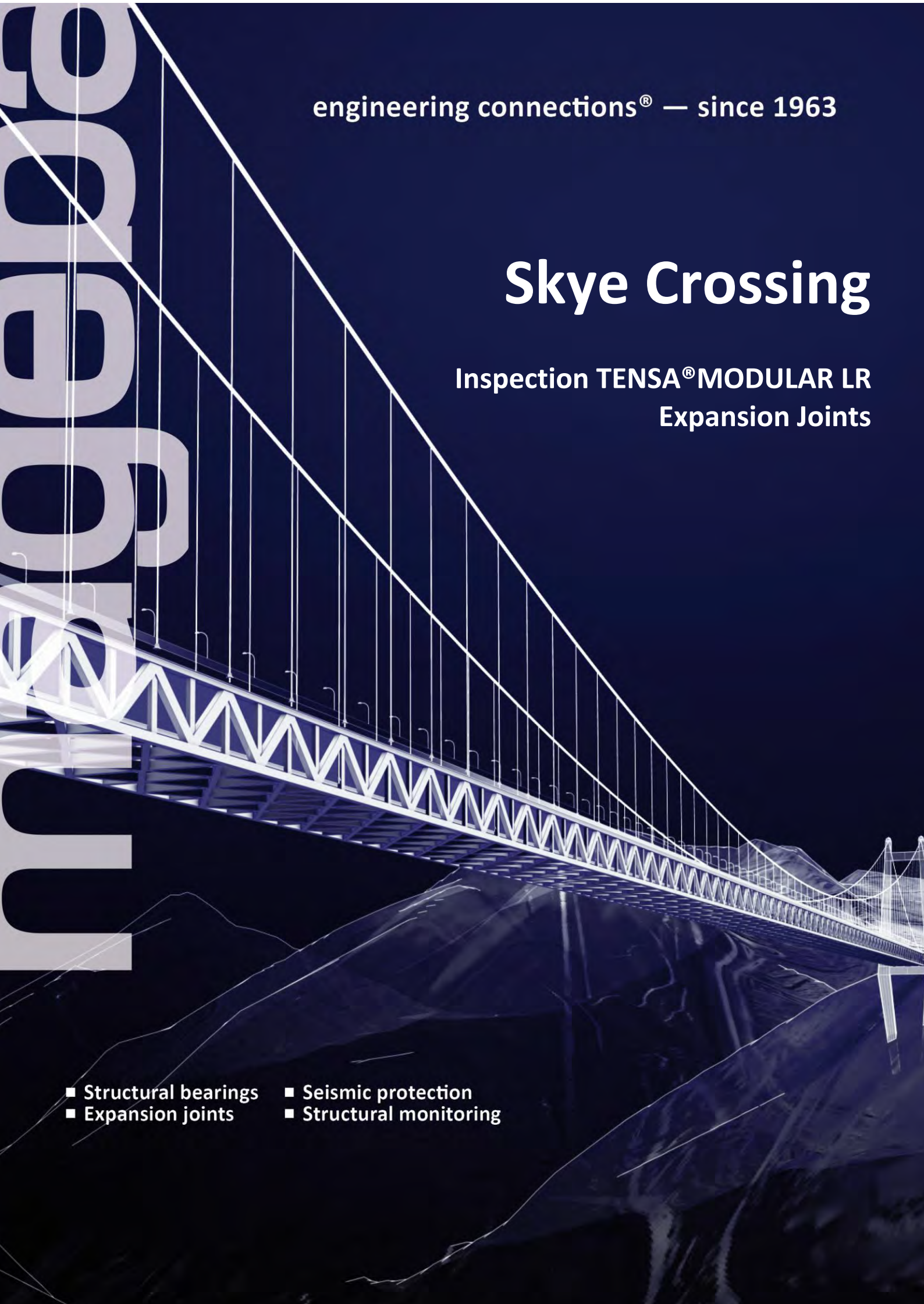
engineering connections® — since 1963

Skye Crossing

Inspection TENSA®MODULAR LR Expansion Joints



- Structural bearings
- Expansion joints
- Seismic protection
- Structural monitoring

mageba

DOCUMENT CONTROL SHEET

Project Name :	Skye Bridge; Inspection
Building Object :	BO101036-01
Project Number :	CH13076
Report Title :	Skye Bridge, Inspection TENSA®MODULAR LR Expansion Joints

Issue status	Prepared	Reviewed	Approved
Rev. 0.0	redacted date: 05.07.2018	redacted date: 05.07.2018	redacted date: 05.07.2018

Contents

1 INTRODUCTION 4

1.1 General 4

1.2 Expansion Joints 5

2 INSPECTION 6

2.1 General 6

2.2 Inspection Skye Bridge 7

2.3 Inspection Carrich Viaduct 10

3 Advise 11

3.1 General 11

3.2 Skye Bridge 11

3.3 Carrich Viaduct 13

Appendix 1; drawing TENSA®MODULAR LR4 .....

Appendix 2; drawing TENSA®MODULAR LR4 .....

Appendix 3; drawing TENSA®MODULAR LR2 .....

Appendix 4; drawing TENSA®MODULAR LR3 .....

Appendix 5; brochure Box-in-Box replacement .....

1 INTRODUCTION

1.1 General

The Skye Crossing forms part of the A87 crossing Loch Alsh connecting the Isle of Skye via the Island of Eilean Bàn to the Scottish mainland. Constructed in the period 1992 to 1995 the Skye Crossing consist of 2 bridges, The Skye Bridge and the Carrich Viaduct.

Skye Bridge	
Start of construction	1992
Year of completion	1995
Structure type	Haunch girder bridge Box girder bridge
Construction method	Balanced cantilever method
No. of spans	5
Total length	570m[1] (125m[1] southern side spans, 250m[1] main span, 126m[1] northern side span and 38m[1] + 31m[1] northern approach viaduct)

Carrich Viaduct	
Start of construction	1992
Year of completion	1995
Structure type	single T-section girder bridge
Construction method	Incremental launching
No. of spans	8
Total length	198m[1] (20.8m[1], 6 x 26m[1] and 20.8m[1])

Skye Crossing

1.2 Expansion Joints

The Skye Crossing features a total of five TENSA®MODULAR LR expansion joints supplied by mageba SA in 1995. Three TENSA®MODULAR expansion joints are installed in the Skye Bridge while the Carrich Viaduct features two TENSA®MODULAR LR expansion joints.

Skye Bridge

Axis	Type	Movement capacity	Design movement
01	TENSA®MODULAR LR4-A65	320mm	2.68 mm/°C
04	TENSA®MODULAR LR6-A65	480mm	3.00 mm/°C
06	TENSA®MODULAR LR2-A65	160mm	0.40 mm/°C

Carriach Viaduct

Axis	Type	Movement capacity	Design movement
01	TENSA®MODULAR LR3-A65	240mm	1.50 mm/°C
09	TENSA®MODULAR LR3-A65	240mm	1.50 mm/°C

Skye Crossing, expansion joint locations

2 INSPECTION

2.1 General

In January 2018 a pulled out strip seal and a large gap opening of the 1st cell at the main span side of the TENSA®MODULAR LR6 at axis 4 of the Skye Bridge was detected by BEAR Scotland Ltd as the responsible maintenance contractor for this highway section.
Starting from June 4th, 2018 mageba performed a two day inspection of the expansion joints commissioned by BEAR Scotland Ltd. The inspection was performed by mageba technician Karsten Beck accompanied and supported by representatives of BEAR Scotland Ltd.

Skye Bridge axis 04, TENSA®MODULAR LR6 uneven gap

2.2 Inspection Skye Bridge

2.2.1 Axis 01; TENSA®MODULAR LR4

Manufacturer:	Mageba SA	**Model and type:**	TENSA®MODULAR LR4-A65
Ordernr.:	1617	**Inspector:**	redacted
Drawingnr.:	1-023.240.861 rev.01	**Inspection date:**	06.06.2018

Inspections performed acc. to AW8871 Inspection and maintenance manual for mageba TENSA®MODULAR joints

Element of inspection		**Actions**	**Result/comments**
01	Noise	None	
02	Evidence of water leakage	Substantial	Leakages at lower part in the carriage way.
03	Corrosion protection	Substantial/ minor	Substantial corrosion of lamella's and cover plates at both footpaths. Minor corrosion at underside of the joint.
04	Adjacent bridge structures	None	
05	Alignment of joint	None	
06	Distribution of gap widths	None	
07	Sliding surfaces	Minor	No signs of damages, cleaning required
08	Elastomeric sealing profiles	Minor	No signs of damages, signs of ageing.
09	Wear components (sliding bearings, sliding springs, control springs)	Substantial	Wear within tolerances. Springs show signs of ageing, minor cracks and de-bonding from vulcanised parts.
10	Cover plates	Substantial	Substantial corrosion of coverplates
11	Opening and closing capacity	None	
12	Bolted connections	None	Signs of corrosion on bolted connections
13	Welds	None	
14	Connecting pavement	None	

The overall condition of the expansion joint can be considered fair.

Structural components:
Edge profiles, lamella beams and joist beams are in good condition and show no signs of damages.
Mild corrosion at the underside of the expansion joint of all carbon steel parts.
Heavy corrosion of lamella beams, edge profiles and cover plates in footpath area and lower side of carriage way.
It's expected that minor corrosion in the clamp area of the seals at the lower end of the carriage way cause leakage.

Support system
Mild corrosion of all carbon steel parts of the support system.
Sliding springs, sliding bearings and sliding shoes operate within the tolerances but reached the end of their service life.
Sliding frames show mild corrosion as well as all bolted connections.
Stainless steel sliding sheets show no signs of damage but are polluted.

Control system
Mild corrosion of all carbon steel parts and bolted connection of the support system.
Control springs are over the end of their service life and show aging and crack in the rubber.

Strip seals
The strip seals show no damages or failures but do show ageing and can be considered at the end of their service life
The cells between the lamellas are filled with dirt and debris which can potentially cause puncture and/or push-out resulting in leakages.

