

Haydn Evans Consulting
Civil and Structural Design Engineers

**Principal Inspection
Report
Bridge No 1093**



**North Bridge, Station Road
Oundle**

**NORTHAMPTONSHIRE
COUNTY COUNCIL**

May 2018

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Northamptonshire County Council
One Angel Square
Angel Street
Northampton
NN1 1ED



Jones Marine Technologies Ltd
171 Station Road,
Fordingbridge,
Hampshire,
SP6 1DS, UK

Haydn Evans Consulting
Orchard House
31-37 St Helens Street
IPSWICH
Suffolk IP4 2JL

STRUCTURE DETAILS

Structure Name: North Bridge
Structure No: 1093
Road No: A427 Station Road
OS Grid Reference: TL 04469 88924

Report Prepared by

Name: 
Title: Principal Engineer
Date: May 2018

Signed:

Report Checked by

Name: 
Title: Director
Date: May 2018

Signed:

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1.0 SUMMARY

North Bridge carries the A427 Station Road over the River Nene on the outskirts of the town of Oundle in Northamptonshire. The bridge has undergone a number of re-constructions and widenings over its lifetime with the initial construction taking place following the destruction of the original bridge in 1570.

There are 13 arches with the form of construction varying from arch to arch. This variation in the construction of the arches is probably the result of the number of re-builds/widenings that have taken place over the years.

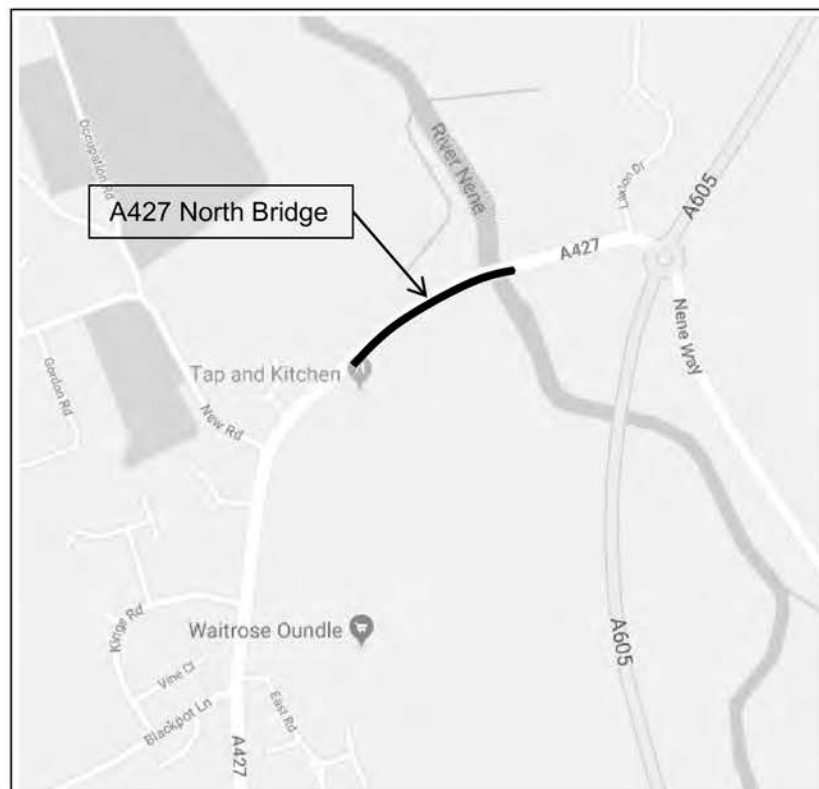
The arches were inspected using floating pontoons to provide access to the intrados of the arches. A tap hammer survey of the arch faces was carried out and all visible defects noted. The majority of the arches had longitudinal cracks which generally ran the full circumference of the arches, indicating the transverse movement is occurring. This is of particular concern as longitudinal cracks tend to indicate that the arches are beginning to divide into separate sections, which will affect the ability of the arch to spread the applied loads evenly to the abutments and piers. There are also significant cracks between the voussiors and the masonry arches indicating the spandrel walls are separating the arch rings. It is recommended that consideration is given to installing transverse ties through the bridge to hold the bridge together.

There are significant vertical cracks in the cutwaters/pilasters on the south (upstream) elevation as well as a number of diagonal cracks in the parapets. There is a horizontal crack running along the string course between arches 6 and 7. Both the vertical cracks in the cutwaters/pilasters and the horizontal crack are possibly the result of vehicular impact on the parapets. There are also a number of vertical and diagonal cracks in the masonry parapets. It is recommended that the cracks are repaired using a stainless steel crack stitching system with the cracks sealed using resin injection and then re-pointed.

The carriageway surfacing is in a poor condition with potholes, poor patch repairs and ponding around the surface water gully inlets. The drainage appears to be blocked which is causing the ponding around the gully inlets. It is recommended that the bridge is resurfaced.

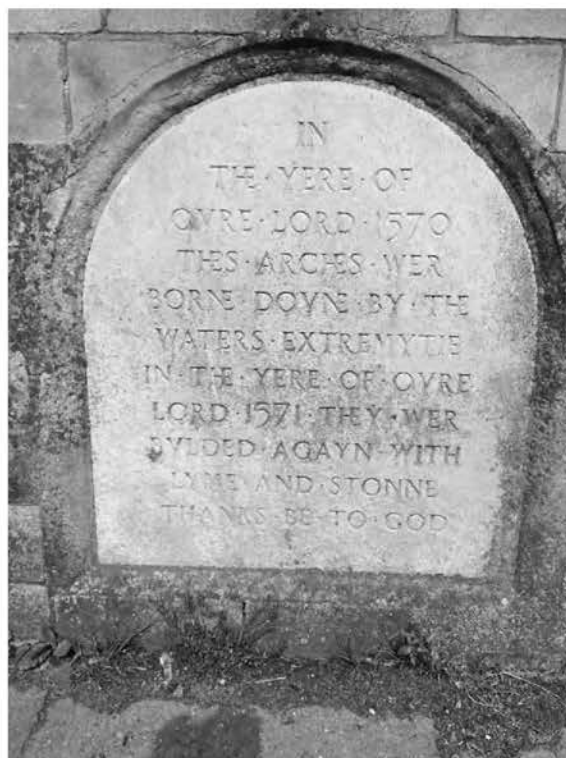
2.0 PLANS

LOCATION



3.0 STRUCTURE INFORMATION

Purpose of the Inspection:	Principal inspection of the structure to determine the current condition.
Structure Name:	North Bridge
Structure Number:	1093
Location:	Oundle, Northamptonshire
OS Reference:	TL 04544 88924
Type of Structure:	Multi-span arch bridge (13 arches)
Carrying:	A427 Station Road
Obstacle Crossed:	Nene River
Date of Construction:	Date of original construction is unknown but records indicate that the original bridge was destroyed by floods in 1570 and a new bridge built in 1571. It was then re-built in 1835 and again in 1912 when it also was widened. Further repairs were carried out following the Second World War in 1946.





Form of Construction:

The bridge consists of 13 masonry arches with stone masonry spandrel walls, abutments and parapets.

The bridge has been rebuilt twice since 1571 when a new build was built after floods destroyed the original bridge. This is reflected in the construction of the arches with arches 3,4,12 & 13 having three different forms of construction consisting of stone, 'red' clay bricks and 'blue' clay bricks. The remaining arches are constructed using the blue bricks.

It is likely that the original stone sections of the arches date back to the initial rebuild in 1571, the 'red' clay brick construction dating back to the 1835 rebuild with the 'blue' clay brick construction dating to the 1912 rebuild.

Spandrel walls and parapets are constructed using stone masonry.

Approximate Principal Dimensions:

length \approx 291.5m

Width between parapets \approx 11.0m

Carriageway width \approx 7.6m

Arch spans:	Arch 1	- 4.56m
	Arch 2	- 4.60m
	Arch 3	- 3.65m/3.80m
	Arch 4	- 6.00m/6.25m
	Arch 5	- 3.65m
	Arch 6	- 3.20m/3.15m
	Arch 7	- 4.85m
	Arch 8	- 6.10m
	Arch 9	- 6.40m
	Arch 10	- 6.55m
	Arch 11	- 6.20m
	Arch 12	- 4.82m/5.10m/4.88m
	Arch 13	- 4.20m/4.25m

Services:

North Verge	- WPD PL (Street lighting) National Grid LP Gas Main (62PE) GTC LP Gas Main (80PE) WPD HV (11kV)
South Verge	- BT WPD PL (Street lighting)

Drainage:

Road gullies with outfall through the arches into the watercourse.

Traffic Speed:

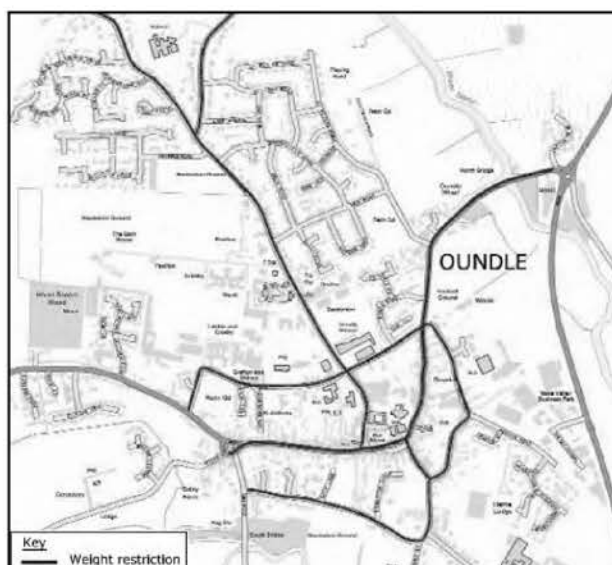
30mph

Height Restriction:

N/A

Weight Restriction:

There is a general 7.5 tonne weight restriction in place through the town of Oundle, approximately between the A605 and Mill Road. North Bridge falls within the restricted zone (see figure below).

**Extent of 7.5 tonne weight restriction****Previous Reports**NCC Bridge Inspections - 2014 Bridge Scour Inspection
(12/05/2014)**Environmental Information:**

Conservation Area	No
Special Protection Area	No
Site of Special Scientific Interest	No
RAMSAR	No
National Nature Reserve	No
Listed Structure	Grade II (1189074)

4.0 INSPECTION SUMMARY**4.1 Previous Inspection**

A scour inspection was carried out by Mike Jones Technologies Ltd in May 2014. No previous inspection reports were made available.

4.2 Present Inspection**4.2.1 Inspected by**

Name	Position	Company
[REDACTED]	Engineer	Haydn Evans Consulting
	Supervisor	Mike Jones Technologies Ltd
	Survey Technician	Mike Jones Technologies Ltd
	Survey Technician	Mike Jones Technologies Ltd
	Diver	Mike Jones Technologies Ltd
	Diver	Mike Jones Technologies Ltd

4.2.2 Dates of Inspection

Date	Weather
30.04.2018	Heavy rain and wind
01.05.2018	Dry and cool
02.05.2018	Heavy rain and wind
03.05.2018	Dry and warm

4.2.3 Method of Inspection

The arches and waterside spandrel walls were accessed using two floating pontoons which allowed access to the intrados of the arches. The carriageway, parapets and landside spandrel wall were inspected on foot.

All elements of the bridge were inspected where visible. This was generally carried out visually within touching distance. The soffit of the masonry arches were hammer tested by lightly tapping a hammer over the surface to locate areas where the arch ring separation may have occurred. All defects were recorded and photographs taken.

A scour survey of the main navigational arches was carried as part of this inspection, the results of which are contained in separate Scour Report to be provided by Jones Marine Technologies Ltd

No intrusive inspections or testing was carried out

4.2.4 Bridge Condition Indicators

Extent of Defect:

- A - No significant defect.
- B - Slight, not more than 5% of surface area/length/number.
- C - Moderate, 5% to 20% of surface area/length/number.
- D - Wide, 20% to 50% of surface area/length/number.
- E - Extensive, more than 50% of surface area/length/number.

Severity of Defect:

- 1 - As new condition or defect has no significant effect on the element (visually or functionally).
- 2 - Early signs of deterioration, minor defect/damage, no reduction in functionality of element.
- 3 - Moderate defect/damage, some loss of functionality could be expected.
- 4 - Severe defect/damage, significant loss of functionality and/or is close to failure/collapse.
- 5 - The element is non-functional/failed

Priority:

- L - Low, element can wait before undertaking repairs or requires non urgent maintenance.
- M - Medium, element is in need of attention.
- H - High, urgent further investigation/repair works required.

Extent	Severity				
	1	2	3	4	5
A	L				
B	L	L	M	M	H
C	L	L	M	H	H
D	L	L	M	H	H
E	L	L	H	H	H

5.0 INSPECTION RESULTS

5.1 Arches

There are 13 arches which are numbered west to east, with Arch 1 at the west (Oundle) end of the bridge and Arch 13 on the east (A605/Peterborough) end of the bridge. The arches vary in span and construction.

The construction of the arch rings varies from stone to clay bricks with both the stone and clay bricks varying in quality. It is assumed that the various types of construction relate to the re-builds which have taken place over the life of the bridge. The assumed dates for the various construction types is given below.

1571 Stone construction

1835 'Red' clay bricks

1912 'Blue' clay bricks

The arches were inspected using floating pontoons to provide access to the arch intrados. A hammer tap inspection of the arch intrados was carried out but due to the varying densities of the stone/bricks, it was not possible to determine if ring separation has occurred.

5.1.1 Arch 1

Construction: Clay 'blue' bricks with a stone voussoirs

Span: 4.560m

BCI	Extent	Severity	Priority
	E	3	H

There are longitudinal cracks along the full width of the arch with transverse cracking at the south end of the arch. The cracks vary in width from hairline to approximately 3mm and generally show sign of water seepage with salt deposits. Localised areas of bulging generally associated with transverse cracking were noted but on the whole, the arch does not appear to be significantly out of shape.

There is a large crack between the voussoirs and masonry arch. The crack measured approximately 20mm wide and 170mm deep at the apex of the arch.

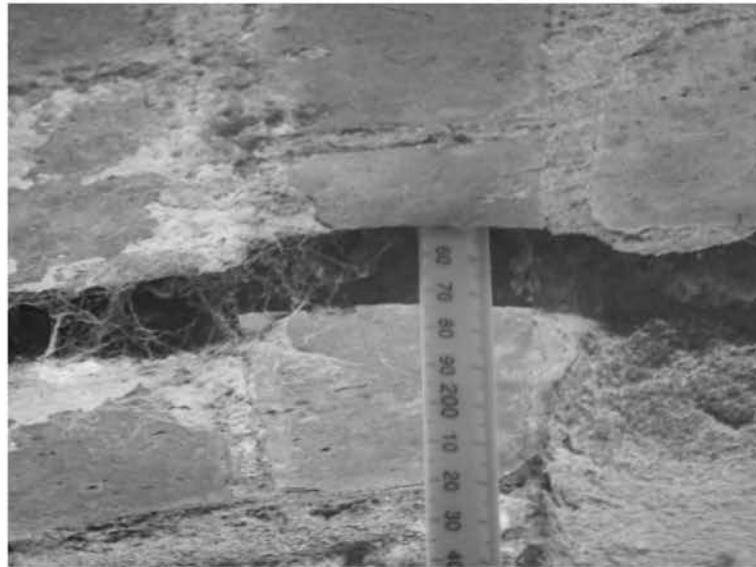
The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Area of cracking at the south end of the arch



Crack between South Voussoirs and the masonry arch



Close-up of crack showing depth

5.1.2 Arch 2

Construction: Clay 'blue' bricks with a stone voussoirs

Span: 4.600m

BCI	Extent	Severity	Priority
	E	3	M

There is generally both longitudinal and transverse cracks along the full width of the arch. The cracks typically vary in width from hairline to approximately 3mm and generally show sign of water seepage.

There is a diagonal crack in the north west corner. The crack measures a maximum of 15mm wide with a depth of 110mm.

There is a large transverse crack located midway along the east side of the arch and approximately at the arch's third point. The crack is 3.8m long and is 6mm wide with a depth of 40mm. The lower course of brick have been displaced outwards by about 10mm.

There is further cracking to the south end of the arch with some areas of bulging noted. The crack widths vary between 5mm and 12mm with some minor loss of pointing.

The stonework to the south voussoirs shows sign of erosion damage. There is a crack between stone Voussoirs and the masonry arch.



Diagonal crack in the north west corner



Close-up view of the diagonal crack



Transverse crack in east side of the Arch



Close-up view of crack showing displaced bricks

5.1.3 Arch 3

Construction:	North section	- stone masonry (4.42m in length)
	South section	- Clay 'blue' bricks with a stone voussiors (5.15m in length)
Span:	North section	- 3.650m
	South section	- 3.750m

Northern Stone Section

BCI	Extent	Severity	Priority
	B	2	M

The northern stone masonry section appears to be in a reasonable condition. However, there is a longitudinal crack running along the edge of the voussiors.



