CALENBERG

SANDWICH BEARING Q

Reinforced elastomeric bearing loadable up to 28 N/mm²

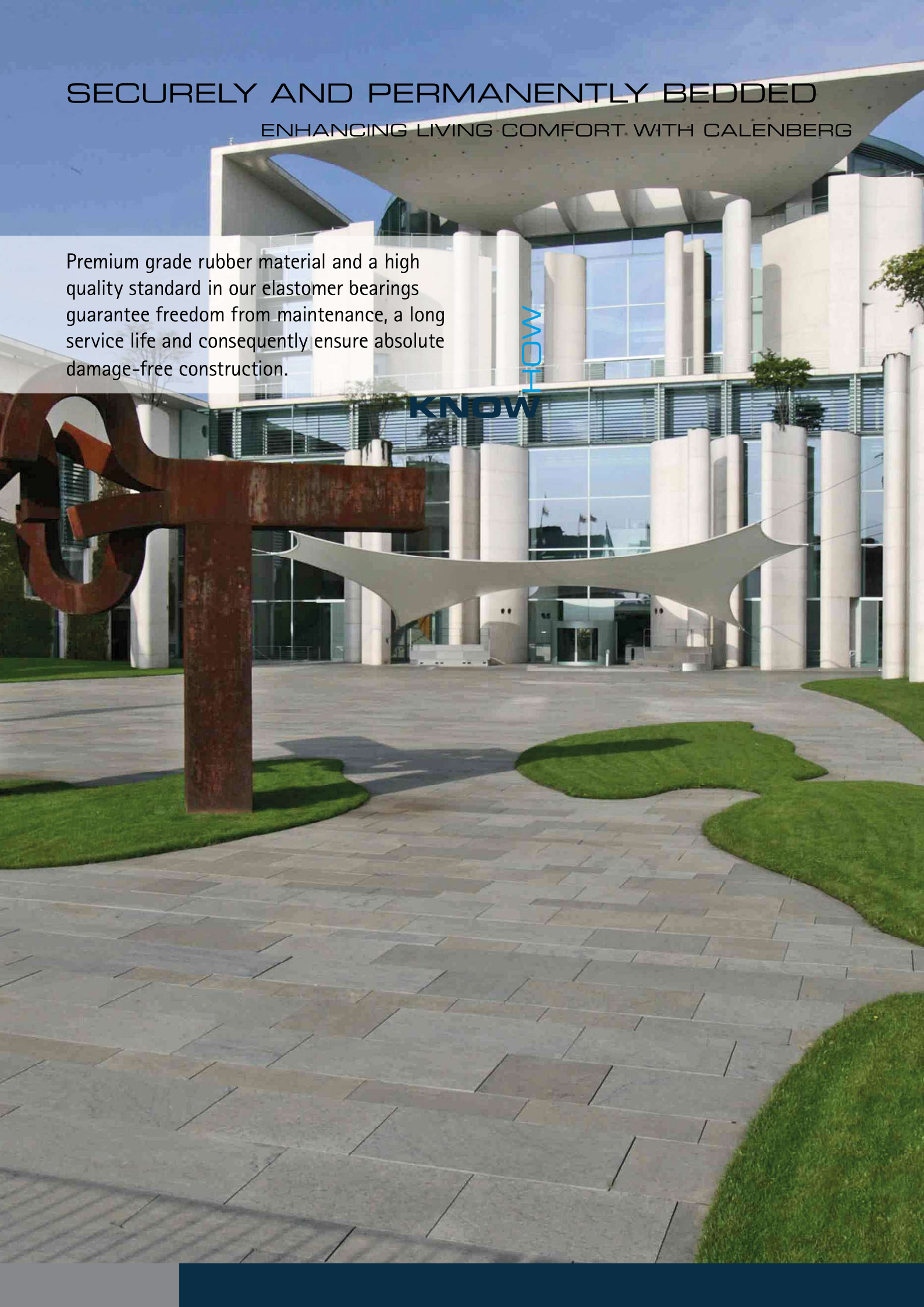
A LISEGA Group Company

SECURELY AND PERMANENTLY BEDDED

ENHANCING LIVING COMFORT WITH CALENBERG

Premium grade rubber material and a high quality standard in our elastomer bearings guarantee freedom from maintenance, a long service life and consequently ensure absolute damage-free construction.

