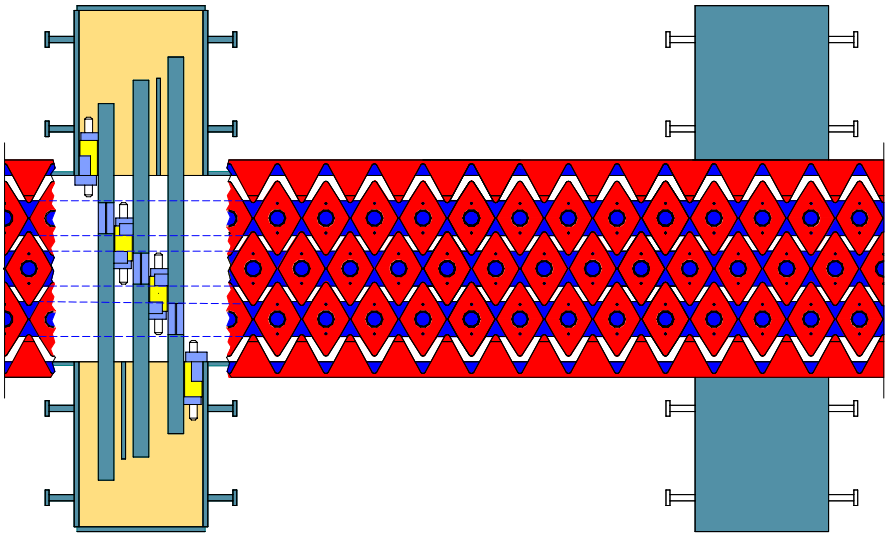
Bauwerkschutzsysteme

LOW-NOISE MAURER LAMELLA EXPANSION JOINTS XL TYPE

TECHNICAL APPROVAL ACCORDING TO TL/TP FÜ (Stand 03/05)

According to the requirements of:

German Federal Ministry of Transportation,
Building Industry and Housing
Department for Road construction, Road Traffic / Department S 18
Robert-Schuman-Platz 1
D-53175 Bonn



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University Stuttgart
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Technical Approval
of static and construction engineering aspect according to TL/PFÜ (Stand: 03/05) tested, see Inspection report-Nr.: 06/07 dated 12.11.2007

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Dipl.-Ing. W. Neumann, 58091 Hagen

MAURER SÖHNE
Innovationen in Stahl
Seit 1876

M A N U A L

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0. Field of application

The technical approval covers Construction of frequently repeated methods of construction. Currently there are the following limitations of the range of use to be considered:

- Movement direction 60° ≤ □ ≤ 120°
- At the joint, the superstructure must be guided in an unequivocal way, for example by a one-axle movable bearing
- The carriageway must not exceed 10% slope in the direction of the joint and 6 % orthogonal.
- Allowed displacements according to table 3.2 have to be kept.
- According to the ground plan, direction changes of the joint design are allowed only between two parapet units

Deviations from the above limitations and subsequent specifications are possible but they require a test for each single case separately.

1. Persons in charge

1.1 Applicant and Operator

MAURER SÖHNE GmbH & Co. KG
Frankfurter Ring 193
80807 Munich

Technical Office Munich
Dr. Braun, Mr. Volk

1.2 Manufacturer of the expansion joint

MAURER SÖHNE GmbH & Co. KG

Technical Office:	Manufacturing sites	Installation crews
Frankfurter Ring 193 80807 Munich	Frankfurter Ring 193 80807 Munich	Frankfurter Ring 193 80807 Munich
Zum Holzplatz 2 44536 Lünen		Zum Holzplatz 2 44536 Lünen
Kamenzer Str. 53 02994 Bernsdorf	Kamenzer Str. 53 02994 Bernsdorf	Kamenzer Str. 53 02994 Bernsdorf

1.3 Manufacturer of special components

See "The List of approved suppliers" in the appendix of the company's work instruction QSA 1.810 in current version.

1.4 Quality Assurance

QS-System

The quality management system meets the DIN EN ISO 9001 standards. It was certified by DVS-Zert.

Monitoring

The Monitoring is divided into external and internal supervision. The documents and working instructions that form the basis of this TECHNICAL APPROVAL will be tested on their compliance with these regulations. Responsible for the External Monitoring is the

German Federal Materials Testing Institute of the University Stuttgart
Pfaffenwaldring 32/ D-70569 Stuttgart

1.5 Approvals and verifications

Approvals for Welding

Factory Munich 15018	"The Extensive Proof of Suitability" according to DIN 18800 Part 7, DIN (DIN 18809 included in DIN 15018), DIN 4099 and DS 804
Factory Bernsdorf 4099 and	"The Extensive Proof of Suitability" according to DIN 18800 Part 7, DIN DS 804 (DIN 18809)
Branch Lünen 18809,	"The Extensive Proof of Suitability" according to DIN 18800 Part 7, DIN DIN 4099 and DS 804

Approval of Factory Welders

The condition required to obtain an Approval is a Licence according to DIN EN 287-1.

Approval of site welders

According to component demands, only welders with a valid verification certificate according to DIN EN 287-1 and site welder's verification according to DIN 4099 are deployed. The related verification is at their disposal on the site.

For lamella welding with copper jaw touch according to QSA 1.510, Point 2.1 "Site butt joint of the-lamella" a special Certificate of Qualification has to be presented.

1.6 Manufacturer's statement

MAURER SÖHNE GmbH & Co. KG herewith declare

- Compliance with the design conditions of all documents with the test certificates, listed in the index from 1.02.2007
- Compliance with quality assurance standards listed in the supervision contract from 01.04.2002.

Munich, 1. February 2007

Company Management | Technical office

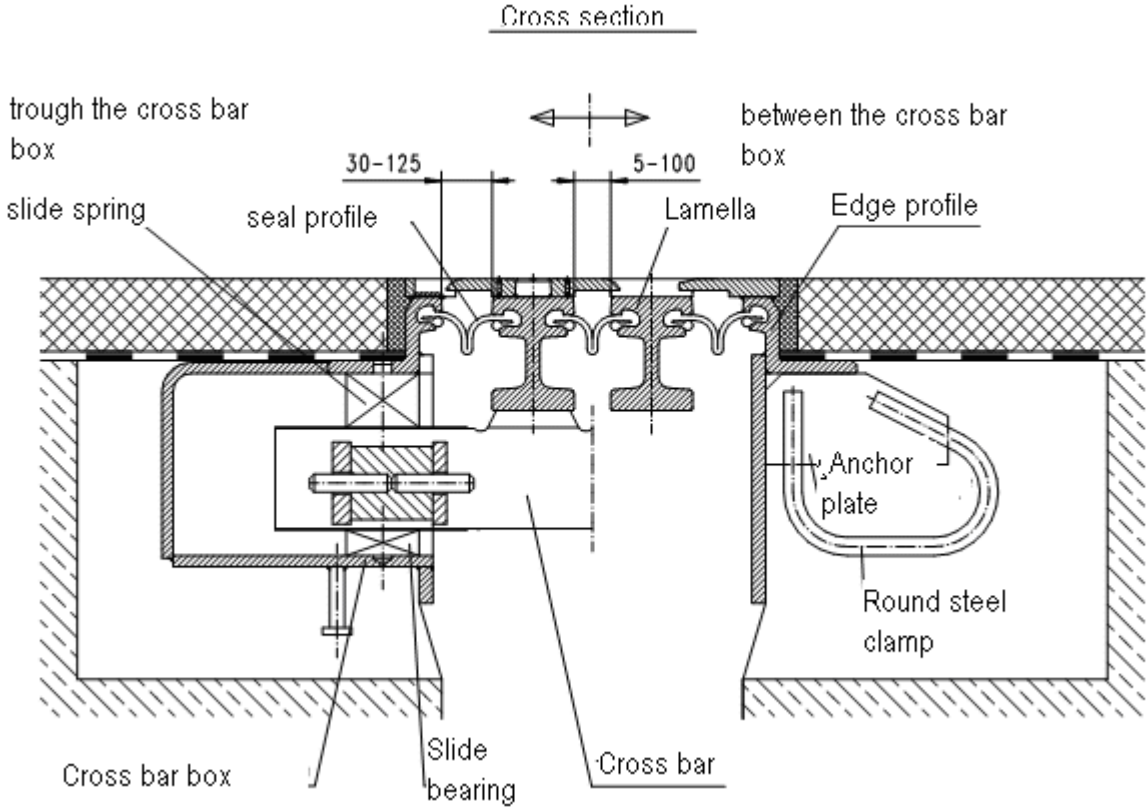
2. Description of the system

2.1 General

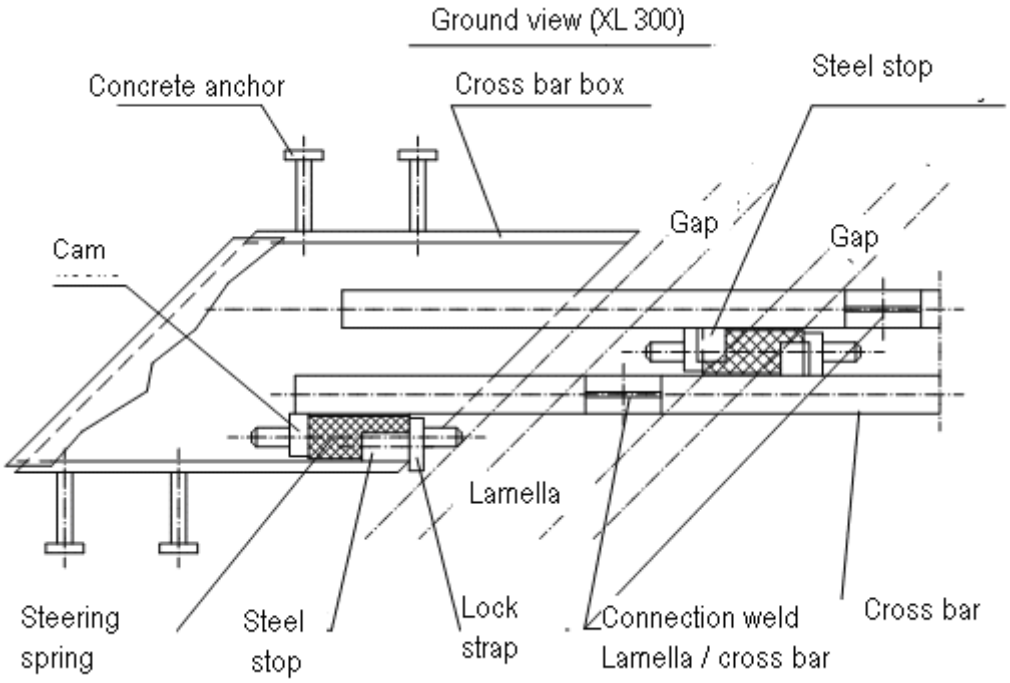
At MAURER-lamella expansion joints of Type XL each lamella is rigidly welded to the assigned joists. So an internal relocatable girder grid is provided. This expansion joint is to be applied in situations where, at both joint edges, i.e. at the abutment and at the superstructure, there is enough space, or enough space can be provided, to install the joist- box in. Joists, due to their construction, require the same expansion space at both gap edges. This Technical Approval covers the Types XL200 – XL600.

2.2 Mode of operation

The cross bars (joists) are positioned according to the moving direction of the structure. Other planned moving components than specified are not going to be absorbed. For this reason bearings have to be placed under the movable superstructure in order to compensate the rectangular movement effectively.



MAURER-lamella expansion joints always adapt to the deformation of the structure. Control springs, positioned between cross bars or between the cross bar and the sidewall of the cross bar box, provide an equal distribution of the whole movement to each joint gap. Steel stops on the cross bars prevent the opening of individual gaps for more than 100 mm.



The control springs consist of mostly closed cell Polyurethane, a suitable material for dynamic and shock stressed spring elements. The high deformation allowed (up to 80 % pressure deformation, relating to the uncompressed basic position) enables the production of elements with large allowed spring travel at small dimensions. The self damping of the material provides at the same time for oscillation and shock damping of dynamic stressed constructional parts.

The method of arrangement of block pins for attachment of the control springs onto cross bars causes a compression of the springs as the gap opens. At each opening state the springs are tense; the pressure pre-tensioning is lowest when the gap is closed.
The advantages of this control system are:

- Adaptability to production tolerances
- Low accident sensitivity
- Durability
- Insensitivity to movement enforcements
- Noise damping
- The possibility of expanding individual gaps for maintenance works

2.3 Transmission of wheel load

The wheel loads burden rhombic elements on the bars directly. Because of eccentric raiding wheel loads, based internal force variables are transferred through the bars over welded joints to the cross bars. From there they are transferred over the bearing elements and control springs into the gap edges.

2.4 Elastic support of cross bars (joists)

Cross bars at their structure edges are spring elastically supported on sliding bearings. The cross bars` lift-off from the sliding bearings within the cross bar box is prevented by means of a pre-stressed sliding spring arranged above the cross bars.

Through this elastic support the momentum of the wheels is damped when transferred to the absorbed elements of the cross section or to the neighbouring anchor parts. The arrangement of the elastomer bearing elements between all relatively converging components prevents any metal-to-metal contact and assures at the same time high damping of noises within the vulcanised rubber elements.

The elastomer bearing elements allow rotations about all three axes, whereby for instance unplanned restraint forces can be prevented.

2.5 Anchorage

Edge profiles are anchored with non stretchable anchor plates and welded round steel clamps in the concrete of the construction. The cross bar boxes have welded head bolt dowels to connect to neighbouring concrete. In steel bridges the edge construction is supported on steel consoles or support holders parallel to the end cross beam.

2.6 Sealing profile

The bulbous-shaped EPDM strip is waterproof and pullout sealed and is installed in a claw in the edge beam and centre beams without the need for additional clamping bars. At the thickened places at the edge of the seal expansion joints a web is formed, which ends as a beaded rim. When the seal expansion joint is placed into the steel profile the thickened part presses, using the wedging force against the steel profile. By this means, in addition to a form-locking connection, a friction-fitted Seal-/Steel profile contact is provided. At the same time the formed web with beaded rim acts as a lock which prevents it fromjumping out in the case of dragging forces. The connection is watertight, with the sealing element set below the road surface level. In this way it is protected against direct wheel- or snowplough-contact.

The admissible displacement of the sealing profile rectangular in the direction to the gap is 95 mm. With its preformed articulated section it is possible to move the seal strip in the direction of the carriageway without any appreciable strain. The admissible displacement in the direction to the gap of ±50 mm causes a strain in the sealing profile.