Crack in northern section of the arch

Southern Masonry Section

BCI	Extent	Severity	Priority
	E	3	H

The southern brick masonry section is cracked both longitudinally and transversely. There has been an attempt to repair these cracks, however, a number of cracks have opened up since the repair was carried out. As the cracks appear to have been covered with a paint-like coating, it was not possible to determine the width or depth of the cracks.



Cracking in the southern section of the arch

5.1.4 Arch 4

Construction:	North section	- stone masonry (6.90m in length)
	South section	- Clay 'blue' bricks with a stone voussiors (4.88m in length)
Span:	North section	- 6.000m
	South section	- 6.250m

Northern Stone Masonry Section

BCI	Extent	Severity	Priority
	E	4	H

There are large areas where the stone appears to be weathering resulting in significant loss of stone. The stone in these areas is very soft and crumbly. This weathering coincided with a longitudinal crack along the edge of the voussiors. This weathering is likely due to water percolating through the arch.

There are longitudinal cracks along the length of the section, one of which runs full span of the arch.



Weather stone and crack along the edge of the Voussiors



Longitudinal cracking in arch

Southern Brick Section

BCI	Extent	Severity	Priority
	E	3	H

There are a number of longitudinal cracks, most of which show sign of seepage. There is also a transverse crack adjacent to the construction joint between the two materials with some spalled bricks. The crack is approximately 40mm deep.

There is a large crack between the stone voussoirs and the brick arch.



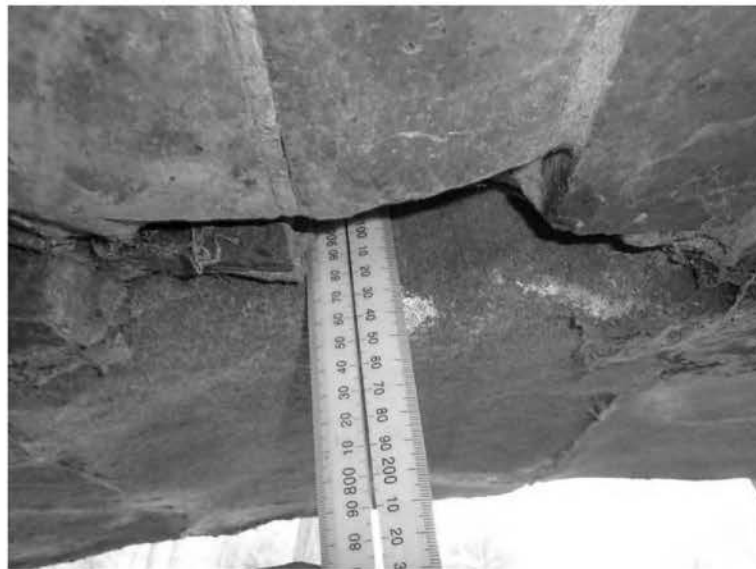
Transverse crack adjacent to construction joint



Cracking in barrel of the arch



Crack between Stone Voussoirs and brick arch



View showing depth of crack

5.1.5 Arch 5

Construction: Clay 'blue' bricks with a stone voussoirs

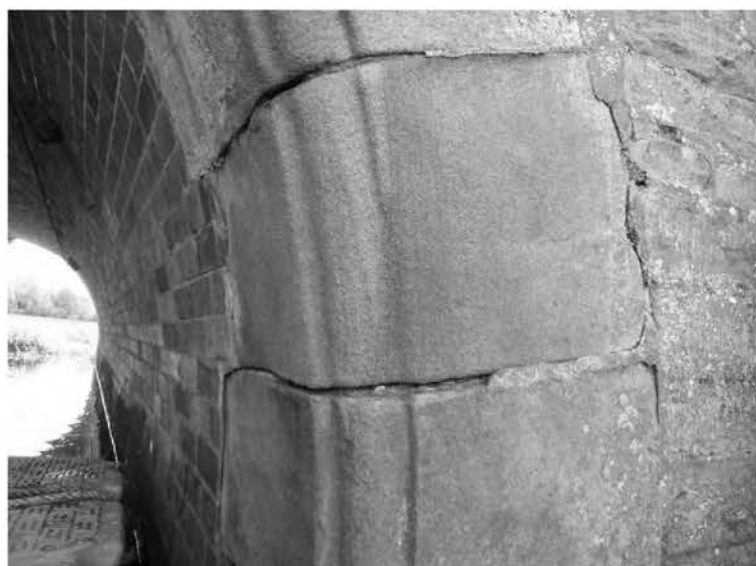
Span: 3.650m

BCI	Extent	Severity	Priority
	E	3	High

There are a number of circumferential hairline cracks along the northern half and larger cracks towards the southern end of the arch, both transverse and longitudinal cracking at the south east end of the arch. The cracks vary in width from hairline to approximately 3mm and generally show sign of water seepage with salt deposits.

There are longitudinal cracks between the southern voussoirs and masonry arch.

The stonework to the south voussoirs shows signs of erosion damage with some loss of mortar.



Eroded stonework and missing mortar to the Southern Voussoirs



Vertical & Horizontal Cracks near the south end of arch



Longitudinal cracks between the south voussoirs and masonry arch

5.1.6 Arch 6

Construction:	North section	- stone masonry (7.640m in length)
	South section	- Clay 'blue' bricks with a stone voussoirs (4.275m in length)
Span:	North section	- 3.200m
	South section	- 3.150m

Northern Stone Masonry Section

BCI	Extent	Severity	Priority
	B	2	Low

Generally in reasonable condition. There are areas of previous repairs to the arch ring with some minor spalling



Cracking and vegetation in northwest corner



Areas of re-pointing



Areas of repairs and minor spalling

Southern Brick Section

BCI	Extent	Severity	Priority
	E	3	H

There is extensive cracking towards the southern end of the arch, both circumferential and transverse. The cracks vary in width from hairline to approximately 3mm and generally show sign of water seepage with salt deposits.

There are longitudinal cracks between the southern voussoirs and masonry arch.

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Extensive cracking near southern end of arch



Close-up view of cracks



Crack between southern stone voussoirs and masonry arch

5.1.7 Arch 7

Construction: Clay 'blue' bricks with a stone voussoirs

Span: 4.850m

BCI	Extent	Severity	Priority
	E	3	H

There are a number of circumferential cracks throughout the arch. The cracks vary in width from hairline to approximately 2mm but get worse towards the southern end. There is a large circumferential crack between masonry arch and stone voussoirs. The crack increases in width towards the apex of the arch possibly indicating that the spandrel wall is being displaced

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Circumferential crack near southern end of arch



Cracking with displaced bricks near southern voussoirs



View of crack showing displacement of the bricks



Crack between the masonry arch and the southern voussoirs



Depth of crack between the arch and the voussoirs

5.1.8 Arch 8

Construction: Clay 'blue' bricks with a stone voussiors

Span: 6.100m

BCI	Extent	Severity	Priority
	E	3	H

There are circumferential cracks both near the middle of the arch and towards the southern end. The cracks vary in width from hairline to approximately 2mm. There is a large crack between the masonry arch section and the southern voussiors extending from waterline to waterline.

There is also a crack between the stone voussiors and the spandrel wall at the south east corner of the arch. This crack extends up the spandrel wall/cutwater to the parapet and is likely due to vehicular impact.

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Circumferential cracking near mid-span



Crack extended across the apex of the arch



Cracking with some displacement of brickwork near the north west corner



Cracking between the masonry arch and the southern Voussoirs



Cracking between the voussoirs and spandrel wall
at the south east corner

5.1.9 Arch 9

Construction: Clay 'blue' bricks with a stone voussiors

Span: 6.450m

BCI	Extent	Severity	Priority
	D	3	M

The arch appears to be in a reasonable condition. There are longitudinal cracks between the voussiors and the masonry arch at both ends.

There is also a crack between the stone voussiors and the spandrel wall at the south east corner of the arch. This crack extends up the spandrel wall/cutwater to the parapet and is likely due to vehicular impact.

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Cracking between the masonry arch and the northern voussiors



Cracking between the masonry arch and the southern voussoirs



Cracking between the voussoirs and spandrel wall
at the south east corner

5.1.10 Arch 10

Construction: Clay 'blue' bricks with a stone voussiors

Span: 6.550m

BCI	Extent	Severity	Priority
	D	3	M

The arch appears to be in a reasonable condition. There are longitudinal cracks between the voussiors and the masonry arch at both ends.

There is also a crack between the stone voussiors and the spandrel wall at both ends of the arch.

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Crack between the northern voussiors and the spandrel wall
with evidence of water seepage



Crack between the southern voussoirs and the spandrel wall

5.1.11 Arch 11

Construction: Clay 'blue' bricks with a stone voussoirs

Span: 6.200m

BCI	Extent	Severity	Priority
	B	3	M

The arch appears to be in a reasonable condition with generally only hairline cracks

There is also a crack between the stone voussoirs and the spandrel wall at the southern end of the arch.

The stonework to the south voussoirs shows sign of erosion damage with some loss of mortar.



Typical longitudinal hairline crack in arch



Crack between the southern voussoirs and the masonry arch

5.1.12 Arch 12

Construction:

North section - stone masonry (3.900m in length)

Central section - Clay 'red' bricks (2.550m in length)

South section - Clay 'blue' bricks with a stone voussoirs (5.150m in length)

Span: North section - 4.900m
 Central section - 5.100m
 South section - 4.880m

BCI	Extent	Severity	Priority
	B	2	Low

All the sections appear to be in a reasonable condition with no visible signs of structural distress. Some hairline cracks towards the southern end of the arch.



Junction between the stone and 'red' brick masonry sections.



Hairline cracking to face of arch near the south east corner

5.1.13 Arch 13

Construction:	North section	- stone masonry (3.800m in length)
	Central section	- Clay 'red' bricks (2.900 to 3.450m in length)
	South section	- Clay 'blue' bricks with a stone voussiors (4.400m in length)
Span:	North section	- 4.300m
	Central section	- 4.250m
	South section	- 4.250m

Northern Stone Masonry Section

BCI	Extent	Severity	Priority
	B	2	Low

The stone masonry arch appears to be in a reasonable condition with no visible structural defects. There is evidence of repairs having been carried to the arch barrel.

There is some cracking and damaged stonework along the joint between northern voussiors and the spandrel wall.



Cracking and damaged stonework along northern Voussiors



Previous repairs to arch showing the line of the original voussoirs

Central 'Red' Brick Section

BCI	Extent	Severity	Priority
	B	2	Low

The central section of the arch appears to be in a reasonable condition with no visible structural defects.



View showing junction between the north stone and the central 'red' brick sections

North 'Blue' Brick Section

BCI	Extent	Severity	Priority
	C	3	M

The central section of the arch appears to be in a reasonable condition with some hairline cracking to the arch. There is a crack between the north voussiors and the masonry arch which the full circumference of the arch.



Hairline cracking to arch barrel



Cracking along the joint between the voussiors and masonry arch



Cracking along the joint between the voussoirs and masonry arch

5.14 North (Downstream) Elevation

BCI	Extent	Severity	Priority
East Retaining wall	C	3	M
Central Retaining walls	B	2	L
Spandrel Walls (General)	C	2	L
Spandrel Wall Arch 3	E	3	M

The north elevation was previously extensively covered in ivy which was removed prior to the inspection by Northamptonshire county council to allow the elevation to be accessed. There are numerous trees and shrubs growing on the embankments between the arches from Arch 2 to 8 which restricted access to these sections of walls.

The spandrel and retaining walls are of stone masonry construction and appears to be in a reasonable condition with only the following defects noted.

- 5.14.1 There is extensive damage and loss of pointing to the north east retaining wall (before Arch 13). The damage is likely due to vegetation growth which at some point has been removed.



Damage to eastern retaining wall due to vegetation growth

- 5.14.2 There are vertical cracks running up the spandrel wall between the arches. The cracks vary in width from hairline to approximately 3mm and typically extend up to the string course below the stone parapet.



Vertical crack in spandrel wall between Arches 11 & 12



Cracking in spandrel wall between Arches 1 & 2.
Note crack between the Voussoirs and spandrel wall

- 5.14.3 The string course over Arch 3 have been replaced with a steel joist supported on stone corbels. The spandrel wall and parapet are supported off the beam. There is a substantial void behind the beam/spandrel wall which is approximately 760mm deep in places. The date of the repair is not known but could have been carried out in 1946. Both the end corbels are cracked and eroded.



General view of steel joist and stone corbels



View of beam and stone corbel



View of void behind beam



Damage to east end corbel

5.15 South (Upstream) Elevation

BCI	Extent	Severity	Priority
Retaining walls	B	2	L
Central Retaining walls	C	3	M
Cutwaters/Pilasters	E	4	H

The spandrel and retaining walls are of stone masonry construction with cutwaters between Arches 1 and 2 and between Arches 7 and 12. The cutwaters form pedestrian refuges at carriageway level. The spandrel/retaining walls generally appear to be in a reasonable condition with only the following defects noted.



View of South Elevation showing cutwaters (Arches 10, 11, 12 & 13)

- 5.15.1 There are vertical cracks running up the face of the cutwaters, adjacent to the stone edging. The cracks vary in width from relatively small to approximately 10mm and typically occur at every cutwater. The cracks tend to increase in width towards the top and extend above the stone string course with significant displacement occurring in the parapets. Tell-tale crack gauges have previously been fixing across the cracks to try and monitor any movement that could be taking place. It is possible that these cracks are due to vehicular impact



View of cutwater between Arches 1 and 2



View if cutwater between Arches 8 and 9



View of crack in cutwater

5.15.2 Horizontal Crack below String Course/Parapet

There is a significant horizontal crack which extends from the crown of Arch 7 towards Arch 6 with some displacement of the masonry. The crack appears to extend into the keystone of Arch 7. It is possible that the damage is due to vehicular impact.



View of crack

5.16 Carriageway and Parapets

BCI	Extent	Severity	Priority
Carriageway	B	2	L
Pavements	A	2	L
Parapets	C	3	M

5.16.1 Carriageway

The carriageway surfacing is in a poor condition with numerous previous patch repairs starting to break up. There is ponding around the surface water gulley inlets due to the drains not working. This ponding is also likely to be contributing to the damage around the gulley inlets.



View looking east from Oundle end of bridge



Area of patch repairs



Ponding and damage around gully inlets



Cracking and potholes in the carriageway surfacing.

5.16.2 Pavements

The pavements appear to be in a good condition with no missing or significantly displaced pavers. The kerbstones were generally in a good condition and reasonable well aligned.

5.16.3 Parapets

The parapets generally appeared to be in a reasonable condition, there are some significant defects, in particular, cracks in the parapets above the cutwaters in the southern parapet. These cracks vary in width, with some showing signs of displacement having occurred. There are also a number of diagonal cracks in the parapet. It is likely that a number of these defects were caused by vehicular impact.



Diagonal crack in parapet at the northwest corner



Typical diagonal cracking in the south parapet



Crack in parapet over the cutwater between Arches 1 & 2



Crack in parapet over the cutwater adjacent to Arch 8



Area of minor water damage to bottom coarse of stone

6.0 COMMENTS AND RECOMMENDATIONS

Although the bridge appears to be in a reasonable condition, there are a number of significant defects which should be addressed to insure the continued serviceability of the bridge. These are listed below.

6.1 Arches.

The arches all vary in span and construction with most of them having significant longitudinal cracks running the full circumference of the arches. These cracks are more prevalent in the newer upstream 'blue' clay brick sections, with most having a significant crack between the voussiors and the masonry arch. This indicates that there is possibly movement occurring across the width of the arch and that the spandrel walls are becoming detached from arches. These longitudinal cracks reduce the arch's ability to distribute the loads evenly throughout the arch and onto the supporting abutment/piers.

A hammer tap survey of the arches was undertaken however, due to the low density of the older 'red' clay bricks and stone masonry, it was not possible to determine if ring separation has occurred in these sections of the arches. The newer 'blue' clay bricks section appeared to be sound.

It is recommended that transverse ties are installed to reconnect the spandrel walls to the arches and to tie the arches together.

The condition of the stone masonry section in Arch 4 is very poor with large areas where the stone has crumbled away. It is recommended that a further intrusive investigation is undertaken to determine the extent of the damage and suitable remedial work.

6.2 Spandrel walls, Retaining walls and Abutments

There are a number of significant cracks in the spandrel wall. These appear to be more prevalent on the south (upstream elevation), in particular, the cutwaters. It is likely that these cracks are as a result of vehicular impact on the parapets. It is recommended that the cracks are repaired using a suitable stainless steel crack stitching system and the crack sealed using resin injection and re-pointed.