KNOW HOW



Prevention of structural damage

Permanent loads (e.g. inherent weight of the structure), variable influences (e.g. wind) and constraining forces (e.g. from temperature changes, creep, component tolerances or settlements) result in deformations of structural components. Without the use of suitable elastomeric bearings, these impacts mentioned will cause damage to structures. In addition to cracks and spalling, there can also be large-scale destruction of the adjacent components, which need to be repaired at considerable expense in terms of time and cost.

In component connections, the elastic effect of the structural bearings transfers forces centrically and at the same time compensates for plane-parallel deviations. Shear deformations from non-permanent horizontal effects are absorbed by the elastomer bearings.

Advantages for our customers

The extremely high bearing loads of the bearings enable filigree and cost-effective structural designs. Elastomer bearings do not require maintenance and do not need to be replaced if correctly dimensioned and installed. The designers also secure the material reserves in the event of unforeseen load conditions. The service life of the construction bearings is at least equal to the service life of the adjacent components. Our elastomeric bearings increase the value of the building by avoiding structural damage and eliminating renovation and maintenance costs. The static elastomeric bearings transmit forces, twists and displacements into the adjacent components permanently and damage-free.

Product features

- Simple design
- Maintenance free
- Weather and ozone resistant
- Extremely durable
- Very low creep behaviour
- Premium grade material (CR)
- Approved by building authorities

The Sandwich bearing Q

Product description

Calenberg Sandwich bearing Q is a steel reinforced elastomeric bearing and consists of CR elastomeric layers vulcanized with a transverse tensile reinforcement of weather resistant steel. A distinctive characteristic are the cylindrical studs arranged in a square pattern, which help to level out any unevenness in the bearing surfaces during the initial load phase.

Use and areas of application

Calenberg Sandwich bearing Q is used in all areas of construction as permanently elastic articulating connection elements. The elastomeric bearing is used for highly stressed components.

Functional features

The studded areas arranged on both sides deflect elastically by about 2.5 to 3 mm under a load of up to 2 N/mm^2. Thereby the unevenness of the support surface is compensated.

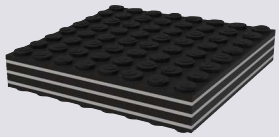
Building authority approval

The approval for use as a construction bearing in building construction is regulated by the standard building authority certification Z-16.33-480, issued by the Deutsches Institut für Bautechnik.

Behaviour in fire

For fire safety requirements, the fire safety report No. 3799/7357-AR by the Technical University (TU) of Braunschweig shall be taken into account. The report describes the minimum dimensions and other measures that meet the requirements of DIN 4102-2.

EXCERPT FROM THE TECHNICAL DATA

	Type of bearing	Bearing thickness [mm]	Compressive stress	Approval
	Reinforced deformation bearing	10	$\sigma_{R,d} = 28$ N/mm^2	Approval no. Z-16.33-480, issued by the DIBt Berlin
		20		
		30		
		40		

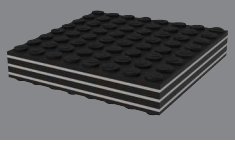
Delivery forms

Calenberg Sandwich bearings Q are supplied in almost any desired dimension for the specific structure. The bearings can be provided with holes, cut-outs, slots, etc.

The bearings are embedded in polystyrene at the factory and equipped with a water-repellent plastic cover for in-situ concrete construction.

For fire protection requirements, a Ciflamon fire protection board with a width of at least 30 mm shall be provided if required.