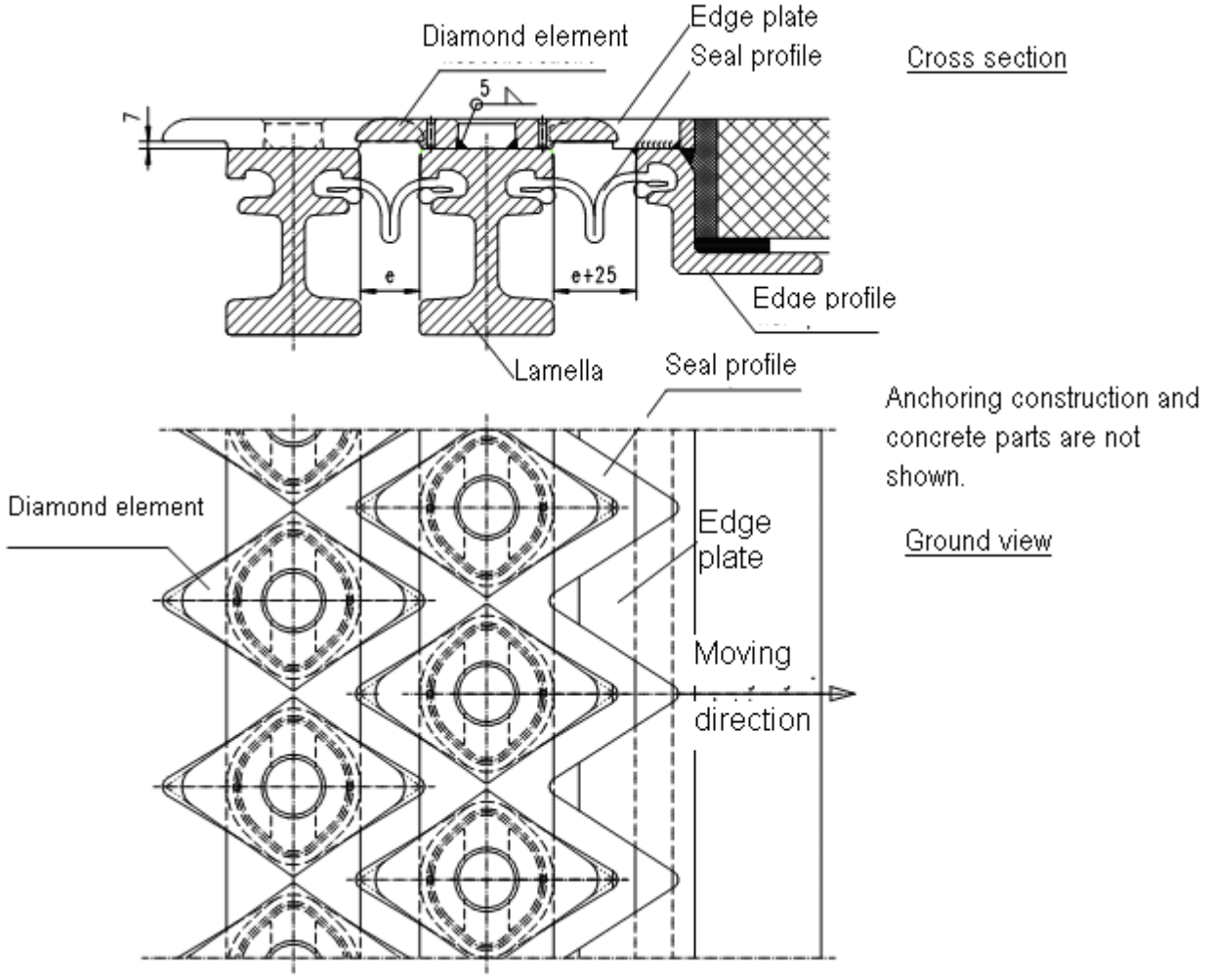
Sealing elements can be replaced from above with a pry bar when the individual gaps are ≥ 60 mm. The gap width can be enlarged by moving the lamellas. The bulbous edge section of the sealing element locks it in the steel claw and is capable of withstanding wheel pressure or any impurities (e.g. stones, grit, snow etc.). The sealing element adapts to different kinds of joint design and bridge cross sections.

2.7 Noise reduction

On bridges the noise radiates not only from the carriageway but also underneath and is often additionally amplified by the swinging impulses of the bridge superstructure. The noises on uneven road surfaces and expansion joints are regarded as especially disturbing.

With the use of rhombic elements the tyres do not hit the steel edges rectangularly, but diagonally against rounded tops, and so a noticeable impact and noise reduction is achieved.

The rhombic elements are attached to the underneath lamellas through punched welding. The tops of the rhombic elements project over the edges of the lamellas and don't touch neighbouring lamellas or the edge profile. The elements partly cover the neighbouring gap of the joint without building a passing through gap on the joint. There are sinusoid cut-out edge plates welded onto the edge profiles.



This gives a noise reduction of approximately 7 dB for cars and trucks compared to usual joints made with lamellas crossed over rectangular to the gap (ε = 90°).

By welding on the rhombic elements the carriageway geometry is also changed. The influence on the wheel load spreading at the cross section construction was technically experimentally tested at the TU-Munich, Prüfamt Landverkehrswege, with comparative analysis of results for the lamellas with and without rhombic elements. The truck wheel was placed centrally above the middle lamella and at the second line of the experiment between two lamellas. Additionally the load position of 5 different gap widths was tested.
The results showed that the lamellas with and without rhombic elements had to absorb almost the same wheel load. In present forms there are also no static relevant differences. But, when the maximal single gap width expands from 70 mm to 100 mm, the fatigue strength relevant gap dimension also changes from 52, 5 mm to 75 mm. That fact causes a rise of the fatigue strength relevant vertical load from 60% to 65%.
All other known design concepts for carriageway cross sections have full validity for the rhombic variety too.

The tests showed no differences in traffic security concerning the tyre grip between the constructions of lamellas with and without rhombic elements on non profiled surfaces.
As the rhombic elements are hammer forged, the driving surfaces obtain an additionally chequered structure. This provides a better grip between the wheel and the diamond element, and it is carried out as an advancement of technical traffic security regardless of positive test results.

As the rhombic elements are pouch welded, there is a non welded gap on the outer edge of the contact surface. To prevent corrosion damage the following method was developed to provide adequate sealing.

The gap is sealed at the outer edge by a special sealing material. Silicon mass is pressed through a borehole into a sealing groove in the welded construction. Two control gaps enable the operator to check whether there was enough sealing mass injected. After this procedure the borehole is closed with a smashed in cylinder bolt. The hardening of silicon prevents lateral leaking later on.

3. Hints for the user

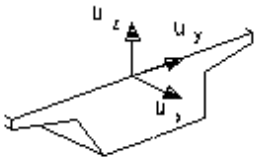
3.1 Checklist for Planning and Inspection

At the girder planning and inspection respect the following points:

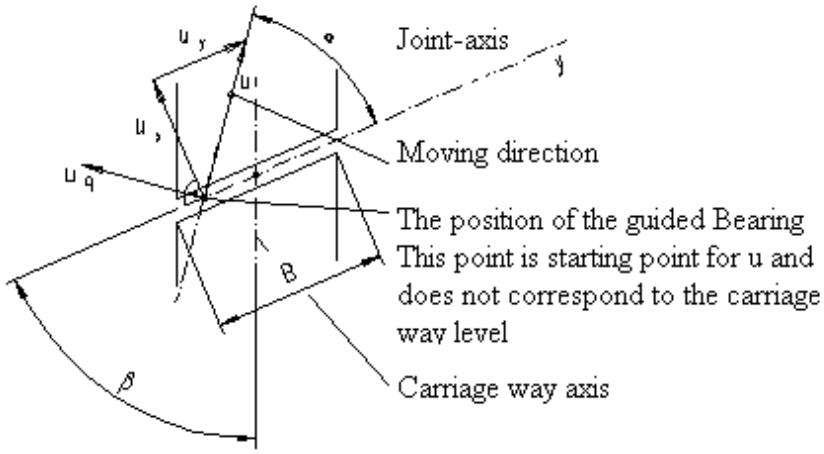
1	**Field of application**
1.1	Review of the ancillary conditions for the application area and the choice of the type of cross-section.
2	**Movements**
2.1	The calculation of movements of the cross section from rotation and displacement of neighbouring components due to ■ Temperature ■ Shrinkage and Creep ■ Lifting to exchange the bearing ■ Braking/drive away ■ Displacement of fixed points ■ Elasticity of the foundation ■ Other Effects
2.2	Determining of adverse moving combinations at the gap
2.3	Selection of Cross section considering the allowed movement according to specifications in the Tables in part 3.2
2.4	Check of final rectangular girder deformation in respect of specifications according to TL/TP-FÜ (03/05)
3	**Loads**
3.1	Check of loads affecting the cross section through load estimates according to TL/TP-FÜ (03/05) (special vehicles, inspection devices)
4	**Pre-adjustment**
4.1	Determination of the planned mounting temperature and the appropriate rectangular and parallel presetting according to the gap
4.2	Defining the change of dimensions of pre-adjustment in mm/°C
5	**Recesses**
5.1	Determination of the size und configuration of recesses according to Part 3.4 for anchoring of cross section's
5.2	In special cases: Dimensioning with approval of company Maurer Söhne
6	**Anchoring**
6.1	Planning of connecting armour or supporting constructions with steel constructions regarding the loads given in Part 3.5
6.2	Adjustment of reinforcements at the installation location of carriageway cross sections
6.3	Designing of reinforcements capable of trouble-free mounting with anchoring at connecting brackets of the cross section construction
7	**Handling by the company MAURER SÖHNE**
7.1	Issuing general arrangements and detailed drawings of specific structures
7.2	Examination and the proof of the geometrical operating conditions
7.3	Adjustment to the arrangement of the bars according to special construction requirements (clamping elements, recesses)

3.2 Overview of the allowed movements determined within the scope of the Technical approval

All acceptable movements may arise in any combination within the given tolerance areas. For the angles φ_X, φ_Z and the displacement u_Z following formulae are valid.



Orthogonal coordination system
The x and y directions are positioned at the carriageway-level!

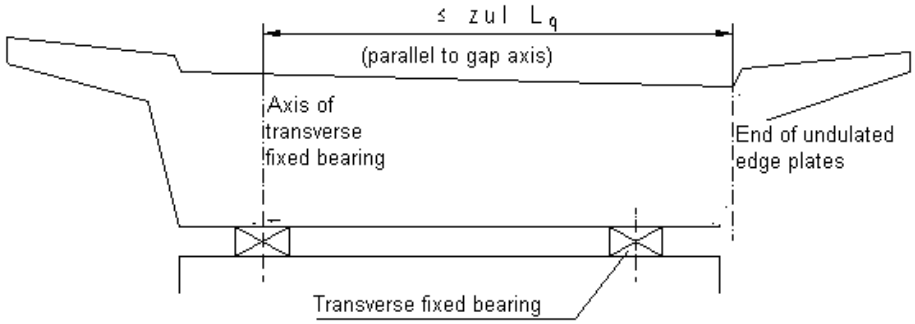


n Number of Sealing profiles	type	u_x [mm] total dilatation path	u_z [mm] e=40 mm	u_z [mm] e=50 mm	φ_x e=50 mm B=15 m	$\varphi_{y,stat}$	$\varphi_{y,dyn}$	φ_z e=50 mm B=15 m	α [°]	β [°]
2	XL200	190	± 19,6	± 21,1	± 0,161°			± 0,688°		
3	XL300	285	± 29,4	± 31,7	± 0,242°			±1,031°		
4	XL400	380	± 39,2	± 42,2	± 0,323°	± 4,311°	± 1,031°	± 1,375°	90°±30°	any
5	XL500	475	± 49,0	± 52,8	± 0,403°			± 1,718°		
6	XL600	570	± 58,8	± 63,6	± 0,484°			± 2,062°		

n... Number of the sealing profiles
u... Movement direction of the superstructure ends (apply on guided bearings)
u_x... Movement component rectangular to the gap axis ($n \times 95$ mm)
u_y.. Movement component parallel to gap axis ($\pm(\pm n \times 50$ mm (only for sealing profiles))
u_z.. Height offset of the edge profile in z-direction as geometrical sustainable ($\pm 0{,}0754 \times n \times (90 + e[mm])$)
Limit in special cases of dimensioning (for example earth quake loads)
φ_x... Rotation about x-axis rectangular to the gap ($\pm\arctan((2 \times 0{,}0754 \times n \times (90 + e[mm]) / B[mm])$)
φ_y... Rotation of cross bar bearings about y-axis (gap axis)
φ_z... Rotation about the z-axis at the driving surface ($\pm\arctan((u_{x,zul} - u_{x,vorh}) \times 2 / B)$)
α... Angle between gap axis y and moving direction u
β... Angle between gap axis y and carriage way axis
s... Single gap width between the lamellas or between edge profile and lamella
B... Gap length in y-direction

Instruction: The proof of incline change according to TL/TP-FÜ (03/05) Section 3.5.6 (3) is irrelevant for requested longitudinal incline $s_{Fb} \leq 6\%$!