2.2.2 Axis 04; TENSA®MODULAR LR6

Manufacturer:	Mageba SA	**Model and type:**	TENSA®MODULAR LR6-A65
Ordernr.:	1617	**Inspector:**	redacted
Drawingnr.:	1-023.360.369 rev.02	**Inspection date:**	06.06.2018

Inspections performed acc. to AW8871 Inspection and maintenance manual for mageba TENSA®MODULAR joints

Element of inspection		**Actions**	**Result/comments**
01	Noise	None	
02	Evidence of water leakage	Substantial	Leakages at lower part in the carriage way. Pulled-out strip seal of first cell.
03	Corrosion protection	Substantial/ minor	Substantial corrosion of lamella's and cover plates at both footpaths. Minor corrosion at underside of the joint.
04	Adjacent bridge structures	None	
05	Alignment of joint	None	
06	Distribution of gap widths	Substantial	Failure of control springs first cell.
07	Sliding surfaces	Minor	No signs of damages, cleaning required
08	Elastomeric sealing profiles	Minor	No signs of damages, signs of ageing.
09	Wear components (sliding bearings, sliding springs, control springs)	Substantial	Wear within tolerances. Springs show signs of ageing, minor cracks and de-bonding from vulcanised parts. Control springs first cell broken.
10	Cover plates	Substantial	Substantial corrosion of cover plates
11	Opening and closing capacity	None	
12	Bolted connections	None	Signs of corrosion on bolted connections
13	Welds	None	
14	Connecting pavement	None	

The overall condition of the expansion joint can be considered fair.

Structural components:
Edge profiles, lamella beams and joist beams are in good condition and show no signs of damages.
Mild corrosion at the underside of the expansion joint of all carbon steel parts.
Heavy corrosion of lamella beams, edge profiles and cover plates in footpath area and lower side of carriage way.
It's expected that minor corrosion in the clamp area of the seals at the lower end of the carriage way cause leakage.

Support system
Mild corrosion of all carbon steel parts of the support system.
Sliding springs, sliding bearings and sliding shoes operate within the tolerances but reached the end of their service life.
Sliding frames show mild corrosion as well as all bolted connections.
Stainless steel sliding sheets show no signs of damage but are polluted.

Control system
Mild corrosion of all carbon steel parts and bolted connection of the support system.
Control springs are damaged and require replacement. The first cell have failed causing uneven gap distribution and pull out of the strip seal. Control springs at the remaining cells are over the end of their service life and show aging and crack in the rubber.

Strip seals
The strip seals show no damages or failures but do show ageing and can be considered at the end of their service life
The cells between the lamellas are filled with dirt and debris which can potentially cause puncture and/or push-out resulting in leakages.

2.2.3 Axis 06; TENSA®MODULAR LR2

Manufacturer:	Mageba SA	**Model and type:**	TENSA®MODULAR LR2-A65
Ordernr.:	1617	**Inspector:**	redacted
Drawingnr.:	1-023.120.2194 rev.02	**Inspection date:**	05.06.2018

Inspections performed acc. to AW8871 Inspection and maintenance manual for mageba TENSA®MODULAR joints

Element of inspection		**Actions**	**Result/comments**
01	Noise	None	
02	Evidence of water leakage	Substantial	Leakages at lower part in the carriage way. Pulled-out strip seal of first cell.
03	Corrosion protection	Substantial/ minor	Substantial corrosion of lamella's and cover plates at both footpaths. Minor corrosion at underside of the joint.
04	Adjacent bridge structures	None	
05	Alignment of joint	None	
06	Distribution of gap widths	Substantial	Even distribution, gap widths to small.
07	Sliding surfaces	Minor	No signs of damages, cleaning required
08	Elastomeric sealing profiles	Minor	No signs of damages, signs of ageing.
09	Wear components (sliding bearings, sliding springs, control springs)	Substantial	Wear within tolerances. Sliding springs show signs of ageing, minor cracks and de-bonding from vulcanised parts. Control springs show significant crack and initial failure.
10	Cover plates	Substantial	Substantial corrosion of cover plates
11	Opening and closing capacity	Investigate	Insufficient closing capacity. Gap width too small for theoretical closing of the joint due to temp. rise
12	Bolted connections	None	Signs of corrosion on bolted connections
13	Welds	None	
14	Connecting pavement	None	

The overall condition of the expansion joint can be considered fair.
Structural components:
Edge profiles, lamella beams and joist beams are in good condition and show no signs of damages.
Connection lamella joist beams executed as rigid (welded) connection.
Mild corrosion at the underside of the expansion joint of all carbon steel parts.
Heavy corrosion of lamella beams, edge profiles and cover plates in footpath area and lower side of carriage way.
It's expected that minor corrosion in the clamp area of the seals at the lower end of the carriage way cause leakage

Support system
Mild corrosion of all carbon steel parts of the support system.
Sliding springs and sliding bearings operate within the tolerances but reached the end of their service life.
Stainless steel sliding sheets show no signs of damage but are polluted.

Control system
Mild corrosion of bolted connections of the support system.
Control springs are damaged as they are over the end of their service life showing signs of aging and cracks in the rubber. Failure of the control springs is likely if not replaced on a short notice

Strip seals
The strip seals show no damages or failures but do show ageing and can be considered at the end of their service life.
Leakage is noticed through and is expected to occur at the bends in the edge profiles/lamella at the lower end of the carriage way through the clamp area.
Current gap width doesn't allow replacement, for replacement a minimum gap width of 35mm is required.

2.3 Inspection Carrich Viaduct

2.3.1 Axis 01 and 9; TENSA®MODULAR LR3

Manufacturer:	Mageba SA	**Model and type:**	TENSA®MODULAR LR3-A65
Ordernr.:	1617	**Inspector:**	redacted
Drawingnr.:	1-023.180.1125 rev.01	**Inspection date:**	05.06.2018

Inspections performed acc. to AW8871 Inspection and maintenance manual for mageba TENSA®MODULAR joints

Element of inspection		**Actions**	**Result/comments**
01	Noise	None	
02	Evidence of water leakage	Substantial	Leakages at lower part in the carriage way.
03	Corrosion protection	Substantial	Heavy corrosion of joist beams 1 to 3, lamella's and brackets at lower end. Substantial corrosion underside and topside of the rest expansion joint.
04	Adjacent bridge structures	None	
05	Alignment of joint	None	
06	Distribution of gap widths	None	Even distribution.
07	Sliding surfaces	Minor	Corroded at joist beams 1 to 3. Minor corrosion at remaining joist beams. cleaning required
08	Elastomeric sealing profiles	Minor	No signs of damages, signs of ageing.
09	Wear components (sliding bearings, sliding springs, control springs)	Substantial	Wear within tolerances. Springs show signs of ageing, minor cracks and de-bonding from vulcanised parts.
10	Cover plates	Substantial	Substantial corrosion of cover plates
11	Opening and closing capacity	None	Gap width very small at time of inspection (19mm at $T_{structure}$ = 12°C). Gap width deemed to be insufficient to accommodate theoretical displacement for temperature rise.
12	Bolted connections	None	Signs of corrosion on bolted connections
13	Welds	None	
14	Connecting pavement	None	

The overall condition of the expansion joint can be considered poor/unsatisfactory.
Condition of both the expansion joint at axis 1 and axis 9 are nearly identical.

Structural components:
Edge profiles are in fair condition and show no signs of damages.
Lamella beams and joist beams are in unsatisfactory conditions at joist beams 1 to 3 at lower end of the expansion joint.
Lamella beams and joist beams at the centre of the carriageway are in fair condition.
Heavy corrosion at the topside of lamella beams, edge profiles and cover plates in footpath areas
It's expected that minor corrosion in the clamp area of the seals at the lower end of the carriage way cause leakage.

Support system
Sliding springs, sliding bearings and sliding shoes are at their outer tolerances and reached the end of their service life.
Sliding frames show heavy corrosion at the outer ends and mild corrosion at the centre of the carriageway.
Stainless steel sliding sheets at the lower ends (beams 1 to 3) show heavy corrosion and defects.

Control system
Heavy corrosion on frames at the outer three joist beams, mild corrosion of all carbon steel parts and bolted connection of the support system at the centre of the carriageway.
Control springs are over the end of their service life and show aging and cracks in the rubber.

Strip seals
Two strip seals are punctured approx. 1m[1] from the verge in the carriageway. Strip seals show ageing and can be considered at the end of their service life

3 Advise

3.1 General

In the following paragraph the advised maintenance and works are summarized per axis or expansion joint type.

3.2 Skye Bridge

3.2.1 Axis 01; TENSA®MODULAR LR4

Replacement of all wear components of the support system:
- Sliding bearing;
- Sliding springs;
- Control springs;
- Sliding shoes.

Replacement of the strip seals

Repair and touch-up of corrosion protection.

Alternatively to repairing the corrosion protection on the joist beam frames and control spring brackets which have to be removed for replacement of the wear components it can be considered to replace these parts with new hot dip galvanized parts which will expedite maintenance works.

3.2.2 Axis 04; TENSA®MODULAR LR6

Replacement of all wear components of the support system:
- Sliding bearing;
- Sliding springs;
- Control springs;
- Sliding shoes.

Replacement of the strip seals

Repair and touch-up of corrosion protection.

Alternatively to repairing the corrosion protection on the joist beam frames and control spring brackets which have to be removed for replacement of the wear components it can be considered to replace these parts with new hot dip galvanized parts which will expedite maintenance works.

3.2.3 Axis 06; TENSA®MODULAR LR2

Replacement of all wear components of the support system:

- Sliding bearing;
- Sliding springs;
- Control springs;
- Sliding shoes.

Replacement of the strip seals

Repair and touch-up of corrosion protection.

Alternatively to repairing the corrosion protection on the joist beam frames and control spring brackets which have to be removed for replacement of the wear components it can be considered to replace these parts with new hot dip galvanized parts which will expedite maintenance works.