STANDARD CUT-OUTS



Hole

Slot

Slit notch

Diagonal cut

Corner notch

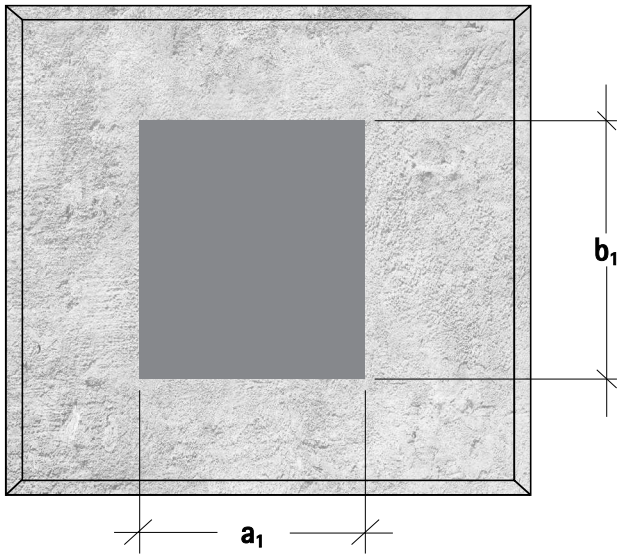
Rectangular notch

Rectangular hole

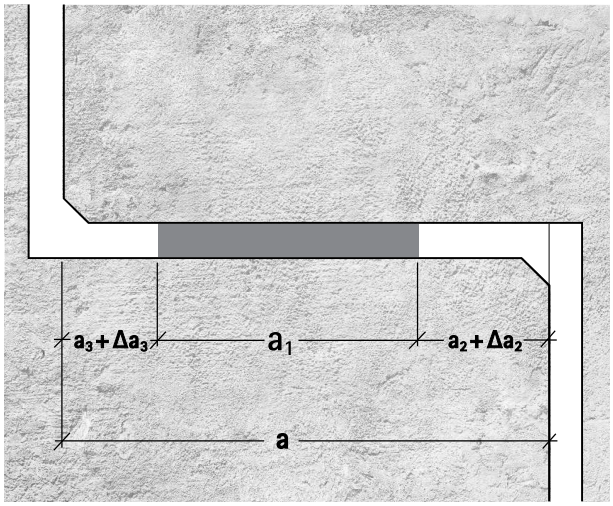
DIMENSIONS		
Bearing thickness	Maximum cut size	Minimum cut size
10, 20, 30, 40 mm	600 mm x 600 mm	90 mm x 90 mm for round bearings Ø = 90 mm

The bearing areas must be designed in accordance with the structural specifications and standards. The required edge distances shall be taken into account in accordance with DIN EN 1992-1-1 (2011-01). The elastomeric bearing must be located within the reinforcement in order to allow planned deformation of the bearing and to avoid spalling at the edge.

EDGE DISTANCE TOP VIEW



EDGE DISTANCE SIDE VIEW



LEGEND

Values for determining the required edge distances according to DIN EN 1992-1-1

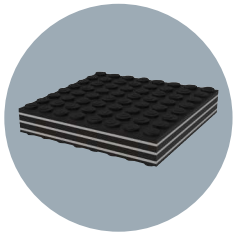
a | a_1 | a_2 | Δa_2 | a_3 | Δa_3 | b_1

Extract from the installation instructions

Prior to installation, it must be ensured that the elastomer bearings and bearing surfaces are free of dirt, ice, snow, grease, solvents, oils or separating agents.

In in-situ concrete construction the bearing joints must be filled and covered so that no concrete slurry can penetrate them. The spring effect of the bearing must be guaranteed.

Extract from our client reference projects



SANDWICH BEARING Q

- Federal Chancellery of Berlin, Germany
- Köstritzer Brewery, Bad Köstritz, Germany
- Hotel Titanic, Berlin, Germany
- Alu-Reclingwerk, Nachterstedt, Germany
- Audi Car Body Construction, Ingolstadt, Germany
- US-Depot Germersheim, Germany
- Coca Cola, Vienna, Austria
- Stadium Lech Poznan, Poznan, Poland
- Lia-Manoliu Stadium, Bucharest, Romania
- New Campus-Center University, Saarbrücken, Germany
- State Theatre, Löwentorstraße, Stuttgart, Germany
- Brewery Wernesgrün, Wernesgrün, Germany
- Crane track bearing, Maxhütte, Unterwellenborn, Germany
- Noise protection measure at "A2 Vught", Lelystad, Netherlands
- Office building La Chambeaudie, Paris, France
- Nederlands Dans-Theater, The Hague, Netherlands
- Opera House, Wenzhou, China
- Westphalian Horse Museum Münster, Germany

