

EKSPAN BEARING INSPECTION REPORT 2012 AND 2019 ESTIMATE

----- Original Message -----

From: Spencer Goff <Spencer.Goff@ekspan.co.uk>

Cc: John Senior <john.senior@ekspan.co.uk>

Date: 04 October 2019 at 16:58

Subject: Brunel Way Bearing Inspection Report

Hi

It is difficult to budget this type of work as it always comes down to what access you can have and the sequence in which it is undertaken.

As very rough guide you be looking around £10m to undertake the full replacement of bearings on all structures.

If you have any queries please do not hesitate to contact me.

Best regards

Spencer

Spencer Goff BSc (Hons)

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Sent: 03 October 2019 18:56
To: Spencer Goff <Spencer.Goff@ekspan.co.uk>
Subject: RE: Brunel Way Bearing Inspection Report

Hi Spencer.

Thanks very much for the report, very interesting.

Was there ever a total cost for all the work that is required, and if so can you tell me.

Regards

From: Spencer Goff
Sent: 03 October 2019 15:40
Subject: Brunel Way Bearing Inspection Report

Hi

Please see attached as requested.

If you have any queries please do not hesitate to contact me.

Best regards

Spencer

Spencer Goff BSc (Hons)

Project Manager



BEARING INSPECTION REPORT

Brunel Way, McAdam Way & Ashmead Way Roller Bearings

Cabot Way, Bennett Way & Bristol Gate Elastomeric Bearings

Client: NPS Services/Bristol CC

Client Ref: PO10251956

Prepared By: Craig Bruce
Ekspan Ltd
410 Brightside Lane
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Ref: 5492-7043

Date: 25 September 2012

Rev	Modification	Prep	Check	App	Date
A	First Issue	CB	RC	RC	25/09/12

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1. Introduction

1.1. Brief

Ekspan were contracted, by NPS Service on behalf of Bristol City Council, to carry out an inspection of a selection of roller bearings and elastomeric bearings to establish their condition, any defects, residual serviceable life and to recommend maintenance actions.

The inspection consisted of a visual inspection of the bearings to determine their physical condition, assess current movement and to determine the bearing dimensions.

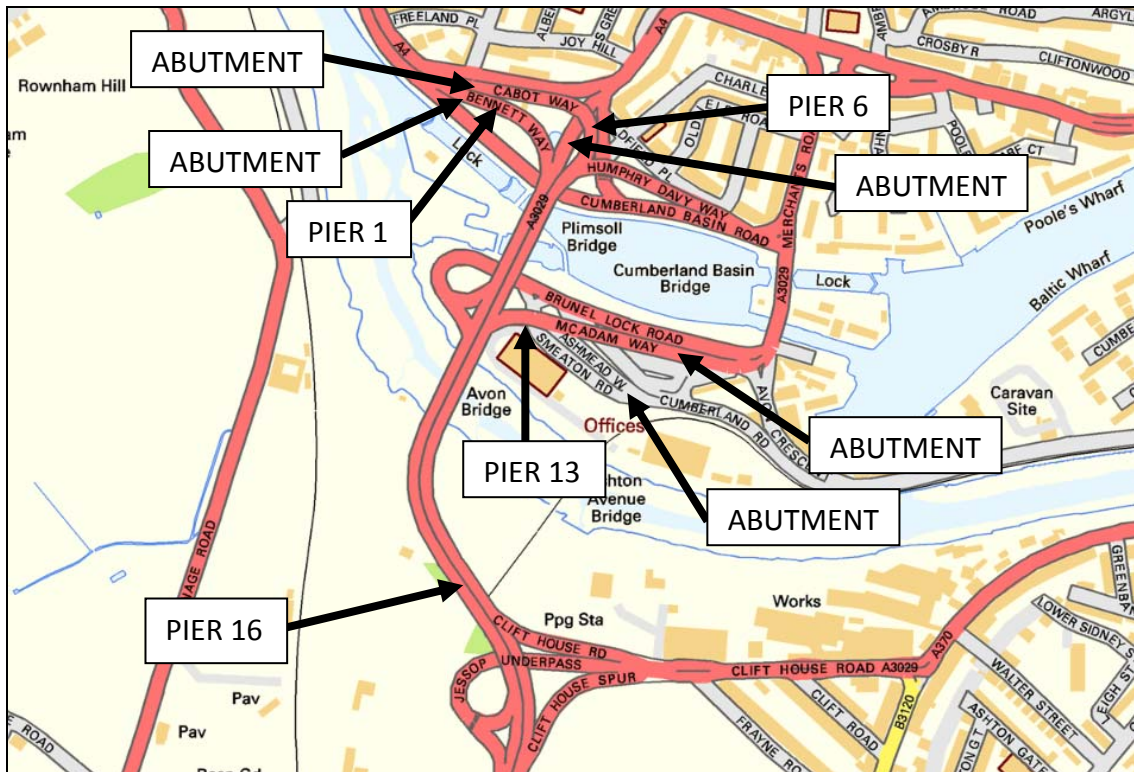
The report provides conclusions, recommendations and dimensions of the current bearings.

This report has been produced using reasonable skill and care. The assessment, views and recommendations of the author are based on evidence and information available at the time of inspection.

1.2. Location of Structure



The structures were located to the south west of Bristol city centre.



1.3. Description of Structure

The structures inspected are all part of an interchange of the A4 running through Bristol and crossing the river Avon. The structure comprises of a reinforced concrete deck with circular reinforced concrete columns forming the piers.

1.3.1. Bearings

Each of the column and abutment bearings are either a roller bearing encased in a protective grease box to reduce any environmental effects on the bearings or elastomeric bearings. The column bearings are all usually encased in cowlings while abutment bearings have no extra protection.