It was observed that the gap widths of the TENSA®MODULAR LR2 were exceptionally small and nearly similar to the pre-setting in which the expansion joints have been applied.
Without ruling out other causes, which are likely to introduce problems/damages to the bridge bearing, we assume the expected creep and shrinkages didn't cause a structural gap opening displacement.
In order to replace the strip seals a minimum gap opening of the expansion joint cells of 35mm is required.
We therefore advise to execute the maintenance works in a relatively cold period.
Furthermore the already small structural gap opening underneath a TENSA®MODULAR LR2 in general complicates replacement of wear components.

3.3 Carrich Viaduct

3.3.1 Axis 01 and 9; TENSA®MODULAR LR3

Replacement of the 3 outer joist beams at each side of the expansion joint with new joist beams incl. new stainless steel sliding sheets.
In order to replace the joist beams the following additional works are required:

- Removal of adjacent pavement above the sliding side of the joist beam. (longer joist box);
- Removing the top cover of the joist boxes;
- Welding new support lugs in the opened joist boxes;
- Exchange of the existing joist beams with the new joist beams;
- Installing and sealing new joist box covers;
- Application/repair of waterproofing membrane;
- Repair pavement/surfacing.

Replacement of the fixing plates, joist beam frames and control spring brackets of the 3 outer joist beams at each side of the expansion joint.

Replacement of all wear components of the support system:

- Sliding bearing;
- Sliding springs;
- Control springs;
- Sliding shoes.

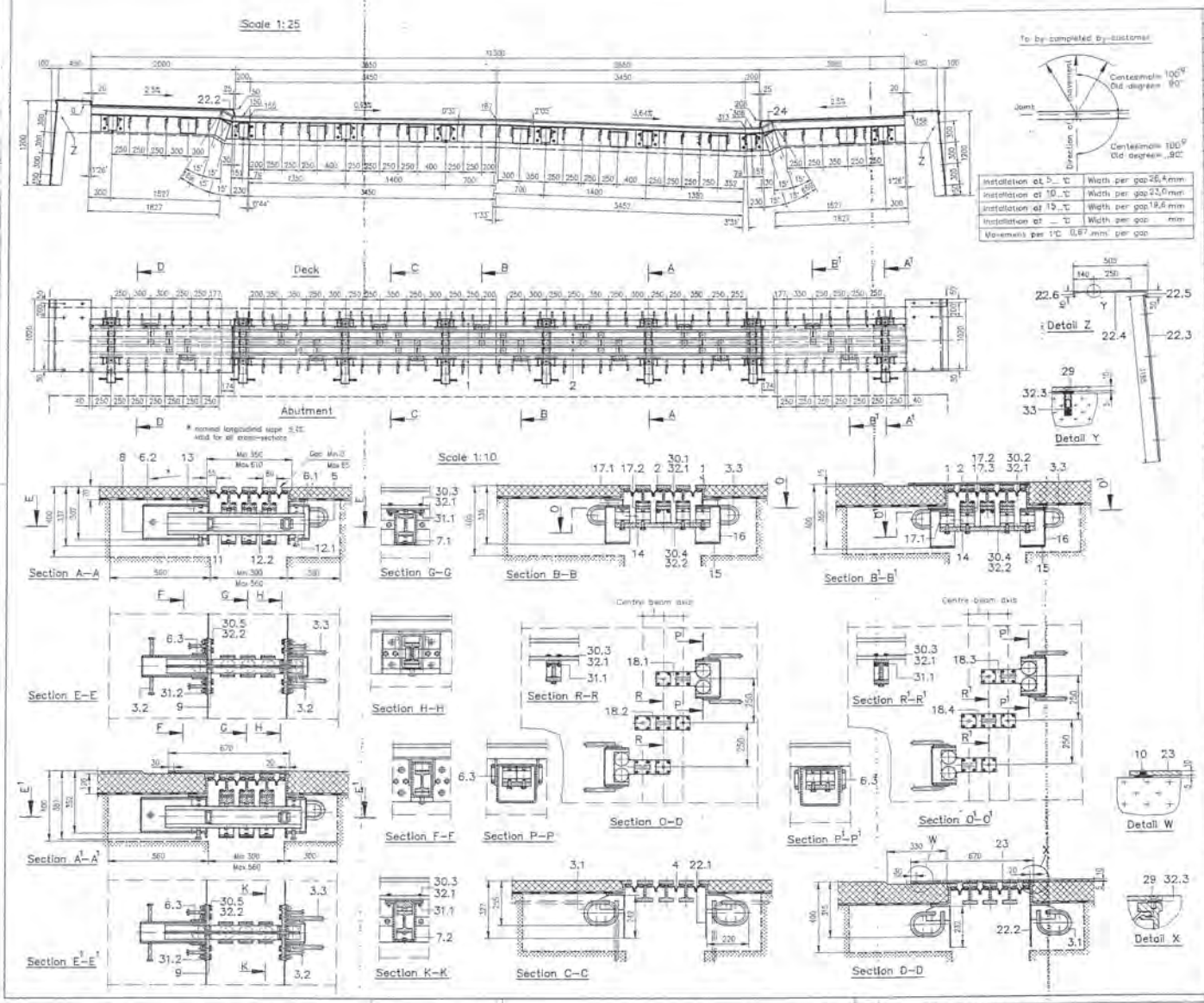
Replacement of the strip seals

Rebuild of the corrosion protection on the edge profiles and lamella beams.
Repair of the corrosion protection system on remaining steel components.

Alternatively to repairing the corrosion protection on the joist beam frames and control spring brackets which have to be removed for replacement of the wear components it can be considered to replace these parts with new hot dip galvanized parts which will expedite maintenance works.

Considering the current state of both expansion joints in the Carriach Viaduct and accumulated time in which the bridge needs to be (partially) closed for traffic a box-in-box replacement of the expansion joint can be considered.
In this method the existing joist boxes, steering boxes and lower part of the edge profiles are re-used where the support system, control system and lamella beams are replaced with factory assembled unit.

Appendix 1; drawing TENSA®MODULAR LR4



180	Nut DIN 934	M12	31 1	8	6158	
64	Hexagon screw DIN 933	M16x45	30 5	8 8	40527	
56	Hexagon screw DIN 933	M16x40	30 4	8 8	5702	
180	Hexagon bolt DIN 931	M12x60	30 3	8 8	43253	
32	Hexagon bolt DIN 931	M12x55	30 2	8 8		
80	Hexagon screw DIN 933	M12x35	30 1	8 8	36014	
40	Countersunk screw DIN 7991	M12x30	29	10 9	6643	
4	Flat steel	90x10x130	24	St 37-2	37656	
2	Footway cover plate	670x10x30	23 3	St 37-2	Checkered pl.	
3	Footway cover plate	670x10x88	23.2	St 37-2	Checkered pl.	
2	Footway cover plate	670x10x1968	23 1	St 37-2	Checkered pl.	
2	Parapet cover plate	1020x10x30	22 6	St 37-2		
2	Parapet cover plate	1020x10x40	22.5	St 37-2		
2	Parapet cover plate	1020x10x485	22.4	St 37-2		
2	Parapet cover plate	1020x10x1165	22 3	St 37-2		
16	Shuttering plate (footway)	d=4 ,1,31 m²	22 3	St 37-2	37036	
26	Shuttering plate (carriag.)	d=4 ,1,16 m²	22 1	St 37-2	37036	
2	Distance plate (Footway)	2-Nr 4-018 163	18 4	St 37-2		
4	Distance plate (Footway)	2-Nr 4-018 162	18 3	St 37-2		
5	Distance plate (Carriag.)	2-Nr 4-018 163	18.2	St 37-2		
10	Distance plate (Carriag.)	2-Nr 4-018 162	18 1	St 37-2		
8	Spacer block	2-Nr 4-018 301	17 3	St 37-2		
28	Spacer block	80x27x60	17.2	St 37-2	39131	
28	Spacer block	ø80x22	17 1	St 37-2		
14	Control spring box cover	210x4x210	16	St 37-2	37036	
14	Control spring box	220x220x10x130	15	St 44-3		
56	Control spring	ø78x81	14	NR	34330	
40	Sliding spring	ø78x45	13	CR/PTFE	34306	
24	Sliding bearing (Frame)	ø78x19	12.2	PA	43232	
16	Sliding bearing (Box)	ø80/78x19	12 1	PA	43216	
32	Synthetic shoe	37x28x67	11	PUR	43141	
28	Synthetic sliding pad	ø40x12	10	RIGN 1000	20024	
32	Facing plate (Box)	2-Nr 4-018 166	9	St 37-2	4150	
16	Joint box cover	112x4x192	8	St 37-2	37036	
8	Joint box frame footway	2-Nr 4-018 191	7.2	St 37-2		
18	Joint box frame carriag.	2-Nr 4-018 271	7 1	St 37-2		
80	Joint box support	80x10x150	6 3	St 37-2	3905	
8	Joint box	2-Nr 4-018 168	6.2	St 37-2		
8	Joint box	2-Nr 4-018 167	6 1	St 37-2		
8	Joint	2-Nr 4-018 169	5	St 52-3		
4	Riegel 65 rubber seal	L=11400	4	CR	28740	
44	Loop anchor	ø20	3.3	St 37-2	43255	
80	Stud	ø16x100	3.2	St 37-3k	43258	
46	Carriageway anchor	170x320	3.1	St 37-2	37564	
8	Riegelmelle z.sprayed	L= 201	2.5	St 52-3	36228	
8	Riegelmelle z.sprayed	L=1827	2 4	St 52-3	36228	
8	Riegelmelle z.sprayed	L= 270	2 3	St 52-3	36228	
3	Riegelmelle z.sprayed	L=3450	2.2	St 52-3	36228	
3	Riegelmelle z.sprayed	L=3450	2 1	St 52-3	36228	
4	Riegelrand RS-A12 z.spr	L= 204	1.5	St 37-2	37622	
4	Riegelrand RS-A12 z.spr	L=1827	1 4	St 37-2	37622	
4	Riegelrand RS-A7 z.spray	L= 258	1 3	St 37-2	36244	
2	Riegelrand RS-A7 z.spray	L=3450	1 2	St 37-2	36244	
2	Riegelrand RS-A7 z.spray	L=3450	1 1	St 37-2	36244	
NUM	DESCRIPTION	DIMENSION mm	POS	MATERIAL	ARTICLE	