State Theatre Stuttgart, Germany

Federal Chancellery Berlin, Germany

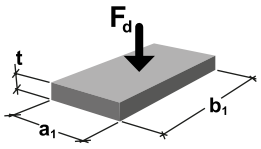
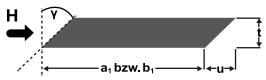
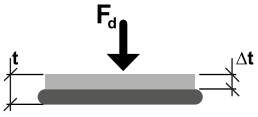
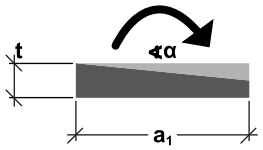
Sandwich Bearing Q

Structural bearing for static structural members

Design values

The bearings are dimensioned according to the general building authority approval up to a compressive stress $\sigma_{R,d} = 28\,N/mm^2$. Holes, cut-outs and the required edge distances must be taken into account according to DIN EN 1992.

TYPE OF LOAD ACTING

Design value of bearing resistance (max. compressive stress)	max. shear deformation	Deflection	max. rotation
			

FORMULA

$\sigma_{R,d} = 28\,N/mm^2$	t = 10 mm: $u_{max} = 0.4 \times t$ t > 10 mm: $u_{max} = 0.5 \times t$ Horizontal force $H = c_{s(t)} \times u \times A_E / 10{,}000\ mm^2$ A minimum compressive stress of 2 N/mm^2 is required to prevent the bearing from slipping. $c_{s(t)}$-values and boundary conditions s. page 4	s. page 4	t = 10 mm: $\alpha_{max} = 200\,‰ \times t/a_1 \leq 40\,‰$ t > 10 mm: $\alpha_{max} = 350\,‰ \times t/a_1 \leq 43\,‰$ Acc. to technical approval: 10 ‰ from obliquity 625 ‰ x mm/a from unevenness see also booklet 600, DAfStb

LEGEND FORMULA SYMBOLS

F_d	Vertical force	α	Bearing rotation
H	Horizontal force	$c_{s(t)}$	Shear stiffness
A_E	Bearing area	u	Shear deformation of the bearing
a_1	Short side of bearing	γ	Push angle
b_1	Long side of bearing	t	Thickness of bearing
$\sigma_{R,d}$	Design value of the load capacity	Δt	Bearing deflection
		D	Bore diameter

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Sandwich Bearing Q

Structural bearing for static structural members

Thicknesses: 10, 20, 30 and 40 mm

The table below depicts the design values of the load capacity and the allowable angle of distortion, depending on the bearing dimensions. Interim values can be inpolated.

RECTANGULAR BEARINGS								
BEARING WIDTH a [mm]	Bearing Thickness							
	t = 10 mm		t = 20 mm		t = 30 mm		t = 40 mm	
	Shear Deformation							
	u = 4 mm		u = 10 mm		u = 15 mm		u = 20 mm	
	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}
	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]
90	28.0	22.2	28.0	43.0	28.0	43.0	28.0	43.0
100	28.0	20.0	28.0	43.0	28.0	43.0	28.0	43.0
110	28.0	18.2	28.0	43.0	28.0	43.0	28.0	43.0
120	28.0	16.7	28.0	43.0	28.0	43.0	28.0	43.0
130	28.0	15.4	28.0	43.0	28.0	43.0	28.0	43.0
140	28.0	14.3	28.0	43.0	28.0	43.0	28.0	43.0
150	28.0	13.3	28.0	43.0	28.0	43.0	28.0	43.0
200	28.0	10.0	28.0	35.0	28.0	43.0	28.0	43.0
250	28.0	8.0	28.0	28.0	28.0	42.0	28.0	43.0
300	28.0	6.7	28.0	23.3	28.0	35.0	28.0	43.0
350	28.0	5.7	28.0	20.0	28.0	30.0	28.0	40.0
400	28.0	5.0	28.0	17.5	28.0	26.3	28.0	35.0
450	28.0	4.4	28.0	15.6	28.0	23.3	28.0	31.1
500	28.0	4.0	28.0	14.0	28.0	21.0	28.0	28.0
550	28.0	3.6	28.0	12.7	28.0	19.1	28.0	25.5
600	28.0	3.3	28.0	11.7	28.0	17.5	28.0	23.3