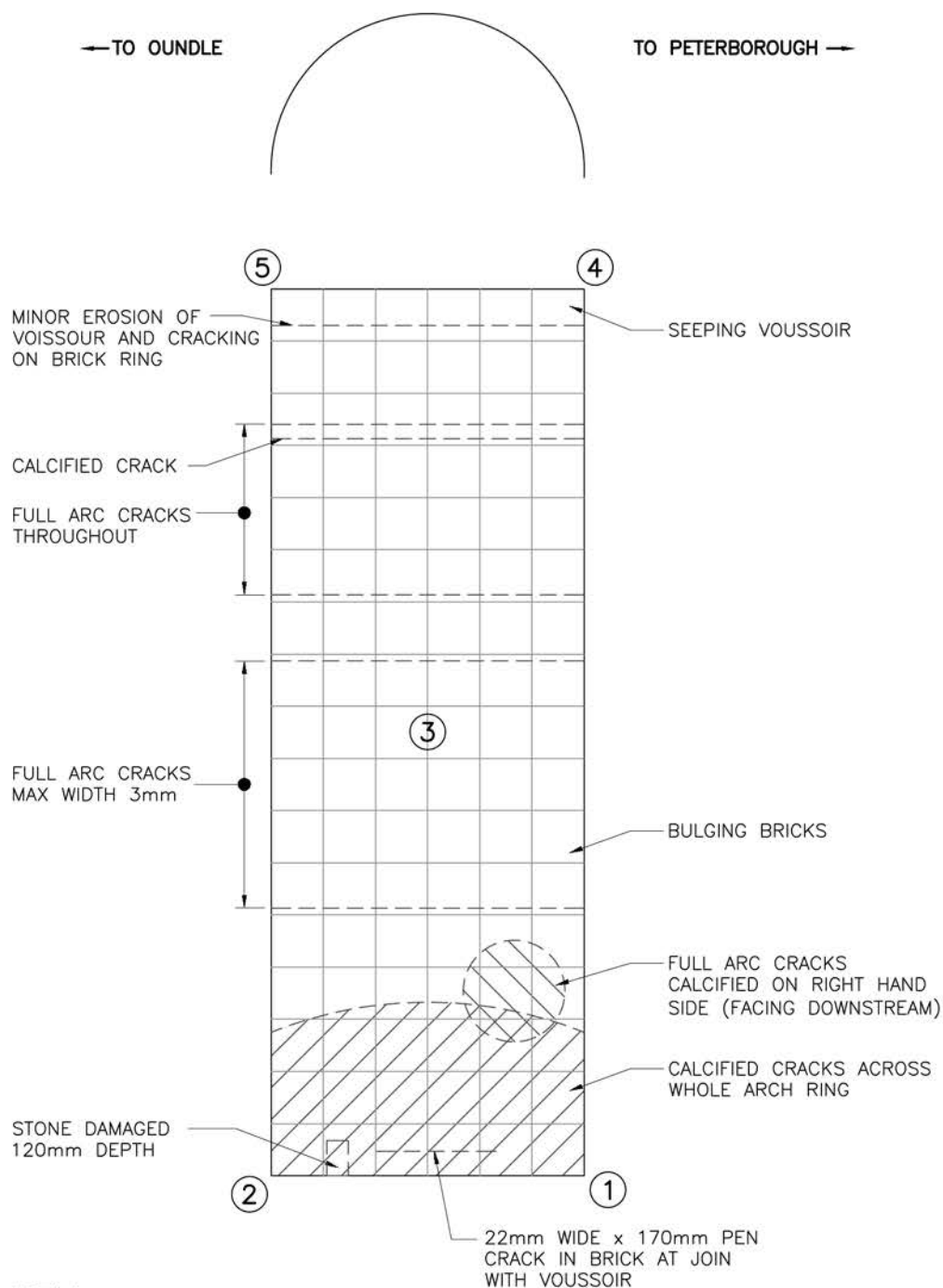
6.3 Parapets

The cracks in the cutwaters are reflected in the parapets and there are a number of diagonal cracks in the parapets. It is recommended that the cracks are repaired using the same stainless steel crack stitching system as the walls.

6.4 Surfacing and Drainage

The carriageway surfacing is in a poor condition with damage around the surface water gully inlets and areas of cracking and potholes. It is recommended that the drainage is jetted clear and the bridge is re-surfaced.

APPENDIX A
DEFECT SHEET



KEY

- ① 600 SILT, 1100 INVERT
- ② 650 SILT, 950 INVERT
- ③ 550 SILT, 1200 INVERT
- ④ 750 SILT, 1300 INVERT
- ⑤ 750 SILT, 1300 INVERT



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 1 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

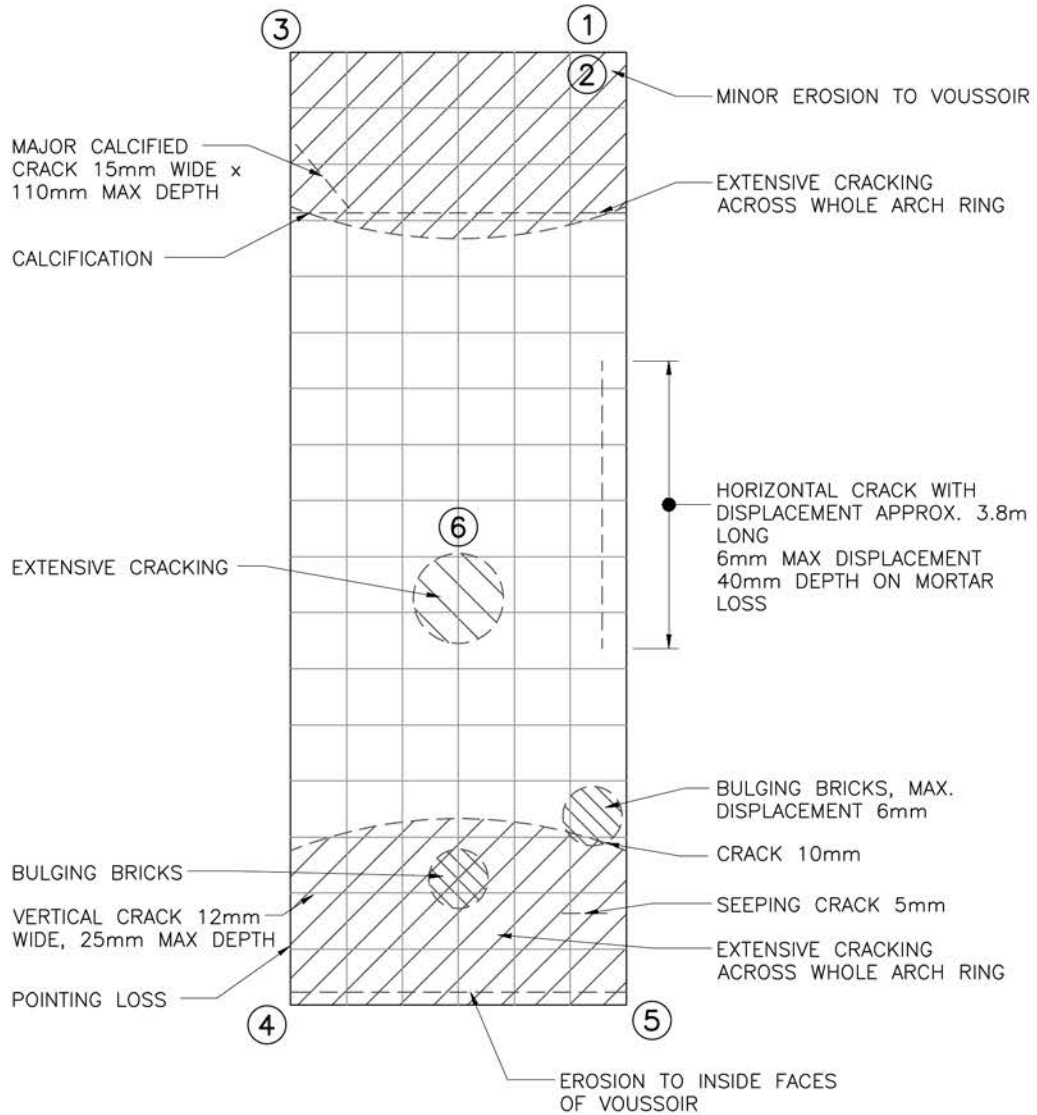
127/299/1

REV.

—

← TO OUNDLE

TO PETERBOROUGH →



KEY

- ① 1350mm TO CONCRETE INVERT
- ② 950mm SILT
- ③ 850mm SILT, 1350mm INVERT
- ④ 800mm SILT, 1150mm INVERT
- ⑤ 750mm SILT, 1300mm INVERT
- ⑥ 900mm SILT, 1250mm INVERT



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 2 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

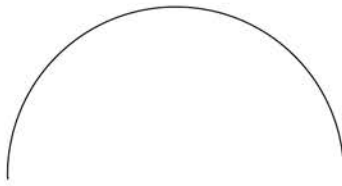
127/299/2

REV.

—

← TO OUNDLE

TO PETERBOROUGH →

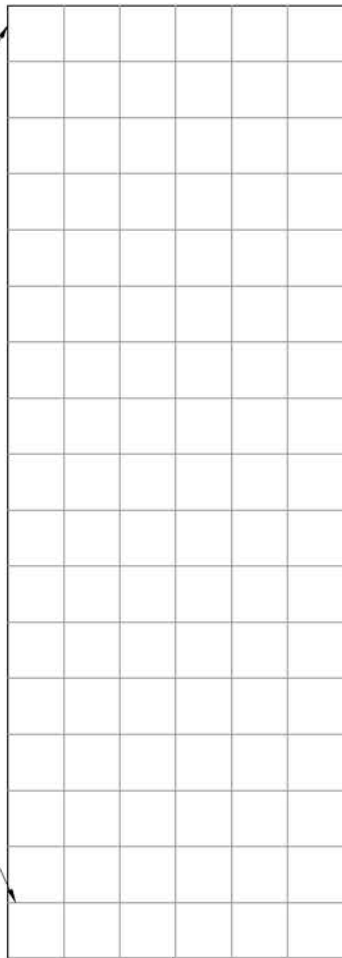


CRACK BEHIND
SANDSTONE BLOCK FROM
WATER LINE TO 1.5m UP

HORIZONTAL CRACK
FROM FACE OF
UPSTREAM PREVIOUS
REPAIR

CRACK STARTS A THIRD OF
THE WAY UP AND RUNS
TO BREAK WATER

CRACK THROUGH
KEY STONE



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 3 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

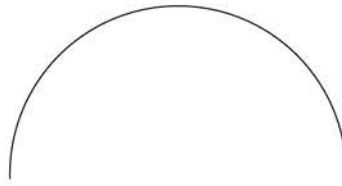
127/299/3

REV.

—

← TO OUNDLE

TO PETERBOROUGH →



NOTE:
LOSS OF STONE IS MINOR BUT
WORST FROM 10o'clock TO
2o'clock FACING DOWNSTREAM

LOSS OF STONE WORK
700x600x130mm MAX
DEPTH

LOSS OF STONE

FULL ARC CRACK

LOSS OF STONE WORK
1000x300x60mm MAX
DEPTH

LOSS OF STONE
250x300x200mm MAX DEPTH

CRACKING FULL ARC
CRACKED REPAIRS MAX 3mm

MISSING POINTING,
MAX 40mm DEPTH

SEEPING CRACK FROM CROWN
TO RIGHT HAND SIDE WATER
LINE, MAX 6mm WIDTH

REPAIRED POINTING

CRACK & EXPLODING BRICK

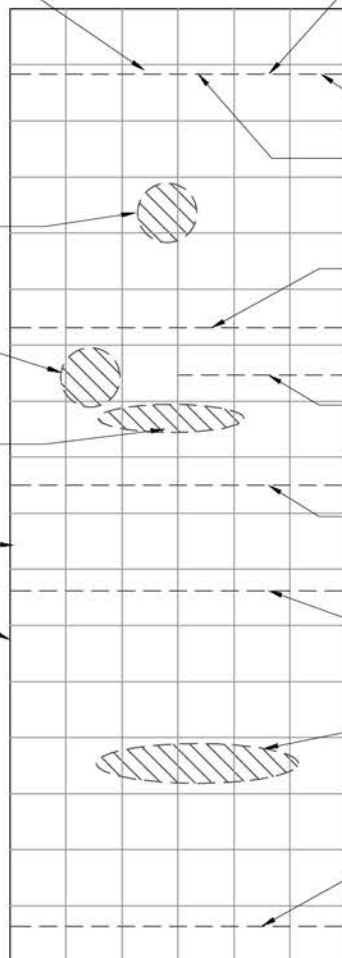
CRACK AND SPALLED
BRICK. 30mm

FULL ARC CRACKING

SPALLED BRICK,
30mm

CALCIFIED CRACKING

VOUSSOIR ERODING AND
CRACKING FROM ARCH
RING. 130mm MAX DEPTH



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 4 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

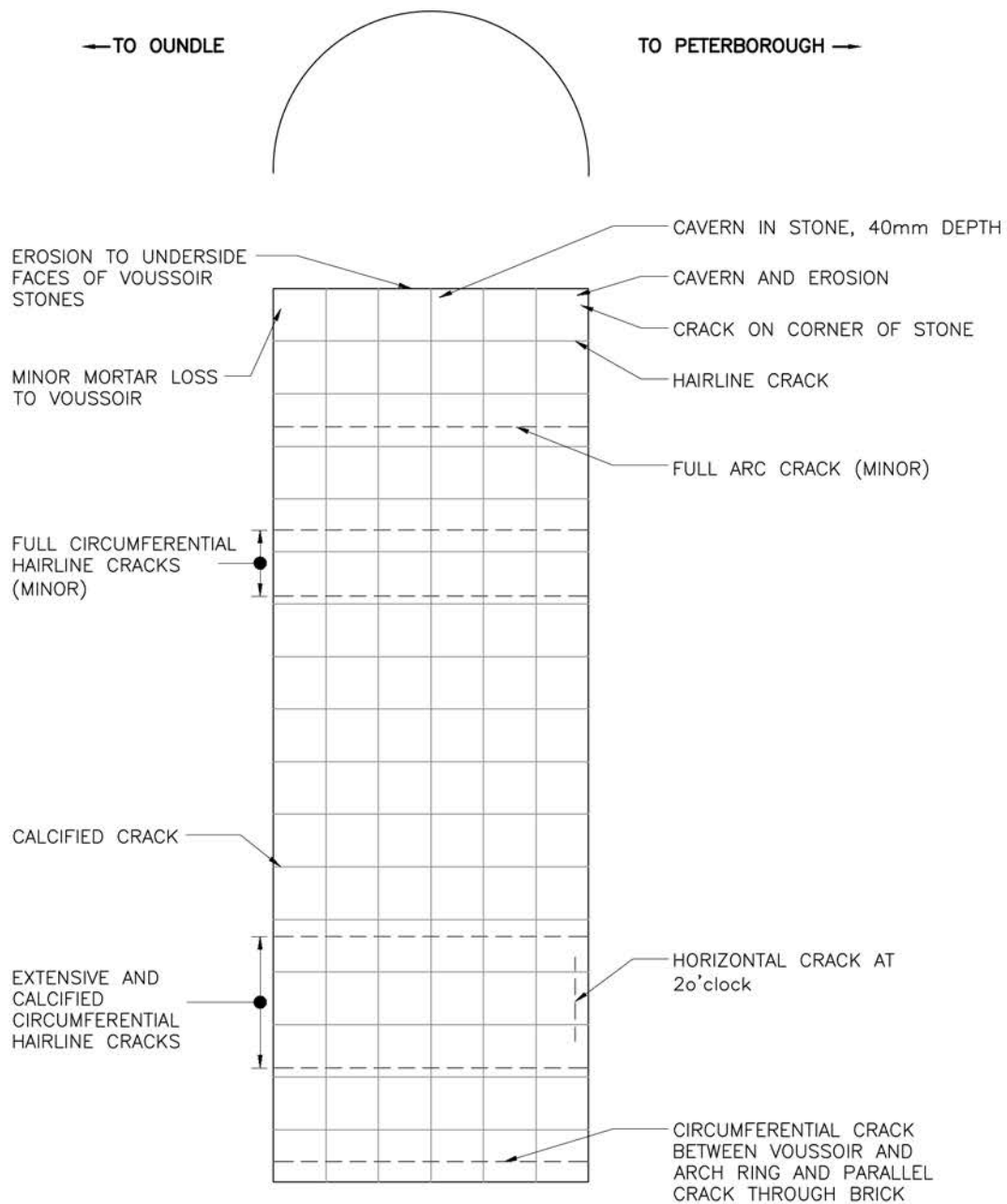
Scale: 1:100

DRAWING No.