12	Dowel DIN 1234	M20x50	33	St		
85	Washer DIN 125A	ø24,5/34x2,5	32 3	PA		
120	Washer DIN 125A	ø30/37x2	32.2	St	17152	
472	Washer DIN 433	ø20/13x2	32 1	St	43254	
64	Cap. nut DIN 1587	M16	31 2	6	6262	
NUM	DESCRIPTION	DIMENSION mm	POS	MATERIAL	ARTICLE	

Paint specification
1 Blast cleaning SA 2 1/2
2 1st coat: Zinc phosphate epoxy blast primer (2-pack), 30µm
3 2nd coat: M10 epoxy undercoat (2 pack), 80µm
4 3rd coat: M10 epoxy finish (2 pack), 80µm

Paint system
See enclosure 342

Remark

Inclination of expansion joint in longitudinal direction of superstructure at time of installation: 6,50%
Due to these pre-settings, the nominal longitudinal slope of 5,40% will be reached after 2/3 of calculated creep and shrinkage shortening of superstructure has occured

Paint specification (for footpath and parapet coverplate only)
1 Blast cleaning SA 2 ½, 80 µm
2 1st coat: zinc spray galvanized
3 2nd coat: M10 epoxy undercoat (2 pack), 80 µm
4 3rd coat: M10 epoxy finish (2 pack), 80 µm

Rev.	Date	Drawn	Checked	Approved
03				
02	13.2.95	redacted		APPROVALS + SIG. BY COORDINATOR
01	28.9.94	redacted	redacted	AMENDED ACCORDING FAX 28.9.94

SKYE CROSSING

SCOTTISH OFFICE ROADS DIRECTORATE

DEVELOPER: SKYE BRIDGE TOLLS LTD.

CONTRACTOR: Joint Venture
MILLER — DYWIDAG
Miller Civil Engineering Ltd. Edinburgh — Dyckerhoff & Widmann AG Munchen

DESIGNER: Dyckerhoff & Widmann AG
Design Department

SUBJECT: MAIN BRIDGE

AS BUILT DRAWING — REFER TO SCHEDULE AT FRONT FOR REFERENCE

OBJECT: EXPANSION JOINT AXIS 1

Consultant: mageba sa

Coordinator: Dyckerhoff & Widmann AG, Design Department

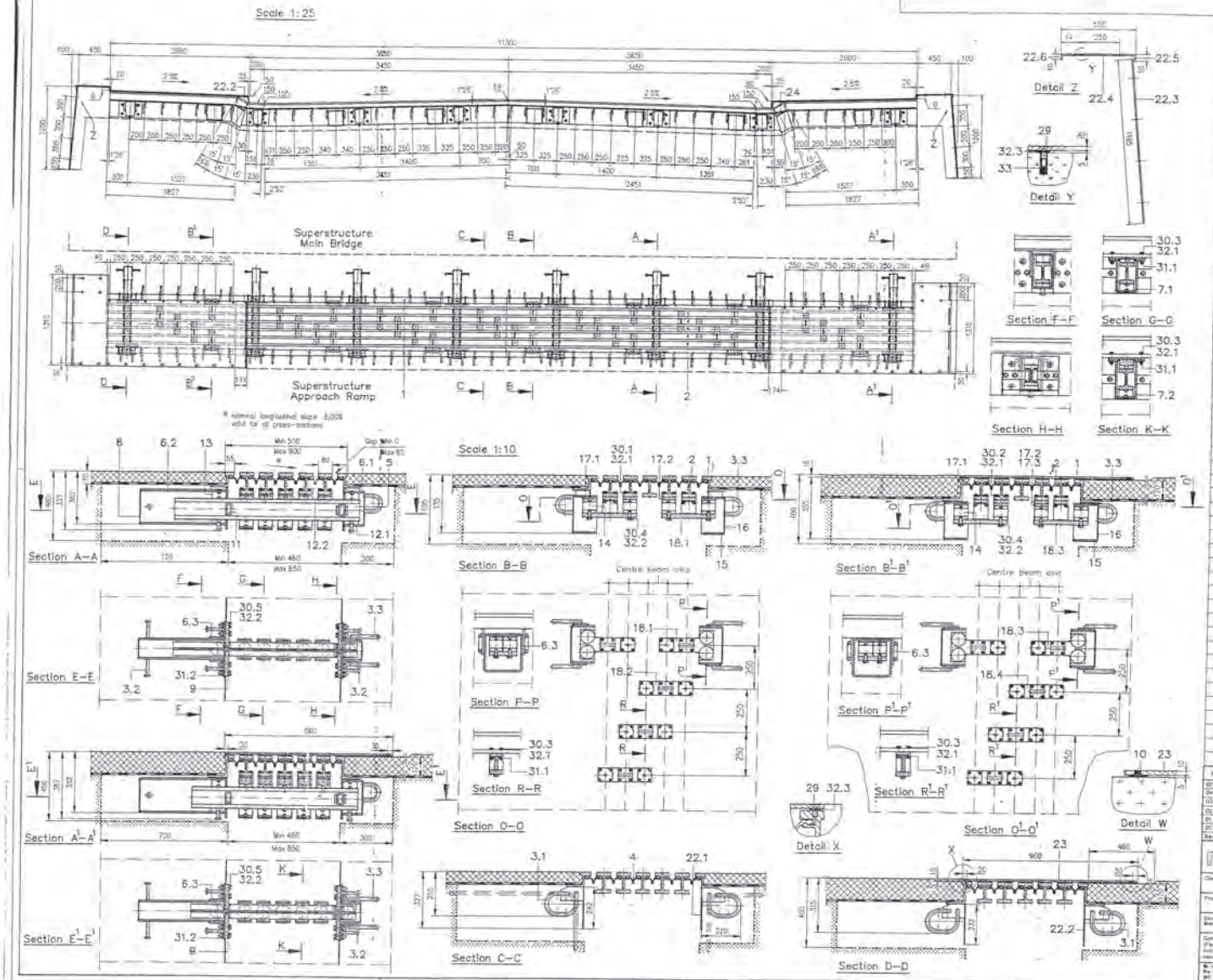
	Date	Name	Signature
Drawn	3.5.94	KN	
Checked	3.5.94	KN	
STATUS	Issued	Rev.	Signature / Date
Exp. Agent / JV			redacted 25.8.94
Checker / DW	Consent		redacted
Designer / JV	Initiated		
Checker / DW			redacted 2.10.94
Designer / JV			13.2.95

Scales:

Project Number	Drawing Number	Rev.
191161	05.50.101	02

Contract No. 45690
General tolerances according DIN 7168-eg
Miller Dywidag Joint Venture
Skye Crossing Main Bridge
Structure Number: Expansion joint LR4-A65
Location: Axis 1
Order-No. 1617
Sheet-No. 1
Drawing-No. 1-023.240.861
Revision 01

Appendix 2; drawing TENSA®MODULAR LR6



82*	Washer	DIN 433	ø20/13x2	35 1	St	43354								
84	Cap nut	DIN 1587	M18	31 3	8	6283								
300	Nut	DIN 934	M12	31 1	E	6189	12	Dowel	DIN 1234	M20x50	33	St		
84	Hexagon screw	DIN 933	M16x45	30 5	8 8	40527	68	Washer	DIN 125A	ø24/13x2,5	32 3	PA		
84	Hexagon screw	DIN 933	M16x40	30 4	8 8	5700	148	Washer	DIN 125A	ø30/17x3	32 2	St	17135	
300	Hexagon bolt	DIN 931	M12x60	30 3	8 8	43253	NUM.	DESCRIPTION		DIMENSION mm	POS	MATERIAL	ARTICLE	
84	Hexagon bolt	DIN 931	M12x55	30 2	8 8									
160	Hexagon screw	DIN 933	M12x35	30 1	8 8	16014								
40	Countersunk screw	DIN 7991	M12x30	28	10 9	6643								
4	Flat steel		90x10x130	24	St 37-2	37656								
2	Footway cover plate		960x10x30	23 3	St 37-2	Checkered pl.								
2	Footway cover plate		960x10x88	23.2	St 37-2	Checkered pl.								
2	Footway cover plate		960x10x1968	23 1	St 37-2	Checkered pl.								
2	Parapet cover plate		1310x10x30	22 6	St 37-2									
2	Parapet cover plate		1310x10x40	22 5	St 37-2									
2	Parapet cover plate		1310x10x485	22.4	St 37-2									
2	Parapet cover plate		1310x10x1185	22.3	St 37-2									
16	Shuttering plate (footway)		ø=4 ,1,31 m²	22 2	St 37-2	37036								
26	Shuttering plate (carriag.)		ø=4 ,2,16 m²	22.1	St 37-2	37036								
6	Distance plate (Footway)		Z-Nr.4-018.163	18 4	St 37-2									
4	Distance plate (Footway)		Z-Nr 4-018.162	18 3	St 37-2									
15	Distance plate (Carriag.)		Z-Nr 4-018.163	18 2	St 37-2									
10	Distance plate (Carriag.)		Z-Nr 4-018.162	18.1	St 37-2									
16	Spacer block		Z-Nr.4-018 301	17 3	St 37-2									
56	Spacer block		80x27x60	17 2	St 37-2									
28	Spacer block		ø60x22	17 1	St 37-2	39131								
14	Control spring box cover		210x4x210	16	St 37-2	37036								
14	Control spring box		220x220x10x130	15	St 44-3									
84	Control spring		ø78x61	14	NR	34330								
56	Sliding spring		ø78x45	13	CR/PTFE	34306								
40	Sliding bearing (Frame)		ø78x19	12 2	PA	43232								
16	Sliding bearing (Box)		ø80/78x19	12 1	PA	43218								
32	Synthetic shim		37x26x67	11	PUR	43141								
28	Synthetic sliding pad		ø40x12	10	RICH 1000	20024								
32	Fixing plate (Box)		Z-Nr 4-018 166	9	St 37-2	4150								
16	Joist box cover		112x4x192	8	St 37-2	37036								
10	Joist box frame (footway)		Z-Nr 4-018 191	7 2	St 37-2									
30	Joist box frame (carriag.)		Z-Nr 4-018.271	7 1	St 37-2									
80	Joist box support		80x10x150	6 3	St 37-2	3905								
8	Joist box		Z-Nr 4-018 166	6 2	St 37-2									
8	Joist box		Z-Nr 4-018.167	6 1	St 37-2									
8	Joist		Z-Nr 4-018 169	5	St 52-3									
6	Riegel 65 rubber seal		L= 11400	4	CR	28746								
44	Loop-anchor		ø20	3.3	St 37-2	43255								
60	Stud		ø16x100	3.2	St 37-3k	43258								
50	Carriageway anchor		170x220	3 1	St 37-2	37564								
10	Riegelamelle 2 sprayed		L=201	2.4	St 52-3	36228								
10	Riegelamelle 2 sprayed		L=1827	2 3	St 52-3	36228								
10	Riegelamelle 2 sprayed		L= 268	2.2	St 52-3	36228								
10	Riegelamelle 2 sprayed		L= 3451	2.1	St 52-3	36228								
4	Riegelrand RS-A12 2 spr.		L= 204	1.4	St 37-2	37632								
4	Riegelrand RS-A12 2 spr.		L= 1827	1.3	St 37-2	37632								
4	Riegelrand RS-A7 2 spray		L= 257	1 2	St 37-2	36344								
4	Riegelrand RS-A7 2 spray		L= 3451	1 1	St 37-2	36344								
NUM	DESCRIPTION		DIMENSION mm	POS	MATERIAL	ARTICLE								

