BOK1/283 BE4 Assessment and Inspection Report

A104, Dalston Lane, Hackney, London

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National Highways – Historical Railways Estate
VAR9/7410

HRE Assessment Programme
1 April 2025

BOK1/283 BE4 Assessment and Inspection Report

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Executive summary

Structure Type: Single span cut and cover tunnel

Superstructure Form: Cast iron girders and jack arches, concrete encased steel girders

Substructure Form: brick side walls

Span: Square Span: 7.54m (24' – 9")

Assessment Code: BE4

Live Load Capacity: 8 ton axle loads

Capacity Critical Element: Cast iron girders

Restriction: 8 ton axle

Condition: Fair/poor

Local Authority: Hackney

OS Reference: TQ 336 847

This report presents the load carrying capacity for the bridge and identifies the data used to derive the assessment. The load carrying capacity of the bridge is based only on the assessment of visible spans that were amenable to inspection. It has been prepared by Jacobs for the exclusive use by HRE and should not be relied on by third parties. It has been based on site measurements and investigation by Jacobs or historical information provided by HRE, as appropriate.

The description of condition does not represent a principal inspection, nor should it be relied on for the development of maintenance works. Close inspection of members was limited by the constraints of safe access possible within the site visits described.

Identification of defects is principally based on ground level observation of visible members. The structural arrangement of the bridge meant that the following elements were not examined as part of the inspection for assessment:

- Cast iron girders – Due to the jack arch construction and infill at both ends of the tunnel, only the underside of the bottom flanges of the girders were visible. The webs and top flanges of the girders were considered as built-in parts protected by the deck construction and not amenable for inspection.
- Concrete encased girders – The girders were considered as built-in parts protected by the deck construction and not amenable for inspection.
- Propping columns – the columns are formed from channel sections welded together to form a 'square' section. The inside faces are not amenable to inspection and are therefore considered as built-in parts.

The dimensions of all hidden elements have been based upon the available historical information. No intrusive investigations have been completed at this structure and therefore the deck makeup has been assumed to comprise of the concrete shown on the historical drawings, 100mm of tar macadam road surfacing and miscellaneous fill. The deck makeup over the footpaths/pedestrian areas is assumed to be miscellaneous fill with concrete paving slabs.

Contents

Appendices

1. General Description and Structural Details

1.1 Introduction

Jacobs was appointed by National Highways – Historical Railways Estate (HRE) to undertake a BE4 assessment of structure BOK1/283.

1.2 Location and General Description

Structure BOK1/283 carries the A104 'Dalston Lane' over the former Broad Street to Dalston West Junction line within the borough of Hackney, London.

The structure carries a single lane carriageway with two marked lanes over the structure. There is a bus stop partially supported by the structure on the north side of the carriageway and another bus stop to the west of the structure on the south carriageway. The width of the surfaced carriageway is 10.5m (34' – 5 ⅜") over the tunnel. The remainder of the structure supports paved pedestrian areas but there are no barriers preventing vehicle loading.

Traffic flow over the structure is high with regular HGV use and there is a bus route over the structure.

The OS Grid reference is TQ 336 847.

The Broad Street to Dalston West railway line was opened circa 1865. The cast iron elements of the structure likely date from this time. The section which carries the road was reconstructed accommodating tram lines along Dalston Lane, most likely in the early 1900s.

1.3 Construction Type

The structure is a cut and cover tunnel lying on a slight curve. The square span between the side walls generally remains the same at 7.54m (24' – 9"). The overall length along the centreline is approximately 53m.

For the purpose of this assessment the girders have been labelled 1 to 42 from north to south corresponding with historical information. Refer to Appendix D.

The majority of the superstructure comprises cast iron girders (1 to 19 and 36 to 42) which span between the side walls. The superstructure beneath Dalston Lane comprises 16 concrete encased steel girders. Two span square between the abutments, seven span skew between the side walls but parallel to the road and the remainder span between the side walls and the edge girders of the skewed section.

1.3.1 Girder Dimensions

Girders 1 and 40

These girders are cast iron with an overall height of 1' – 9". The bottom flange is 1' – 4" x 1 ⅞". The details of the web thickness and top flange are not known. Both span square between the side walls.

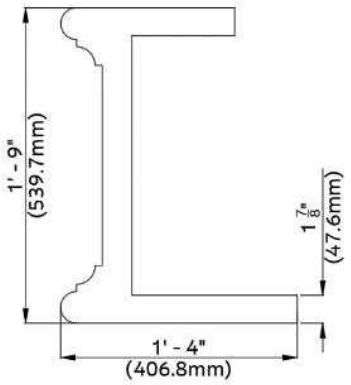


Figure 1. Girders 1 and 40 cross section

Girders 2 to 19 and 36 to 39

These girders are cast iron with an overall depth of 1′ – 9″ at midspan. Historical information indicates that they have a hogback profile and that the depth at the supports is approximately 16 ⅝″. The bottom flanges are 1′ – 8″ x 1 ½″. The top flanges are 6″ x 2 $^{1}/_{16}$″. The thickness of the web is1 ¾″. All span square between the side walls.