1.3.2. Abutments and Piers

The abutments on McAdam Way & Ashmead Way are mass reinforced concrete walls. Each of the abutments on Cabot Way, Bennett Way & Bristol Gate consists of curtain wall with pilasters at each location of a bearing. No drawings have been provided confirming the types of abutments.

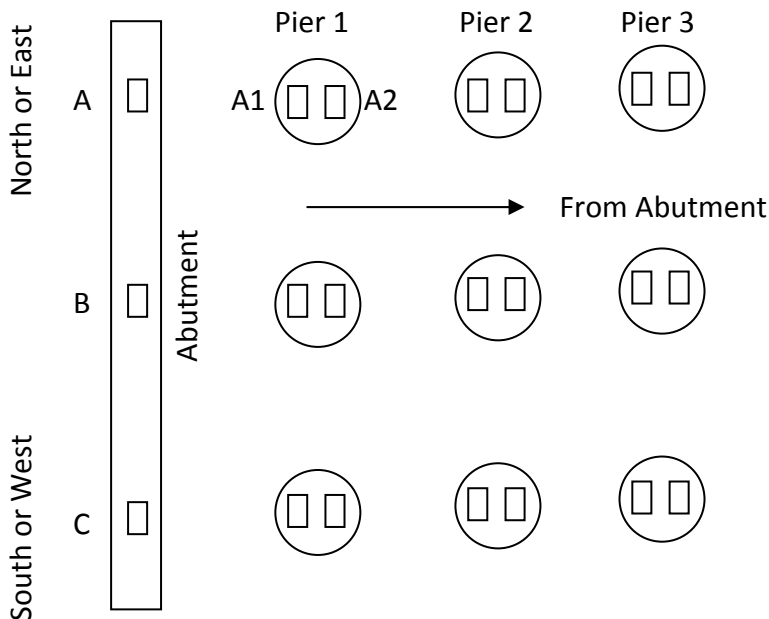
1.3.3. Expansion Joints

A top side inspection of the joints was not undertaken but the joints are of an asphaltic plug joint construction on Brunel Way Pier 13, Cabot Way Pier 6, McAdam Way Pier 13 & abutment and Bristol Gate abutment. Bennett Way and Cabot Way abutments both have nosing joints with steel nosings. Ashmead Way abutment has a tooth joint.

1.3.4. Deck

The deck is a continuous reinforced concrete deck.

1.3.5. Location and identity of bearings



2. Inspection Report

2.1. Executive summary

2.1.1. General

We did not conduct a top side inspection of the structure so we cannot make any judgements on the state of the surfacing or expansion joints.

The structure was largely noted to be in good to fair condition with abutments being in good condition. There is some water staining to the ends of the deck at each joint. There is a large repaired crack along the south wing wall of Cabot Way which may have been caused by settlement along its edge.

The pier columns appear to be in good condition with little evidence of significant defects. There are some small areas of delaminated concrete, spalling and very fine cracking to the tops of columns.

The deck is mostly in good condition but any defects that are present are found adjacent to expansion joints. These defects include delamination of concrete with small areas of spalling. There are some areas of exposed reinforcement to deck soffits adjacent to joints.

The bearings vary in condition but the majority of roller bearings that were inspected were in good condition with very minor surface corrosion to the top plates and the top of the rollers with very few that were more significant. There are varying levels of pitting to the surface of the rollers. It is the grease box covers and steel plinths that are in very poor condition with heavy corrosion and delamination with a lot of fixings suffering from loss of section, in some cases up to 90% loss. The elastomeric bearings inspected have failed and the elastomer is deteriorated and cracked with the steel plates exposed and corroding.

2.1.2. Bearings**2.1.2.1. Brunel Way - Pier 13**

Bearing B2;
Loss of section to nut of bearing B2 top plinth which is common to all bearings across the pier.



Bearing D1;
Heavy corrosion to grease box and steel plinths is common across the pier. There was a large amount of grease leaking from the box at this location.
There was a large dirt/debris build up to column D between the two bearings, of which most was removed to remove grease box.



Bearing B1;
Loss of section to nut of steel plinth.



Bearing A2;
Delamination of steel and corrosion to bolts made it difficult to remove the sides of the grease boxes.



Bearing D2,
There was a large amount of water came out of bolt holes of the grease boxes upon removal at C2 & D2. Here at D2 to you can see the condition of grease upon the removal of the box.



Bearing C2;
Typical condition of rollers at pier 13.
Minor surface pitting is common across the surface of the rollers.



Bearing D1;
This is the largest rotation to a guide on the structure.



Bearing A2;
The roller to bearing A2 is in the worst condition of the 8 at pier 13. There is more pitting to the surface and surface corrosion mostly across the top of the roller, this may be due to reduced cover from grease.
Also note the surface corrosion to the top plate.



Bearing A1;
Pitting and surface corrosion is common to the upper elements of the guide arrangement.
Also note how the roller guide has been set on the wrong tooth.



Bearing D2,
Missing fixing to south guide of bearing.
The missing fixing was not found during
removal of grease so it can be assumed
that there was never a fixing attached.



Bearing D2;
Failed repair to deck soffit adjacent to
joint exposing reinforcement to the
south of bearing D2.



Bearing B2;
Typical condition of base plate and base
plate fixings.

All steel plinth plates have heavy surface corrosion with delamination of steel and at least some loss of section to the holding down nuts. All of the grease boxes to the bearings are also covered with heavy surface corrosion and areas of delamination which along with corrosion to fixing bolts hindered the removal of the grease boxes. Due to the state of the grease boxes towards the joints the removal of the rear plate of the grease box was not possible in the time frame we had for the inspection.