Number of boreholes ≤ 4
Percentage of boreholes in the bearing area ≤ 10 %
Minimum dimensions of the bearing a ≥ 90 mm, b ≥ 90 mm without borehole, a ≥ 120 mm, b ≥ 120 mm with borehole
Bore diameter ≤ 60 mm
Edge distance ≥ 20 mm

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Sandwich Bearing Q

Structural bearing for static structural members

Thicknesses: 10, 20, 30 and 40 mm

The table below depicts the design values of the load capacity and the allowable angle of distortion, depending on the bearing dimensions. Interim values can be inpolated.

ROUND BEARINGS								
DIAMETER D [mm]	Bearing Thickness							
	t = 10 mm		t = 20 mm		t = 30 mm		t = 40 mm	
	Shear Deformation							
	u = 4 mm		u = 10 mm		u = 15 mm		u = 20 mm	
	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}	$\sigma_{R,d}$	α_{max}
	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]	[N/mm²]	[‰]
90	28.0	22.2	28.0	43.0	28.0	43.0	28.0	43.0
100	28.0	20.0	28.0	43.0	28.0	43.0	28.0	43.0
110	28.0	18.2	28.0	43.0	28.0	43.0	28.0	43.0
120	28.0	16.7	28.0	43.0	28.0	43.0	28.0	43.0
130	28.0	15.4	28.0	43.0	28.0	43.0	28.0	43.0
140	28.0	14.3	28.0	43.0	28.0	43.0	28.0	43.0
150	28.0	13.3	28.0	43.0	28.0	43.0	28.0	43.0
200	28.0	10.0	28.0	35.0	28.0	43.0	28.0	43.0
250	28.0	8.0	28.0	28.0	28.0	42.0	28.0	43.0
300	28.0	6.7	28.0	23.3	28.0	35.0	28.0	43.0
350	28.0	5.7	28.0	20.0	28.0	30.0	28.0	40.0
400	28.0	5.0	28.0	17.5	28.0	26.3	28.0	35.0
450	28.0	4.4	28.0	15.6	28.0	23.3	28.0	31.1
500	28.0	4.0	28.0	14.0	28.0	21.0	28.0	28.0
550	28.0	3.6	28.0	12.7	28.0	19.1	28.0	25.5
600	28.0	3.6	28.0	11.7	28.0	17.5	28.0	23.3