04							
03							
02	19 2 95	Amended according Fax 27.1.95	KR	KR	DS	DS	PC
01	29 8 94	Amended according Fax 20.5.94	Gos		DS		PC
00	29 4 94	For approval	Kh		NH		PC
Revision	Date	Description	Drawn		Reviewed		Approved

mageba sa — SUBSTRATE AG CH-8180 BÜLACH TELEFON 01/860 44 55

Article-No. 46375

General tolerances according DIN 7168-sg

Client: Miller Dywidag Joint Venture

Project: Skye Crossing Main Bridge

Structure Section: Expansion Joint LR6–A65 — Location: Axis 4 — Drawing-No. 1617 — Sheet-No. 1

Surface Protection: 1) Spec. above 2) — 3) — 4) — Thickness: — my

Drawing-No. 1-023.360.269 — Revision 02

We reserve all rights in this document and in the subject thereof. On acceptance of the document the recipient acknowledges these rights and undertakes not to publish the document nor the subject thereof in full or in part, nor to make them available to any third party without our prior express written authorisation, nor to use it for any purpose other than that for which it was delivered to him.

To be completed by customer

Installation at 0 ...°C	Width per gap 74,0 mm	
Installation at 30 °C	Width per gap 71,0 mm	
Installation at 35...°C	Width per gap 68,0 mm	
Installation at ... °C	Width per gap ... mm	
Movement per 1°C 0,5 mm per gap		

Remark:

Inclination of expansion joint in longitudinal direction of superstructure at time of installation 9,00‰.
Due to these pre-settings, the nominal longitudinal slope of 8,00‰ will be reached after 2/3 of calculated creep and shrinkage shortening of superstructure has occured.

Paint specification
1 Blast cleaning SA 2 ½
2 1st coat Zinc phosphate epoxy paint primer (2-pack), 30µm
3 2nd coat M10 epoxy undercoat (2 pack),80µm
4 3rd coat M10 epoxy finish (2 pack),80µm

Paint diagram
See enclosures 1+2

Paint specification (for footpath- and parapet coverplate only)
1 Blast cleaning SA 2 ½, 60 µm
2 1st coat zinc spray galvanized
3 2nd coat M10 epoxy undercoat (2 pack), 60 µm
4 3rd coat M10 epoxy finish (2 pack), 60 µm

Rev.	Date	Name	Name	Signature	Amendments
		Drawn	Checked		
03	13 2 95	SHEJKAL	BERGER		APPROVAL • SKE MF COORDINATOR
02	2 2 95	Kri	DS		AMENDED ACCORDING FAX 27.1.95
01	29 8 94	BDS	DS		AMENDED ACCORDING FAX 20.5.94

SKYE CROSSING

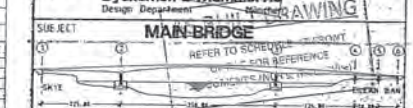
SCOTTISH OFFICE ROADS DIRECTORATE

DEVELOPER: SKYE BRIDGE TOLLS LTD.

CONTRACTOR: Joint Venture — MILLER (Miller Civil Engineering Edinburgh) — DYWIDAG (Dyckerhoff & Widmann AG München)

DESIGNER: Dyckerhoff & Widmann AG, Design Department, München

SUBJECT: MAIN BRIDGE



OBJECT: EXPANSION JOINT AXIS 4

Consultant: mageba sa — Coordinator: Dyckerhoff & Widmann AG, Design Department

	Date	Name	Signature
Drawn	29 4 94	KH	
Checked	29 4 94	RA	

redacted

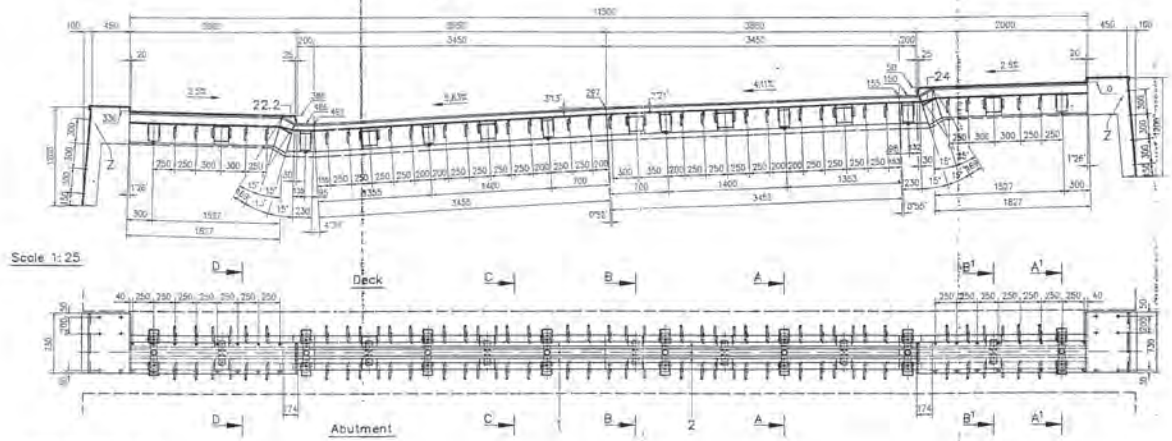
STATUS	Action	Rev.	Signature	Date
S.A.S.	Approved			15 8 94
Checked/SAL	Checked			
Dimension/CH	Checked			
Checked/SAL	Approved			23 3 94
Drawing-No.	Approved			13 2 95

redacted

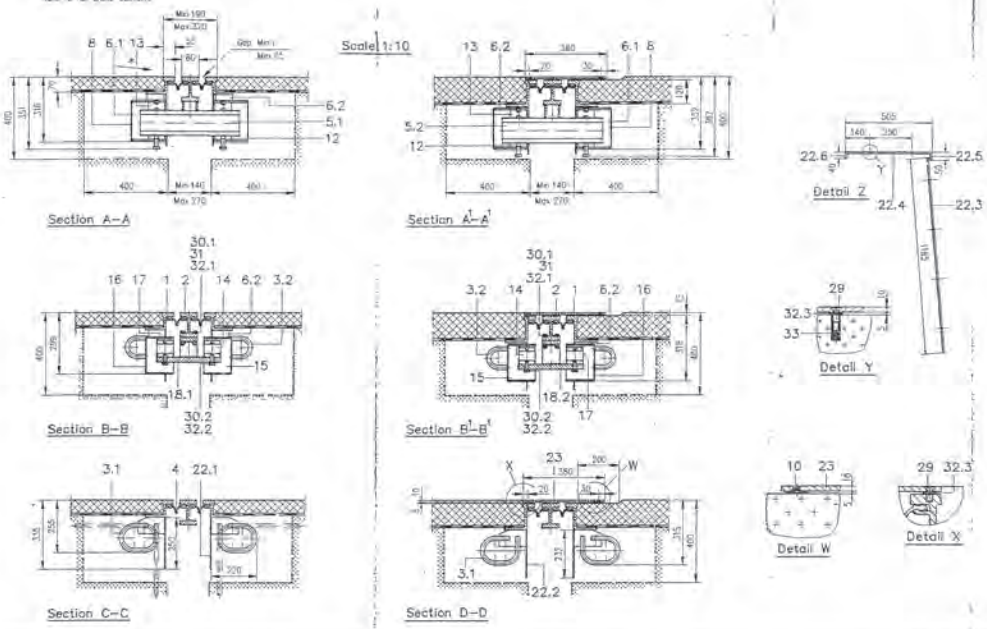
Scale: —

Project Number	Drawing Number	Rev.
19 1161	05-50.102	03

Appendix 3; drawing TENSA®MODULAR LR2



* nominal longitudinal slope 8,00% valid for all cross-section



Remark:

Inclination of expansion joint in longitudinal direction of superstructure at time of installation: 8,00%

Due to these pre-settings, the nominal longitudinal slope of 8,00% will be reached after 2/3 of calculated creep and shrinkage shortening of superstructure has occured.