During the removal of the grease boxes there was water leaking from the holes when bolts were removed, notably to bearings C2 & D2 where water was coming out of bolts higher up. The cause of the water ingress is unknown but it is assumed that water is running through the joint, down the back of the deck and into the grease box.

Once the grease boxes were removed and grease removed enough to permit an inspection it could be noted that the rollers are largely in good condition with small amounts of pitting and minor surface corrosion. Bearings A1 & C1 are most affected by pitting and surface corrosion. The guides and teeth have some minor pitting to their surface with mostly minor surface corrosion to elements higher up again likely due to the majority of grease covering lower elements.

The bearing guides appear to have been set incorrectly to bearings A1, B1, C1, C2 & D2. The top teeth of the roller guide are not set to the centre tooth of the rack, this would appear to be an installation error and due to there not being enough depth on the teeth as it is on the outside edge there is the possibility of stress being placed on the guide roller. Currently there doesn't appear to be any damage or fatigue to the teeth of the roller guide. As built drawings would be required to confirm that the guide positions are acceptable. Bearing D1 was not fully supported across the length of the roller which may be increasing the stress on the rest of the roller. The portion unsupported is 40mm to the northern end of the roller.

The base plates of all bearings are in good condition as are the fixings, the top plates however are affected by minor surface corrosion to the front edge of the plate but the bearing faces are in good condition.

2.1.2.2. McAdam Way – Pier 13



Bearing A2
Heavy corrosion to steel plinths and loss of section to nuts.



Bearing A2;
Small spall in top of column adjacent to corner of steel plinth.



Bearing B2;
Delamination to bottom steel plinth.



Bearing C2;
Significant loss of section to nut of top steel plinth.



Bearing A2;
Light to moderate surface corrosion over 80% of surface of roller.



Bearing B1;
Roller to bearing B1 however is in good condition with minor pitting to surface.



Bearing C1;
Surface corrosion over large area of roller.



Bearing A2;
Surface corrosion along front face of top plate.



Bearing C1;
Base plate and fixings are in good condition.



Bearing C1
Significant corrosion over surface of guide rack and some pitting and light surface corrosion to higher level of roller guide.



Bearing A2;
Again, corrosion to guide rack and roller but also the guide appears to have been set on the wrong tooth.



Adjacent to Bearing C1 & 2
One corroding steel plate has been left attached to the deck soffit adjacent to deck edge but similar plates have been removed from along the rest of the deck edge.

Most notably at pier 13 of McAdam Way is that the outer bearings are in much poorer condition than the inner bearings. Like Brunel Way the grease boxes and steel plinths are in very poor condition with heavy corrosion and delaminating steel with loss of section to nuts. But unlike at Brunel Way when the grease boxes were removed despite there being less water present during the removal of the grease boxes the roller bearings are in a poorer condition. All four of the outer bearings at pier A & C have more significant surface corrosion to them and covering a larger area. The base plates and fixings were still fine but again the top plates were affected more than at Brunel Way.

At the bearings on pier C the grease had almost completely dried out at the rear thus failing to protect the bearing. Again there were a couple of guides that were fitted incorrectly at A2 & B1 which may place stresses on the roller guides teeth.

2.1.2.3. McAdam Way – Abutment**Bearing B**

Moderate to heavy corrosion across steel plinth plates. Note no loss of section to nuts.

**Bearing A**

The rollers and top plates are in good condition with minor pitting and surface corrosion.

**Bearing C**

Bottom plates and fixings are in good condition.



Bearing C;
We do not know at what angle the guides were set at but all three of the abutment bearings appear close to their limits of translation on the guides.



Adjacent to Bearing B;
There is delaminated concrete along the soffit of the deck adjacent to the deck edge.



Adjacent to Bearing A;
Again, visible delamination of concrete along the deck edge. Also present along the back of the bearing shelf is a build-up of dirt and debris.

The steel plinths of the abutment are again in poor condition but are much better than out at the piers. The grease boxes were in fair condition with little corrosion present. Once the grease boxes were taking off all the rollers, top plates and bottom plates were in good condition along with the guide rollers and racks. What has been noted is that all the guide rollers have been set to the central tooth in the racks and that all three rollers appear to be at their expansion limit.

2.1.2.4. Ashmead Way – Abutment



Bearing B;
Corrosion to steel top plinth with flaking paintwork and pitting to surface.



Bearing B;
Typical condition of the Ashmead Way abutment bearings are very good.



Bearing A;
End of roller bearing with roller guide removed for ultrasonic testing which is in good condition.



Bearing A;
The base plates and fixings are in good condition.



Adjacent to Bearing B;
There is delaminated concrete to the deck soffit adjacent to the deck edge.



Bearing A;
The roller guide has been set to wrong position.

The overall conditions of the bearings to Ashmead Way abutment are in fair condition. The steel plinths are suffering from moderate corrosion and are in much better condition than most. The grease box plates were found to be in good condition although they were leaking some grease.

Once the grease boxes were removed the actual bearings were in good condition with little corrosion present. However, bearing A was not fully supported, there was a gap above the last 35mm to the south end of the roller and the guides are set on the wrong tooth.

2.1.2.5. Cabot Way Elastomeric Bearings – Abutment & Pier 6

Abutment

The elastomeric bearings to the abutment and pier 6 of Cabot Way have all failed and are no longer serviceable. The elastomer to all bearings is split and bulging with exposed corroding steel plates. There is exposed reinforcement to the top plinth of bearing C of pier 6 which requires repairing and delaminated concrete along the deck edge above the abutment which also requires attention. There is no detectable movement to any of the bearings.



Bearing E;
The elastomerics are splitting and exposing corroded steel plates which are themselves delaminating.



Bearing A;
Splitting of the elastomer and exposed
corroding steel plates.