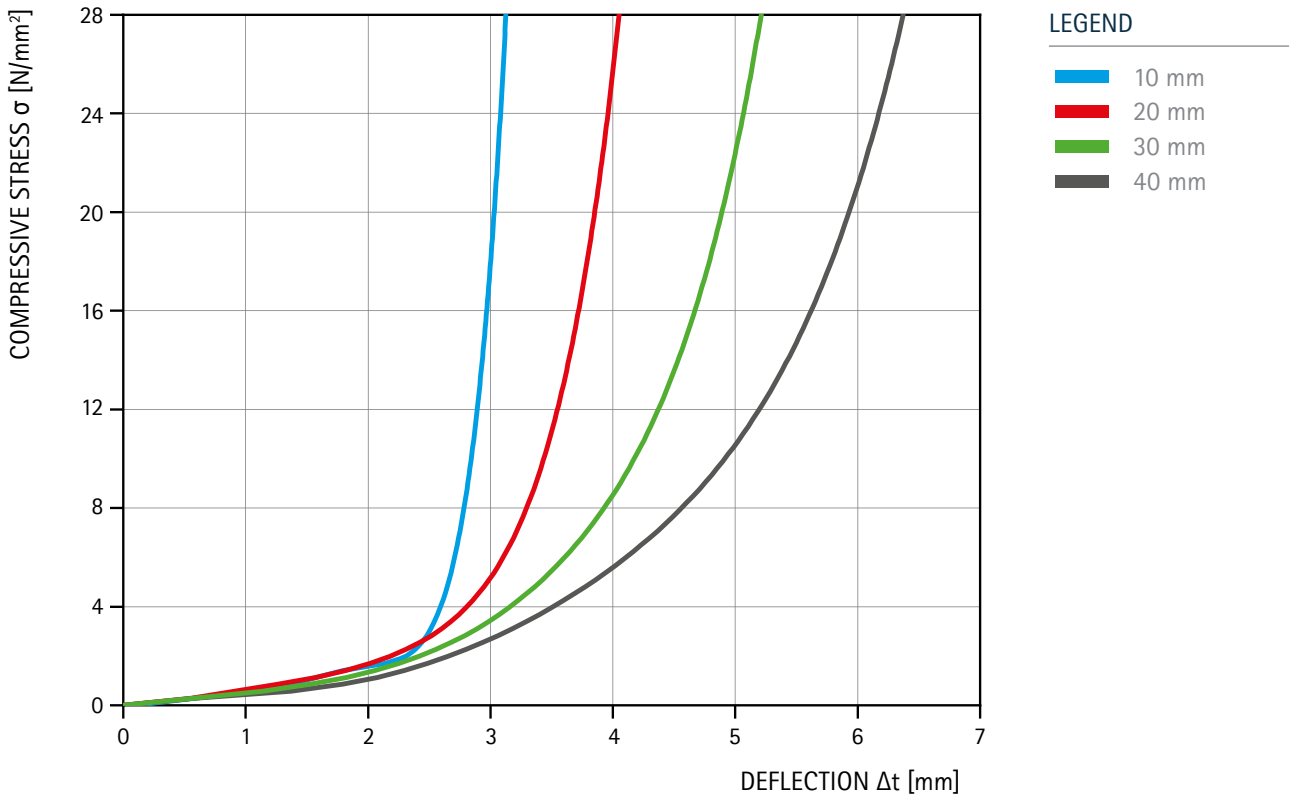
Number of boreholes ≤ 4
Percentage of boreholes in the bearing area ≤ 10 %
Minimum dimensions of the bearing D ≥ 90 mm without borehole, D ≥ 120 mm with borehole
Bore diameter ≤ 60 mm
Edge distance ≥ 20 mm