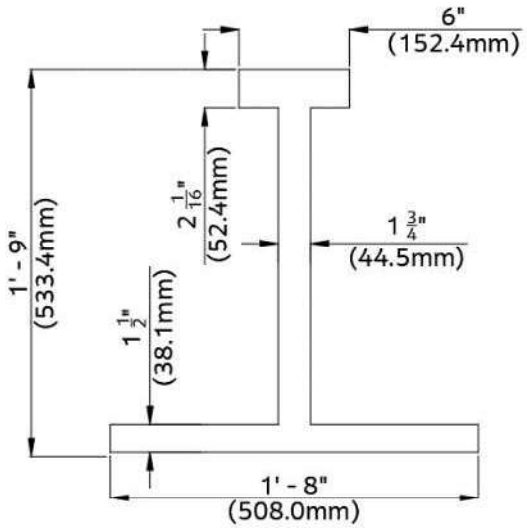


Figure 2. Girders 2 to 19 and 36 to 39 cross section (midspan)

Girders 41 and 42

Historical information indicates that they are probably cast iron channels with an overall height of 1′ – 9″ a width of 12″ and the bottom flanges have a thickness of 1 ¾″. They are placed with their open sides facing and the void between is shown on the historical drawing as filled. They spanned skew between the side walls at the south end with a clear span of 27′ – 10 ½″. Only the outside web faces and part of the bottom flanges are visible due to the concrete retaining wall constructed at the south end.

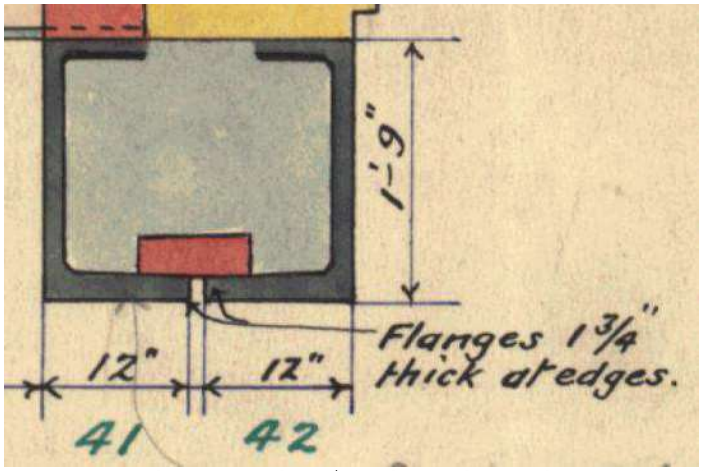


Figure 3. Girders 41 and 42 (North London Railway Drawing)

Girders 20 and 35

4″ x 4″ x ⅝″ angles attach 14″ x ½″ flange plates to a ⅝″ thick web plate. There are two flange plates both top and bottom. The web increases in depth from 12″ at the ends to 16″ at midspan. The girders span square between the side walls and have an overall length of 29′ – 3″. There are 3″ x 3″ x ½″ angles as stiffeners along the length of the girders. ⅞″ rivets are used throughout but the pitch changes from 3″ near to the ends to 4″ across the central section of the girder.

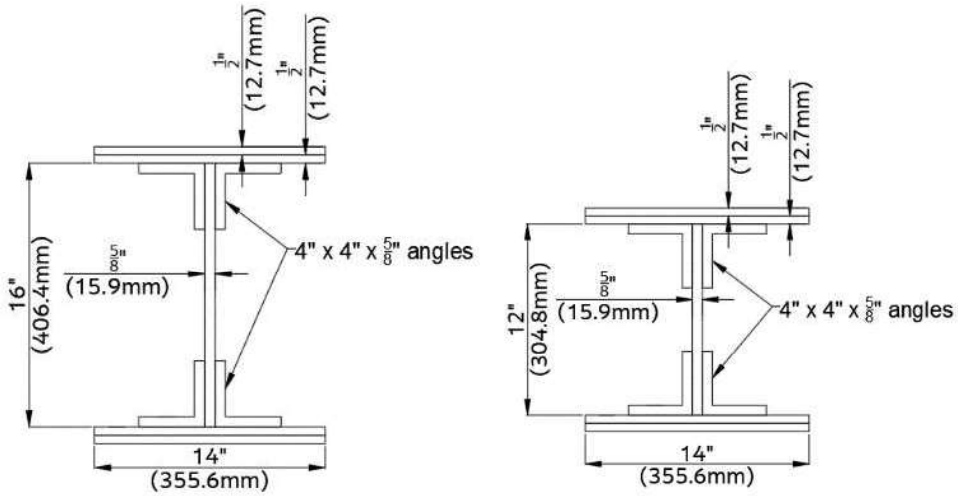


Figure 4. Girders 20 and 35 cross sections (Midspan left, support right)

Girders 21 and 34

They have the same angles and flanges as girder 21 and 35. The web is also ⅝″ thick and increases from 11 ½″ at the ends to 16″ at midspan. The girders span perpendicular to the side wall between the side wall and the edge girders of the skewed section. Girder 21 is supported on Girder 25 and Girder 34 is supported on Girder 31. They have an overall length of 25′ – 3″. There are 3 ½″ x 3 ½″ x ½″ angles as stiffeners along the length of the girders. ⅞″ rivets are used throughout but the pitch changes from 3″ near to the ends to 4″ across the central section of the girder.