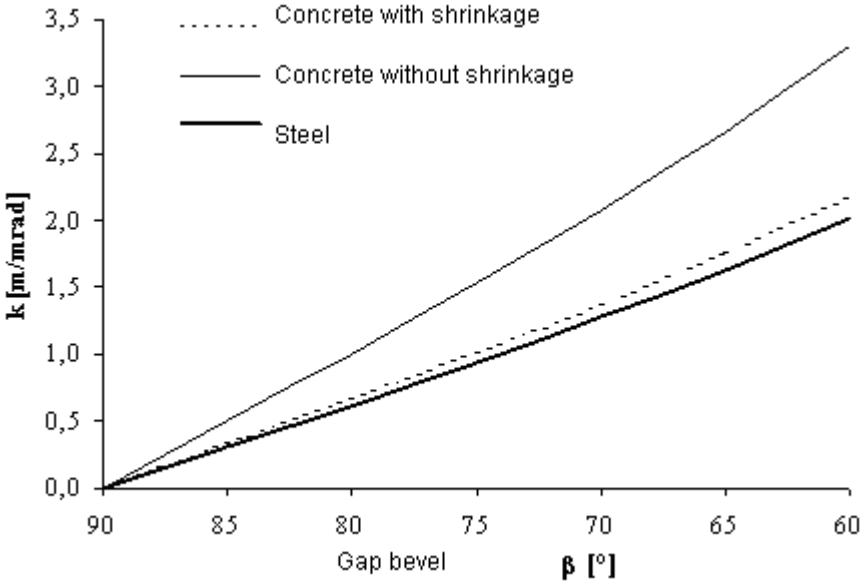
3.3 Allowed constructional lengths in the carriageway area



Allowing for constructional bearing play of 1 mm it follows:

n [-]	Prestressed concrete bridge with shrinkage zul L_q [m]	Prestressed concrete bridge without shrinkage zul L_q [m]	Steel girder concrete and steel bridges zul L_q [m]
2	13,2	20,0	12,3
3	20,8	31,4	19,3
4-6	28,3	42,9	26,3

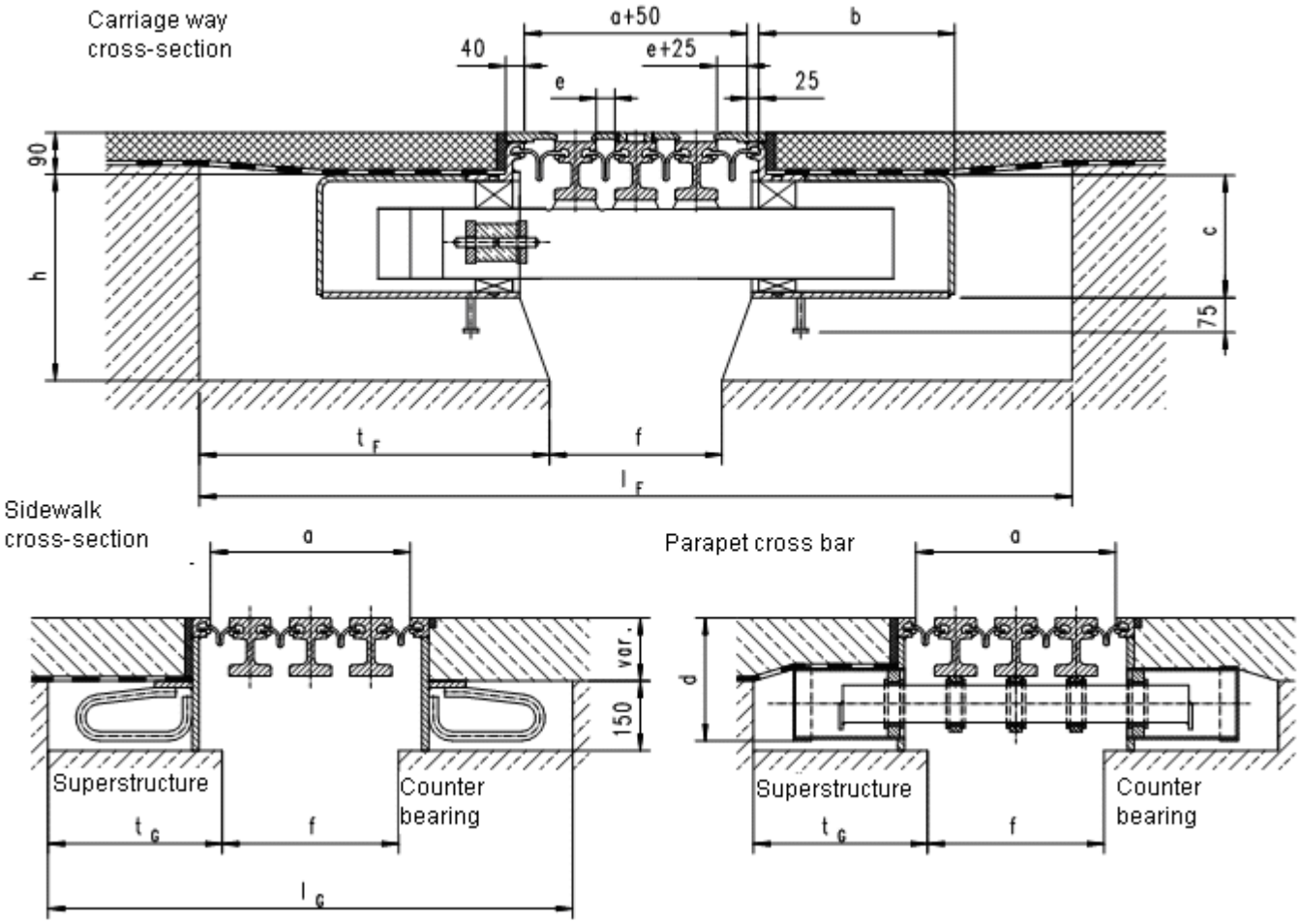
With oblique bridge ends the end field twist φ_y [mrad] of the superstructure has an effect on the allowed construction length L_q.
The distance between the superstructure centre line and carriageway change-over is adopted with h = 2 m:



$$zul\grave{L}_q = zulL_q - k \times \varphi_y$$

(With zul L_q according to upper table)

3.4 Recess-sizes



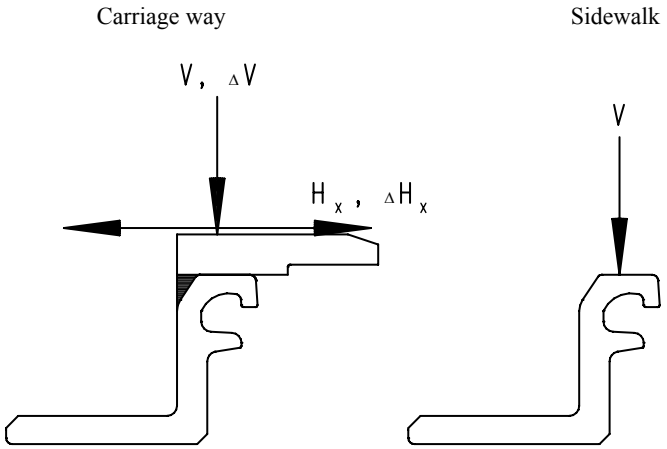
MAURER expansion joint			Construction measure-ments				Recess dimensions			Concrete-Gap dimensions			
n	**Type**	**α** [°]	**a** [mm]	**b** [mm]	**c** [mm]	**d** [mm]	**h** [mm]	**t_F** [mm]	**t_G** [mm]	**f_{min}** [mm]	**f_{max}** [mm]	**l_F** [mm]	**l_G** [mm]
2	XL200	90°-60°	190	237	226	255	350	400	300	170	190	970	770
3	XL300		330	337	246	255	370	500	350	300	330	1300	1000
4	XL400		470	437	266	255	390	600	400	430	470	1630	1230
5	XL500		610	540	286	255	410	700	450	560	610	1960	1460
6	XL600		750	650	306	255	430	800	500	690	750	2290	1690

- all dimensions rectangular to gap axis y
- n = number of sealing profiles
- a, f and l apply for adjustment dimension e = 50 mm per joint gap. If the dimension e differs, it has to be corrected with Δe.
- Recesses for pavement cross bars and cable conduits have to be considered individually.
- due to the specific design of the construction, in special cases smaller recesses are possible. As long as the dimensions of the steel construction remain unchanged, suchlike deviation requires no special approval but falls within the competence of the bridge designer and the engineer competent for testing of the structure (consider the capability for concreting).
- Consider specifications given in Part 6.1.

3.5 Anchoring powers

Irrespective of carriageway inclination, V always acts vertical and H always horizontal. Stated power specifications apply at same size and direction for cross bar bearing boxes and edge profiles when connecting a steel bridge. The values for wear out evidence already contain the increase factor $\gamma_E = 1{,}25$.

Edge profile



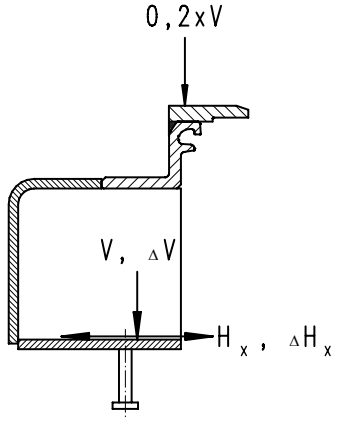
Moving resistance (friction and control)	
H_x [kN/m]	3,0 + 1,5 × n
H_v [kN/m]	negligible

Certificate for load bearing		
	Carriage way	Sidewalk
V [kN] *)	140	50
H_X [kN] *)	47,4	3,0
H_y [kN] *)	negligible	-

	Certificate for tiredness	
ΔV [kN] *)	136,5	(κ = -0,3)
ΔH_x [kN] *)	32	(κ = -0,73)
ΔH_v [kN]	negligible	

*) the quoted loading lengths apply to wheel widths b=0,60 m for the carriageway and b=0,40 m for the sidewalk

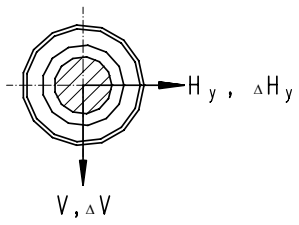
Cross bar box



Certificate for load bearing	
V [kN]	123,8
H_X [kN]	46,4
H_y [kN]	46,4×tanα

	Certificate for tiredness	
ΔV [kN]	120,7	(κ = -0,3)
ΔH_x [kN]	30,7	(κ = -0,73)
ΔH_v [kN]	30,7×tanα	(κ = -0,73)

Parapet unit



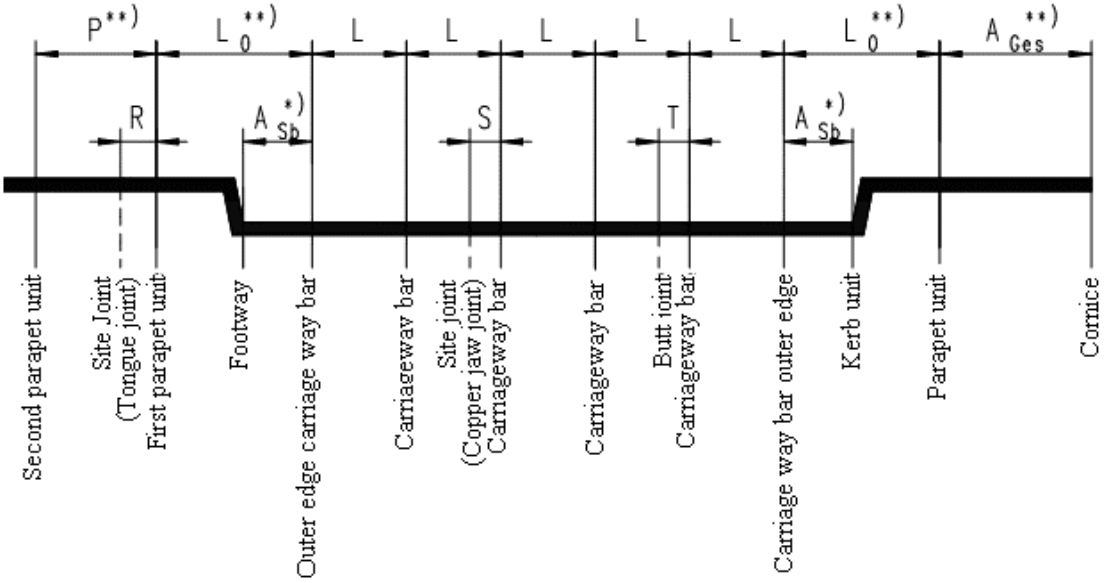
Certificate for load bearing	
V_{max} [kN]	39,6
V_{min} [kN]	-38,4
H_V [kN]	37,5

	Certificate for tiredness	
ΔV [kN]	-28,8	(κ = 0)
ΔH_v [kN]	28,1	(κ = 0)

4. Construction requirements for the technical approved expansion joints

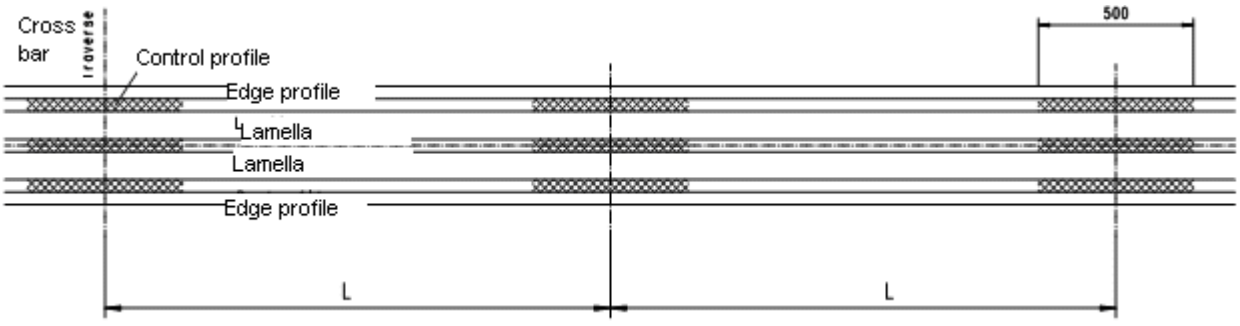
4.1 Allowed cross bar interspaces and arrangement of the butts

Cross section in direction of the Joint-axis



*)The values for A_{Sb} have to be maintained for each neighbouring n-1 Cross bar.
**)ee Part 4.2

n	Type	s	A_{Sb} [mm]	L [mm]	R [mm]	S_{min} [mm]	S_{max} [mm]	T_{min} [mm]	T_{max} [mm]
2 to 6	XL200 to XL600	≤3%	≤830	≤1630	≤1630	115	500	60	370
		≤4%				118	467	65	342
		≤5%				122	433	70	313
		≤6%				125	400	75	285

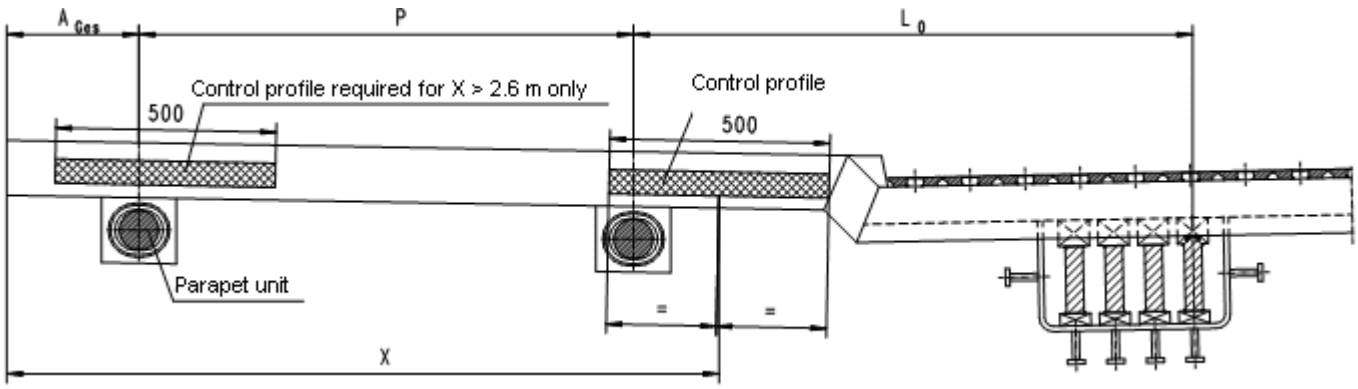


When the bridge declination > 3% on all cross bar boxes of the carriageway an 0,5 m long guiding profile has to be inserted.