Bearing C;
Splitting and bulging of the elastomer and
exposed corroding steel plates.



Adjacent to Bearing A;
Delaminated concrete to the deck soffit
and top plinth of bearing A adjacent to
the deck edge.



Between Bearings C & D;
Further delaminating concrete to the deck soffit adjacent to the deck edge.



Above Bearing E;
Failed repair to the south end of the deck at abutment.

2.1.2.6. Cabot Way – Pier 6



Bearing B;
Deterioration of bearing exposing corroding steel plates.



Bearing C;
Splitting of elastomer



Bearing C;
Spalled concrete and exposed corroding
reinforcement to top plinth.

2.1.2.7. Bennett Way – Abutment & Pier 1

All of the elastomeric bearings to Bennett Way abutment and pier 1 have failed and are no longer serviceable. The elastomer is delaminating and cracked exposing corroding steel plates. There is no detectable movement in any of the bearings.

Abutment



Bearing A;
Deterioration to the elastomer and
corrosion to exposed steel plates.



Bearing D;
Deterioration to the elastomer and
corrosion to exposed steel plates.



Bearing E;
Deterioration to the elastomer and
corrosion to exposed steel plates.



Between Bearings D & E;
Spalled concrete exposing corroded
reinforcement to the deck soffit.



Between Bearings C & D;
Delaminated concrete to the deck soffit
adjacent to joint.

Pier 1



Bearing B;
Deterioration of elastomer, exposing steel
plates which are corroded.

2.1.2.8. Bristol Gate Abutment

All of the elastomeric bearings to Bristol Gate abutment have failed and are no longer serviceable. The elastomer is delaminating and cracked exposing corroding steel plates. There is no detectable movement in any of the bearings. There is evidence of water penetration through the joint at both ends and there is a reinforcement corrosion crack to the deck soffit along its east edge towards the bearing shelf.



Bearing A;
Cracking to elastomer and corroding steel plates.



Bearing C;
Cracking to elastomer and corroding steel plates.



West End of Abutment, Adjacent to Bearing D;
Heavy water staining around and below the joint.



Deck Edge Adjacent to Bearing A;
Reinforcement corrosion crack along deck edge.

3. Survey Measurements

3.1. Survey Measurements of Both Types of Bearing

See appendix B for survey measurements.

3.2. Measurement of Movement in the Roller Bearings

There were no visible indications of movement so measurements were taking to measure the displacement between the bottom and top bearing plates. As we do not have any as built drawings to compare this to, these measurements are an indication of possible movement only. Positive measurements indicated expansion and negative indicate contraction. Also noted in the table below is the angle of the roller guide off vertical.

BEARING	NORTH EDGE (mm)	SOUTH EDGE (mm)	ANGLE OF GUIDE
Brunel Way 13A1	18	18	-6°
Brunel Way 13A2	17	12	+7°
Brunel Way 13B1	22	21	-6°
Brunel Way 13B2	12	12	+6°
Brunel Way 13C1	14	14	-6°
Brunel Way 13C2	14	13	-11°
Brunel Way 13D1	16	12	+7°
Brunel Way 13D2	28	28	+28°
McAdam Way 13A1	6	2	+5°
McAdam Way 13A2	18	14	-6°
McAdam Way 13B1	14	15	+24°
McAdam Way 13B2	9	11	+4°
McAdam Way 13C1	15	14	+10°
McAdam Way 13C2	8	10	+6°
McAdam Way Abut A	50	50	+24°
McAdam Way Abut B	47	46	+25°
McAdam Way Abut C	48	48	+27°
Ashmead Way Abut A	11	11	+20°
Ashmead Way Abut B	15	15	+7°

4. Conclusions

Although the steel plinths and grease boxes are in overall very poor condition, once the grease boxes and grease were removed the roller bearings themselves were found to be in mostly good condition. There were a small number where there was significantly more surface corrosion to them than the rest, this was also common to the top plates. All of the base plates and fixings were found to be in good condition. There appears to be no damage to any elements due to dirt ingress therefore the grease has been doing its job well. It is when there is reduced grease at the higher elements of the bearing where corrosion is most evident, this may be due to a combination of less grease and water ingress into the grease boxes where it is pooling and leading to corrosion.

It has been noted that out of the 19 roller bearings inspected 8 were found with the guide roller apparently set to the wrong tooth, this is an installation error and although it is unlikely to have an effect on the roller it may be stressing the teeth of the roller guide as there isn't sufficient room for the same type of movement if they were set correctly. Cleaning and re-positioning of guides these bearings will continue to be serviceable for some time.

Ultrasonic testing was undertaken to all of the rollers, no defects were found. Refer to appendix C for the certificate issued.

The elastomeric bearings have all failed. Though at varying levels of failure, the elastomer to all bearings is deteriorated and cracked with steel plates exposed and corroding. There was little evidence of movement to any of the elastomeric bearings though some were suffering from bulging, this may be due to the deterioration and loss of section to the elastomer.

All the elastomeric bearings are no longer serviceable and their life expectancy is almost extinct.

5. Recommendations

In order to increase the serviceable life of the structure and reduce future degradation, we recommend that all grease boxes of the roller bearings to the abutment and piers are replaced so that water can be kept out while ensuring a good seal to encase the grease to prevent any leakage in the future. The steel plinths can be refurbished with new holding bolts and nuts being fitted. The rollers, base & top plates can all be cleaned and re-used.

Further investigation is required into the as-built drawings to determine what the positioning of the roller guides should be. It needs confirming that the current positions of the bearing guides that are not set on the central tooth are ok to do so. If this is not the case then they need to be repositioned along with the top plates.

The elastomeric bearings have all failed and need replacing.