Paint specification:
1 Blast cleaning Sa 2 ½
2 1st coat: zinc phosphate epoxy base prime (2-pack), 35µm
3 2nd coat: MIO epoxy undercoat (2 pack), 80µm
4 3rd coat: MIO epoxy finish (2 pack), 80µm

Paint region:
See exclusive list

Paint specification (for footpath- and parapet coverplate only)
1. Blast cleaning SA 2 ½, 50 ym
2. 1st coat: zinc spray galvanized
3. 2nd coat: MIO epoxy undercoat (2 pack), 60 ym
4. 3rd. coat: MIO epoxy finish (2 pack), 80 ym

To be completed by customer

Installation at 5 °C	Width per gap 20 mm	
Installation at 10 °C	Width per gap 19 mm	
Installation at 15 °C	Width per gap 18 mm	
Installation at ... °C	Width per gap ... mm	
Movement per 1°C 0,20 mm per gap		

NUM	DESCRIPTION	DIMENSION mm	POS.	MATERIAL	ARTICLE
12	Dowel DIN 125A	M20x60	33	St	
68	Washer DIN 125A	ø24/13x2,5	32.3	PA	
14	Washer DIN 125A	ø30/17x3	32.2	St	17152
56	Washer DIN 433	ø20/13x2	32.1	St	43254
26	Nut DIN 934	M12	31	8	6189
14	Hexagon screw DIN 933	M16x40	30.2	8.8	5702
28	Hexagon bolt DIN 931	M12x60	30.1	8.8	43253
40	Countersunk screw DIN 7791	M12x30	29	10.9	6645
4	Flat steel	90x10x150	24	St 37-2	37558
2	Footway cover plate	380x10x30	23.3	St 37-2	Checkered pl
2	Footway cover plate	380x10x88	23.2	St 37-2	Checkered pl
2	Footway cover plate	380x10x1968	23.1	St 37-2	Checkered pl
2	Parapet cover plate	730x10x30	22.6	St 37-2	
2	Parapet cover plate	730x10x40	22.5	St 37-2	
2	Parapet cover plate	730x10x485	22.4	St 37-2	
2	Parapet cover plate	730x10x1185	22.3	St 37-2	
16	Shuttering plate (footway)	d=4 ,1,67 m²	22.2	St 37-2	37036
30	Shuttering plate (carriag.)	d=4 ,3,27 m²	22.1	St 37-2	37036
4	Distance plate (Footway)	2-Nr 4-018,162	18.2	St 37-2	
10	Distance plate (Carriag.)	2-Nr 4-018 162	18.1	St 37-2	
14	Spacer block	ø80x22	17	St 37-2	39131
14	Control spring box cover	174x4x174	16	St 37-2	37036
14	Control spring box	180x180x6x130	15	St 44-3	
14	Control spring	ø76x61	14	NR	34330
16	Sliding spring	ø76x46	13	CR/PTFE	34306
16	Sliding bearing (Box)	ø60/78x19	12	PA	43316
28	Synthetic sliding pad	ø40x12	10	RIGh 1000	20004
16	Joint box cover	112x4x182	8	St 37-2	37036
60	Joint box support	80x10x150	6.2	St 37-2	3905
16	Joint box	2-Nr 4-018 171	6.1	St 37-2	
2	Joint	2-Nr 4-018 214	5.2	St 52-3	
6	Joint	2-Nr. 4-018 214	5.1	St 52-3	
2	Riegel 65 rubber seal	L= 11400	4	CR	28746
28	Lasp anchor	ø30	3.2	St 37-2	43265
54	Carriageway anchor	170x220	3.1	St 37-2	37564
2	Riegelamelle 2 sprayed	L= 201	2.6	St 52-3	36228
2	Riegelamelle 2 sprayed	L= 1827	2.4	St 52-3	36228
2	Riegelamelle 2 sprayed	L= 272	2.3	St 52-3	36228
1	Riegelamelle 2 sprayed	L= 3453	2.2	St 52-3	36228
1	Riegelamelle 2 sprayed	L= 3455	2.1	St 52-3	36228
4	Riegelrand RS-A12 2 spr.	L= 204	1.5	St 37-2	37622
4	Riegelrand RS-A12 2 spr.	L= 1827	1.4	St 37-2	37622
4	Riegelrand RS-A7 2 spray	L= 260	1.3	St 37-2	36244
2	Riegelrand RS-A7 2 spray	L= 3453	1.2	St 37-2	36244
2	Riegelrand RS-A7 2 spray	L= 3455	1.1	St 37-2	36244

Revision	Date	Description	Drawn	Reviewed	Approved
03	10.5.95	Amended according Fax 27.1.95	KH WA	DS	PC
02	29.2.94	Amended according Fax 20.5.94	Dick	DS	PC
01	9.5.94	For approval	KH	KH	PC

mageba sa — Bulach/Zürich, Switzerland, Tel. 01 860 06 66

Article-No. 44800

General Tolerances according DIN 7168-sg

Client: Miller Dywidag Joint Venture

Project: Skye Crossing Main Bridge

Structural Element: Expansion Joint LR2-A65 — Location: Axis 6

Drawing-No. 1617 — Sheet-No. 1

Drawing-No. 1-023.120.2194 — Revision 02

Rev.	Date	Name	Signature
03	10.5.95	SINGHAL	BERGH.
02	6.2.95	KH	DS
01	25.4.94	DCS	DS

APPROVALS - S/O BY: COORDINATOR
AMENDED ACCORDING FAX 27.1.95
AMENDED ACCORDING FAX 20.5.94

SKYE CROSSING

SCOTTISH OFFICE ROADS DIRECTORATE

DEVELOPER: SKYE BRIDGE TOLLS LTD.

CONTRACTOR: Joint Venture — MILLER (Miller Civil Engineering Ltd.) — DYWIDAG (Dyckerhoff & Widmann AG, Munchen)

AS BUILT — REPRO TO MILLER — DOCUMENT ON FILE FOR REFERENCE

DESIGNER: Dyckerhoff & Widmann AG, Design Department, Munchen

SUBJECT: MAIN BRIDGE

OBJECT: EXPANSION JOINT AXIS 6

Consultant: mageba sa — Coordinator: Dyckerhoff & Widmann AG, Design Department

	Date	Name	Signature
Drawn	6.5.94	KH	redacted
Checked	9.5.94	KH	redacted

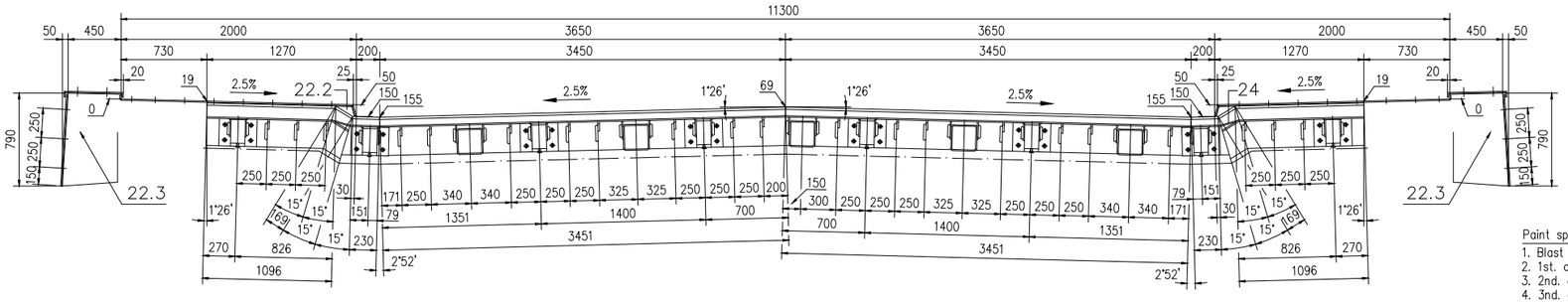
STATUS: Approved

S.A.S. Agent/JVP	Approved	01	
Checker/DAL	Approved		
Developer/JV Pr.	Approved		
Checker/DAL	Approved	01	
Designer/DPB	Approved	02	

Project Number	Drawing Number	Sheet	Rev.
193161	05.50/103	09	

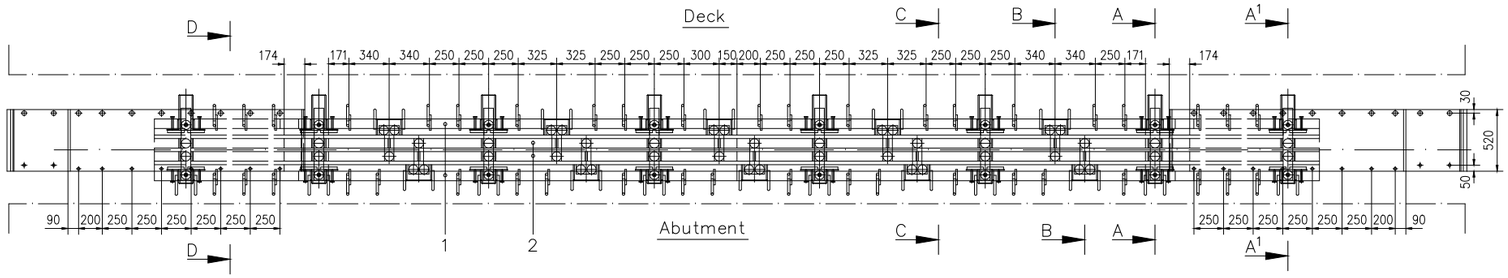
Appendix 4; drawing TENSA®MODULAR LR3

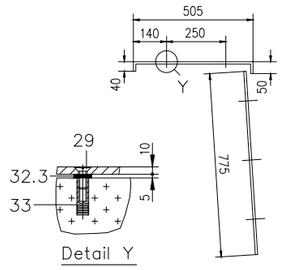
Scale 1:25



Paint specification.
1. Blast cleaning SA 2 1/2
2. 1st. coat: Zinc phosphate epoxy blast primer (2-pack), 30µm
3. 2nd. coat: M10 epoxy undercoat (2 pack),80µm
4. 3nd. coat: M10 epoxy finish (2 pack),80µm