4.2 Arrangement of Parapet units

The Parapet unit shall be of the swivel-type and built-in with a single gap recess-size of e= 40 mm rectangular to the gap axis. According to TL/TP- (03/05) the vertical self frequency f_v = 120 Hz and the horizontal self frequency f_h = 40 Hz are not to be undershoot.

Therefore the overhang length A_{Ges} has to be limited.



n	A_{Ges} [mm]	L_0 [mm]	P [mm]
2	≤400	≤1700	0
to	≤400	≤1700	≤1700
6	≤600	≤1700	≤1500
	≤600	≤1500	0

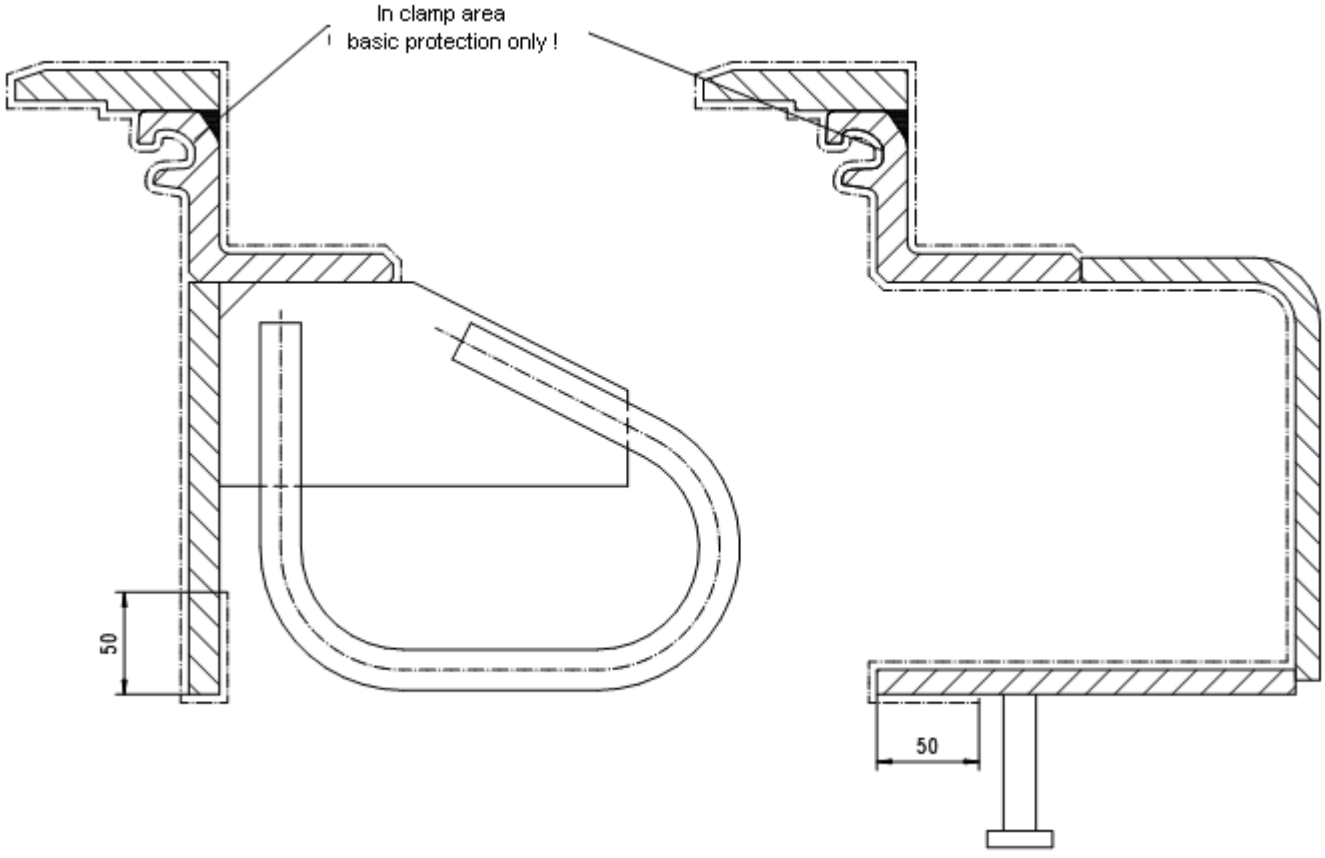
Is the clearance between the outer edge of the parapet area and the middle of the pavement steering at the kerfs shelf X > 2,6 m, on the outer Parapet unit additionally an 0,5 m long guiding profile has to be inserted.

4.3 Factory provided corrosion protection

The corrosion protection of regularly tested constructions is executed according to ZTV-KOR-Steel constructions 2002.
Appendix A

Corrosion protection system No. 1		Target layer thickness	Surface preparation	Materials according to TL/TP-KOR-Steel constructions 2002 Page Nr.
GB	EP-zinc powder	70 µm	Sa 2½	94/95
1.DB	EP (micaceous iron ore)	80 µm each DB		
2.DB				
3.DB				
4.DB				

The blasting is executed in a flow through installation, the coating in airless-procedure following immediately.
The protected area is shown on following drawings:



5. Installation instructions

5.1 Delivery

The expansion joints are delivered to site totally assembled at whole length or section wise. Auxiliary constructions support the transport, storing and installation, so cross sections maintain the right installation position and expert unloading. Hanging points for up and downloading are marked with colour, the installation position is marked and the total weight of each construction is stated on separate hanging plates or adhesive labels. The constructions have to be appropriate stored on site i.e. they have to be put on suitable underlay (i.e. on square shaped timber). Damage and dirt have to be prevented through well aired canvases.

Following tabled running meter loads can serve as guiding values for the crane layout.

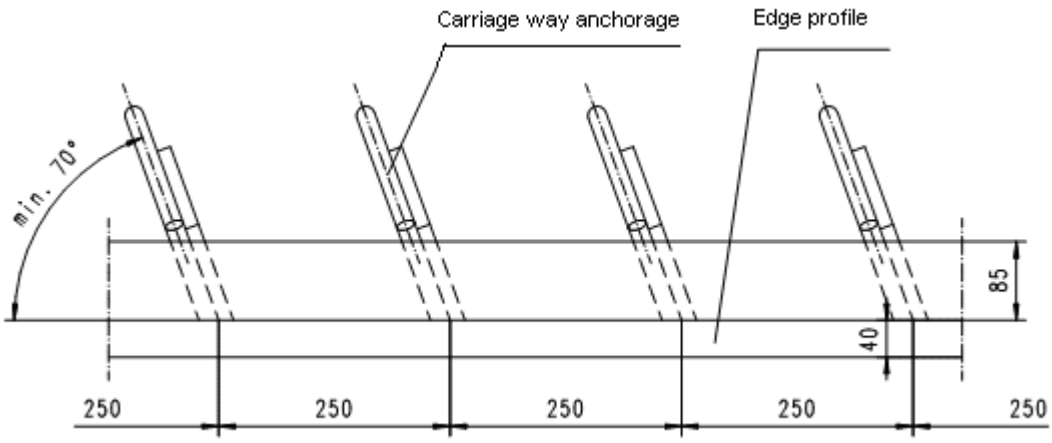
Type	Load[kg/m]
XL200	250
XL300	350
XL400	500
XL500	600
XL600	800

Table: Running meter loads for crane layout (guiding values)

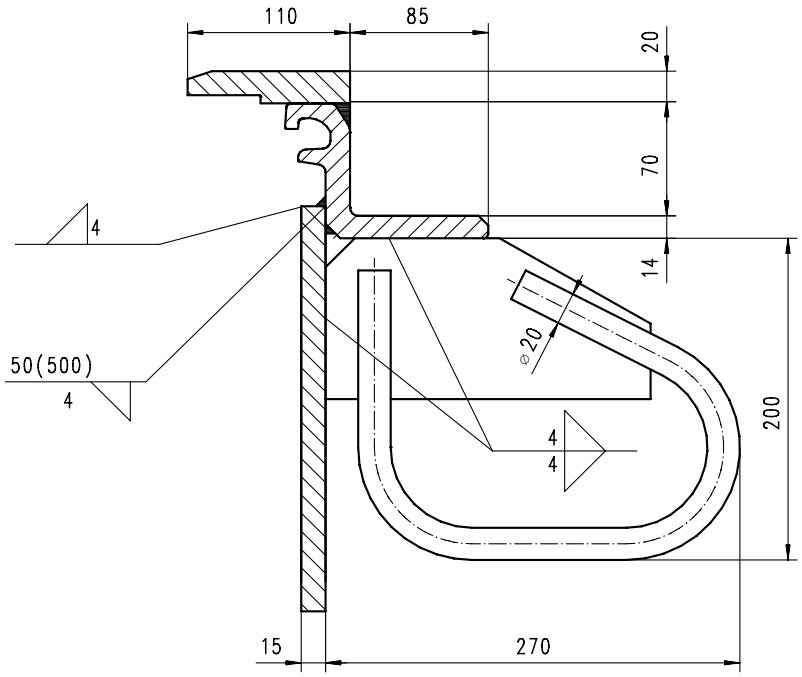
5.2 Installation and supporting structure connection in case of concrete components

The size of recesses at the construction concrete is defined in advance as soon as at the structure planning according to Part 3.3 or finally according to our construction drawings and has to be erected accordingly. Always regard the proper width structure recess based on chosen setting dimension of the dilatation gap. The recess dimensions are to be checked once again just before installing and corrected, if necessary. The surfaces of the recesses have to be treated as working gaps according to DIN 1045.

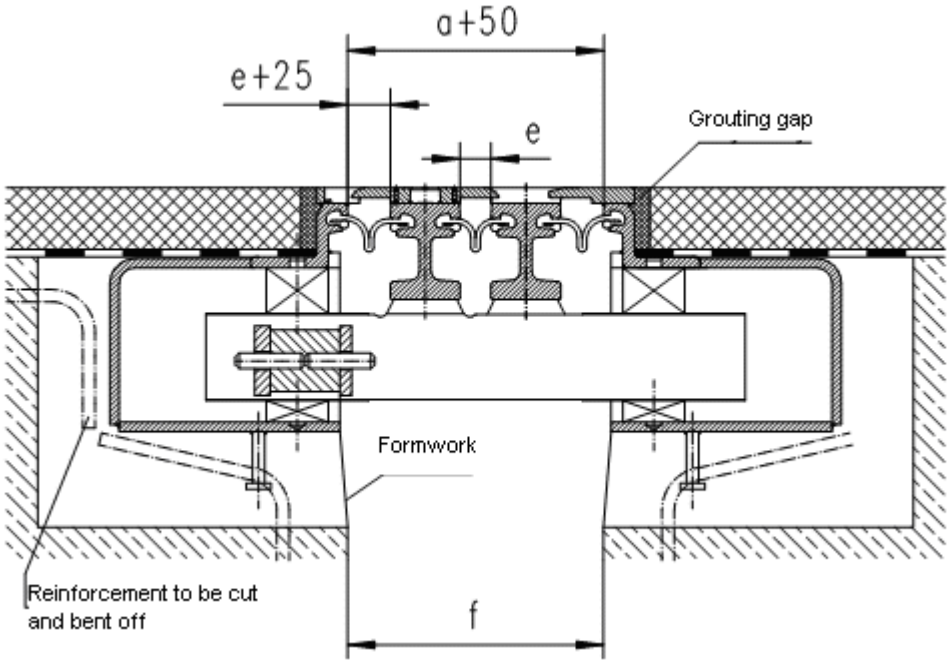
The structural connection has to be executed in accordance with the rules of steel concrete or steel construction. A good connecting reinforcement has to be provided along the whole joint before installation. It has to be considered that normally anchoring loops at the edge profiles are placed rectangular to the joint.. Expected variations from this direction are allowed only within the range of 90° ± 20°. As the anchoring reinforcement of the structure has to be parallel to anchor loops, that has to be considered as soon as at the structure planning and controlled on site.



The following drawing presents the standard-edge profile. It is almost of same shape for all types. The only difference is in the height H of the standing plate. Normally it reaches to the lower edge of the cross bar box. To enable the attachment, the steel plates are lengthened for 30 mm. That standard-edge profile is static equal to the construction for cross sections with a sealing profile according to Übe 1.



A reinforcement in net or sling form has to be provided underneath the cross box as reinforcement against split drag. See the construction plan after section 7 for appropriate data.



Picture 1: Cross section of the cross bar box

Each construction has to be heaved into the recess by adequate truck mounted crane, then levelled to the required height and assembled parallel according to instructions of the site engineer and built in parallel to longitudinal and transversal slope or the carriage way. The edge profiles have to be aligned carefully along according to the ground plan and to the sheer plan. Specifications of the height position of cross section relating to the carriage way surface from TL/TP-FÜ (03/05) have to be regarded.

After the carriage way crossover is aligned, vertical stiffeners are welded on sides of cross bar box as assistant support and the anchor slings and head bolt dowels of the cross bar box are welded with existing reinforcement. Take care, that the welding between the anchor slings and reinforcement first takes place on one side only. On the other side first additional structural steel for horizontal anchoring of head bolt dowels or at each of first anchor slings aside of cross bar boxes is added if missing and welded with the site reinforcement, but not with the construction of cross section. To shorten the period till loosening the installation holder as much as possible, first the welding is done in the area aside the cross bar boxes only then the installations holders are loosened, but not removed, and so additional bending strength is achieved although the possibility of motion is present.

Welding the remaining anchors with the reinforcement fixes the carriage way crossover stable at his final position.

After the attachment to reinforcements, the construction has to bear the appearing structure movements without influence on the later binding process of the concrete.

After our personnel have finished the assembly it must be checked and accepted by the construction supervisor and the completed installation of the construction has to be certified. Use the appropriate form referring to the construction.

Shuttering and concreting is carried out by the construction company. The recesses must be shuttered in such a way that the scheduled dimensions are obtained at the edge beam and the joist boxes. Attention must be paid to careful and close shuttering to avoid concrete tearing into the joist boxes and the joint gap between superstructure and abutment. A sealing drainage (acc. to drawing Was 11) must be assigned for the prevention of banking behind the edge beams.