Duration of Recommended Works;

Design (including temporary)	9/10 weeks
Manufacture of temporary works	3/4 weeks
Design of replacement bearings	4/5 weeks
Manufacture of replacement bearings	8/10 weeks
Installation/remedial works	12/14 weeks

Budget prices for concrete pier works, jacking of bridge, removal of existing bearings, supply and installation of new bearings. (These prices are a guide and refer to large scale works, for smaller scale works prices would be revisited).

Price per Elastomeric Bearing	
Item	Abutments/Piers
32mm radius x 60mm high	£580
32mm radius x 90mm high	£965
765mmx270mmx75mm	£790

Installation of Elastomeric Bearings	
Item	Abutment/Piers
Design temporary works for whole scheme	£5000
Jacking at a single pier location under Brunel Way (Indicative drawing provide)	£55000
Jacking for each pier location under slip roads	£30000
Removal and installation	£800 per Bearing

This does not take into account traffic management, welfare & access

Refurbishment of Roller Bearings & Grease Boxes	
Item	Abutments/Piers
Refurbish Rocker Assembly	£500 per Roller
Supply New Grease Boxes & Seals	£660 per Position
Refurbish Steel Plinths & Replace Fixings	£2500 per Position

Per position means at each column whether there are one or two bearings on the column or at each abutment position.

Re-setting of Roller Guides	
Item	Abutments/Piers
Design temporary works for whole scheme	£5000
Jacking for each pier location under Brunel Way (Indicative drawing provide)	£55000
Jacking for each pier location under slip roads	£30000
Removal and installation	£1200 per Bearing

This does not take into account traffic management, welfare & access

Work schemes could be broken down into different scales of works, prices for these can be estimated using the above prices. A more accurate price may be given if Ekspan are provided with desired work locations.

Minimal works;

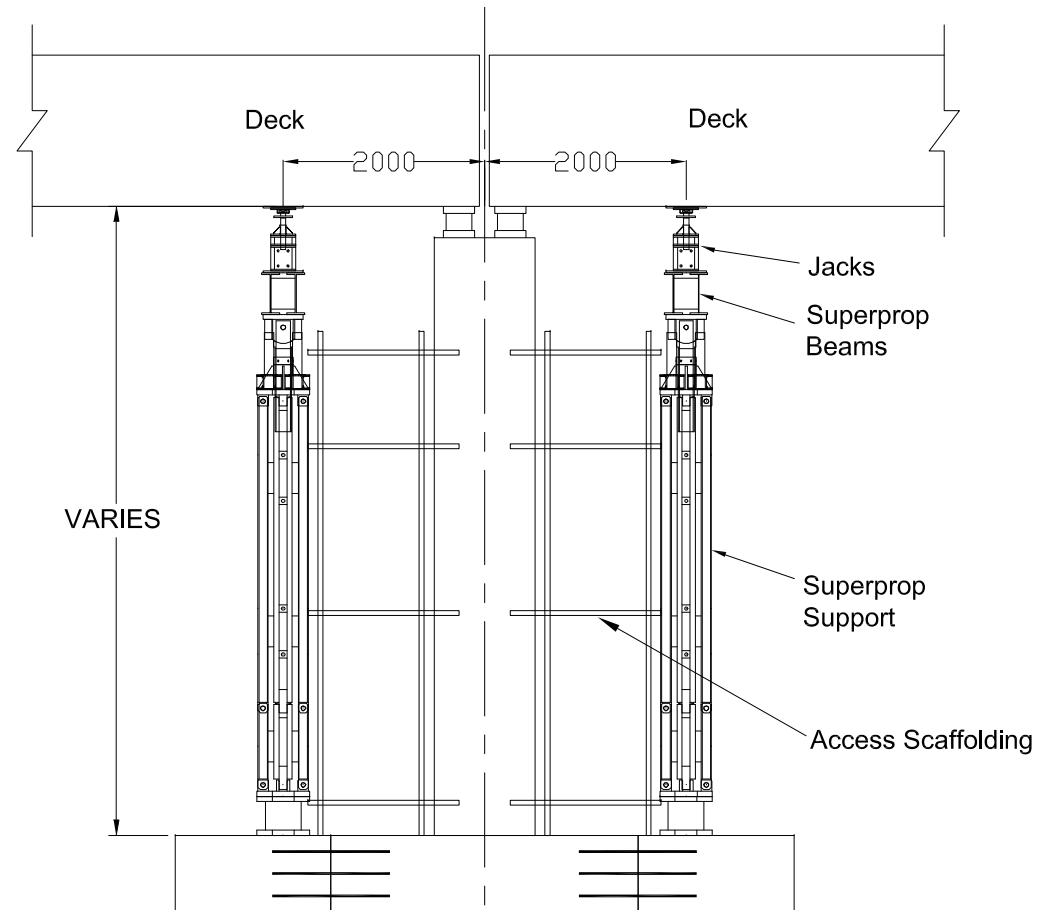
This would include the refurbishment of rocker bearings including new grease boxes & cleaning of the steel plinths. This would not require any jacking of the structure and therefore incur less cost.