127/299/4

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 5 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

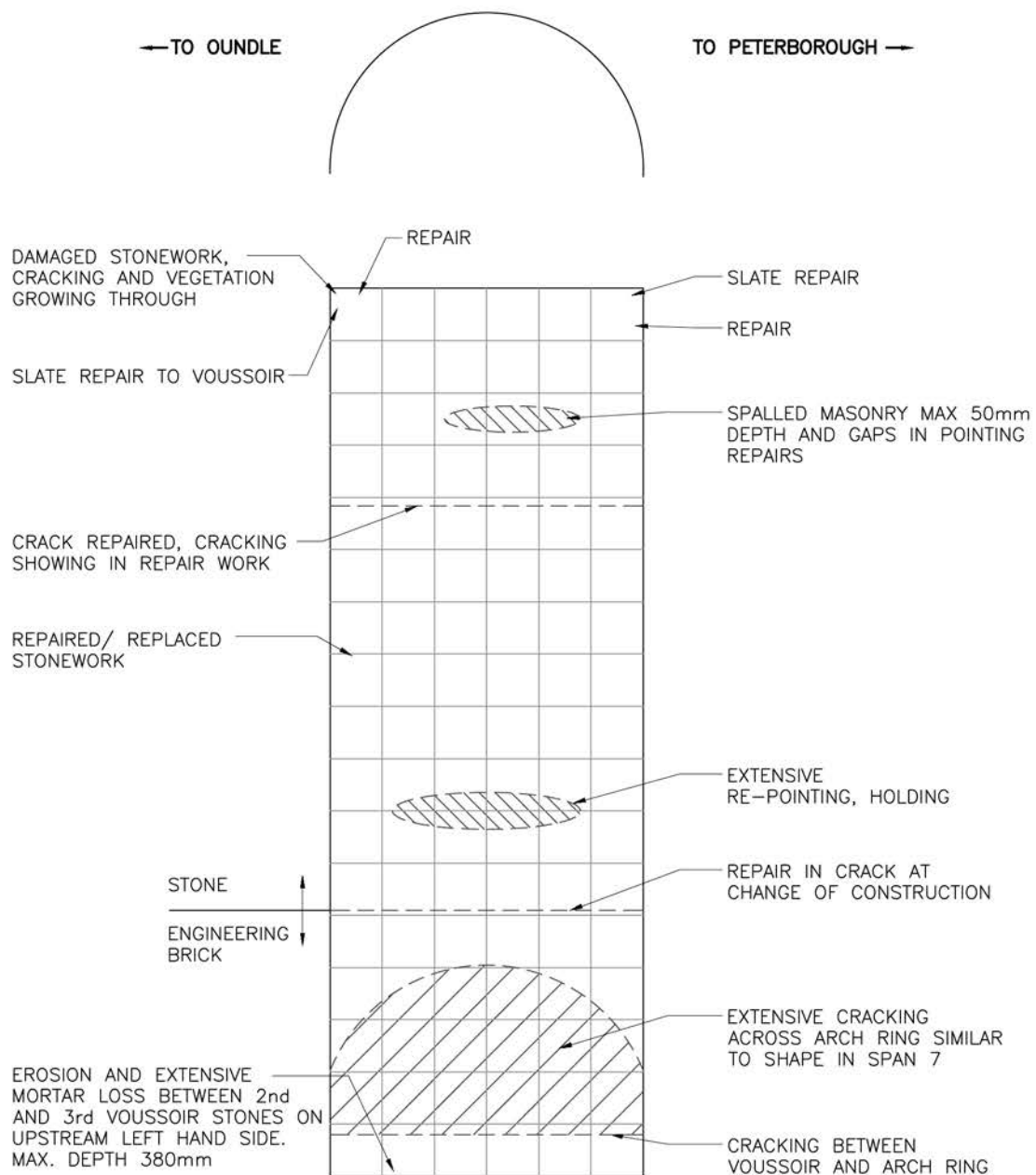
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DRAWING No.

127/299/5

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
 Title: ARCH 6 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

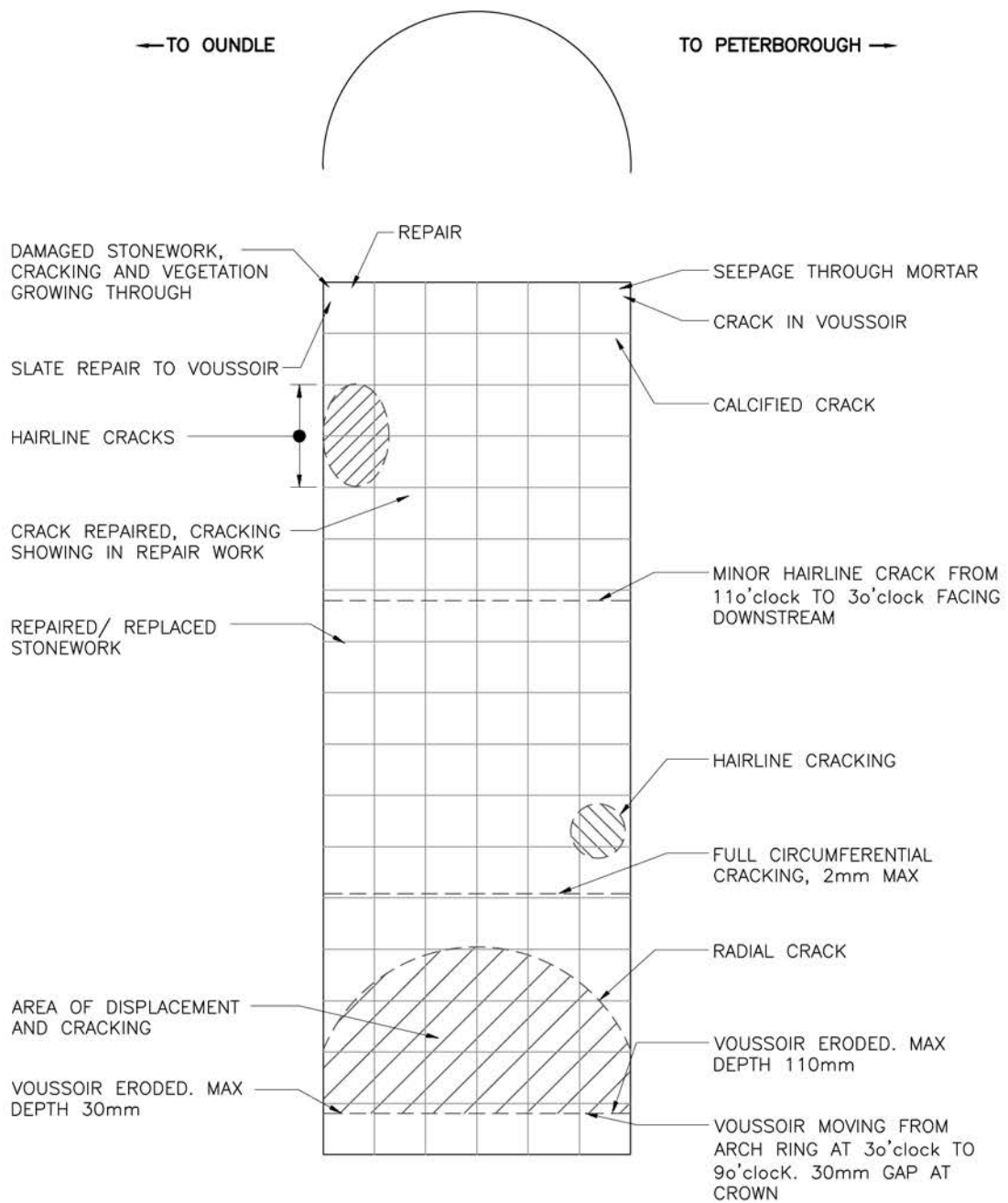
Scale: 1:100

DRAWING No.

127/299/6

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 7 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

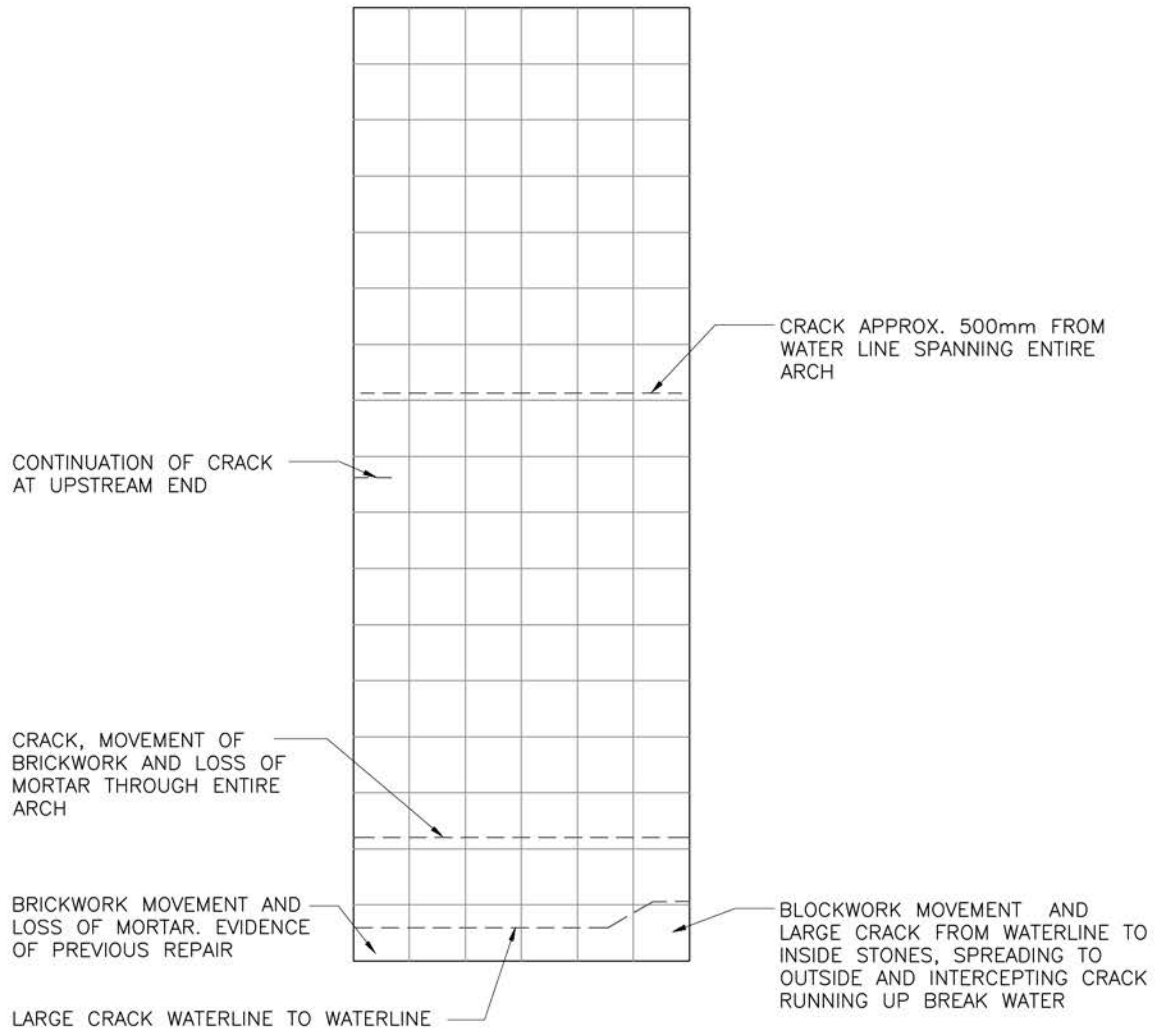
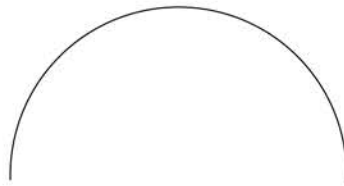
127/299/7

REV.

—

← TO OUNDLE

TO PETERBOROUGH →



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 8 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

127/299/8

REV.

—

← TO OUNDLE

TO PETERBOROUGH →

CRACK AND MISSING
MORTAR, 300mm FROM
WATERLINE APPROX.
1500mm HIGH

MORTAR MISSING FROM THIRD
BLOCK FROM WATERLINE

2no. HAIRLINE CRACKS

2no. HIGH LEVEL CRACKS
APPROX. 1000mm ABOVE
WATER LINE, 1000mm HIGH

MORTAR MISSING AND LARGE
CRACK FROM APPROX. $\frac{1}{4}$ OF
ARCH
BLOCKWORK MISSING

2no. HAIRLINE CRACKS 500mm
ABOVE WATER LINE APPROX.
800mm HIGH

LARGE CRACK FROM CENTRE OF
ARCH TO RIGHT SIDE ABUTMENT.
MORTAR AND BLOCKWORK MISSING.
TIES INTO LARGE CRACK ON
BREAK WATER WHICH EXTENDS TO
TOP OF BRIDGE



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 9 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

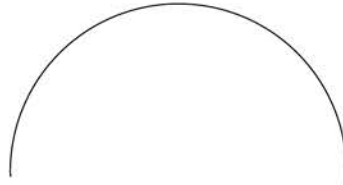
127/299/9

REV.

—

← TO OUNDLE

TO PETERBOROUGH →



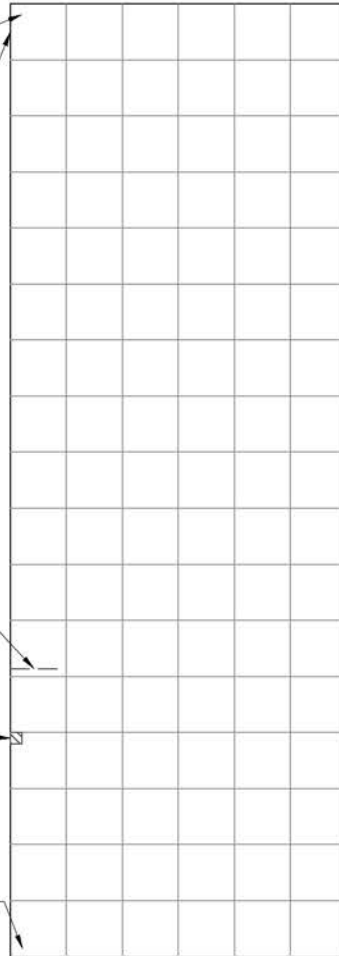
LARGE CRACK RUNNING
ENTIRE HEIGHT OF BRIDGE

MOVEMENT OF BLOCK ON
FACE OF ARCH

CRACK 500mm ABOVE
WATER LINE, APPROX.
800mm LONG. CONTINUES
INTO HAIRLINE CRACK ABOVE

CAST IRON PIPE

LARGE CRACK IN BLOCKWORK
RUNNING DIAGONALLY TO
MEET BREAK WATER



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 10 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

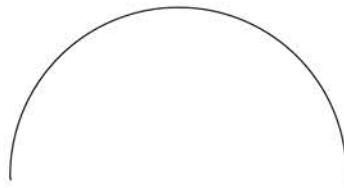
127/299/10

REV.