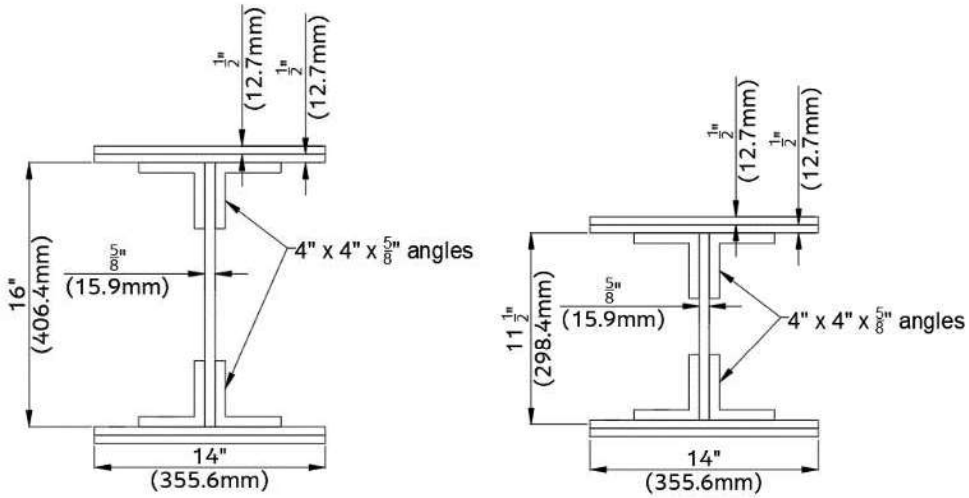


Figure 5: Girders 21 and 34 cross sections (midspan left, support right)

Girders 22 and 33

3″ x 3″ x ½″ angles attach 12″ x ½″ flange plates to a 12″ x ⅝″ web plate. There are curtailment plates on both top and bottom flanges also 12″ x ½″. The lengths of the additional plate are approximately 9′ – 10″ for girder 22 and 9′-0″ for girder 33. The girders span perpendicular to the side walls between the side walls and edge skewed girders. The overall lengths are 19′ – 3″ and 18′ – 6 ¼″ for girders 22 and 33 respectively. There are angles as stiffeners along the length of the girders but the size is not known. ⅞″ rivets are used throughout but the pitch changes from 3″ near to the ends to 4″ across the central section of the girder.

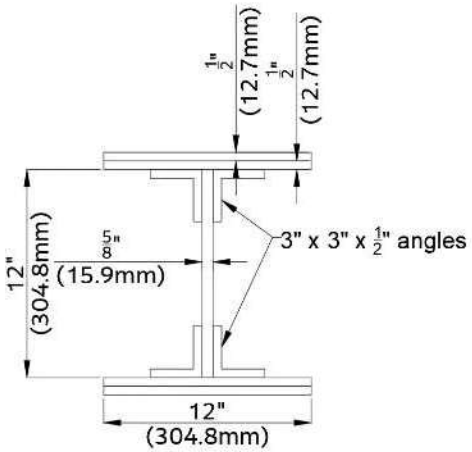


Figure 6: Girders 22 and 33 cross section (midspan)

Girders 23 and 32

3″ x 3″ x ½″ angles attach 9″ x ½″ flange plates to a 12″ x ½″ web plate. These girders also span between the side walls and edge skewed girders. The overall lengths are 12′ – 10″ and 11′ – 2 ¼″ for girders 23 and 32 respectively. Historical drawings show that there are angles as stiffeners along the girder though the dimensions are not known. ⅞″ rivets are used throughout but the pitch is not known.

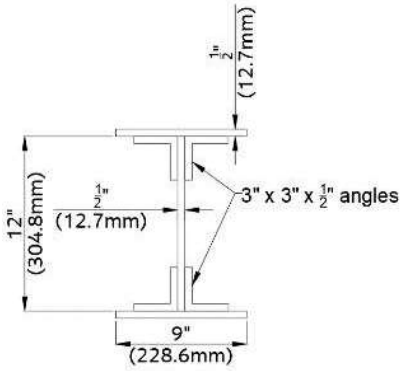


Figure 7: Girders 23 and 32 cross section (midspan)

Girder 24

2 ½" x 2 ½" x ½" angles attach 9" x ½" flange plates to a 9" x ½" web plate. This girder spans between the west side wall and girder 25. The overall length is 7' – 1". ⅞" rivets are used throughout but the pitch is not known.

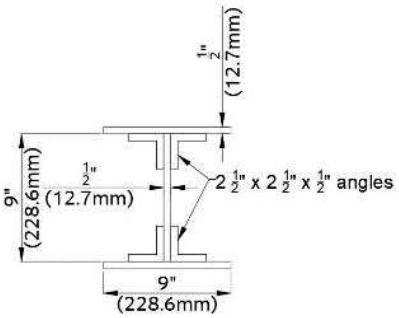


Figure 8: Girder 24 cross section (midspan)

Girder 25 and 31

4" x 4" x ⅝" angles attach 16" x ½" flange plates to a 24" x ⅝" web plate. Both girders have two additional 16" x ½" curtailment plates on both the top and bottom flanges. The lengths of additional plates are 18' – 8" and 12' – 0". The girders span skewed between the side walls with a clear span of 29' – 6". The overall length of the girders is 33' – 9". There are 4" x 4" x ½" angles as stiffeners along the length of the girder but the spacing is not known. ⅞" rivets are used throughout but the pitch changes from 3" near to the ends to 4" across the central section of the girder.