Larger works;

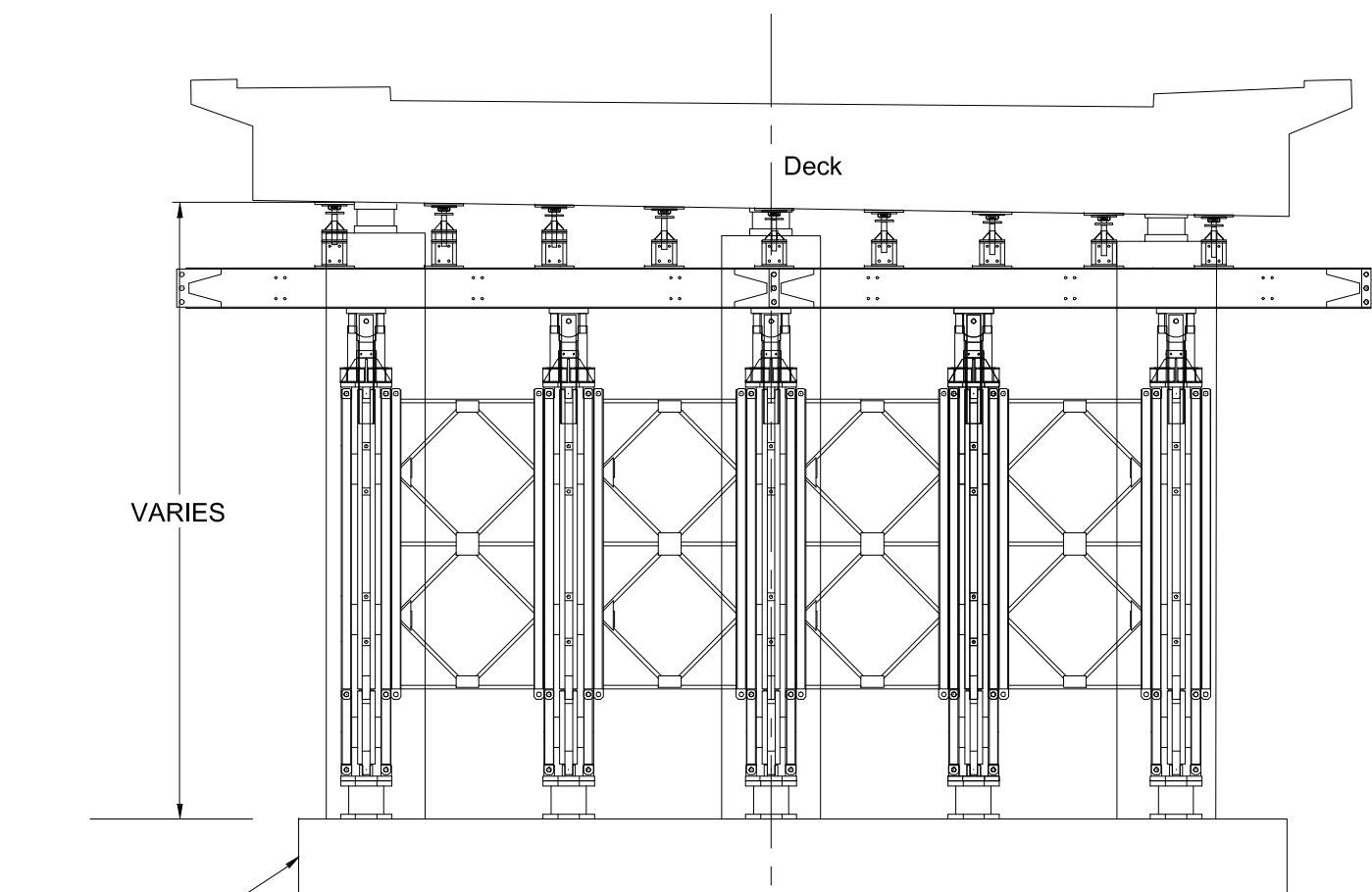
This would include the re-alignment of roller bearing guides and all of the above. This would require jacking to facilitate.

Full scale works;

This would include all of the above plus the replacement of all elastomeric bearings. This would include jacking and some hydro-demolition dependant on condition of roller bearing plinth bolts.




Elevation
Scale 1:75



Elevation
Scale 1:75

REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECK	APP'D
1	FIRST ISSUE	26/09/2012	CB	RC	RC

CLIENT	Bristol City Council	IF IN DOUBT ASK	DO NOT SCALE DRAWING
STRUCTURE	McAdam Way	EKSPAN <small>COMPASS WORKS, 410 BRIGHTSIDE LANE, SHEFFIELD S9 2SP</small> <small>TEL: 0114 2611126</small> <small>FAX: 0114 2611165</small> <small>enquiry@ekspan.co.uk</small> <small>www.ekspan.com</small>	
POSITION	Typical		
		TITLE:	Indicative Propping Arrangement
		DWG NO.	5492-02-GA
		REVISION	1
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		WEIGHT:	N/A
		SCALE:	1:75
		SHEET:	1 OF 1
			A4