—

← TO OUNDLE

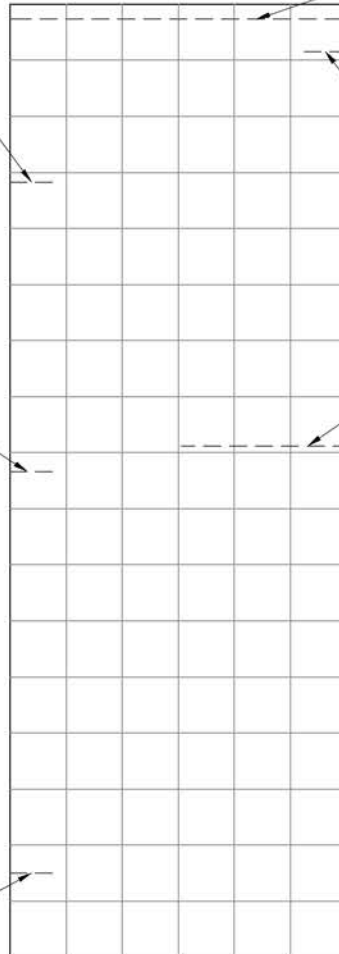
TO PETERBOROUGH →



HAIRLINE CRACK 500mm
FROM WATERLINE
SPLITTING INTO THREE
SEPARATE CRACKS

HAIRLINE CRACK FROM
WATERLINE TO APPROX.
1500mm HIGH

HAIRLINE CRACK FROM
WATERLINE TO 1000mm HIGH.
MOVEMENT TO BRICKWORK
ABOVE



LARGE CRACK AND MORTAR
MISSING RUNNING FULL SPAN
OF ARCH AND ENTIRE INSIDE
OF ARCH FACE

LARGE CRACK 5mm WIDTH
FROM WATERLINE TO 1300mm
HIGH

HAIRLINE CRACK FROM APPROX.
1000mm ABOVE WATERLINE TO
TOP OF ARCH



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 11 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

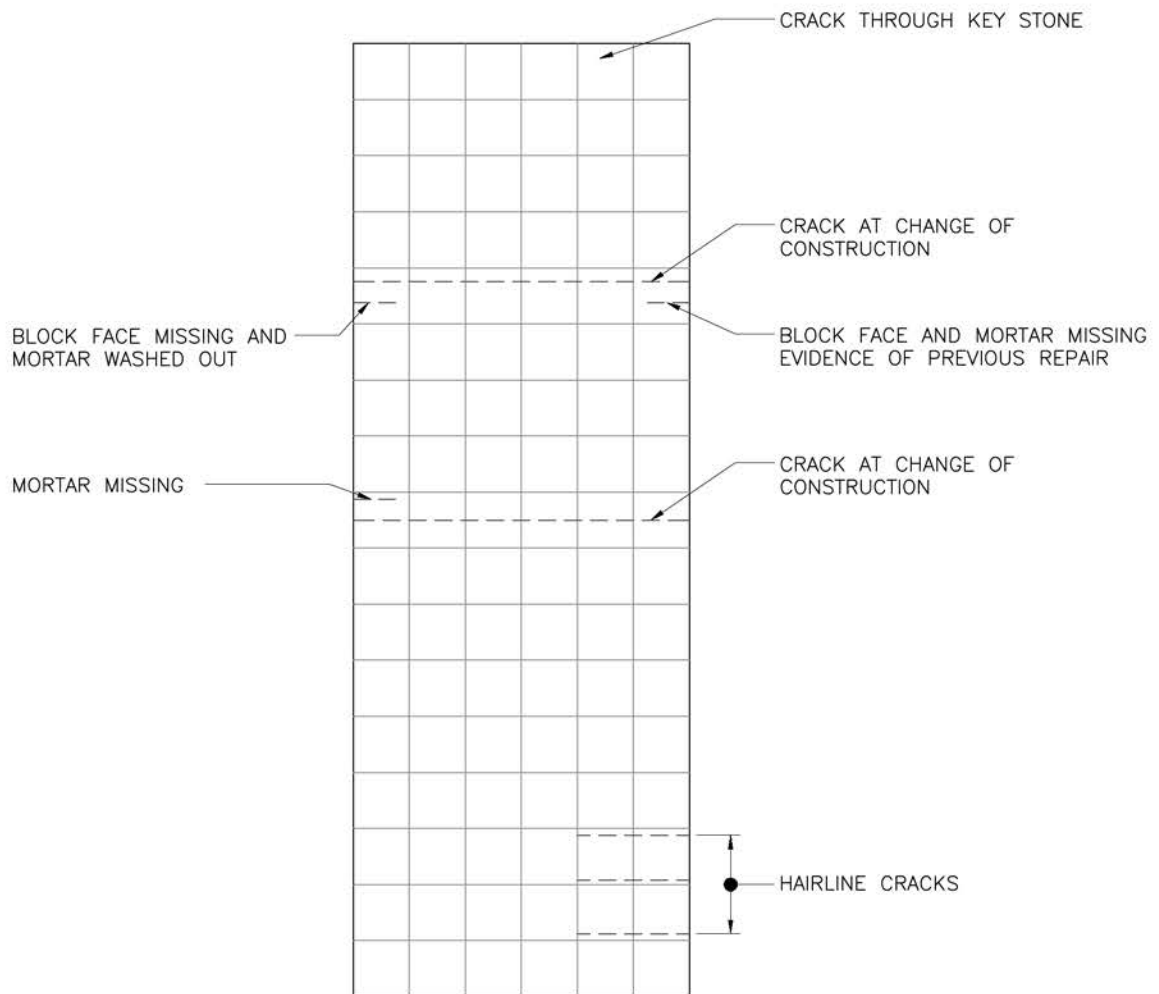
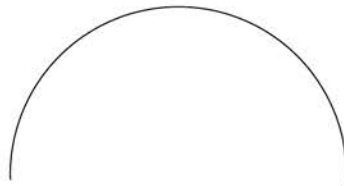
127/299/11

REV.

—

← TO OUNDLE

TO PETERBOROUGH →



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 12 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

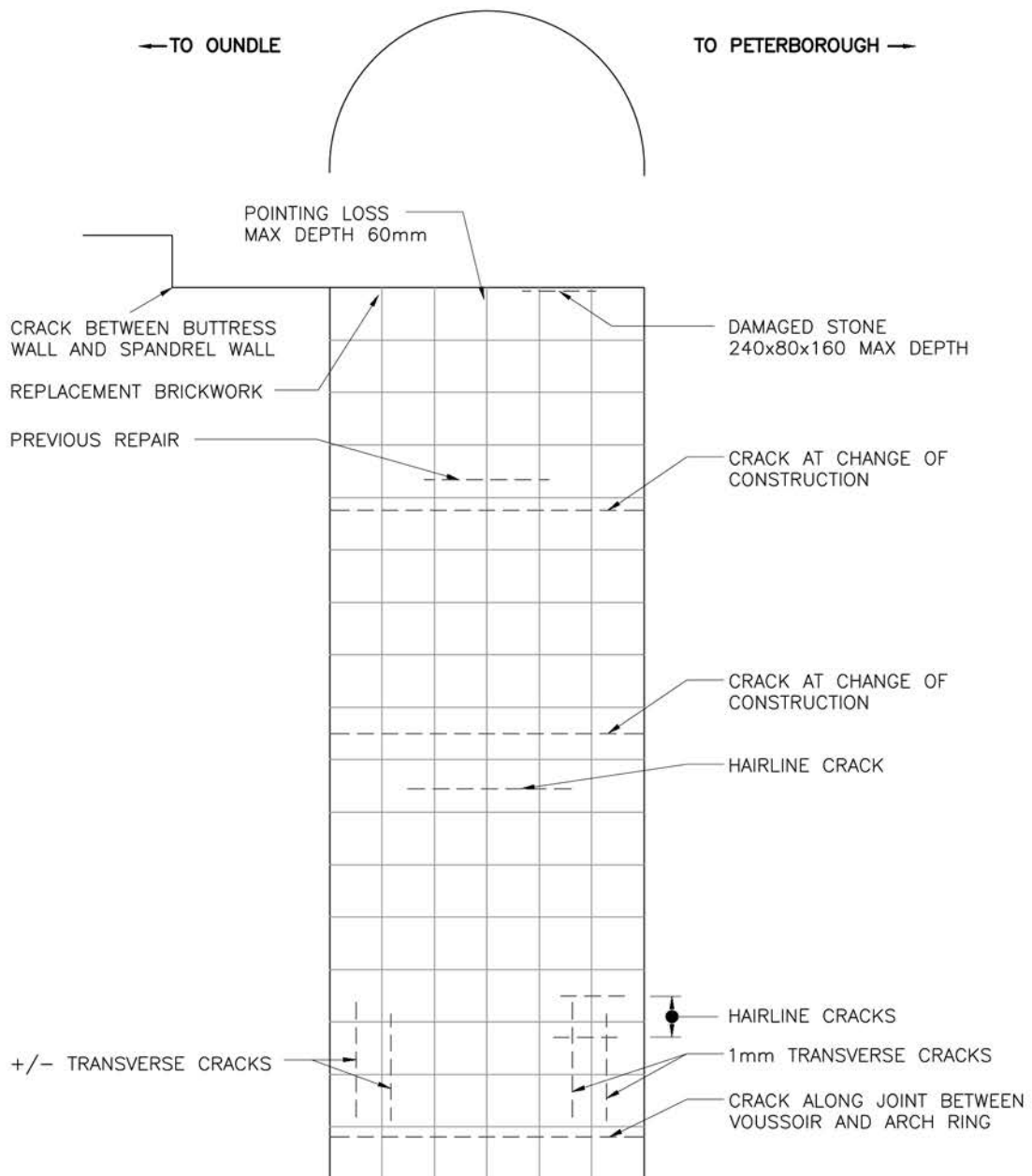
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DRAWING No.

127/299/12

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 13 INSPECTION SURVEY

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.

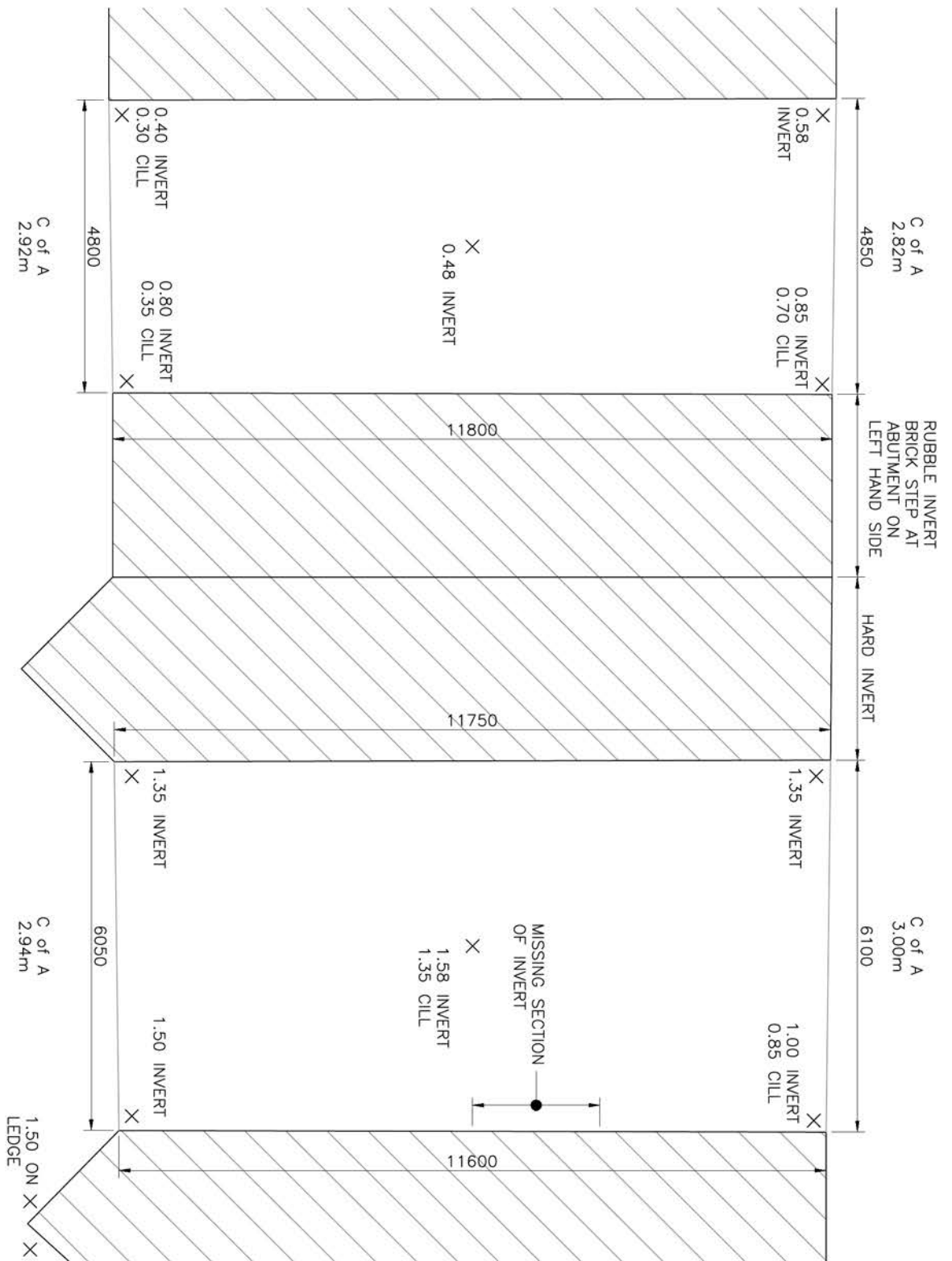
127/299/13

REV.

—

ARCH 7

ARCH 8



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 7-8 SITE DIMENSIONS

By: EJS

Date: MAY 2018

Chkd:

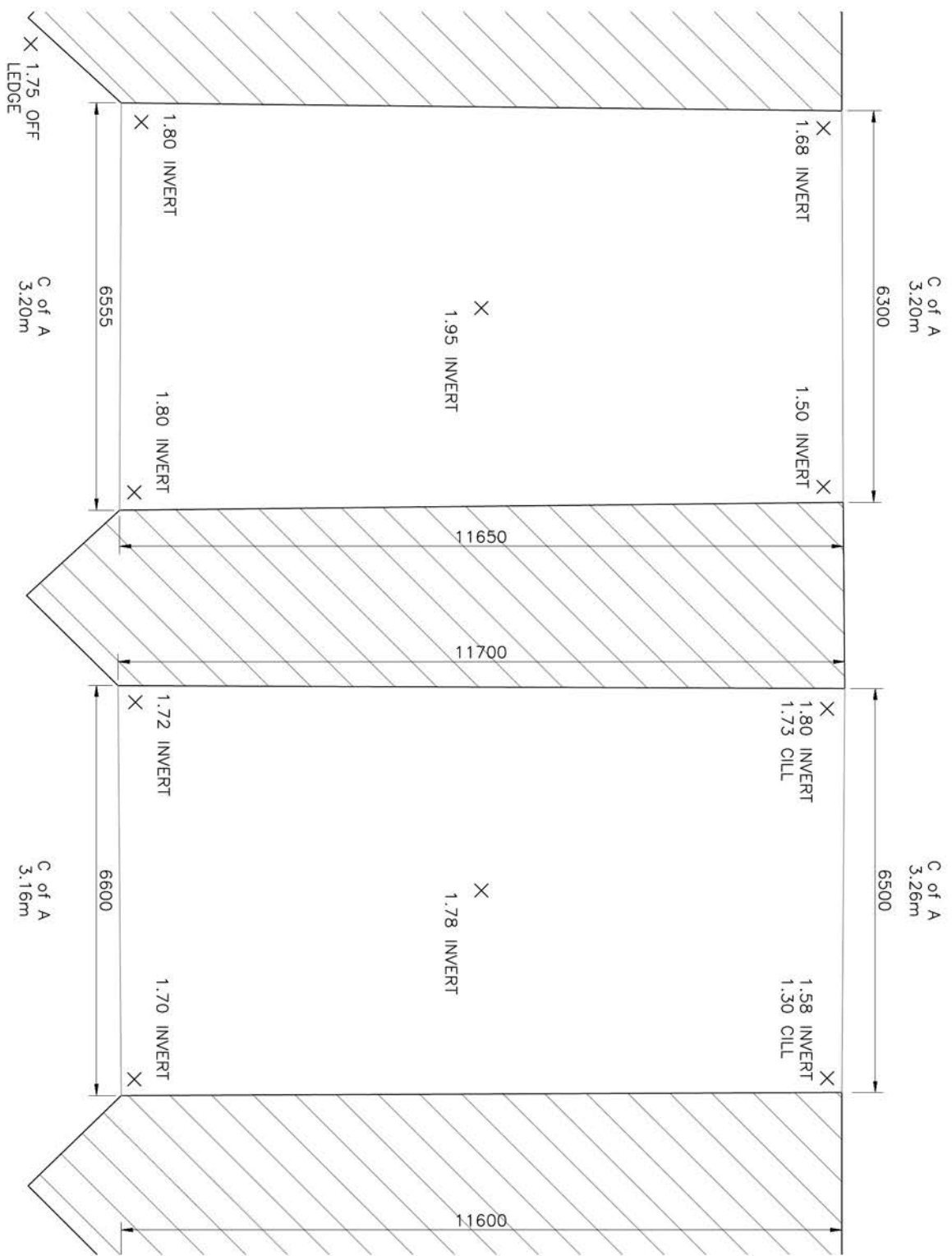
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DRAWING No.

127/299/16

REV.