The recesses must be cleaned carefully before concreting. Levels and axial position, as well as the correct width of the expansion joint, must be checked once again. It is obligatory to stick to the minimum measures of the concrete and the dimensions and position of reinforcements according to the constructional plan on page 4 after part 7.

Concreting the superstructure section requires the client's approval. The lean-mixed concrete must be low shrink and of even or higher strength than the structural concrete, at least quality B C30/37. During concreting special attention must be paid to the compression of the concrete at the anchor plates, under the base plates of joist boxes and under the horizontal flange of the edge beams, so that a solid bearing of the steel elements to the concrete is guaranteed and a sufficient composite action is obtained.

The steel and sealing elements must be protected during concreting or be cleaned with water immediately after the concreting procedure, so that there is no setting of concrete anywhere on the expansion joint.

After the setting of concrete the transit clamps, fastened on the superstructure, must be removed. Lastly, the shuttering within the joint gap has to be removed and the joint has to be cleaned.

5.3 Anchoring in the cap area

The anchoring of the expansion joint in the cap area is not allowed. A bitumastic filler has to be provided between the edge profile of the cross section and the cap area in the marginal and median strip range. The joint shows a wedge-shaped design to avoid cavitations. The bitumastic filler only allows movements of a few millimetres between the cap area and the structural concrete. Constructional design should ensure that larger movements remain impossible.

While concreting the cap area, due to inevitable construction tolerances, the end position of the possibly existent cover plates is to be considered. Shuttering aid can facilitate the accurate installation.

5.4 Procedure for bridges with steel carriageways

The working processes are analogue to fastening to concrete components (See chapter 5.2).
Basically there are three different methods:

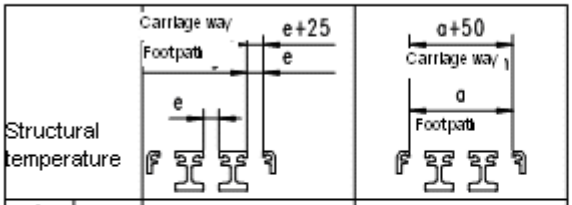
a) Bearing on a continuous beam, mounted before the end cross girder.
b) Bearing on individual consoles connected to the end cross girder
c) Direct connection of the supporting sides of the cross bar box to the end cross girder

The kind of construction strongly depends on structure and shall be planned, verified and proofed individually in detail. The technical approval covers no steel connections Start with the attachment of cross section to the steel superstructure when installing.

5.5 Control of the installation dimension

The bridge design engineer determines the temperature-dependent gap and assembly dimensions. If there are no special requirements, the expansion joints are adjusted in the workshop for a structure temperature of +10 °C. The pre-setting already done in the factory and the relevant expected assembly temperature must be registered on the approved drawings The dimensions for the temperature-dependent pre-settings can be obtained from the tables on the final drawings.

Installation dimensions for Type XL

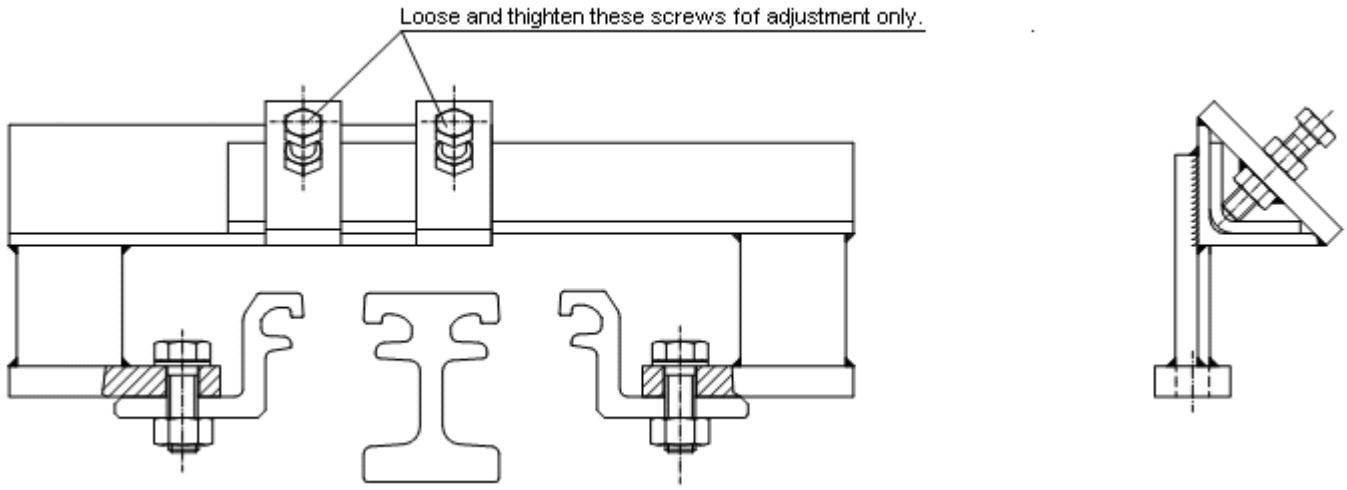


Structural temperature	°C	Gap dimension e	Installation dimension a
	+ 5		
	+10		
	+15		
	+20		

Determine the mean structural temperature before assembly.

Picture 2: Example table for temperature dependent pre-adjustment

Directly before inserting the construction into the recesses, the presetting must be checked by the construction supervision and, if required, readjusted by our fitters. If a correction of the pre-setting becomes necessary, this has to take place in the expected direction of movement. A higher structural temperature requires a closing, a lower structural temperature an opening of the construction. For that purpose the screws of the movable installation holders (see picture 3) have to be unscrewed and then again tightened firmly after adjustment.



Picture 3: Movable installation holders

The slit opening f between skewback chamber wall and outer edge of the superstructure (See Picture 1) has to be checked. The rule is a-10×n [mm] ≤ f ≤ a+50 [mm] (with the exception of the Type XL200, see Picture. 6.1).

Possible changes of measures have to be acknowledged in writing to our specialists by the site engineer.

5.6 Sealing of the structure

In order to prevent the penetration of water between the edge profiles of the expansion joint and the concrete, the waterproofing has to be attached carefully and according to the relevant regulations. For the perfect connection a horizontal flange of 80 mm has to be provided, which must be cleaned carefully before applying the insulation. The sealing has to be attached to the expansion joint over the entire length of the superstructure, i.e. also at the marginal and median strip ranges.

During the surfacing operation the steel and sealing elements must be protected against impurities and excessive heat. A bitumastic filler according to the standard drawing Übe 1 has to be provided as a connection to the edge profiles of the superstructure section.

5.7 Further hints

Appropriate measures should be taken in order to prevent driving over the expansion joint before the surfacing operation. If there is no possibility of redirecting the site traffic running over the expansion joints, then these need to be protected by appropriate bridge-crossings.

If, due to the transportation and traffic related reasons site joints are required, the following has to be considered:

- Construction of joints according to chapter 5.8 to 5.11
- Sealing profiles are generally vulcanised (see chapter 5.12)
- The rhombic elements in connecting areas are put in place after the connection of lamellas.

If the corrosion protection is damaged due to transport or installation, we recommend a touch up with a single component air humidity hardening coating system:

- Machined grinding of steel parts, standard purity level PMa
- If this is not possible or flying rust is present,
  20 µm of Stelpant-PU-Repair has to be applied as a holding bridge. If machine grinding took part no holding bridge is allowed.

Surface coating system:

Priming coating: 1 x 80 µm Stelpant-PU-Zinc
Don't allow greater overlapping with existing coating!

Surface coating: 2 x 80 µm Stelpant-PU-Mica, UV

Final coating: 1 x 80 µm Stelpant-PU-Mica, UV (colour according to plan)

The holding bridge, priming coating and surface coating can be applied on the same day. The final coating can be applied 8 hours after the surface coating. For smaller mending jobs the appropriate coating material is to be delivered to the local construction supervisor so the final coating can be applied on the following day. All products are single-component and can be applied using a roller or brush even at air humidity up to 98%. Even at relatively low temperatures (about 0°C) the coatings dry very quickly.

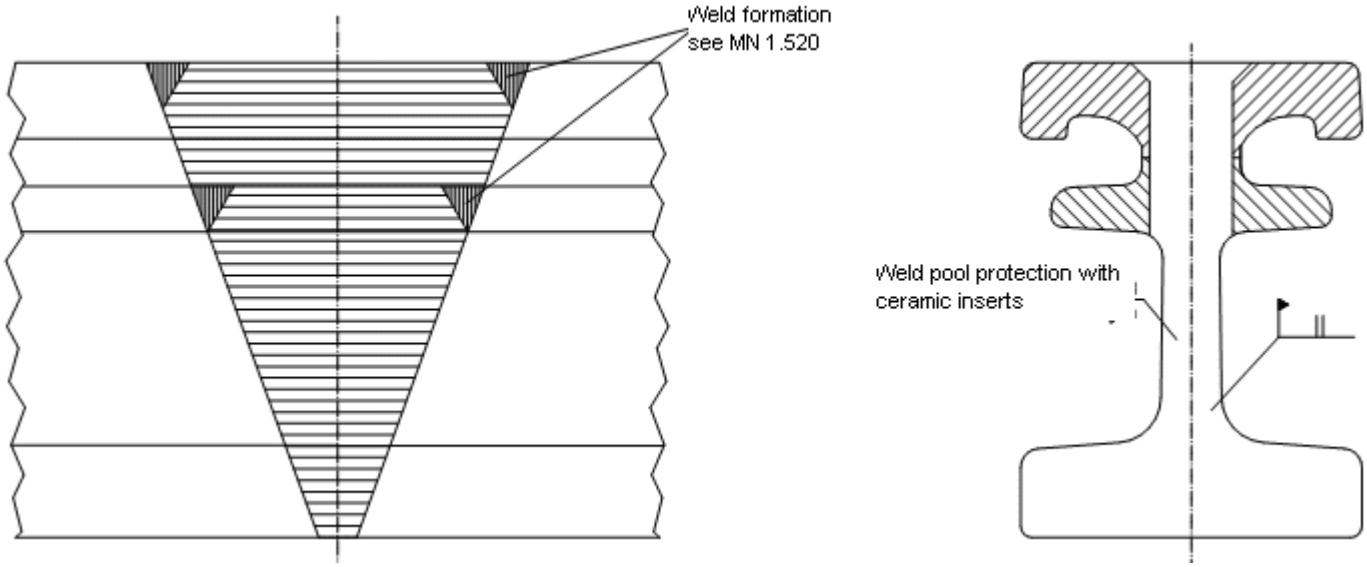
Further possibilities for improving the corrosion protection can be obtained from the ZTV-KOR (Steel constructions).

After all works are done, the "Übe 2" form, as an appendix to the building book according to DIN 1076, as well as the enclosed protocol of the mounting, is to be filled in and signed. For cross sections equipped with supervision marks of the external control institute, according to "Übe 2" lines 3 and 4, providing the certificates or test reports according to EN 10204 (DIN 50049) does not apply.

5.8 Site joints

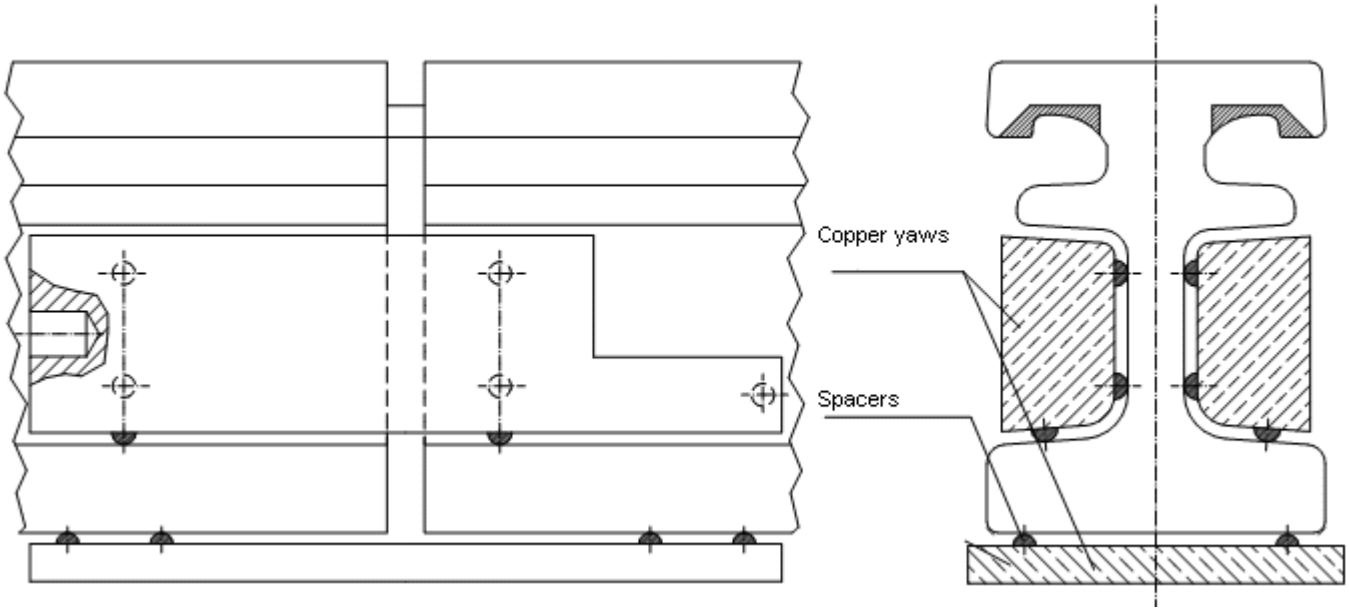
- CeraMag joint (into the carriage way)