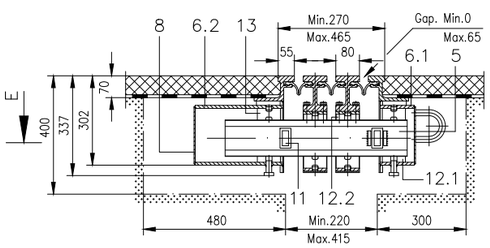
Paint diagram:
See enclosures 1+2



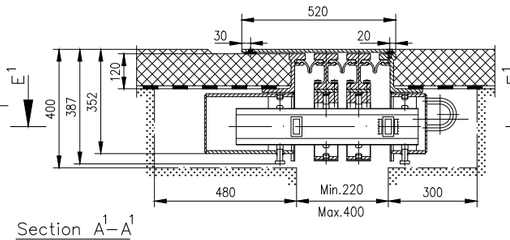


10	Dowel	DIN 125A	M12x50	33	St.	
52	Washer	DIN 125A	ø24/13x2,5	32.3	PA.	
94	Washer	DIN 125A	ø30/17x3	32.2	St.	17152
248	Washer	DIN 433	ø20/13x2	32.1	St.	43254
64	Cap nut	DIN 1587	M16	31.2	6.	6262
104	Nut	DIN 934	M12	31.1	8.	6189
64	Hexagon screw	DIN 933	M16x45	30.4	8.8	40527
30	Hexagon screw	DIN 933	M16x40	30.3	8.8	5702
104	Hexagon bolt	DIN 931	M12x60	30.2	8.8	43253
40	Hexagon screw	DIN 933	M12x35	30.1	8.8	16014
26	Countersunk screw	DIN 7791	M12x30	29	10.9	6643
4	Flat steel		90x10x130	24	St.37-2	37556
2	Footway cover plate		520x10x30	23.2	St.37-2	Teardrop pl.
2	Footway cover plate		520x10x88	23.2	St.37-2	Teardrop pl.
2	Footway cover plate		520x10x1968	23.1	St.37-2	Teardrop pl.
8	Parapet cover plate		d=10 ; 0,70m²	22.3	St.37-2	13995
16	Shuttering plate (footway)		d=4 ;0,84m²	22.2	St.37-2	37036
28	Shuttering plate (carriag.)		d=4 ;2,02m²	22.1	St.37-2	37036
10	Distance plate		Z-Nr.4-018.162	18	St.37-2	
10	Spacer block		80x27x80	17.2	St.37-2	
20	Spacer block		ø80x22	17.1	St.37-2	39131
10	Control spring box cover		210x4x210	16	St.37-2	37036
10	Control spring box		220x220x10x130	15	St.44-3	
30	Control spring		ø78x81	14	NR	34330
32	Sliding spring		ø78x45	13	CR/PTFE	34306
16	Sliding bearing (Frame)		ø78x19	12.2	PA	43232
16	Sliding bearing (Box)		ø80/78x19	12.1	PA	43216
32	Synthetic shoe		37x28x67	11	PUR	43141
26	Synthetic sliding pad		ø40x12	10	RICH 1000	20024
32	Fixing plate (Box)		Z-Nr.4-018.166	9	St.37-2	4150
16	Joist box cover		112x4x192	8	St.37-2	37036
4	Joist box frame footway		Z-Nr.4-018.191	7.2	St.37-2	
12	Joist box frame carraig.		Z-Nr.4-018.271	7.1	St.37-2	
52	Joist box support		80x10x150	6.3	St.37-2	3905
8	Joist box		Z-Nr.4-018.168	6.2	St.37-2	
8	Joist box		Z-Nr.4-018.167	6.1	St.37-2	
8	Joist		Z-Nr.4-018.169	5	St.52-3	
3	Riegel 65 rubber seal		L= 10000	4	CR	28746
36	Loop anchor		ø20	3.3	St.37-2	43255
64	Stud		ø16x100	3.2	St.37-3k	43258
42	Carriageway anchor		170x220	3.1	St.37-2	37564
4	Riegellamelle z.sprayed		L= 201	2.4	St.52-3	36228
4	Riegellamelle z.sprayed		L= 1096	2.3	St.52-3	36228
4	Riegellamelle z.sprayed		L= 268	2.2	St.52-3	36228
4	Riegellamelle z.sprayed		L= 3451	2.1	St.52-3	36228
4	Riegelrand RS-A12 z.spr.		L= 204	1.4	St.37-2	37622
4	Riegelrand RS-A12 z.spr.		L= 1096	1.3	St.37-2	37622
4	Riegelrand RS-A7 z.spray		L= 257	1.2	St.37-2	36244
4	Riegelrand RS-A7 z.spray		L= 3451	1.1	St.37-2	36244
NUM.	DESCRIPTION		DIMENSION mm	POS.	MATERIAL	ARTICLE

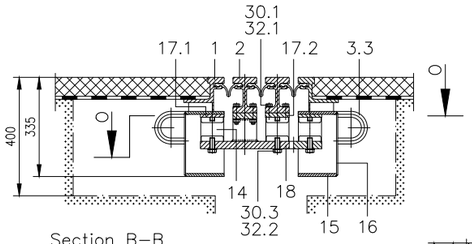
Scale 1:10



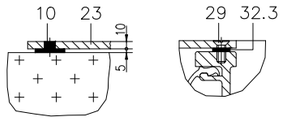
Section A-A



Section A1-A1

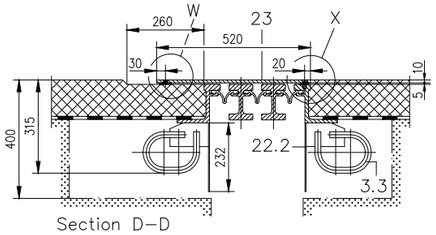


Section B-B

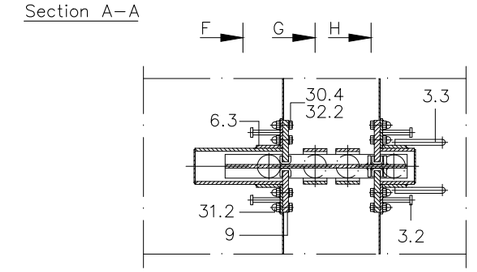


Detail W

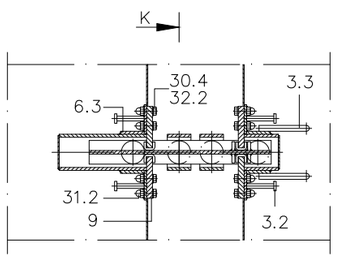
Detail X



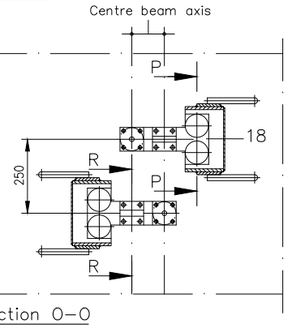
Section D-D



Section E-E

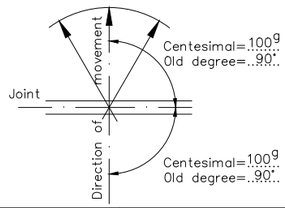


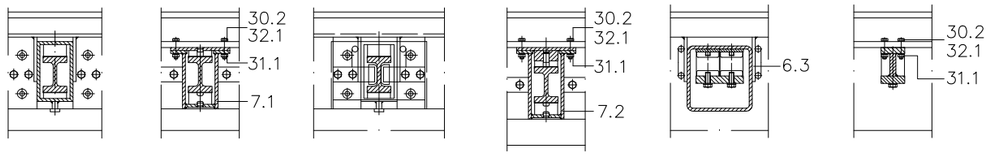
Section E1-E1



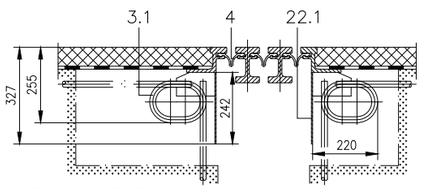
Section O-O

To be completed by customer





Section F-F Section G-G Section H-H Section K-K Section P-P Section R-R



Section C-C

Installation at..5....°C	Width per gap.22.8mm
Installation at..10...°C	Width per gap.20.3mm
Installation at..15...°C	Width per gap.18....mm
Installation at.....°C	Width per gap.....mm
Movement per 1°C..0,5.....mm per gap	

VALID FOR 2 JOINTS

Revision	Date	Description	Prepared	Reviewed	Approved
05					
04					
03					
02					
01	1.12.93	Amendments according fax 16.11.93	K.H.	D.S.	P.C.
00	23.9.93	For approval	K.H.	D.S.	P.C.

mageba sa
SOLISTRASSE 68
CH 8180 BÜLACH
TELEFON 01/860 06 66

Article-No.: 41004

General tolerances according DIN 7168-sg

Client: Miller Dywidag Joint Venture

Project: Skye Crossing Secondary Bridge

Scale | Pos. | Weight

Structural Member: Expansion joint LR3-A65

Location: Axis 0 and Axis 8

Order-No.: 1617

Sheet-No.: 1

Corrosion Protection: (For all surfaces not in contact with concrete)
1) See above
2) ..... Thickness: ..... my
3) ..... Thickness: ..... my
4) ..... Thickness: ..... my