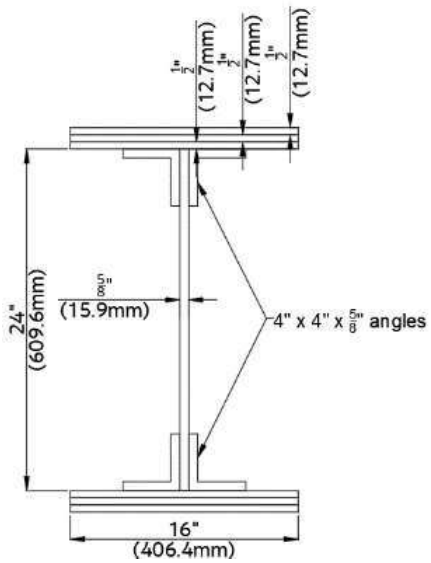


Figure 9: Girders 25 and 31 cross section (midspan)

Girders 26, 27, 29 and 30

4″ x 4″ x ⅝″ angles attach ½″ thick flange plates to a ⅝″ thick web plate. The bottom flange is 14″ wide with an additional plate also 14″ x ½″ approximately 18′ – 2″ long. The top flange is formed from two plates 18″ wide. The plates are positioned so that the edges of the flange are 7″ and 11″ from the centreline of the girder. The girders are positioned in pairs, 26 ½″ centre to centre, so that the extended flange edges are towards each other. The depth of the web increases from 2′ – 0 ⅞″ at one end to 2′ – 6 ⅞″ at the other. There are cut outs at two locations in each girder on the top flanges 7 ¾″ wide. The top flanges and angles are removed from the wider side of the flange and additional pate 12″ x ⅝″ (also with a cut out) is attached to the top of the girders. The cut outs are approximately 7′ – 1″ and 12′ – 2″ from the supports, refer to Figure 12 below.

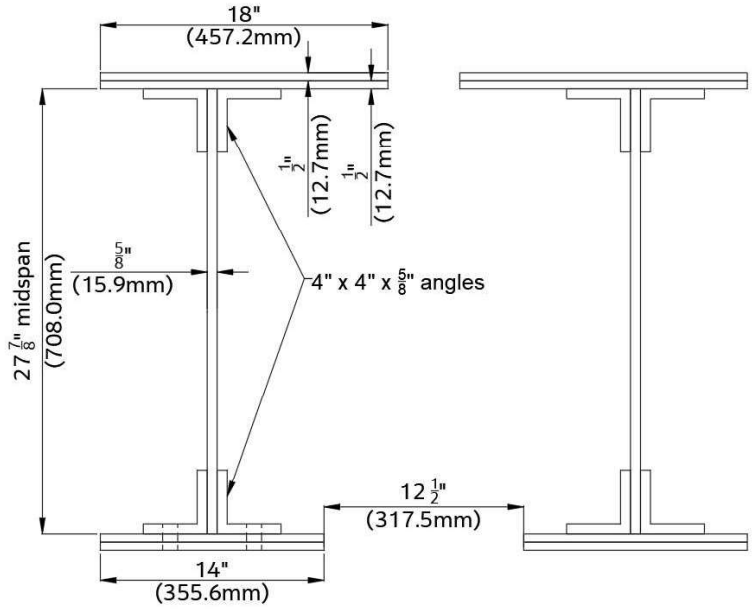


Figure 10: Girder cross section at midspan

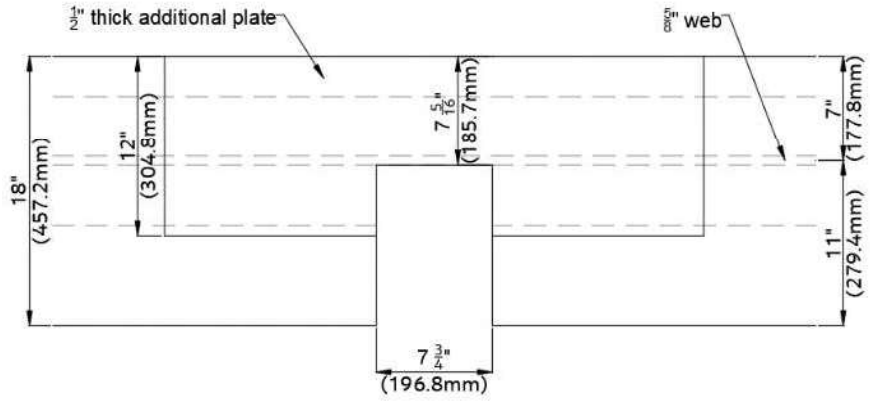


Figure 11: Plan on cut out sections

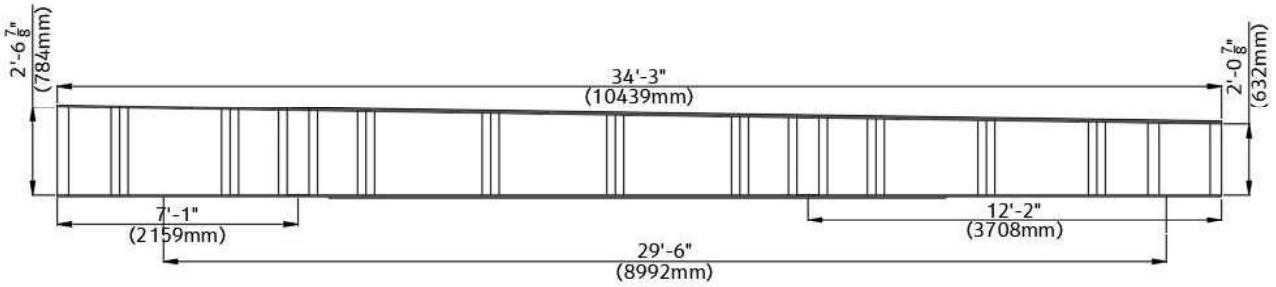


Figure 12: Girder elevation

Girder 28

4″ x 4″ x ⅝″ angles attach 14″ x ½″ flange plates to a 25″ x ⅝″ web plate. There are additional flange plates also 14″ x ½″ and approximately 18′ – 3″ long. 4″ x 4″ x ½″ angles are used as stiffeners but the spacing is not known. ⅞″ rivets are used throughout but the pitch changes from 3″ near to the ends to 4″ across the central section of the girder.