Construction according to work instruction AA 1.541

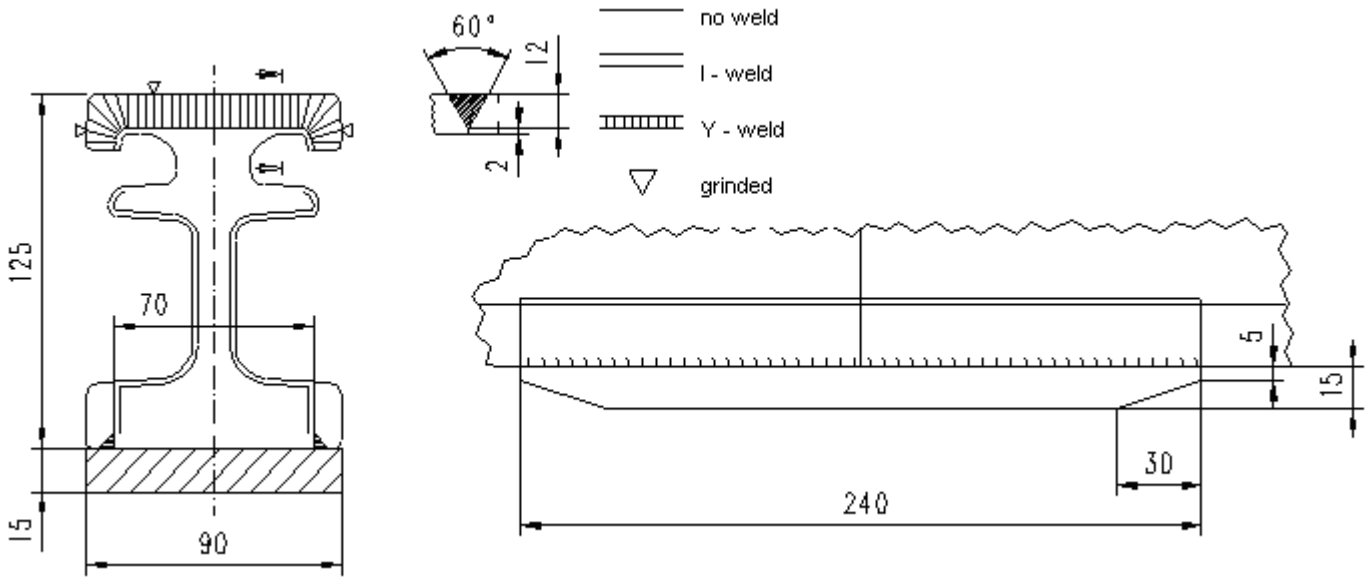


- Copper jaw joint (into the carriage way as alternative to CeraMag)

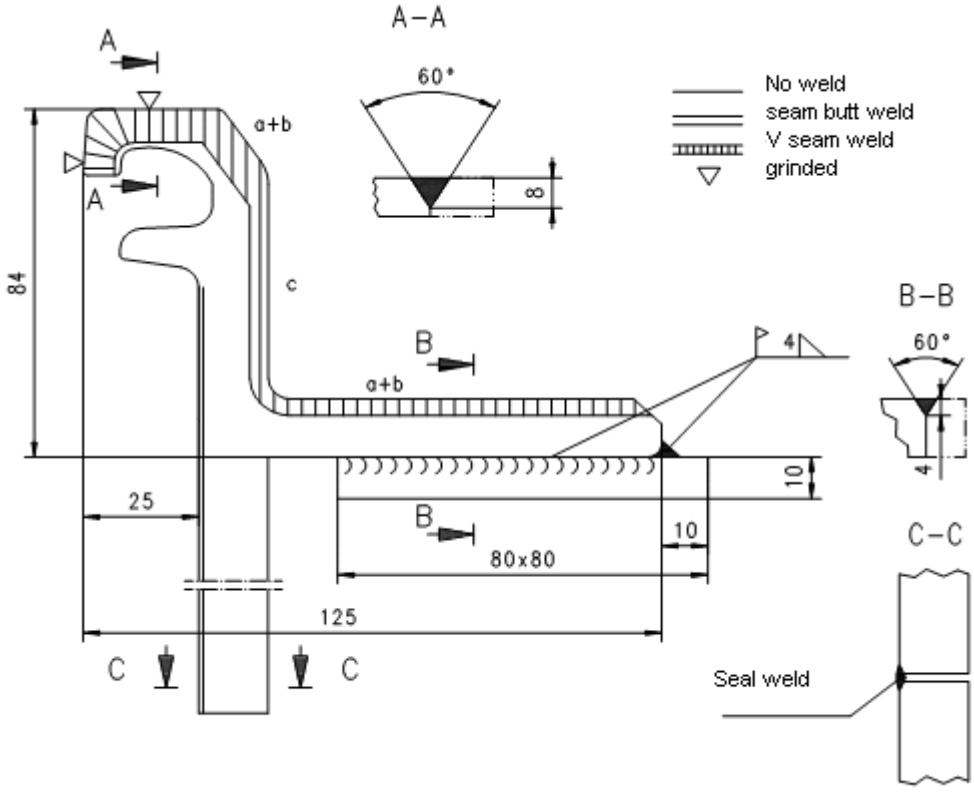
Construction according to work instruction AA 1.510



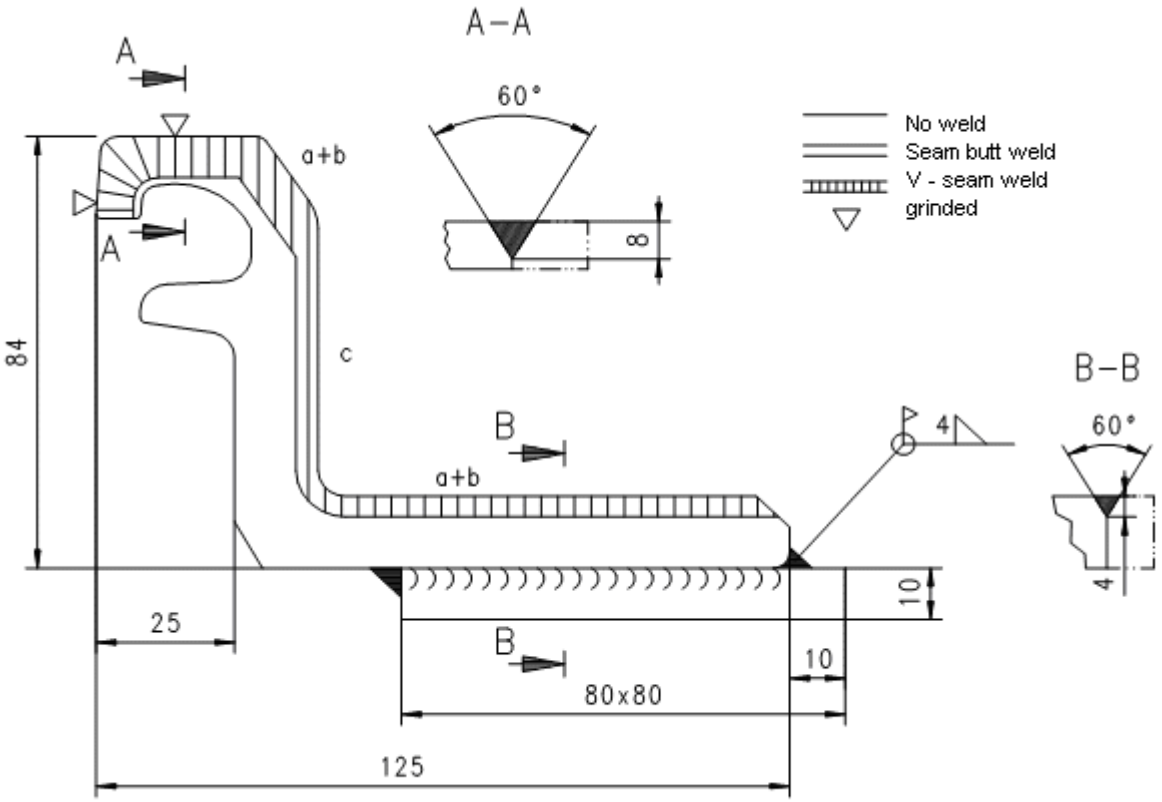
Site joint of the lamella outside the carriageway
Construction according to work instruction AA 1.510



- Site joint of the edge profile in the carriageway
Construction according to work instruction AA 1.510



Site joint of edge profiles outside of the carriageway
Construction according to work instruction AA 1.510



- Vulcanised joint of the sealing profile

If for technical reasons a joint on site is required, it has to be executed according to this instruction. The procedure matches the procedure inspection according to Prüfzeugnis GÜ 26/96 of the Institute for road, railway and airfield construction of the Technical University Munich.

The vulcanised joint is to be setup displaced to the according welded joints of steel profiles.

The side joint has to be executed by special trained staff only. The execution and control of such joints has to be protocol led.

MAURER SÖHNE Innovationen in Stahl

CERTIFICATE OF ACCEPTANCE / INSTALLATION RECORD

Order Number:

Construction: _____

Client (Building enterprise): _____

Contractor: Maurer Söhne GmbH & Co. KG

S c o p e o f s e r v i c e s :

☐ Type _____ r.m. _____ BA _____ Bl. _____ axis _____

Presetting at delivery: a+50 = _____ mm (carriage way) at BW-Temp. _____ °C

Presetting during installation: a+50 = mm (carriage way) at BW-Temp. _____ °C

Structural gap f = _____ mm

Correction on request of _____.

Start of operation: _____, _____ o`clock

☐ Type _____ r.m. _____ BA _____ Bl. _____ axis _____

Presetting at delivery: a+50 = _____ mm (carriage way) at BW-Temp. _____ °C

Presetting at mounting: a+50 =_____ mm (carriage way) at BW-Temp. _____ °C

Structural gap f = mm

Correction on request of _____.

Start of operation: _____, o`clock

☐ Constructions correspond to the approved implementation plans

☐ _____

☐ The corrosion protection is in due order

☐ Approval of the mounting joint bar without complaints

☐ Approval of site joints and vulcanisation joints of the sealing profiles without complaints

☐ Defects:: _____

_____

_____

☐ Comments: _____

_____

_____

At: _____ , Date: _____

_____ _____

MAURER SÖHNE CLIENT

∅ **This protocol is to be enclosed as an appendix to the protocol Übe 2.**

6. Hints for maintenance, preservation and exchange of wear and tear parts

MAURER-Lamella-expansion joints within the frame of the planned use period are maintenance free for at least 20 years. But to spot eventually appearing defects on time before greater damage occurs, regular supervision and inspection of the components is appropriate. Periodic and extent are conforming to valid standards i.e.:

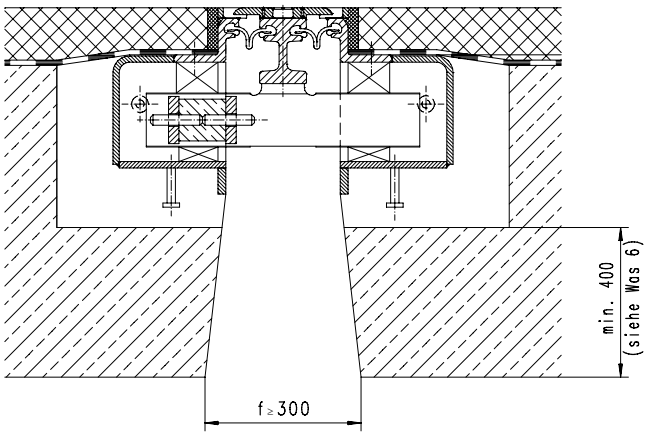
- DIN 1076
- Product specification sheet for construction supervision for buildings (M-BÜ-K)
- Form Übe 2
- Directive for the control, approval and preservation of constructional design and equipment of bridges (RBA-Brü 90)

6.1 Accessibility

All plastic parts can be exchanged directly from the carriageway. A maintenance and inspection run has to be provided with new constructions according to Part 6.2 (construction plan WAS 6 and directive RBA-Brü). The light width in the structure gap adapts according to the movement of the gap and according to the number and breadth of the Lamellas. Just underneath of the cross section construction the light clearance f is in the centre position of the construction (See page 11):

Type	f [mm]
XL200	300
XL300	350...380
XL400	480...520
XL500	610...660
XL600	740...800

*)
You can reach the planned dimension 300 mm for the types XL200 through the enlargement under the gap for constructional reasons only..



With the change of the middle gap width s=50 mm of the carriage way crossover the dimension f changes for n×Δs.

6.2 Structural parts that require regular controll

(1) Sealing profiles

- dirt
- ageing
- butt joints
- damage
- secure hold
- closeness
- regular and sufficient gap widths

(2) Sliding elements

- dirt
- wearing out
- surface damage
- proper adjustment
- smooth movement
- rubbing between individually movable parts

(3) Bearing and spring elements

- correct position
- damage
- crack free
- sufficient pre-stressing and attachment
- notable noise production

(4) Corrosion protection

On driven surfaces the corrosion protection is wearing out in short time and is of no meaning.

- underneath the sealing profiles
- in the footpath area
- underneath the steel cover plates

(5) Steel support construction

- crack free at junctions and firm fit of mechanical joints
- welds on the lamella / cross bar
- site and factory joints of lamellas
- attachments of steering construction (cams and stoppers)
- anchoring of edge constructions
- condition of the concretes underneath the cross bar boxes
- free movement of lamellas and cross bars (concrete defects)

(6) Coating joint

- condition of the pouring gap between edge profile and coating
- deformation of the edge profile in the carriage way
- deformation of the edge profiles at the cap
- coating damages
- rut building
- height evenness of gap edges
- coating bank

(7) Steel cover plates in footway and at the parapet area

- corrosion
- screw connection
- noise production
- constraints
- correct position

The control results have to be protocol led.

6.3 Replacement of sealing profiles

The replacement or damage free mounting and dismounting of sealing profiles is possible from above at single gap widths ≥ 60 mm. For that the lamellas have eventually to be displaced rectangular to the gap.

- opening of the Gap slit with hoists
- dismounting the old sealing profile with special-fitting levers
- control of corrosion-grade of the steel clamps
- check and renewal of corrosion protection (if necessary)
- eventual vulcanising of the joint between remaining and new sealing profile
- paraffin oil greasing of steel clamps
- interlacing of new sealing profiles with special-fitting lever
- right position control

6.4 Replacing the wear parts

(1) Sliding bearings and springs (from carriageway)

If there is maintenance run or with larger types the dismantling from below shall be preferred.

- dismantling the sliding bearings

  Remove welds of some rhombic elements by drilling.

Dismount the sealing profiles in the lifting gear area if necessary.

Enlarge the gap between the bars using hydraulic moulding presses at ca. 80 mm.

Erect the lifting gear.

Hoist the lamella with the lifting gear (slide spring is compressed).

Dismount the slide bearing.

- Dismantling and mounting of slide springs

Remodel the lifting gear after dismantling the slide bearing.

Press down the lamella with hydraulic press (slide spring is set free).

Dismount the slide spring.

Mount a new sliding spring.

- Slide bearing installation

Remodel the lifting gear.

Hoist the lamella the lifting gear.

Install slide bearing.

Take the lifting gear apart.

Set the gap between lamellas.

By installation from above mount the sealing profile.

Place new diamond elements.

(2) Control springs

- Control spring dismantling

Press neighbouring lamellas together to contact with the help of hydraulic press.