1



ARCH 9

ARCH 10



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 9-10 SITE DIMENSIONS

By: EJS

Date: MAY 2018

Chkd:

Scale: 1:100

DRAWING No.
127/299/17

REV.
-

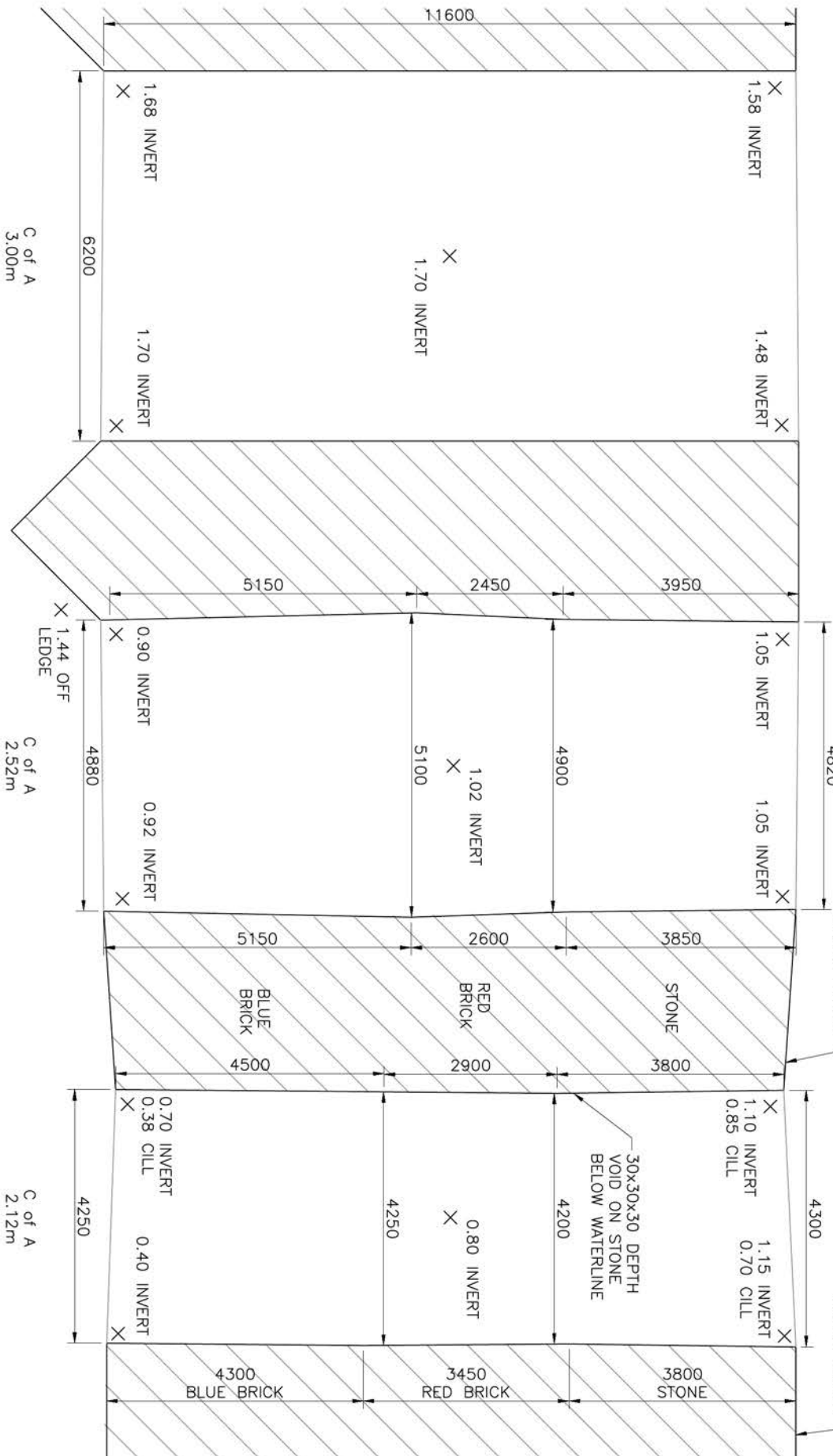
C of A
2.98m

C of A
2.45m

C of A
1.45m

MORTAR LOSS
50mm DEPTH

MORTAR LOSS
70mm DEPTH



ARCH 11

ARCH 12

ARCH 13



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 11-13 SITE DIMENSIONS

By: EJS

Date: MAY 2018

Chkd:

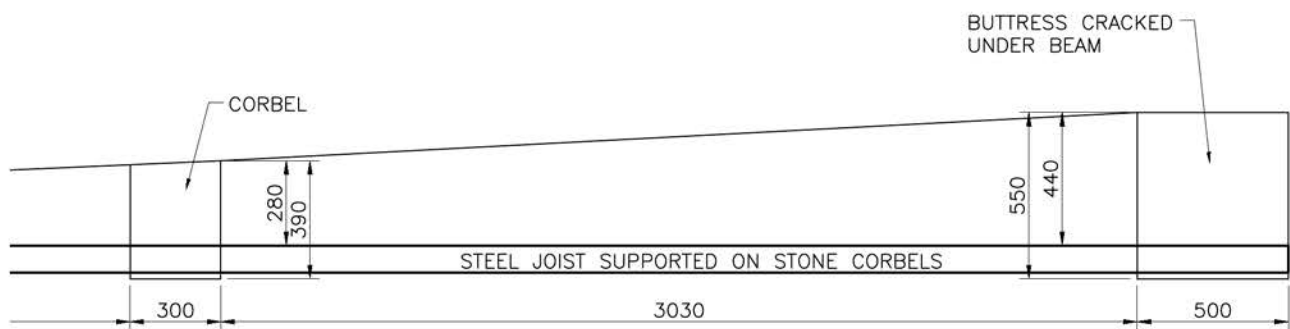
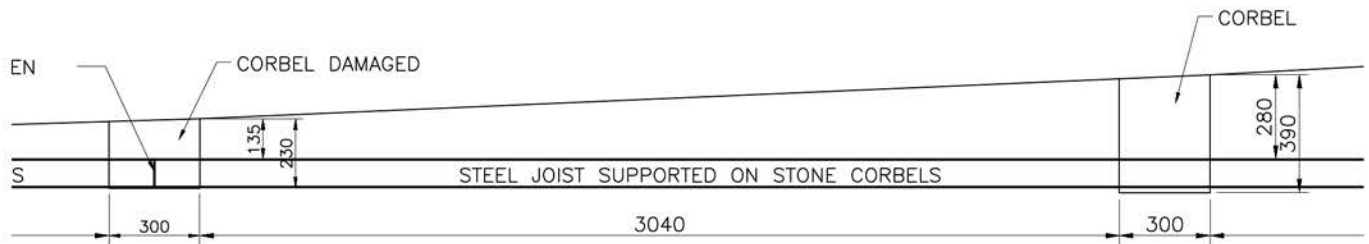
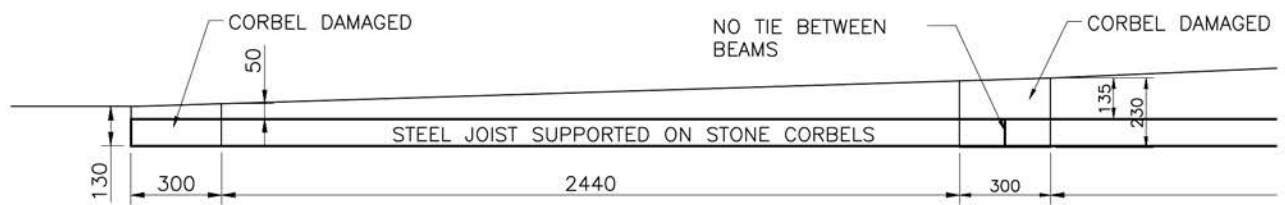
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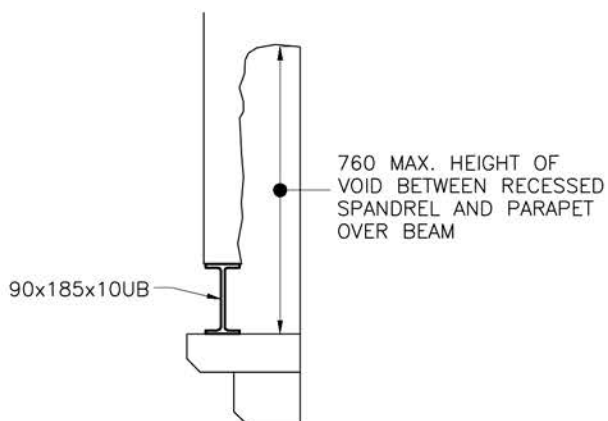
127/299/18

REV.

1



PLAN VIEW OF BEAM AT ARCH 3
SCALE 1:25



TYPICAL SECTION
SCALE 1:20



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: ARCH 3 BEAM INSPECTION

By: EJS

Date: MAY 2018

Chkd:

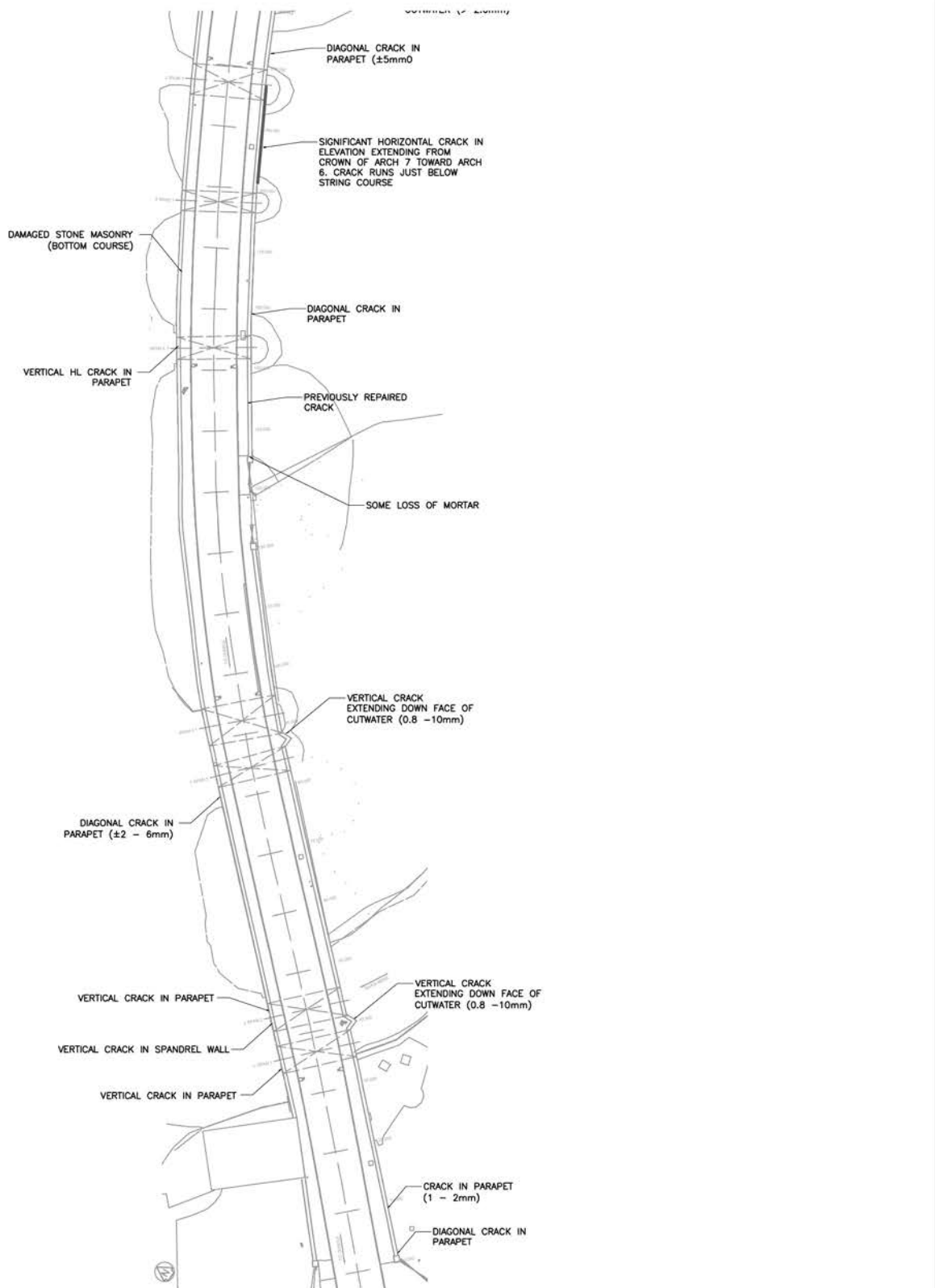
Scale: 1:20

DRAWING No.

127/299/19

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: CARRIAGEWAY DEFECT SHEET 1

By: PJH

Date: MAY 18

Chkd:

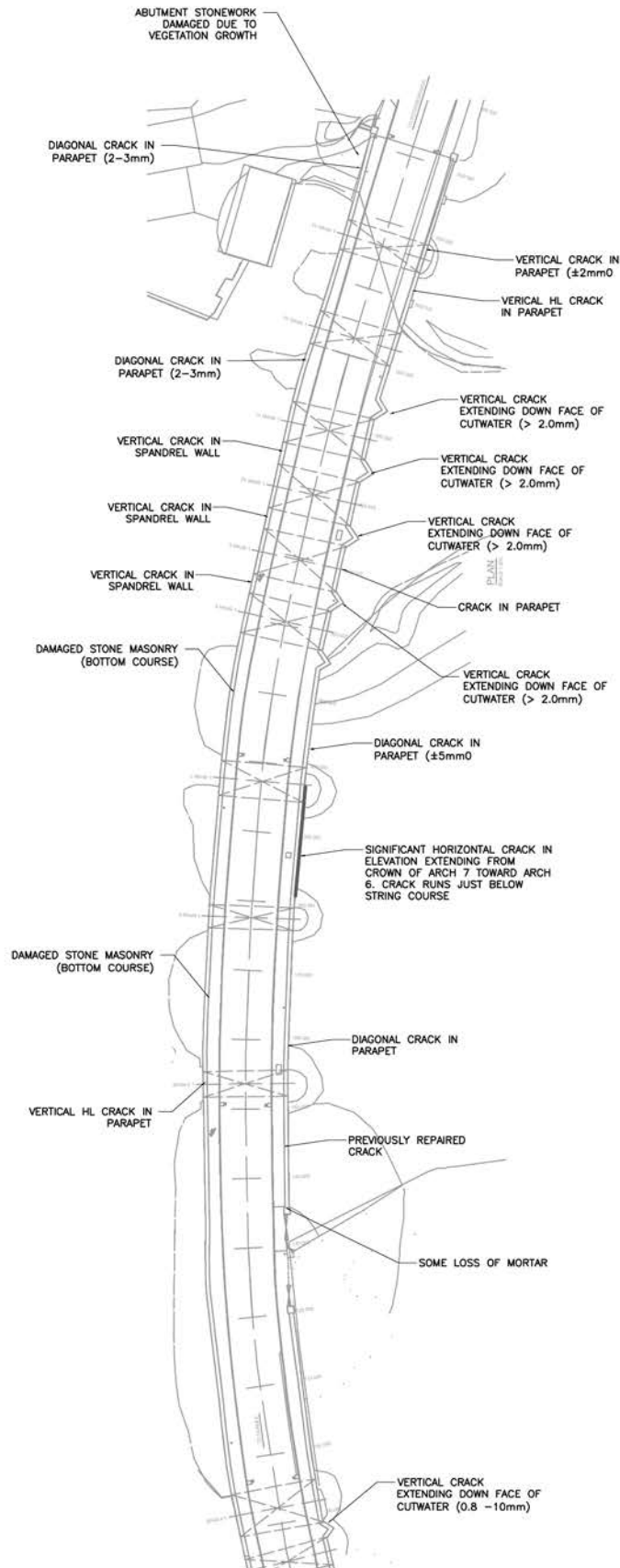
Scale: NTS

DRAWING No.

127/299/20

REV.

—



Haydn Evans Consulting

Project: A427 NORTH BRIDGE OUNDLE
Title: CARRIAGEWAY DEFECT SHEET 2

By: PJH

Date: MAY 18

Chkd:

Scale: NTS

DRAWING No.

127/299/21

REV.

—

APPENDIX B
EXISTING GENERAL ARRANGEMENT DRAWINGS

File name: \\UK.WSPGROUP.COM\CENTRAL DATA\PROJECTS\70030775 - A427 OUNDLE NORTH VIADUCT STRENGTHENING MODELS AND DRAWINGS\BRIDGES\WIP\DWG\70030775-BR-DRG-001.DWG, printed on 24 August 2017 16:55:47, by Tutton, Jack



LOCATION PLAN
1:5000



PHOTO 1 - SPAN 5, 6, 7 (SOUTH ELEVATION)



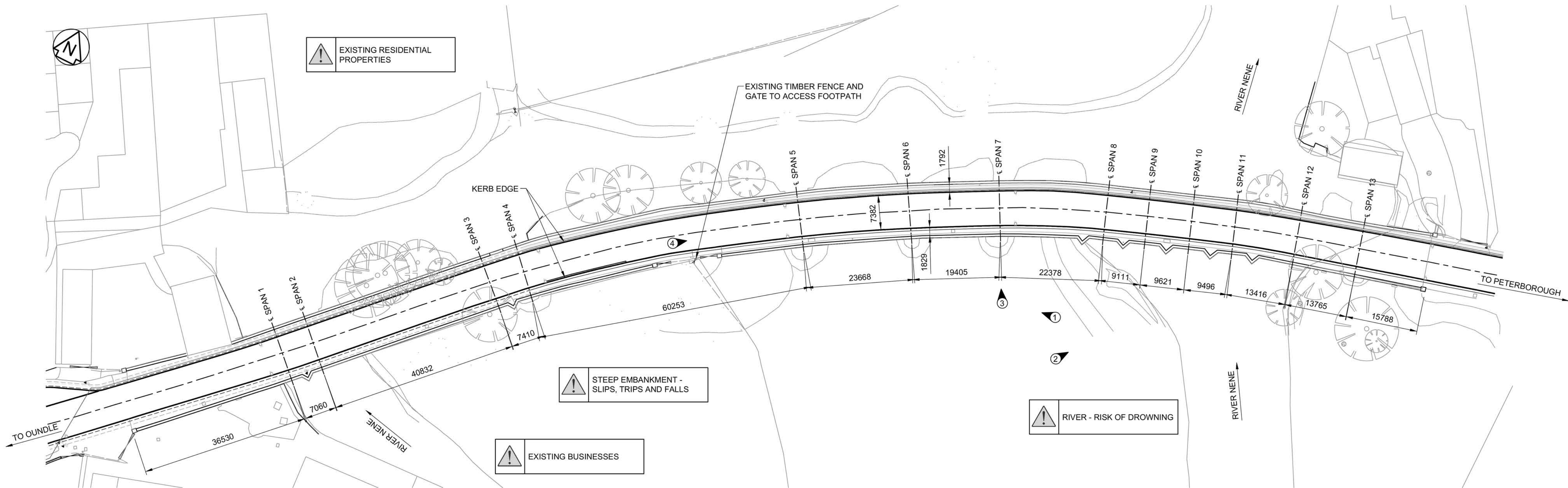
PHOTO 2 - SPAN 9, 10, 11 (SOUTH ELEVATION)



PHOTO 3 - SPAN 7 (SOUTH ELEVATION)



PHOTO 4 - GENERAL VIEW OF THE ROAD



DO NOT SCALE

1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
2. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
3. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWINGS 70030775-BR-DRG-002, 70030775-BR-DRG-003 & 70030775-BR-DRG-004.