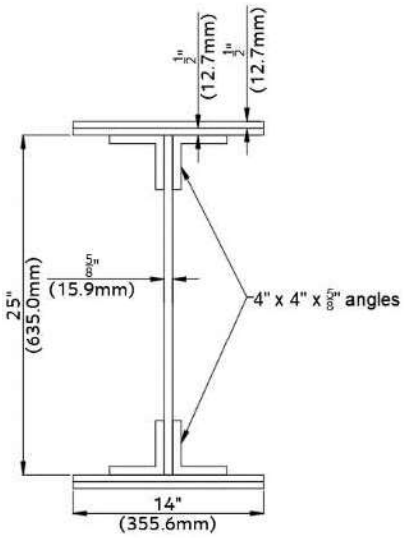


Figure 13: Girder 28 cross section (midspan)

1.3.2 Deck Construction

Jack Arches

Between girders 1 and 2 is a 9″ thick brick jack arch with a span of 3′ – 9 ¼″.

Between girders 2 to 19 are 9″ thick brick jack arches with an average span of 4′ – 3 ½″.

Between girder 39 and 40 there is an assumed 9″ thick brick jack arch with a span of 4′ – 7″.

Concrete Encasement

Girders 36 to 39 have been placed adjacent to each other and encased in concrete.

All of the steel girders are encased in concrete. The deck between the bottom flanges of the steel girders is formed from 9″ thick concrete encasing 3″ x 3″ x ½″ angles at 12″ centres and a metal mesh 1″ from the soffit. There are 1 ¼″ x $^{1}/_{16}$″ 'hoop iron hangers' between the angles and mesh. Between girder 25 and 26 there is no angle between the bottom flanges as these girders are placed close together.

Girder 25 has been tied to girder 26 using 1″ bolts in 2″ 'gas tubing' placed at 5′ – 0″ centres near to the top of the web. Girders 27, 28 and 29 and 30 and 31 have also been tied together but using 3″ x 3″ x ½″ angles fixed to the stiffener angles near to the top of the webs.

Between the girder pairs, 26-27 and 29-30, there was a void which used to be part of the 'conduit current collection' system for the electric tram lines, see Figure 14 below. As no intrusive investigations have been undertaken it is assumed these were backfilled after removal of the tram lines.

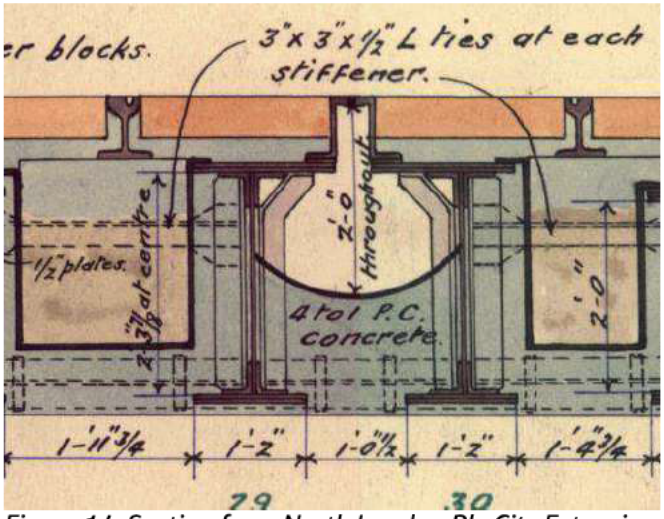


Figure 14: Section from North London Rly City Extension drawing – Girders 29 and 30

Girder 40 to 41

Between girder 40 and 41, 11 ¾" x 6" rolled joists span between the top flanges at 3' – 8" centres. There was originally 4 ½" thick brick jack arches spanning between the joists. Most of the jack arches have been removed and metal sheets are now visible between the top flanges of the joists. It is not known what the deck make up is above the metal formwork.

1.3.3 Propping

Girders 11 and 12 have been propped. Both girders had fractures whilst the railway was still in use. The existing drawings show that the girders were overbridged with RSJs and the location of the fractures supported from above. Girder 12 appears to have been repaired at an earlier date (prior to 1920) with notes on the historical drawings noting girder 11 was found to be cracked in November 1920. There are now columns formed from two 8" x 3" channels welded together along the ends of the flanges at the locations of the fractures on both. It is not clear if the overbridging RSJs have remained in-situ after demolition of the building above, though the plates and bolts from the repairs can still be seen at the girder soffits.