Remove the polyamide holding bolts from control spring.

Remove the tense free control spring downwards.

- Control springs mounting

Install the spring and holding bolts in reverse order.

Reset the gap between lamellas.

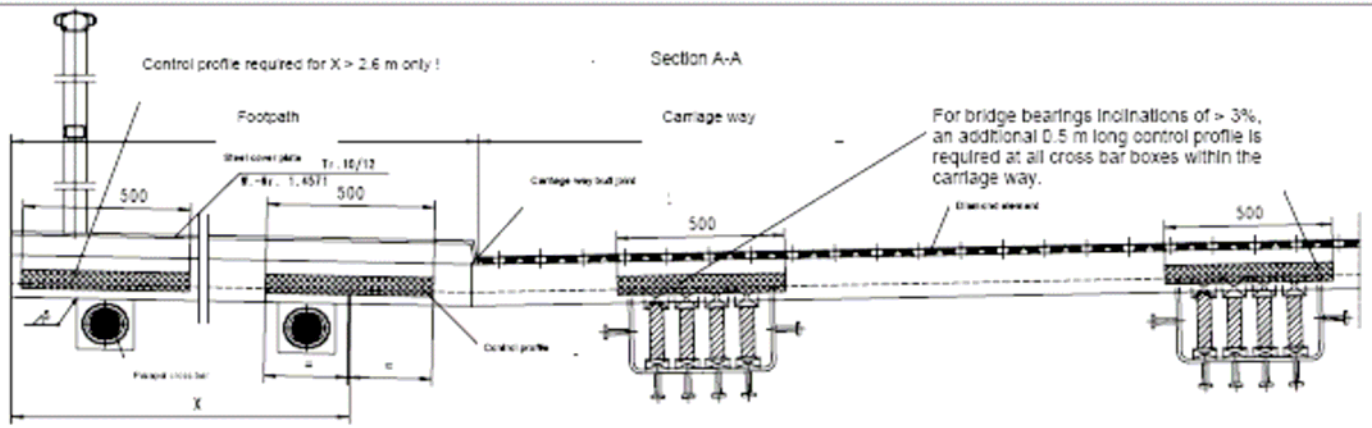
7. Constructional drawings and parts lists (6.2 / 6.3)

The structural drawings show main characteristics and measures of constructions. They are independent of type and direction and serve for general judgement. Following structural drawings are part of the request for the Technical Approval:

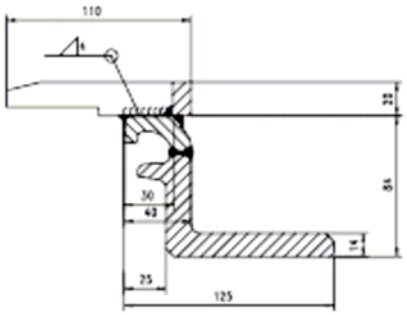
Page No.	Item	Edition	Date	Change
1	Longitudinal section and top view $\alpha = 90°$	A	1.07.2003	1.02.2007
2	Longitudinal section and top view $\alpha = 60°$	A	1.07.2003	1.02.2007
3	Cross sections	A	1.07.2003	1.02.2007
4	Reinforcement plan	A	1.07.2003	1.02.2007

The basis for the technical approval is a variety of work instructions and standard drawings. Elaborating of these in the course of the construction's approval is not planned. The following table provides a summary of the materials of the main construction parts:

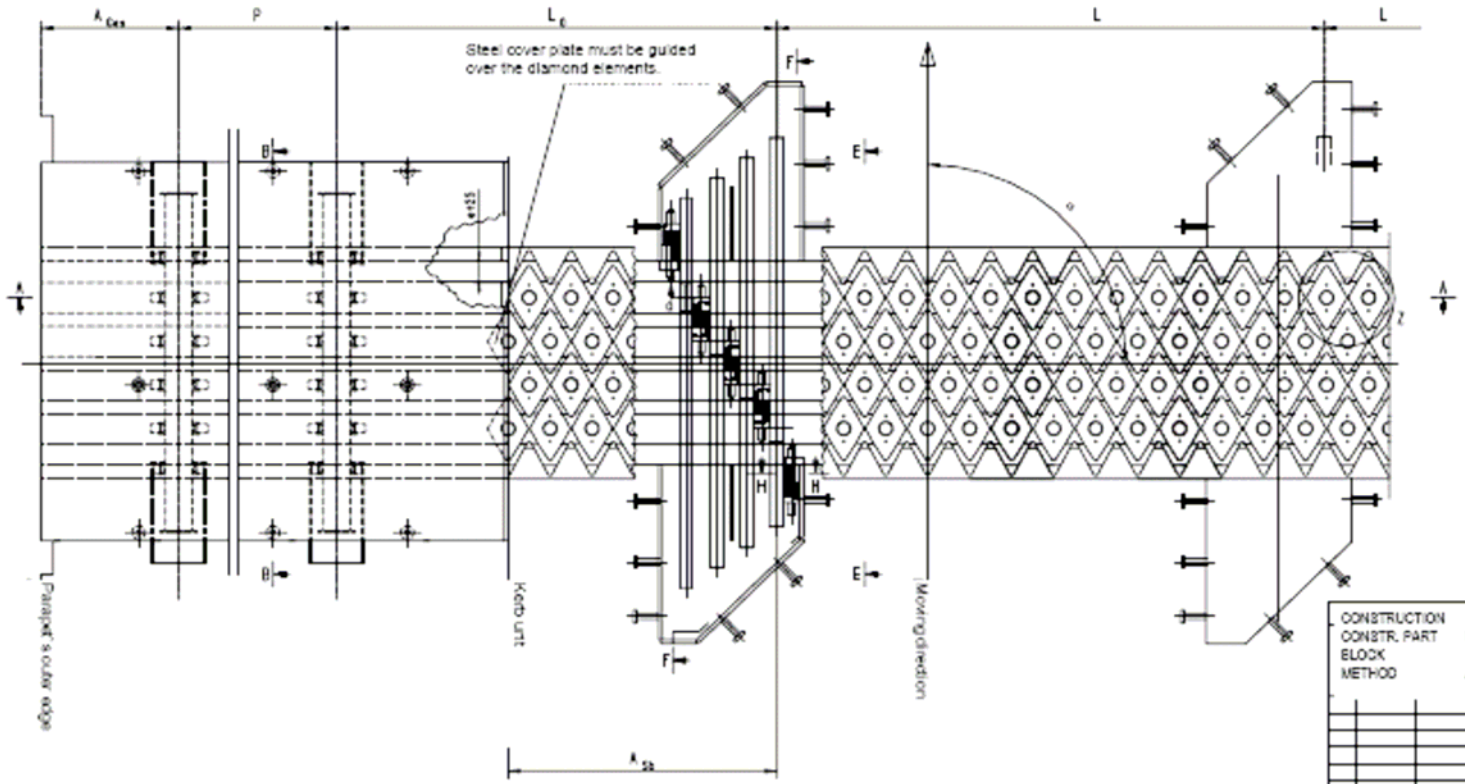
ITEM	Pos.	Tolerance	Semi finished part	MATERIAL	WEIGHT
Blade catch profile	1	DIN ISO 2768-m	rolled section	S355J2+N	21,6 kg/m
TL/TP-FÜ (03/05) metal plates	26	DIN EN 10029 C	Bl. 15	S235JR+N	
Lamellas	2	DIN ISO 2768-m	rolled section	S355J2+N	46,6 kg/m
Sealing profile	3	-		EPDM (black) E2329, 60±5 Shore A	1,45 kg/m
rhombic element	28	DIN 7526 F	Drop forge part	S235JR+N	1,35 kg/m
Edge plate	29	DIN EN 10029 C		S235JR+N	19,0 kg/m
Cross bar	4	DIN EN 10029 C		S355J2+N	
Box half	16	DIN EN 10029 C		S235JR+N, S355J2+N	
Parapet unit	20	DIN ISO 2768-m	Ø 60, 80, 90	1.4462, 1.4571, SBR 80 Shore A, S235JRG	
Elastomeric slide bearing 70/80	5	DIN ISO 2768-m		S235JR+N, CR 60 Shore A, PTFE	0,8 kg
Elastomeric slide springs 70/80	6	M2 DIN 7715		S235JR+N, NR 70 Shore A, PTFE	1,6 kg
Control spring	25	-		Polyurethane, Polyamide	0,35 kg
Carriage way anchor Übe 1	15	DIN EN 10029 C		S235JR+N	3,65 kg
Sidewalk anchor Übe1, 70° to 90°	14	DIN 1013	Rd. St. Ø 20	S235JR+N	1,36 kg



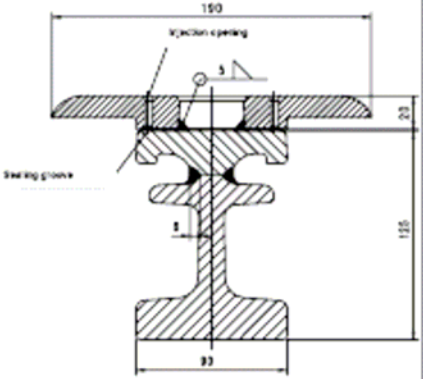
Edge beam Pos. 1 with edge plate Pos. 29



Top view



Lamella Pos. 2 with diamond element Pos. 28



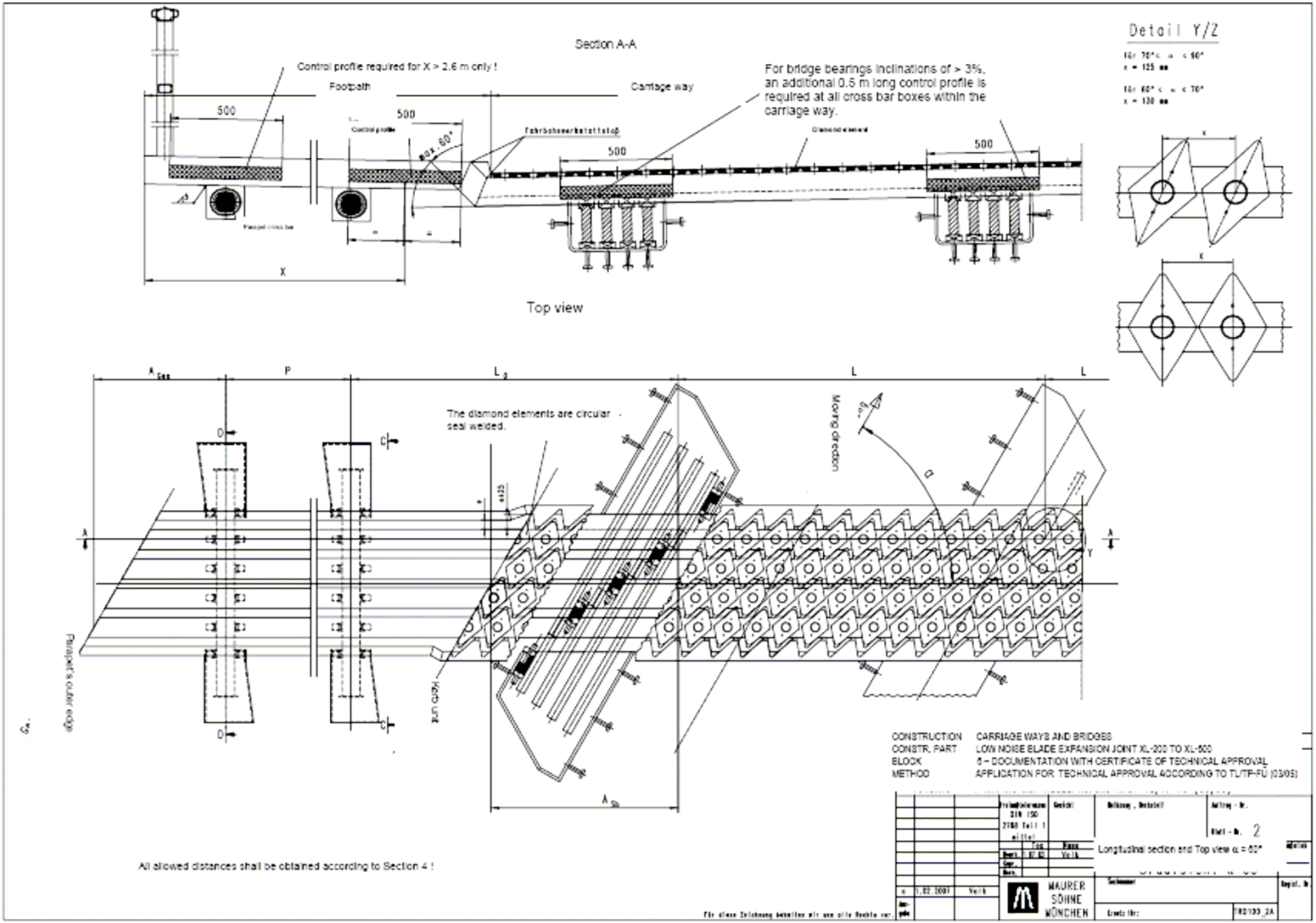
All allowed distances shall be obtained according to Section 4 !