6. **Appendix A**

Photographs

General Views



BRUNEL WAY – PIER 16





Bearing A1



Bearing A1 - North Elevation



Bearing A1 with Grease Box Removed



Bearing A1 - South Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A2



Bearing A2 -North Elevation



Bearing A2 with Grease Box Removed



Bearing A2 - South Elevation



Bearing B1



Bearing B1 – North Elevation



Bearing B1 with Grease Box Removed



Bearing B1 – South Elevation



Bearing B2



Bearing B2 – North Elevation



Bearing B2 with Grease Box Removed



Bearing B2 – South Elevation



Bearing C1



Bearing C1 – North Elevation



Bearing C1 with Grease Box Removed



Bearing C1 – South Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C2



Bearing C2 – North Elevation



Bearing C2 with Grease Box Removed



Bearing C2 – South Elevation



Bearing D1



Bearing D1 – North Elevation



Bearing D1 with Grease Box Removed



Bearing D1 – South Elevation



Bearing D2



Bearing D2 – North Elevation



Bearing D2 with Grease Box Removed



Bearing D2 – South Elevation



McADAM WAY – ABUTMENT



Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A



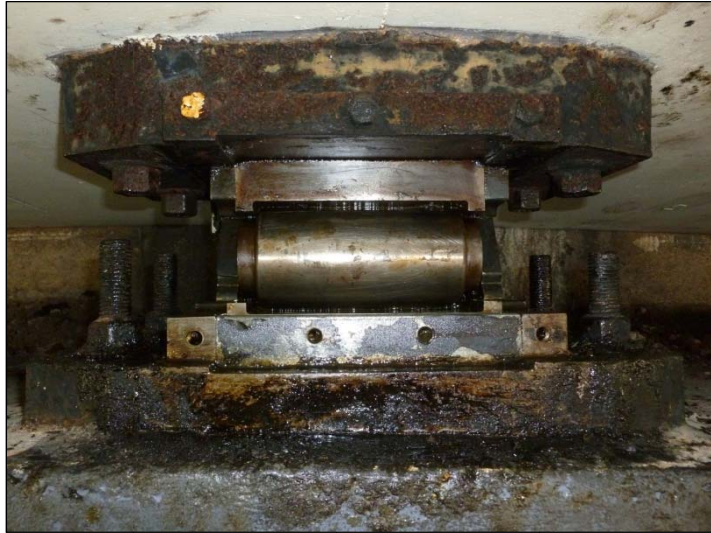
Bearing A – South Elevation



Bearing A – North Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing B



Bearing B – South Elevation



Bearing B – North Elevation

Bristol CC



Bearing C

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C – South Elevation



Bearing C – North Elevation



Bearing C – Roller Guide Removed For Ultrasonic Testing



McADAM WAY – PIER 13



Bearing A1



Bearing A1 – South Elevation



Bearing A1 – North Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A2



Bearing A2 – South Elevation



Bearing A2 – North Elevation

Bristol CC



Bearing B1

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bridge B1 – South Elevation



Bearing B1 – North Elevation



Bearing B2



Bearing B2 – South Elevation



Bearing B2 – North Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C1



Bearing C1 – South Elevation



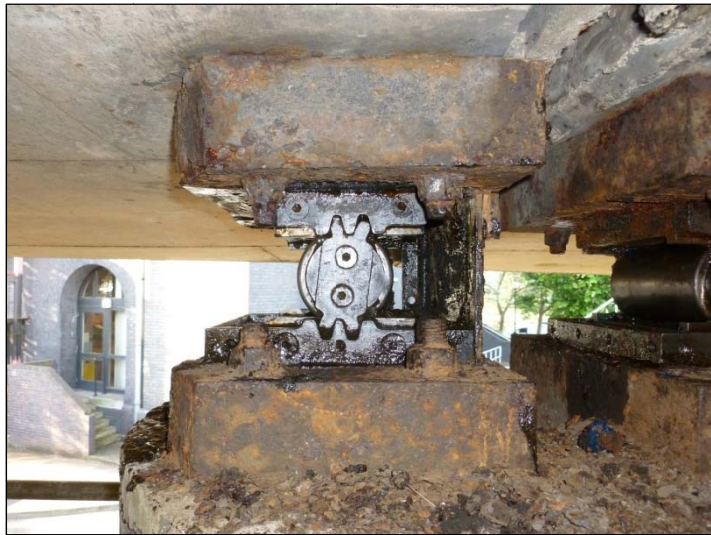
Bearing C1 – North Elevation

Bristol CC



Bearing C2

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C2 – North Elevation



ASHMEAD WAY – ABUTMENT



Bristol CC



Bearing A – Before Removal of Grease Box



Bearing A

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A – North Elevation



Bearing A – South Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



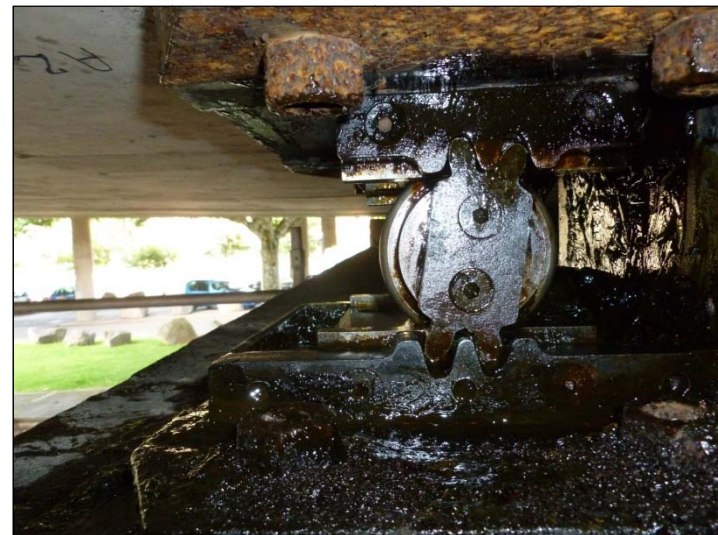
Bearing B before Full Removal of Grease Box



Bearing B – North Elevation



Bearing B



Bearing B – South Elevation



CABOT WAY – ABUTMENT



Bearing A – Front Elevation



Bearing B – Front Elevation



Bearing A – Side Elevation



Bearing B – Side Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C – Front Elevation