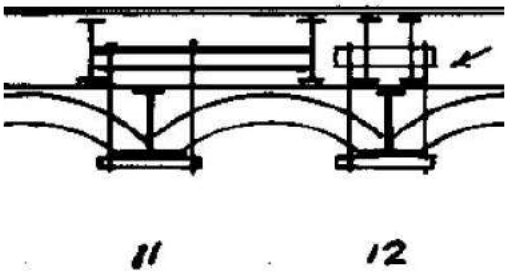


Figure 15: Section from LM&SR Road and Rail Traffic Act 1933 drawing

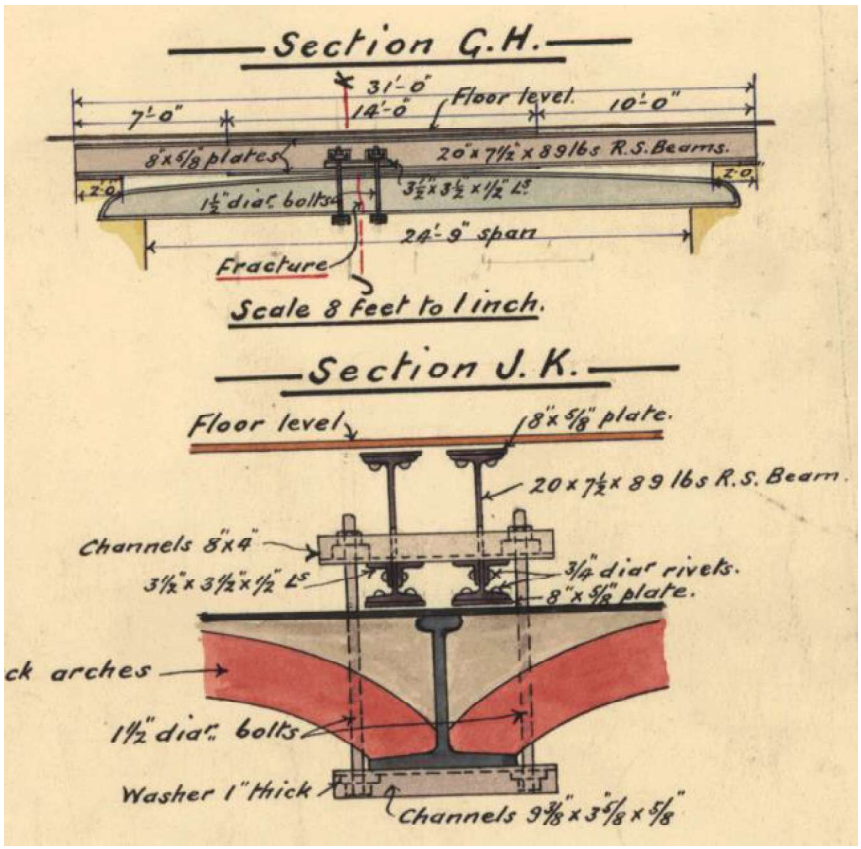


Figure 16: Girder 12 repair section from North London Rly. City Extension drawing (circa 1900-1920)

1.3.4 Substructure

The substructure comprises side walls constructed from brick. There are no longer parapets on the structure and the wingwalls have been completely buried.

Sketches of the plan at road level, sections of the deck and elevation are included in Appendix E.

2. Information Search

2.1 Services Search

A services search was carried out by Jacobs in 2021. Information is supplied in Appendix G.

2.2 Site Investigation Description and Results

No intrusive investigations were undertaken as part of the survey for assessment.

HRE Framework Contractor AMCO set up a confined space entry safe system of work to allow entry into the tunnel. A ladder was used to complete the close visual inspection of the structure soffit as the size of the manhole used for access into the tunnel limits the options for high level access equipment.

2.3 Existing Drawings

A North London Rly – City Extension drawings contains a plan, sections and elevations of the steel girders. A L.M & S.R (Eastern Division) Road and Rail Traffic Act 1933 drawing also contains the same sketches with some levelling data included and the repair to girder 11 added to the long cross section.

3. Structure Condition

3.1 General

Jacobs undertook survey for inspection for BE4 assessment on Tuesday 12th and Wednesday 13th December 2023. Access to the underside was gained via the manhole at the south end of the structure. AMCO set up and maintained a confined space entry space system of work for the duration of the survey. Weather conditions on both days was raining with a temperature of 10°C.

3.2 Structure Condition

Appraisal of the condition was limited to the areas accessible by use of a ladder due to the constrained manhole access to the underside. The soffit of the entire structure was wet at the time of the survey with dripping water throughout particularly on the cast iron girders. Based on previous examination reports the soffit appears to remain wet throughout the year.

3.2.1 Girders

3.2.1.1 Cast Iron

The cast iron internal girders are generally in fair condition. There is surface corrosion across all girders. All girders had some pitting corrosion visible between 2 and 3mm deep. Section loss will be taken as 3mm to all exposed areas for all girders as a conservative assessment. (Photographs 6, 8 and 16)

The north end edge girder could not be inspected due to the tyres blocking the north end (Photograph 1). The south end 'edge' girder (Girder 40) has section loss up to 2mm due to pitting corrosion. Section loss will be taken as 2mm throughout the exposed faces as a conservative assessment.

The visible areas of the channel sections are in similar condition to Girder 40 with 2mm section loss (Photograph 22).

3.2.1.2 Concrete Encased Steel

There are areas of spalled concrete across the underside of this section (Photograph 21). There are four areas where the concrete has spalled exposing the girders. The remaining areas of spalling to the concrete have exposed the mesh only.

Towards the east support of girders 25 and 26 the exposed soffits are damp and there is corrosion throughout. The additional plate on girder 26 is laminated but residual thickness at this location was not possible to determine as there was no safe access (Photograph 20). There is up to 2mm section loss on the exposed areas.

3.2.1.3 RSJs

The RSJs at the south end of the tunnel are in fair condition (Photograph 22). There is surface corrosion on all surfaces with 3mm section loss to the bottom flanges.