Drawing-No.: 1-023.180.1125

Revision: 01

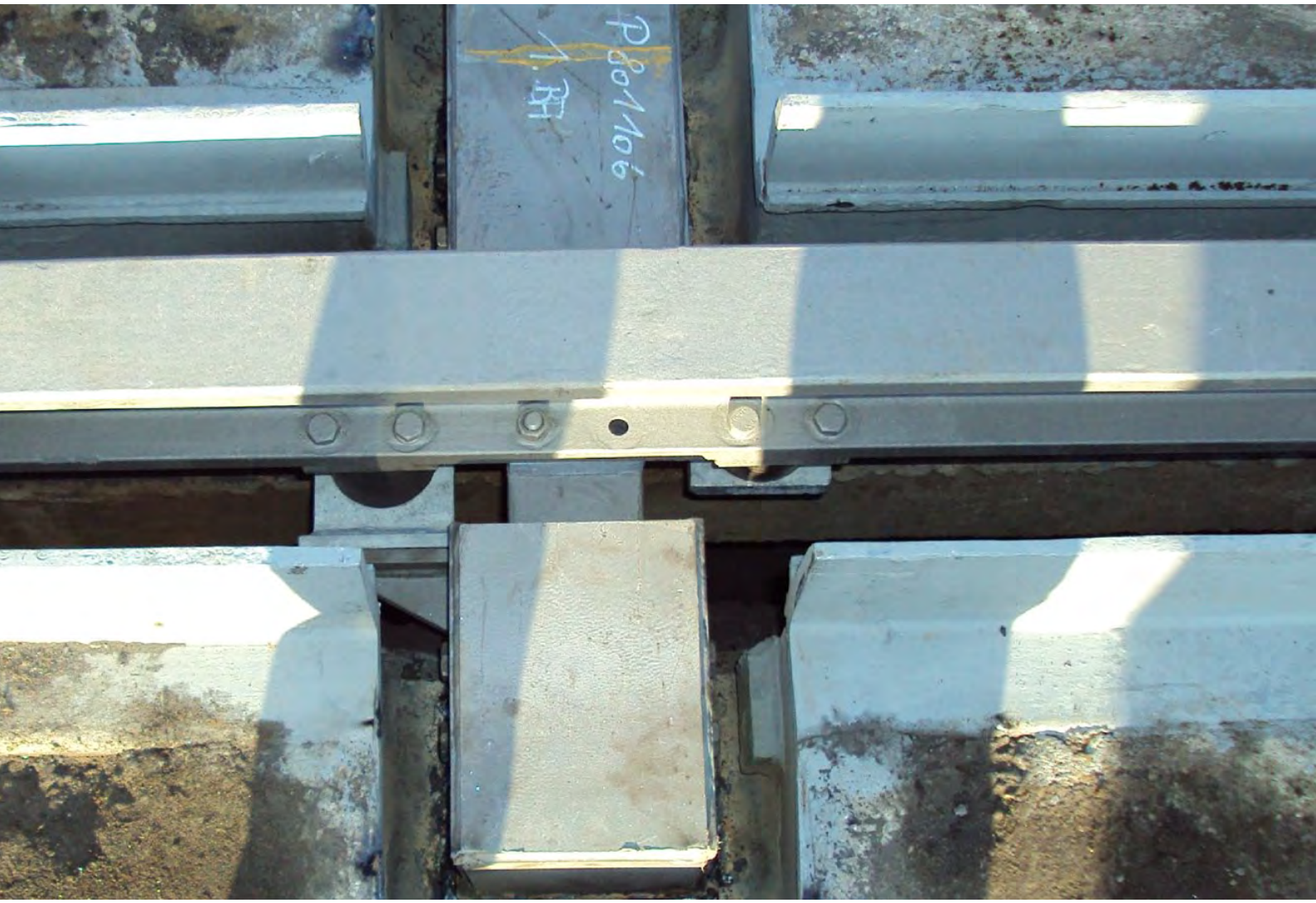
We reserve all rights in this document and in the subject thereof. By acceptance of the document the recipient acknowledges these rights and undertakes not to publish the document nor the subject thereof in full or in part, nor to make them available to any third party without our prior express written authorization, nor to use it for any purpose other than for which it was delivered to him.

mageba

Appendix 5; brochure Box-in-Box replacement

Monitoring & Services

mageba repair and replacement services for modular expansion joints



“Box in box” method

minimal encroachment, quick installation, reduced cost

mageba
Switzerland www.mageba.ch

Concept and planning

Repair and replacement of old or damaged modular expansion joints

In the course of routine structural inspections, damage to expansion joints and deterioration due to age is often observed, which may require a joint to be replaced.

If the bridge structure is otherwise in good condition, it is desirable to minimise the effort required and only replace the expansion joint itself, without any impact on the bridge's structure.

To make this possible, mageba has developed a method which enables the substructure of the old joint to be left in place, saving the need to break it out. The new expansion joint is placed onto the old substructure, after the carrying out of any required repair works.

In doing this, the design of the new joint can be optimised to take account of the fact that deck shrinkage and creep, which had to be considered in the design of the original joint, has already taken place. This may allow a joint with a lower movement capacity to be installed, reducing costs.

mageba - an innovative partner for renovation works

Because such a replacement method is not governed by any norm or standard, mageba ensures that the design is based as closely as possible on existing expansion joint design standards and national approvals.

To satisfy this self-imposed requirement, we use only parts and components which are used as standard in joints which have been awarded national approvals.

The construction methodology is adapted to suit the old joint type and the prevailing circumstances, with the support bar boxes of the new joint being concreted into the retained support bar boxes of the old joint.

Preparatory works

Before commencing work, the necessary road/lane closures and traffic management are arranged in discussion with the bridge owner, to enable the work to be carried out in one or more phases.

In order that the existing substructure can be treated with new corrosion protection, the asphalt and road waterproofing membrane are removed to a distance of 1 m from the joint. This also enables any rutting of the asphalt to be addressed.

Since the substructures of some joint types have only a shear pin instead of a support bar in the deck shoulder, it may be necessary to create a recess for a new support bar in this area.

To improve access, it may also be necessary to erect scaffolding at the edge of the bridge and to remove safety rails and fencing.

1 Old 3-gap expansion joint after removal of asphalt and waterproofing membrane at each side
2 Cutting to enable the support bars of the old joint to be lifted out
3 Substructure after cleaning
4 Lifting in of the new structure, consisting of a lamella beam and connected support bars, complete with boxes

Highlights – mageba "Box in box" method

- Experienced and qualified personnel
- Carrying out of the complete joint renewal project
- Design, fabrication, installation, maintenance and inspection services
- No impact on the load-bearing structure
- No delay to construction while concrete hardens
- Quicker joint replacement, less impact on traffic and lower costs

Joint replacement

Procedure

To optimise the work for all concerned, it is carried out in steps as described below.

Step 1:

Removal of the old elastomeric sealing profiles and lamella beams (centerbeams), and the steel edge profiles at each support bar location. The top of each support bar box is then cut away, enabling the old support bars to be removed. This also clears the way for the support bar boxes of the new joint to be inserted.

Step 2:

All parts which are to be retained are first cleaned of rust by hand, to enable their condition to be evaluated, and then cleaned by sandblasting. A primer coat is then applied to the entire remaining substructure, and intermediate and surface coats to those parts which will not be welded.

Step 3:

The new joint, consisting of lamella beams and pre-connected support bars and support bar boxes, is lifted into place and precisely positioned, with the new support bar boxes inside the open boxes of the old joint. Because existing expansion joints sometimes develop rotations, a height difference between the bridge deck and the abutment may become apparent at this stage, which may require the support level within some existing support bar boxes to be adapted. The new support bar boxes are then welded all around into the existing boxes. After this, the welds are cleaned by blasting and given a primer coat.

Step 4:

Shuttering can now be placed, enabling the spaces between old and new boxes to be filled with fast-drying grout. This ensures that no voids will remain beneath the carriageway, which could later lead to rutting.

Step 5:

After removal of shuttering, the existing steel edge profiles (including waterproofing membrane connection flanges) are reinstated where removed, and equipped with new connection steel for the elastomeric sealing profiles of the joint.

Step 6:

Corrosion protection is now applied as necessary, after blasting clean of the welds.

Step 7:

Finally, the elastomeric sealing profiles of the new joint are inserted and minor cosmetic works are carried out, before the expansion joint can be handed over.

Replacement in phases

If the expansion joint is to be replaced in two or more phases (e.g. one traffic lane at a time to reduce impact on traffic), then the lamella beams of each phase must be welded together on site using the Secheron process. mageba's installation team has the required certification.

Final works

To complete the works, the waterproofing membrane is reinstated and the road surfacing is placed at each side of the joint. The support bar boxes in the deck shoulder are also concreted, and the shoulder geometry re-established.

Acceptance

The works can now be inspected, together with the bridge owner, and handed over.

With the successful completion of the works, mageba demonstrates again and again its competence and innovative spirit in the field of expansion joint renewal.

1 View of a support bar box of the new joint, placed inside the larger support bar box of the old joint and welded all around

2 View of one new support bar and its boxes, following placing of mortar to fill out the voids between new and old boxes

3 New expansion joint during installation, after connection to the structure

4 Application of waterproofing to bridge deck at each side of the new joint

Suggested text for tender requests

Renewal of an existing modular expansion joint.

Removal of all load-bearing and moving parts of the existing joint, and replacement with a new watertight modular expansion joint of proven quality and durability.

Retention of the existing substructure (concreted-in parts) to support the new expansion joint.

All necessary surface treatment and corrosion protection works are to be included in the pricing. Target thickness of corrosion protection to be 390 µm. All voids between existing and new support bar boxes to be filled with non-shrinking grout, and the deck waterproofing membrane reinstated.

Movement capacity of joint: … mm.

Price per metre in the direction of the joint's longitudinal axis.

Option: Including cover plates for deck shoulder and parapet in stainless steel (grade 1.4571 or as agreed).

Option: Including noise-reducing surface plates (e.g. "sinus plates") in the carriageway.

1 Renewal of a 2-gap modular joint (installed in phases) almost completed

2 Traffic management during renewal of a joint in phases (one lane at a time)

Project references – expansion joint renewals

Inn Bridge Simbach (DE)

Ohrntal Bridge Öhringen (DE)

A8 Wendlingen (DE)

Rhine Bridge Frankenthal (DE)

Hindenburg Bridge (DE)

mageba Monitoring & Services

Structural Monitoring

Inspection

Testing

mageba Switzerland www.mageba.ch

mageba sa - Solistrasse 68 - 8180 Bülach - Switzerland - T +41 44 872 40 50 - info@mageba.ch