the TICO Sliding Bearing should be bonded to the structure using Tiflex Marine Epoxy Adhesive. Instructions for use of this adhesive should be carefully followed and are available on request.

Prior to bonding, all surfaces must be clean, level and free of dirt and debris. During curing of the adhesive both members must be clamped down securely ensuring that any securing devices do not damage the sliding surfaces of the materials. If steel backing plates have been used, these can be tack welded in position taking care not to allow an excess build-up of heat which may affect the TICO material. It is advisable to protect the edges of the bearings from contact with, or proximity to, the welding flame.

For cast in-situ work it is recommended that the upper member is bonded to a thick steel plate. The bearing is installed on the support surface with the lower member bonded as before. A filler, e.g. expanded polystyrene, is packed around the bearing up to the form-work. TICO A/ST Sealing Tape should be used to seal all joints prior to casting as the ingress of concrete onto or around the bearing will affect its proper performance. When the concrete has set, all form-work and filler etc. should be removed to allow the sliding bearing to function correctly in service.



Storage and Handling

On arrival at site, TICO Sliding Bearings should be carefully stored away from direct sunlight, excessive heat, chemical or any liquid media. The sliding surface should be protected at all times and not contaminated either during storage or installation by coatings, adhesives etc.

Bearings with clearly damaged surfaces should not be used and brought to the attention of the site supervisor or resident engineer.

Care should be taken not to stack other materials on top of the TICO Sliding Bearing units as these can damage or dent the surface of the pads. Safe Handling data sheets are available for all TICO Sliding Bearing materials on request.

Care should be taken not to stack other materials on top of Slide Bearing Units.

Supply Details

Due to the highly custom nature of these types of bearing, Tiflex generally supply bespoke items cut to size. To aid in design, the following maximum available sheet sizes and standard thicknesses are provided.

Material Grade	Maximum Sheet Size	Standard Thicknesses
CV/S/NG	1200 x 600 mm	2.5 mm
CV/S/PT	1200 x 1200 mm	3, 8 mm
CV/M/PT	1200 x 1000 mm	8, 14.5 & 27 mm
CV/CA/PT	1200 x 1000 mm	8, 14.5 & 27 mm
CV/PF/PT	1200 x 1000 mm	8, 14.5 & 27 mm

Tiflex are happy to supply custom sizes up to the maximum sheet size available. These sliding bearing materials are also available in other non-standard thicknesses on request.

If slots and holes are required to be drilled, please supply a dimensioned drawing indicating required hole/slot positions and sizes.

If the Sliding Bearings are to be situated in an area subject to severe weather conditions it is recommended that all exposed edges are given additional protection with a hypalon based coating applied during manufacture.

Installation

If steel backing plates or members are required, please provide full details of the grade required and full dimensions including thickness. For polished plates please provide also the degree of surface polishing required.

For added protection during transit and storage, steel plates can be painted with a weldable red oxide primer. If this or another coating is required, please advise when making your enquiry or placing your order.

The following standard products are available for use with TICO Sliding Bearings.

TICO A/ST Sealing Tape	Sealing Tape	**74 mm (3") wide x 50 mm roll**	
TICO VF/PA	Void Filler	**1200 x 600 x 12.5 mm 1200 x 600 x 25 mm**	
Tiflex Marine Epoxy (2 parts)	Epoxy Resin	**600 g**	**Approx. coverage 2 m²**

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