3.2.2 Columns

The columns are in fair condition (Photograph 18). There is surface corrosion throughout both and spots of 1mm pitting corrosion across all exposed faces. Section loss is considered to be negligible.

3.2.3 Jack Arches

The jack arches are in fair condition (Photograph 17). There is some minor spalling on isolated bricks and minor mortar loss throughout. Some softening of the mortar is expected due to the damp present across the structure soffit.

The jack arch between girders 18 and 19 has a larger area of spalling covering 0.3m^2 up to ½ brick deep on the south side at midspan (Photograph 19).

3.2.4 Side Walls

The sidewalls are in fair condition (Photographs 12 – 14). There is soot staining throughout and some isolated patches of damp and leachate staining extending from the bearing shelves. There is mortar loss particularly on the upper sections. Around several bearing stones there are missing and spalled bricks (Photograph 15).

3.2.5 Formation

The formation to the north has been infilled and is now part of Dalston Eastern Curve Garden. The formation to the south is also infilled and forms part of Dalston Square.

The north end of the tunnel has been filled with tyres (Photographs 1 and 25). At the south end of the tunnel there is a mass concrete retaining wall with rubble fill behind blocking the end (Photographs 2, 11, 23 and 26). The access shaft at the south west corner is also formed from mass concrete.

Within the tunnel there are various discarded materials including palisade fence panels, tower scaffold decks and bits of wood. Approximately a third of the way along the tunnel is a manhole cover for a drain which flows from west to east.

3.2.6 Road Surface and Traffic Flow

The road surface over the structure is in poor condition (Photographs 3 to 5). There is cracking in the surfacing above the side walls of the tunnel (Photograph 24).

Traffic flow across the structure is high. Regular HGV use was observed during the survey and there are bus stops both east and west of the tunnel. A speed limit of 20mph applies over the structure.

4. Assessment to BE4

4.1 Methodology

Capacities of elements were calculated using estimates of reduced section sizes where corrosion is present. A general condition factor was not applied.

Resistance capacities of the cast iron girders were determined in accordance with BE4 Part I Clause 305(b)(ii). The capacity of the internal girders on the north side of the carriageway was not enhanced by D/d as the embedment details of the girders are not known.

The concrete encased girders are assumed to be steel due to the likely date of construction. The capacities of the steel girders were checked using the permissible stress given in BE4 Part I Clause 304(b).

All of the internal girders are considered to be fully restrained against lateral torsional buckling, the effective lengths were therefore taken as zero.

Loading was applied by simple statics with the load train applied transversely and longitudinally for maximum effect at the girder location under consideration within the carriageway positioning limits as indicated in BE4 Part I Clause 302.

The girders at the edges of the carriageway were checked for vehicles running both parallel to the kerb as per the requirements of BE4 but an additional check for a vehicle running parallel to the girders was also undertaken.

Determination of the adequacy of the jack arches was based upon the empirical method described in Bridgeguard 3 Current Information Sheet No. 22 (Pro-forma for the empirical assessment of brick, masonry and concrete jack arches and associated ties).

The substructure was assessed qualitatively.

4.2 Results

Element: **Cast Iron edge girders**

For the 'edge' cast iron girders not enough information is available from historical sources for a quantitative assessment and access on site to these girders was limited. The visible sections of the south girder appears to be in fair condition with no visible distress and therefore suitable for the imposed dead loads by qualitative assessment.

Element: **Girder 8 – Cast Iron Girder beneath north footway**

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect ($5f_L+2.2f_d$)	Allowable Resistance	Capacity
Bending	Girder 8 midspan	154.3 ton.ft 3.67 ton/sq.in	N/A	154.3 ton.ft 3.67 ton/sq.in	126 ton.ft 3 ton/sq.in	Theoretically overstressed under dead load.

Girder 8 was checked as the girder with the greatest dead load determined by the topographical survey completed. Not all of the cast iron girders have been checked as part of this assessment and therefore there may be other potentially overstressed girders present supporting the pedestrian area north of the carriageway. D/d enhancement was not applied as the embedment details were not investigated during the inspection for assessment.

Element: Girder 19 – Cast Iron Girder at north edge of carriageway

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect ($5f_L+2.2f_d$)	Allowable Resistance	Capacity
Bending	Girder 19 midspan	55.2 ton.ft 1.31 ton/sq.in	51.2 ton.ft 1.12 ton/sq.in	8.99 ton/sq.in	8 ton/sq.in	Not adequate for twin 9 ton axle
Bending	Girder 19 midspan	55.2 ton.ft 1.31 ton/sq.in	39.5 ton.ft 0.94 ton/sq.in	7.59 ton/sq.in	8 ton/sq.in	Adequate for twin 8 ton axle on 24 ton vehicle

Element: Steel Girders 20 & 35 (load effects for girder 20 worst case)

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	45.6 ton.ft	57.9 ton.ft	103.4 ton.ft	302.5 ton.ft	Full C&U loading
Shear	Support	6.5 ton	7.4 ton	13.9 ton	51.6 ton	Full C&U loading

Element: Steel Girders 21 & 34 (load effects for girder 34 worst case)

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	72.2 ton.ft	42.6 ton.ft	114.8 ton.ft	302.5 ton.ft	Full C&U loading
Shear	Support	12.2 ton	6.7 ton	18.9 ton	49.4 ton	Full C&U loading