DRAFT

KEY:

- 1 - VIEW OF PHOTO
- BT
- NATIONAL GRID LP GAS MAIN (62PE)
- GTC LP GAS MAIN (80PE)
- WPD HV (11kV)
- WPD PL
- WPD OVERHEAD HV (33kV)

PD1	24/08/2017	JT	FIRST ISSUE	GO	JM
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: S0 - WORK IN PROGRESS

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T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
wsp.com

CLIENT:

Northamptonshire
County Council

SITE/PROJECT:

A427 OUNDLE NORTH VIADUCT
STRENGTHENING WORKS

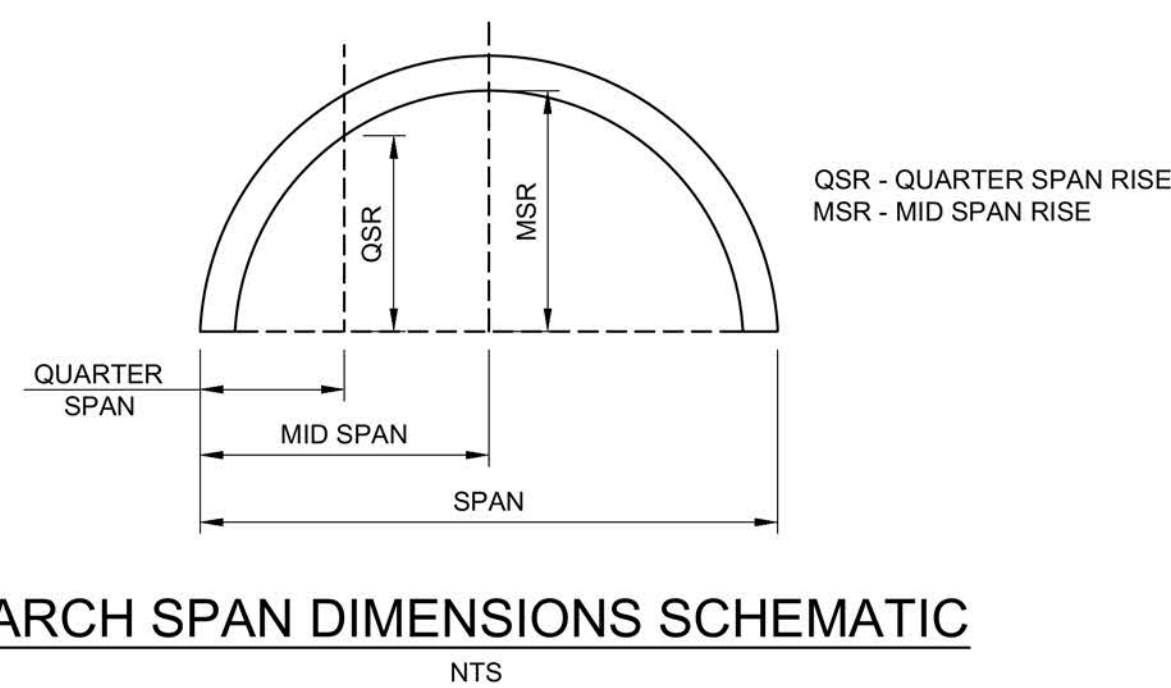
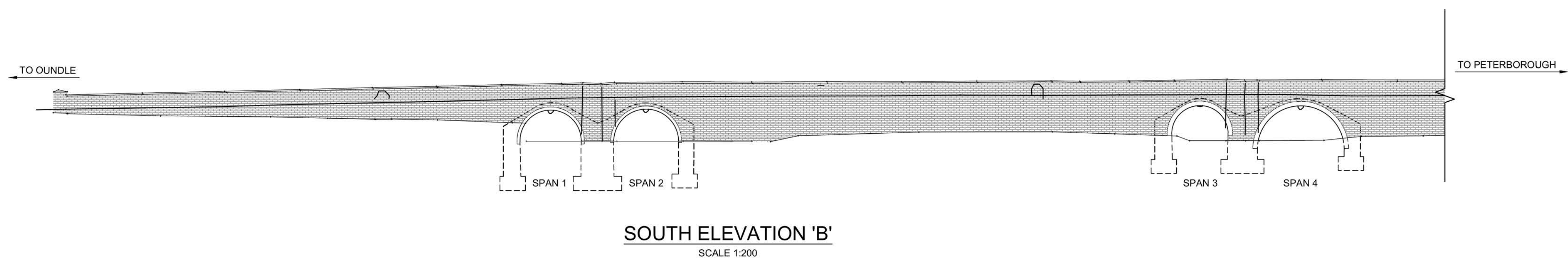
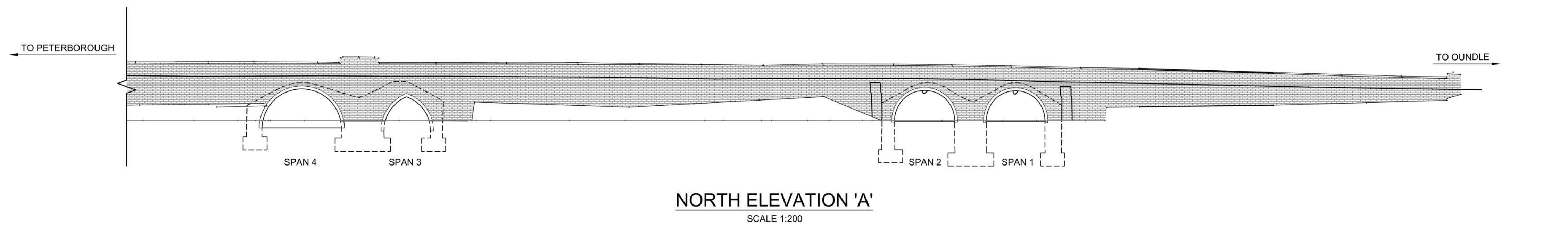
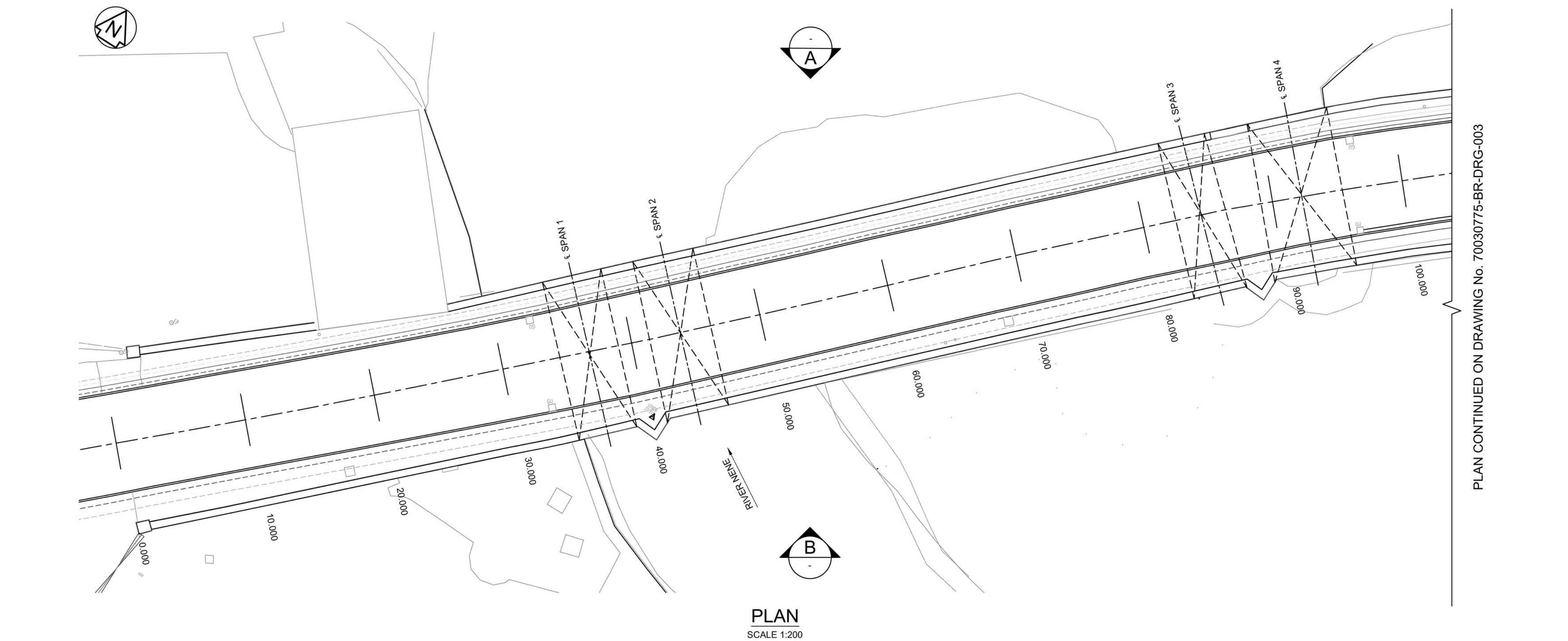
TITLE:

EXISTING GENERAL ARRANGEMENT
SHEET 1 of 4

SCALE @ A1:	AS SHOWN	CHECKED:	GO	APPROVED:	JM
PROJECT NO:	70030775	DESIGNED:	TC	DRAWN:	JT
				DATE:	AUGUST 2017
DRAWING NO:	70030775-BR-DRG-001				REV:
					P01

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File name: \\UK.VSPGROUP.COM\CENTRAL DATA\PROJECTS\70030775\4427 OUNDLE NORTH VIADUCT STRENGTHENING MODELS AND DRAWINGS\BRIDGES\WIP\DWG\70030775-BR-DRG-002.DWG, printed on 24 August 2017 16:57:08, by Tutton, Jack



SPAN DIMENSIONS (CAD FROM NCC - SEE NOTE 4)				
SPAN No.		MSR (m)	QSR (m)	SPAN (m)
1	N & S	2.315	1.987	4.600
2	N & S	2.288	1.960	4.653
3	N	2.583	2.064	3.536
	S	2.163	1.894	4.037
4	N & S	2.946	2.528	6.044

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

SPAN DIMENSIONS (REPORT - SEE NOTE 4 & 5)				
SPAN No.		MSR (m)	QSR (m)	SPAN (m)
1	N & S	2.425	2.103	4.820
2	N & S	2.398	2.083	4.873
3	N	2.583	2.064	3.536
	M	2.163	1.894	4.037
4	S	2.163	1.894	4.037
	N	2.946	2.528	6.044
	S	3.056	2.640	6.264

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

- DO NOT SCALE
- NOTES:
- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
 - ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
 - THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWINGS 70030775-BR-DRG-001, 70030775-BR-DRG-003 & 70030775-BR-DRG-004.
 - SPAN DIMENSIONS OBTAINED FROM 'ARCH PROFILE COMPARISON (2004)' CAD FILE AND NORTHAMPTONSHIRE ASSESSMENT REPORT No. 10583508-AR-1093_initial issue (2014).
 - DIMENSIONS IN RED TO BE CONFIRMED FROM INSPECTIONS/SURVEYS.

DRAFT

- KEY:
- BT
 - NATIONAL GRID LP GAS MAIN (62PE)
 - GTC LP GAS MAIN (80PE)
 - WPD HV (11kV)
 - WPD PL
 - WPD OVERHEAD HV (33kV)