Sandwich Bearing Q

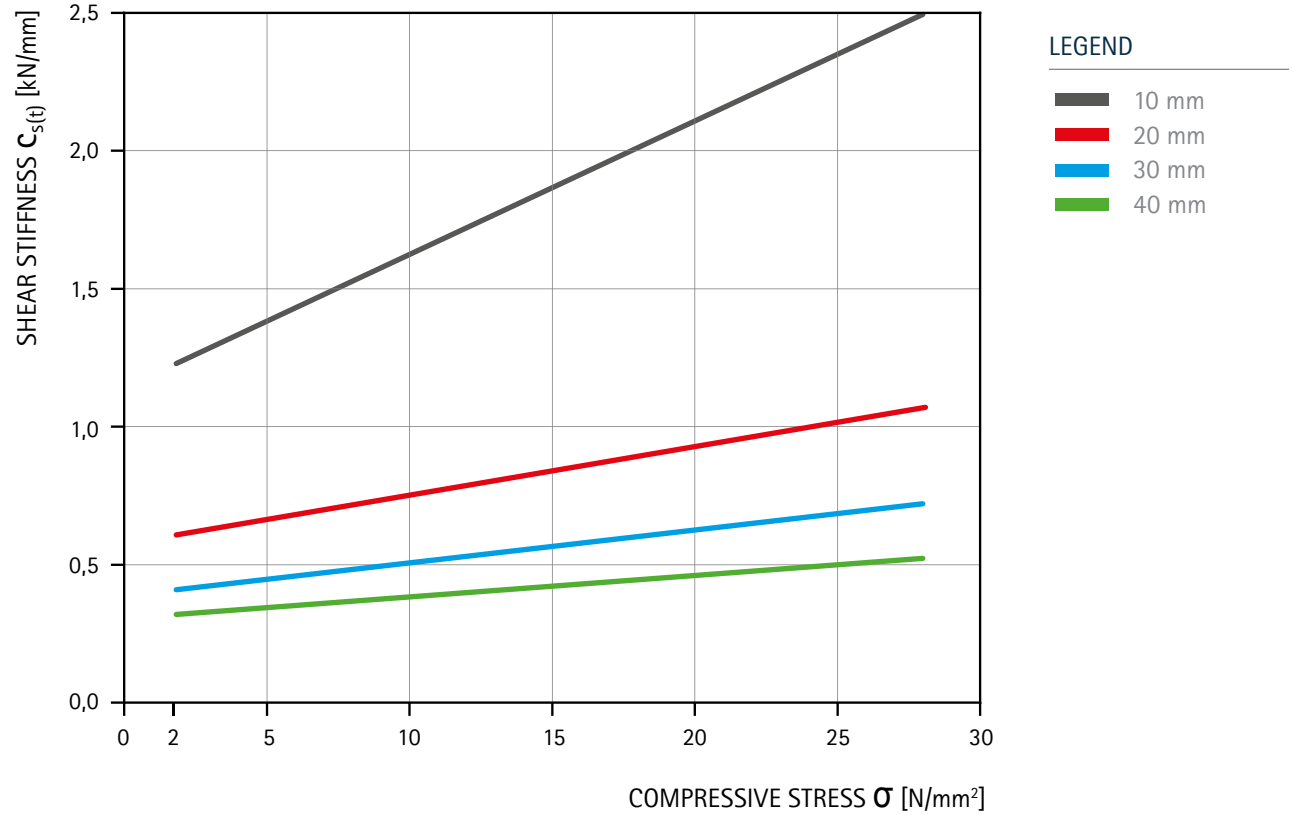
Structural bearing for static structural members

Load deflection curve

The following diagram shows the compression behaviour for different formats when used between concrete surfaces (precast elements).



Shear stiffness



Sandwich Bearing Q

Structural bearing for static structural members

Design example

Given: $F_{E,d}$ = 1232 kN* corresponding to $F_{E,k}$ = approx. $F_{E,d}$/1.4 = 880 kN*, bearing rotation α = 19 ‰, horizontal deformation u = 8 mm

Selected dimensions:	a_1 = 150 mm, b_1 = 300 mm, t = 20 mm
Load capacity:	$\sigma_{R,d}$ = 28.0 N/mm²
	$F_{R,d} = \sigma_{R,d} \times A_E$ = 28,0 N/mm² x 150 mm x 300 mm = 1260 kN
	$F_{R,d} \geq F_{E,d}$ → Load capacity of the bearing is sufficient
Bearing distortion from component deflection:	α = 19 ‰
Additional rotation from obliqness:	10 ‰
Additional rotation from unevenness:	625 (mm*‰) / a = 625 / 150 ‰ = 4,2 ‰
Total rotation to be measured:	α = 19 ‰ + 10 ‰ + 4.2 ‰ = 33.2 ‰
	max. α = 350 ‰ x t / a = 350 ‰ x 20 mm / 150 mm =
	46.7 ‰ > 43 ‰ → max. α = 43 ‰
	max. α ≥ α → Angle of twist for rotation is sufficient
Horizontal deflection of structural members:	u = 8.0 mm
	max. u = 0.5 x t = 10.0 mm
	max. u ≥ u → Shear deformability of the bearing is sufficient

* Note on partial safety factor: The partial safety factor of a compressive load depends on its type. In case of permanent loads it is e.g. 1.35, in case of variable loads 1.5. Since structural bearings in building construction should only be used under predominantly permanent loads, a factor of approximately 1.4 can be used for the ratio between the total characteristic load and the total design rated load.

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