Bearing D – Front Elevation



Bearing C – Side Elevation



Bearing D – Side Elevation



Bearing E – Front Elevation



Bearing E – Side Elevation



CABOT WAY – PIER 6

Bristol CC



Bearing A

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C



Bearing B



BENNETT WAY - ABUTMENT





Bearing A – Front Elevation



Bearing B – Front Elevation



Bearing A – Side Elevation



Bearing B – Side Elevation

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing C – Front Elevation



Bearing D – Front Elevation



Bearing C – Side Elevation



Bearing D – Side Elevation



Bearing E – Front Elevation



Bearing E – Side Elevation



BENNETT WAY – PIER 1

Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A



Bearing C



Bearing B



BRISTOL GATE – ABUTMENT



Bristol CC

BRUNEL WAY, MCADAM WAY & ASHMEAD WAY



Bearing A – Front Elevation



Bearing B – Front Elevation



Bearing A – Side Elevation



Bearing B – Side Elevation



Bearing C – Front Elevation



Bearing D – Front Elevation



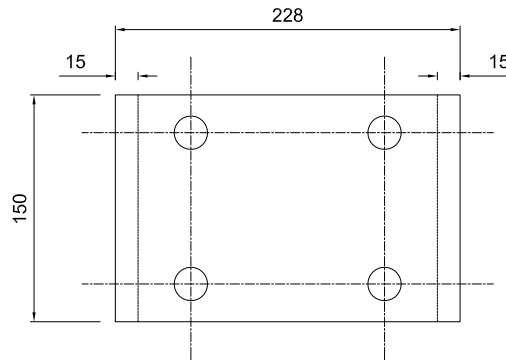
Bearing C – Side Elevation



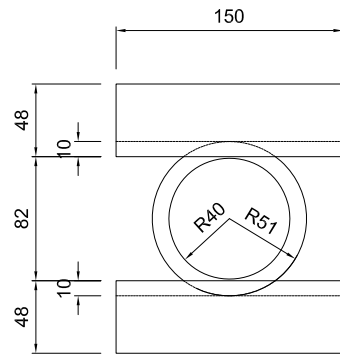
Bearing D – Side Elevation

7. Appendix B

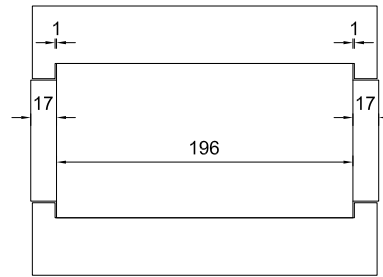
Survey Measurements



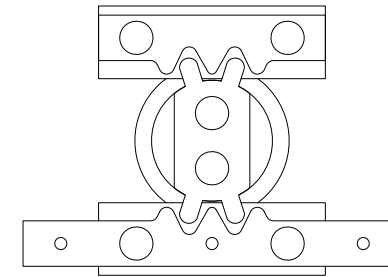
Plan



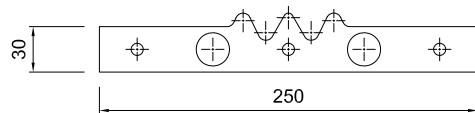
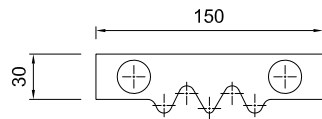
Side Elevation



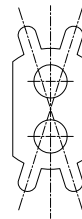
Front Elevation



Side Elevation
Showing Guide Roller & Teeth




Guide Teeth



Roller Guide

REVISIONS					
REV.	DESCRIPTION	DATE	DRAWN	CHECK	APP'D
1	FIRST ISSUE	20/09/2012	CB	RC	RC

CLIENT	Bristol City Council	IF IN DOUBT ASK	DO NOT SCALE DRAWING
STRUCTURE	Brunel Way Pier 13	EKSPAN <small>COMPASS WORKS, 410 BRIGHTSIDE LANE, SHEFFIELD S9 2SP</small> <small>TEL: 0114 261126</small> <small>FAX: 0114 261165</small> <small>enquiry@ekspan.co.uk</small> <small>www.ekspan.com</small>	
POSITION	Typical		
		TITLE:	Site Survey Bearing Basic Dimensions
		DWG NO.	5492-01-GA
THIS DRAWING IS COPYRIGHT OF EKSPAN LTD AND MUST NOT BE COPIED, ISSUED OR DISCLOSED TO 3RD PARTIES WITHOUT WRITTEN CONSENT OF EKSPAN LTD.			
		WEIGHT:	N/A
		SCALE:	1:10
		SHEET:	1 OF 1
			A4

8. **Appendix C**

Ultrasonic Testing Certificate



NDT LTD

MATERIALS TESTING,
TRAINING AND CONSULTANCY

MALTRAVERS ROAD
SHEFFIELD
SOUTH YORKS. S2 5AD
TEL: 0114 272 7317
FAX: 0114 272 7319
E-mail: sales@ndt.ltd.uk
www.ndt.ltd.uk

ULTRASONIC TEST REPORT

CLIENT: Ekspan Compass Works 410 Brightside Lane Sheffield S9 2SP	LOCATION OF ITEM: Macadam Way Bristol BS1 6XS
---	---

Your Order: 252023	Date of Test: 07-09-2012	Customer	Our Job No: U91446
Customer Order No: N/A	Cast No: N/A	Quantity: 19	Your Ref: N/A

DESCRIPTION OF ITEM:			
Item:	Roller bearing		
Part of item tested:	Accessible areas only	Rev:	N/A
Material:	N/A	Rev:	N/A
Surface Condition:	Bright		

PROCEDURE & EQUIPMENT						
Tested to Procedure:	BS EN 10308				Rev:	2002
Quality Acceptance:	Factual Report				Rev:	N/A
Ultrasonic Flaw Detector:	SS 150S		Serial No:	1002412		
Coverage:	Size	Angle	Mhz	Type	Sensitivity	
Accessible surfaces	20	0	2.5	Twin	3mm FBH + 6 dB's	
End to end	24	0	4	Single	3mm FBH + 6 dB's	
Technician:	I Hooley					
Qualification:	PCN level II					
Results:	Acceptable	N/A		Unacceptable	N/A	

Notes: Ultrasonic inspection revealed no evidence of any internal recordable flaws.



For & behalf of Glyn Davies
NDT Ltd Manager, Ultrasonic & Surface Inspection

Stamp

This test certificate may not be reproduced except in full, without the permission of the issuing laboratory.

END