PD1	24/08/2017	JT	FIRST ISSUE	GO	JM
REV	DATE	BY	DESCRIPTION	CHK	APP

DRAWING STATUS: S0 - WORK IN PROGRESS

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SITE/PROJECT: A427 OUNDLE NORTH VIADUCT STRENGTHENING WORKS

TITLE: EXISTING GENERAL ARRANGEMENT SHEET 2 of 4

SCALE @ A1:	AS SHOWN	CHECKED:	GO	APPROVED:	JM
PROJECT NO:	70030775	DESIGNED:	TC	DRAWN:	JT
				DATE:	AUGUST 2017

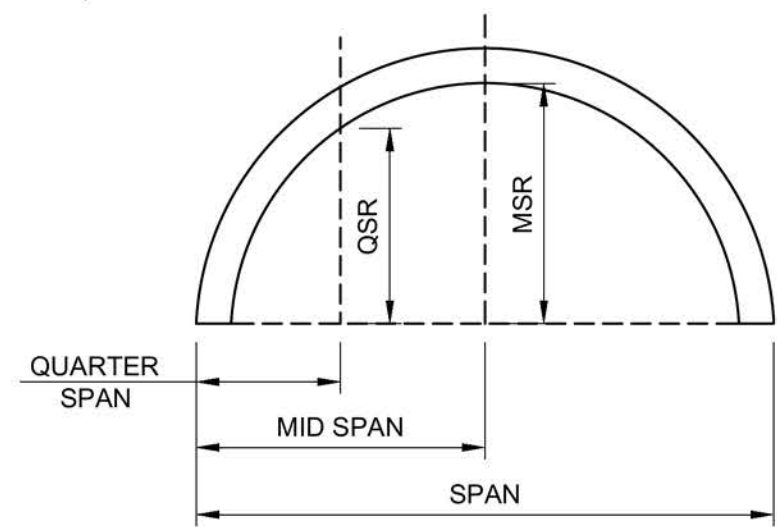
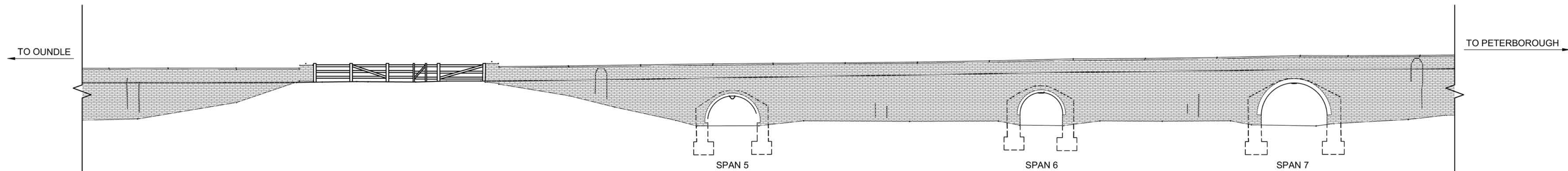
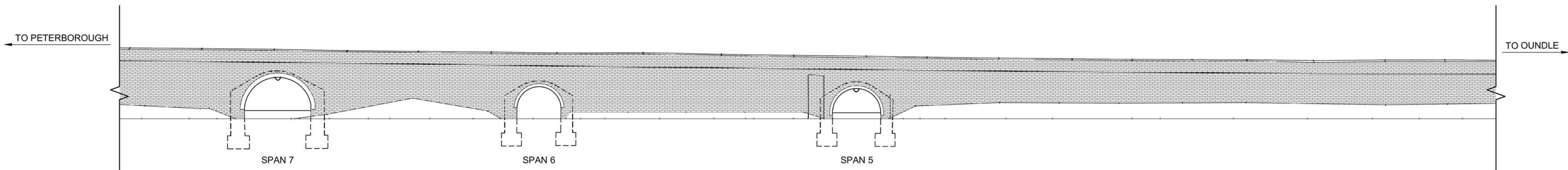
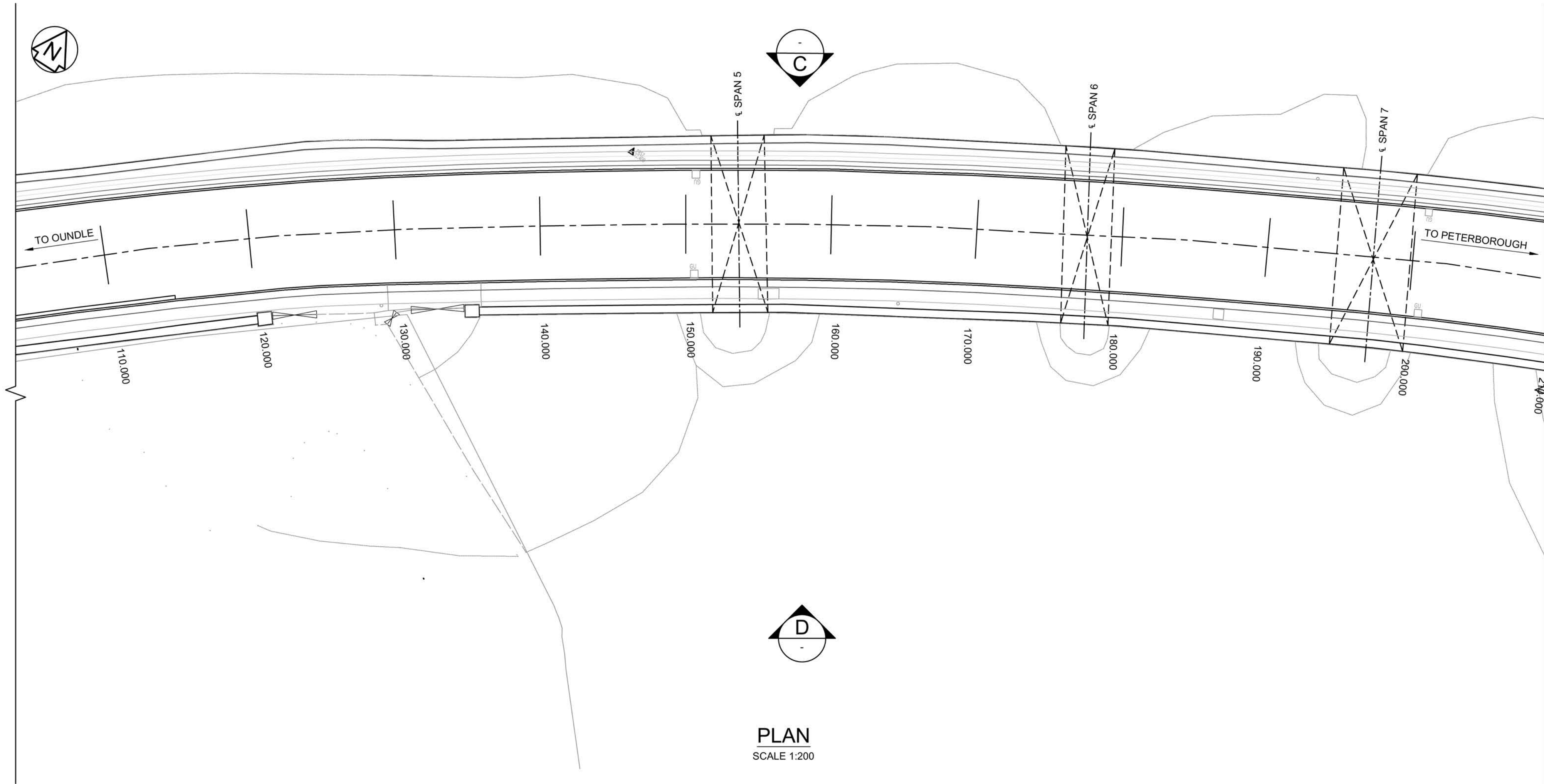
DRAWING NO:	70030775-BR-DRG-002	REV:	P01
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File name: \\UK.VSPGROUP.COM\CENTRAL DATA\PROJECTS\70030775\A427 OUNDLE NORTH VIADUCT STRENGTHENING MODELS AND DRAWINGS\BRIDGES\WIP\DWG\70030775-BR-DRG-003.DWG, printed on 24 August 2017 16:56:27, by Turtun, Jack

CONTINUATION OF PLAN FROM DRAWING No. 70030775-BR-DRG-002

PLAN CONTINUED ON DRAWING No. 70030775-BR-DRG-004



QSR - QUARTER SPAN RISE
MSR - MID SPAN RISE

ARCH SPAN DIMENSIONS SCHEMATIC

NTS

NORTH ELEVATION 'C'
SCALE 1:200

SOUTH ELEVATION 'D'
SCALE 1:200

SPAN DIMENSIONS (CAD FROM NCC
- SEE NOTE 4)

SPAN No.	N or S	MSR (m)	QSR (m)	SPAN (m)
5	N & S	1.932	1.675	3.814
6	N & S	1.589	1.368	3.153
7	N & S	2.446	2.108	4.966

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

SPAN DIMENSIONS (REPORT -
SEE NOTE 4 & 5)

SPAN No.	N or S	MSR (m)	QSR (m)	SPAN (m)
5	N & S	2.042	1.772	4.034
6	N	1.589	1.368	3.153
	S	1.699	1.473	3.373
7	N & S	2.446	2.108	4.966

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

DO NOT SCALE

NOTES:

- ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
- THIS DRAWING IS TO BE READ IN CONJUNCTION WITH DRAWINGS 70030775-BR-DRG-001, 70030775-BR-DRG-002 & 70030775-BR-DRG-004.
- SPAN DIMENSIONS OBTAINED FROM 'ARCH PROFILE COMPARISON (2004)' CAD FILE AND NORTHAMPTONSHIRE ASSESSMENT REPORT No. 10583508-AR-1093_initial issue (2014).
- DIMENSIONS IN RED TO BE CONFIRMED FROM INSPECTIONS/SURVEYS.

DRAFT

KEY:

- BT
- NATIONAL GRID LP GAS MAIN (62PE)
- GTC LP GAS MAIN (80PE)
- WPD HV (11kV)
- WPD PL
- WPD OVERHEAD HV (33kV)

PO1	24/08/2017	JT	FIRST ISSUE	GO	JM
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One Queens Drive, Birmingham, B5 4PJ, UK
T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
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CLIENT:

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SITE/PROJECT:

A427 OUNDLE NORTH VIADUCT
STRENGTHENING WORKS

TITLE:

EXISTING GENERAL ARRANGEMENT
SHEET 3 of 4

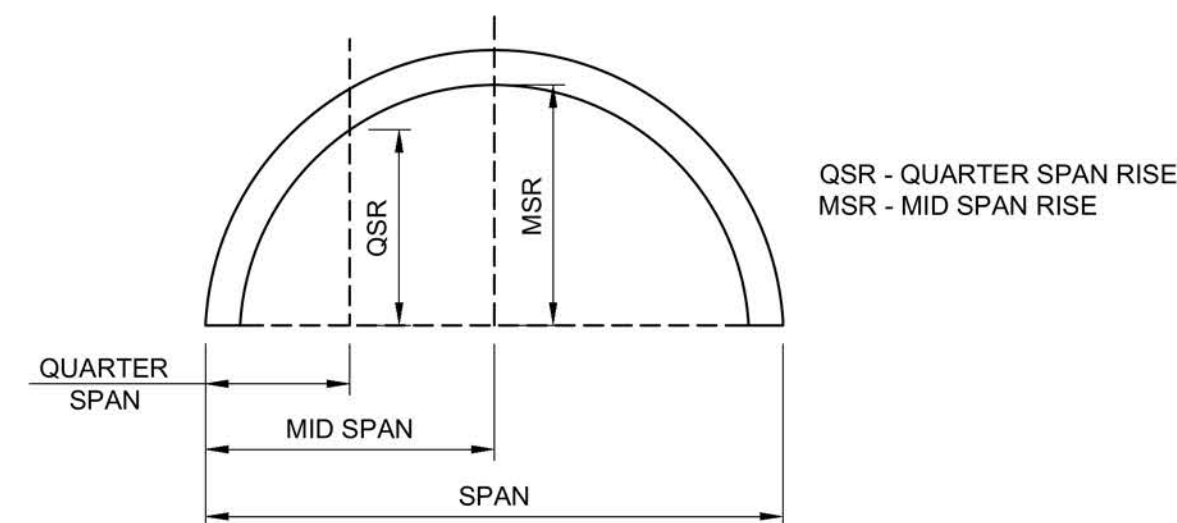
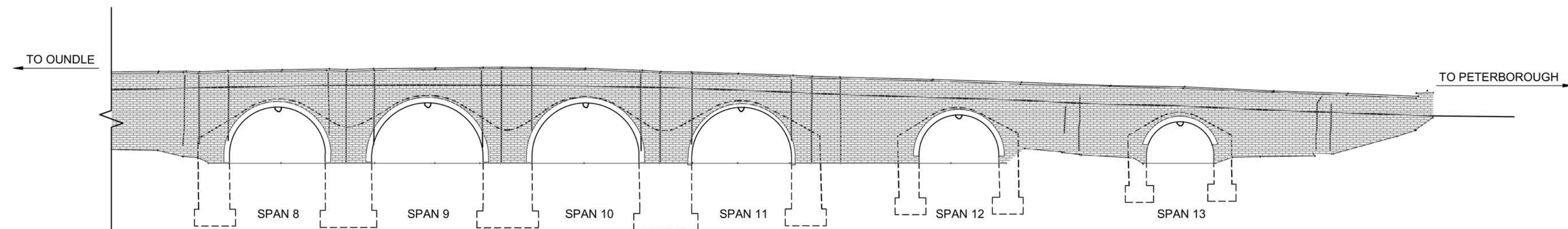
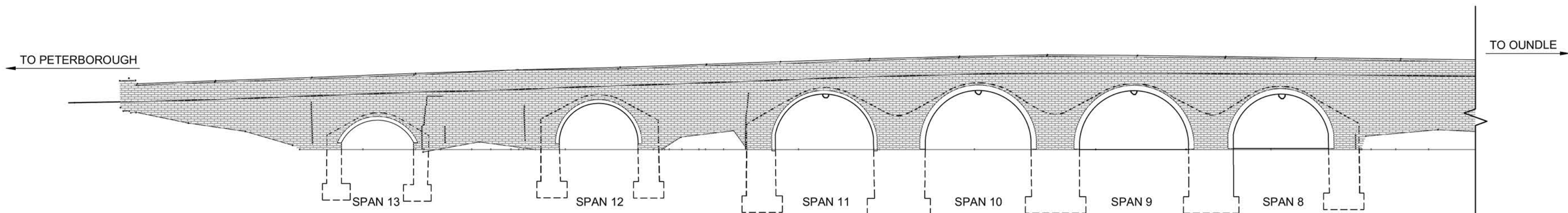
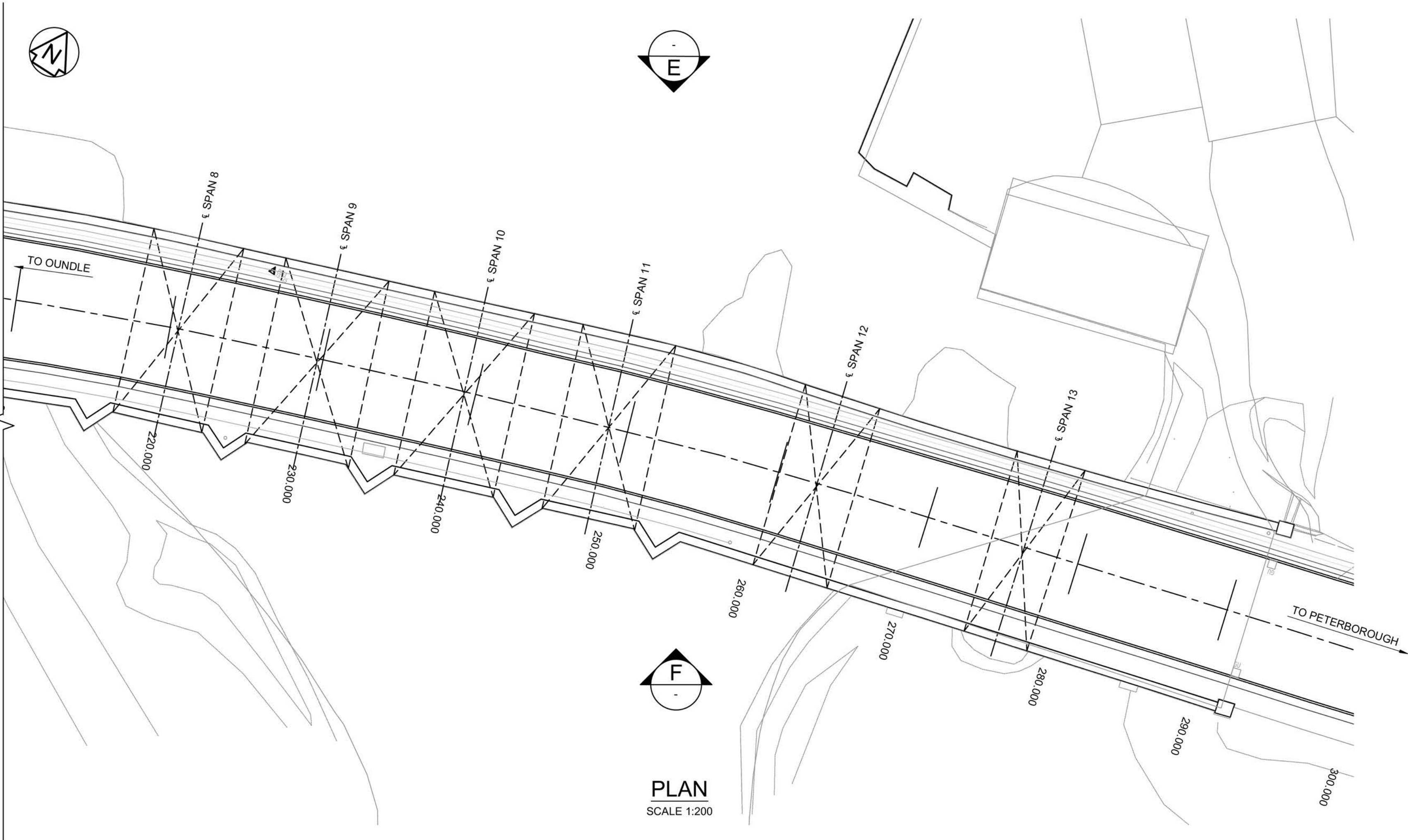
SCALE @ A1:	AS SHOWN	CHECKED:	GO	APPROVED:	JM
PROJECT NO:	70030775	DESIGNED:	TC	DRAWN:	JT
				DATE:	AUGUST 2017

DRAWING NO:	70030775-BR-DRG-003	REV:	P01
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CONTINUATION OF PLAN FROM DRAWING No. 70030775-BR-DRG-003



ARCH SPAN DIMENSIONS SCHEMATIC
NTS

SPAN DIMENSIONS (CAD FROM NCC
- SEE NOTE 4)

SPAN No.	N or S	MSR (m)	QSR (m)	SPAN (m)
8	N & S	3.282	2.863	6.059
9	N & S	3.521	3.070	6.553
10	N & S	3.527	3.065	6.573
11	N & S	3.308	2.875	6.130
12	N & S	2.443	2.090	4.709
13	N	1.345	1.083	4.328
	S	2.070	1.744	4.172

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

SPAN DIMENSIONS (REPORT - SEE
NOTE 4 & 5)

SPAN No.	N or S	MSR (m)	QSR (m)	SPAN (m)
8	N & S	3.282	2.863	6.059
9	N & S	3.521	3.070	6.553
10	N & S	3.527	3.065	6.573
11	N & S	3.418	2.994	6.390
12	N	2.443	2.090	4.709
	M	2.443	2.090	4.709
	S	2.443	2.090	4.709
13	N	1.345	1.083	4.328
	M	1.345	1.083	4.328
	S	1.345	1.083	4.172

MSR - MID SPAN RISE
QSR - QUARTER SPAN RISE

DO NOT SCALE

NOTES:

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PD1	24/08/2017	JT	FIRST ISSUE	GO	JM
REV	DATE	BY	DESCRIPTION	CHK	APP

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One Queens Drive, Birmingham, B5 4PJ, UK
T+ 44 (0) 121 352 4700, F+ 44 (0) 121 352 4701
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SITE/PROJECT:

A427 OUNDLE NORTH VIADUCT
STRENGTHENING WORKS

TITLE:

EXISTING GENERAL ARRANGEMENT
SHEET 4 of 4

SCALE @ A1: AS SHOWN	CHECKED: GO	APPROVED: JM
PROJECT NO: 70030775	DESIGNED: TC	DRAWN: JT
	DATE: AUGUST 2017	

DRAWING NO: 70030775-BR-DRG-004	REV: P01
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