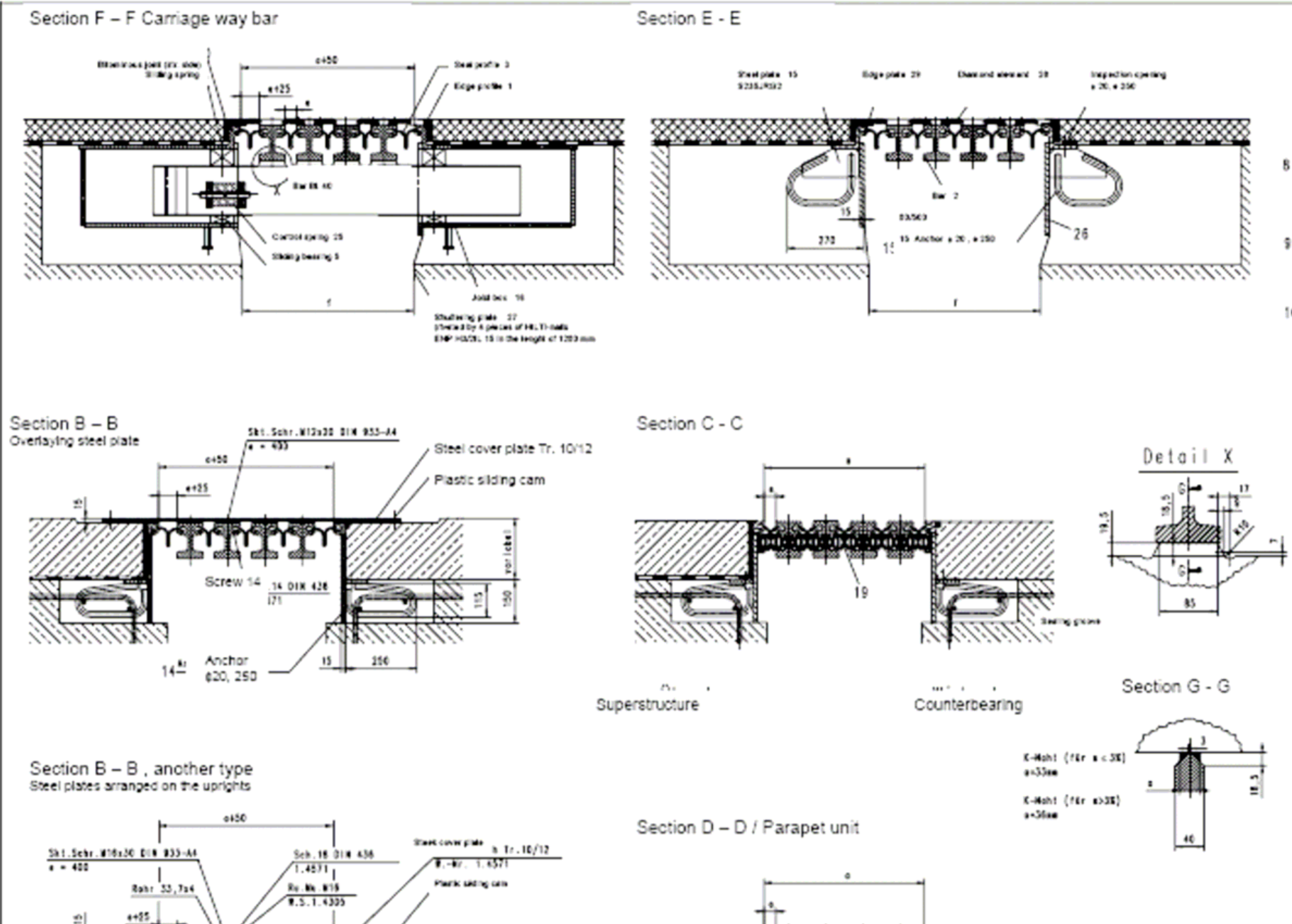
Tecnical Approval Nr. 06/07 of 12.11.07

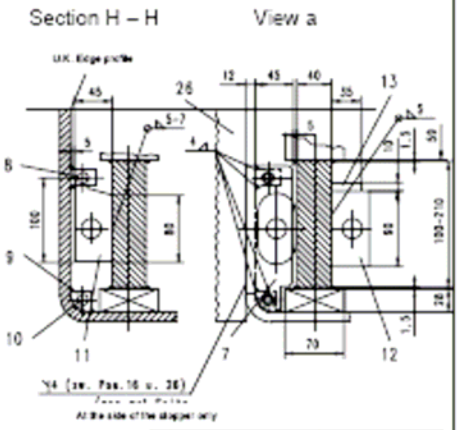
CONSTRUCTION	CARRIAGE WAYS AND BRIDGES
CONSTR. PART	LOW NOISE BLADE EXPANSION JOINT XL-200 TO XL-500
BLOCK	5 – DOCUMENTATION WITH CERTIFICATE OF TECHNICAL APPROVAL
METHOD	APPLICATION FOR TECHNICAL APPROVAL ACCORDING TO TL/TP-FÜ (03/05)

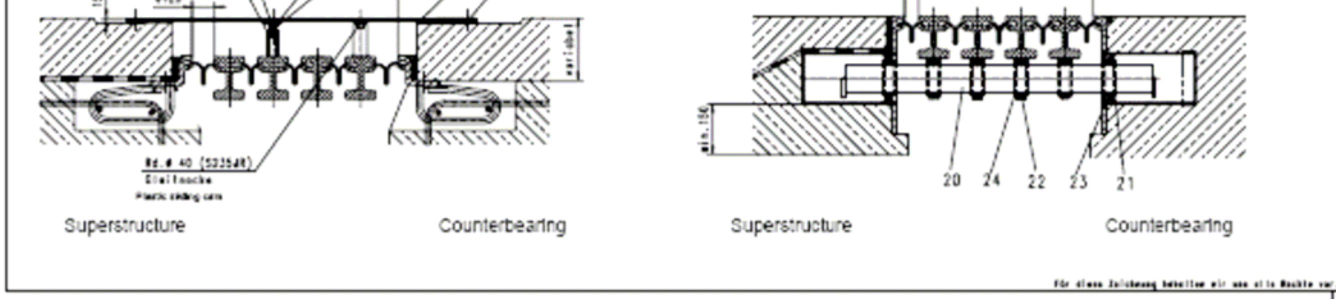
Longitudinal section and Top view α = 90°

MAURER SÖHNE MÜNCHEN


Section A-A
Control profile required for X > 2.6 m only !
Footpath
Carriage way
For bridge bearings inclinations of > 3%, an additional 0.5 m long control profile is required at all cross bar boxes within the carriage way.
500
Control profile
max. 60°
Diamond element
X
Detail Y/Z
Top view
The diamond elements are circular seal welded.
Moving direction
Parapet's outer edge
Kerb unit
All allowed distances shall be obtained according to Section 4 !
CONSTRUCTION CARRIAGE WAYS AND BRIDGES
CONSTR. PART LOW NOISE BLADE EXPANSION JOINT XL-200 TO XL-500
BLOCK 6 – DOCUMENTATION WITH CERTIFICATE OF TECHNICAL APPROVAL
METHOD APPLICATION FOR TECHNICAL APPROVAL ACCORDING TO TL/TP-FÜ (03/05)
Longitudinal section and Top view α = 60°
MAURER SÖHNE MÜNCHEN
TRD100_2A







Nr.	Benennung	Material
1	Randprofil	S355J2+H
2	Lamelle	S355J2+H
3	Dichtprofil	EPDM
4	Traverse-Fahrb. Bl.40xH	S355J2 H/V2A
5	Elastomerlager 70x80x38	S235JR+N, PTFE Chloroprene
6	Elastomerfeder 70x80x30	S235JR+N, Natur-Kautsch., PTFE
7	Riegel	S355J2+H
8	Anschlag	S235JR+H
9	VK-Mutter	S235JR+H
10	SKT-Schraube M12x50	DIN 933-8.8
11	Nocke	S355J2+H
12	Nocke	S235JR+H
13	Anschlag	S235JR+H
14	Gehweganker	S235JR+H
15	Fahrbahnanker	S235JR+H
16	Traversenkasten	S235JR+H/S355J2+H
17	Tränenblech 10/12	1.4571
18	Gleitnocke	PUR
19	Gehwegdichtungsprofil	Neoprene
20	Geländertraverse M60-90	1.4462
21	Hüllrohr	S235JR+H
22	Flacheisen ▭ 25	S235JR+H
23	Flacheisen ▭ 25	S235JR+H
24	Buchse	Neoprene
25	Steuerfeder	ACLACELL/PA 6
26	ZTV-K Blech t=15	S235JR+H
27	Schalblech t=1.5	S235JR+H (verz.)
28	Rautenelement	S235JR+H
29	Randplatte	S235JR+H

CONSTRUCTION CARRIAGE WAYS AND BRIDGES
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Cross sections

c 1.02.2007 Volk

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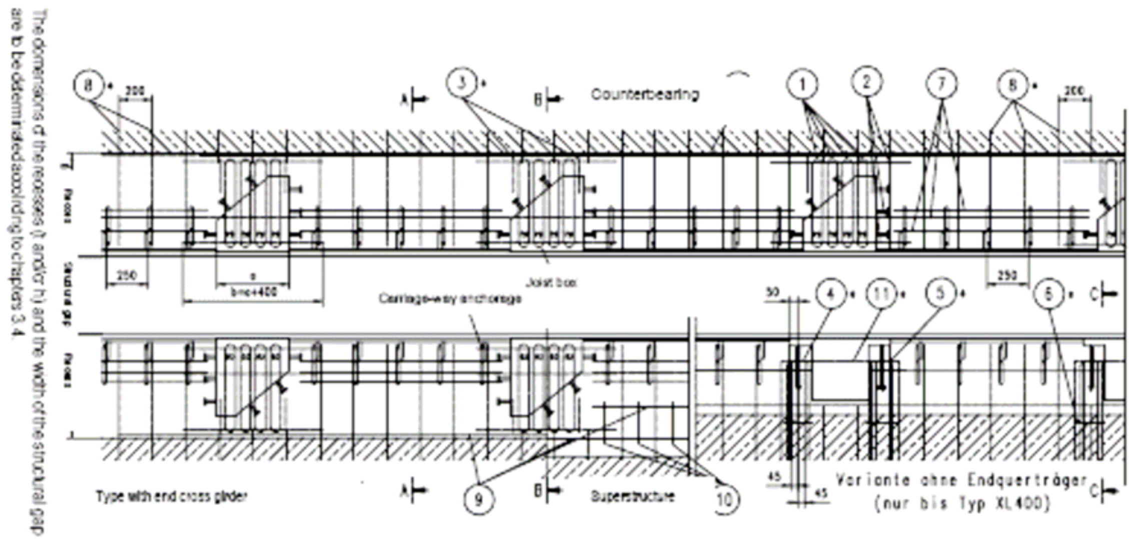
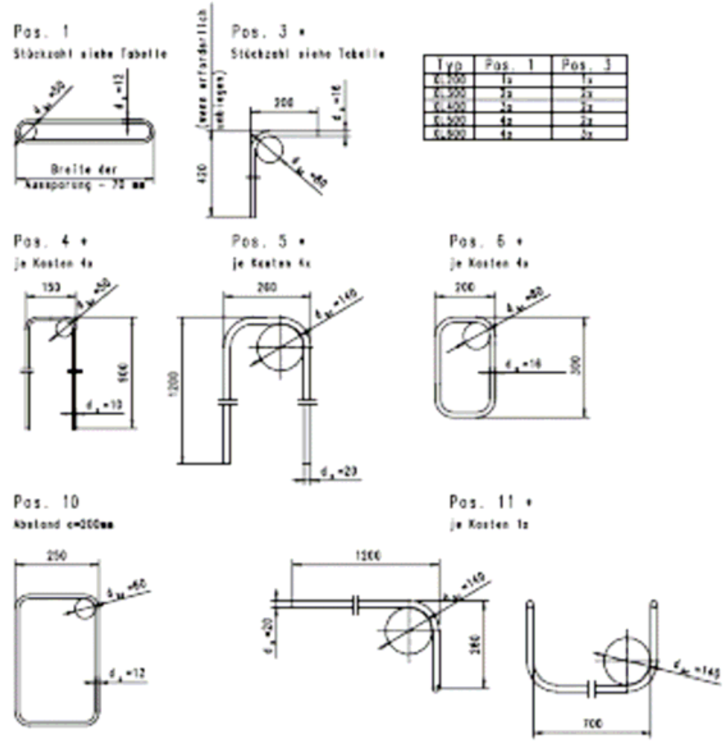
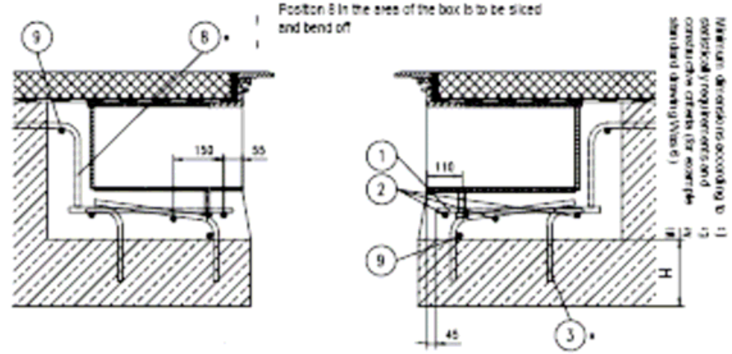
TR0100_3A

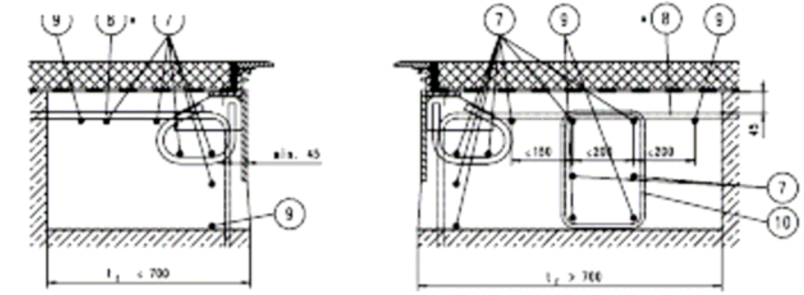




Anchorage of the joist box Section B - B

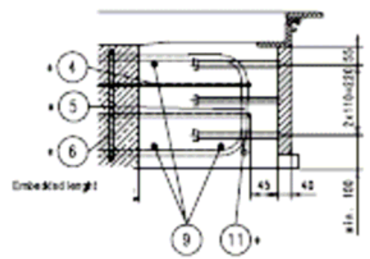


Anchorage of the edge beam Section A - A



Anchorage of the joist box Section C – C

Type without end cross girde for Types ≤ D401 GO



In normal case the reinforcing steels Pos. 1/4/5 and 8 are to be inserted rectangular to the gap. Angle deviations are permitted in the range of + 20°.

Concrete with the recess ≥ CX30/37 low-shrinkage concrete.
Underneath the joist boxes tgrain size 0/16 mm shall be used
Reinforcement in general ≥ Bst. 500 S
Reinforcement positions marked with * are to be placed into the concrete of the girder.

Tecnical Approval
- Nr. 06/07 of 12.11.07

Alle Abmessungen in mm

Pos	Abmessung	Bemerkung	
1	[illegible]	siehe Skizze	
2	[illegible]		
3	Ø16	siehe Skizze	*
4	[illegible]	siehe Skizze	*
5	Ø20	siehe Skizze	*
6	Ø16	siehe Skizze	*
7	Ø16	L entspricht Lichtmass zwischen [illegible]	
8	Ø16	siehe Skizze	*
9	[illegible]	[illegible]	
10	[illegible]	siehe Skizze	
11	Ø20	siehe Skizze	*

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CONSTRUCTION	CARRIAGE WAYS AND BRIDGES
CONSTR. PART	LOW NOISE BLADE EXPANSION JOINT XL-200 TO XL-500
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Blatt-Nr. 4

Cross sections

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TRD100_4A