Element: Steel Girders 22 & 33 (load effects for girder 33 worst case)

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	36.2 ton.ft	29.1 ton.ft	65.3 ton.ft	170.1 ton.ft	Full C&U loading
Shear	Support	8.7 ton	6.6 ton	15.3 ton	49.4 ton	Full C&U loading

Element: Steel Girders 23 & 32 (girder 23 worst case for bending, girder 32 worst case for shear)

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	13.4 ton.ft	18.8 ton.ft	32.2 ton.ft	91.2 ton.ft	Full C&U loading
Shear	Support	4.0 ton	7.1 ton	11.1 ton	41.3 ton	Full C&U loading

Element: Steel Girder 24

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	2.6 ton.ft	8.2 ton.ft	10.8 ton.ft	58.5 ton.ft	Full C&U loading
Shear	Support	1.8 ton	4.5 ton	6.3 ton	30.9 ton	Full C&U loading

Element: Steel Girders 25 & 31

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan (31)	174.6 ton.ft	100.7 ton.ft	275.3 ton.ft	703.3 ton.ft	Full C&U loading
Shear	Support (31)	31.8 ton	12.1 ton	43.9 ton	103.1 ton	Full C&U loading
Bending	Curtailment point (25)	139.7 ton.ft	76.8 ton.ft	216.5 ton.ft	539.6 ton.ft	Full C&U loading
Shear	Curtailment point (25)	9.5 ton	5.1 ton	14.6 ton	103.1 ton	Full C&U loading

Element: **Steel Girders 26, 27, 29 & 30 (load effects for girders 27 and 29 worst case)**

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	86.2 ton.ft	73.6 ton.ft	159.8 ton.ft	602.9 ton.ft	Full C&U loading
Shear	Support	11.1 ton	11.2 ton	22.3 ton	106.9 ton	Full C&U loading
Bending	Cut out	79.1 ton.ft	67.2 ton.ft	146.3 ton.ft	403.1 ton.ft	Full C&U loading
Bending	Curtailment point	60.3 ton.ft	53.7 ton.ft	114.0 ton.ft	228.4 ton.ft	Full C&U loading
Bending	Curtailment point	53.0 ton.ft	47.9 ton.ft	100.9 ton.ft	453.2 ton.ft	Full C&U loading
Bending	Cut out	46.6 ton.ft	42.5 ton.ft	89.1 ton.ft	453.2 ton.ft	Full C&U loading

Element: **Steel Girder 28**

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	97.8 ton.ft	72.9 ton.ft	170.7 ton.ft	517.4 ton.ft	Full C&U loading
Shear	Support	12.7 ton	11.2 ton	23.8 ton	107.4 ton	Full C&U loading
Bending	Curtailment point	63.7 ton.ft	50.1 ton.ft	113.8 ton.ft	373.2 ton.ft	Full C&U loading
Shear	Curtailment point	7.5 ton	7.9 ton	15.4 ton	107.4 ton	Full C&U loading

Element: **Concrete Deck – Angles**

Action	Location	DL & SDL Effect	Live Loads	Total Load Effect	Assessed Resistance	Live Load Capacity*
Bending	Midspan	1.0 ton.ft	0.6 ton.ft	1.6 ton.ft	2.4 ton.ft	Full C&U loading
Shear	Support	0.6 ton	0.4 ton	1.0 ton	6.9 ton	Full C&U loading

Element: **Jack Arches**

The jack arches are compliant with Bridgeguard 3 Current Information Sheet No. 22 and are therefore deemed suitable for the imposed loading.

Element: **Substructure**

By qualitative assessment, the substructure appears to be satisfactory for full C&U loading. The defects described in Section 3.2 of this report are not considered to be detrimental to the load bearing capacity.

5. Conclusions and Recommendations

The steel girders under the central section of the carriageway, which was reconstructed to accommodate tram loading in the early 1900s, remain adequate for BE4 C&U loading with considerable reserves of capacity. There are, however, original cast iron girders under the edges of the carriageway that have reduced or barely sufficient capacity. Also, some of the cast iron girders beyond the edge of the carriageway under the extensive paved areas are potentially overstressed by dead load alone.

All elements of the concrete encased steel section of the deck are sufficient for full C&U loading in accordance with 'The Motor Vehicles (C&U) Regulations 1963 as amended up to 1969'. This includes any 4 axle vehicles to 24 tons and specific 4 axle 28 ton vehicles and specific 4 axle articulated vehicles to 32 tons. There are sections of concrete missing on the bottom flanges with corrosion evident on the exposed girders but the excess capacity shown indicates that even with some section loss, the girders will still be adequate with the worst case showing a maximum of 50% utilisation.

As determined by this assessment, the cast iron girder at the north edge of the carriageway (girder 19) does not have sufficient capacity for full C&U loading in accordance with 'The Motor Vehicles (C&U) Regulations 1963 as amended up to 1969'. It falls short of the full BE4 required capacity of loading from a twin 9 ton axle. It is adequate though for a twin 8 ton axle.

Girder 8 was checked for the imposed dead loads as it was shown to have the greatest fill depth within the pedestrianised section north of the road. The stress due to the dead loads is greater than the permissible stress in cast iron. Fill levels over this northern section appear to have increased significantly (approximately doubled) since the closure of the line. If the embedment conditions could be confirmed, i.e. embedded in concrete, D/d enhancement may be applied which would allow an increase in the capacity and the cast iron girders could be deemed suitable for the dead loads north of the carriageway.

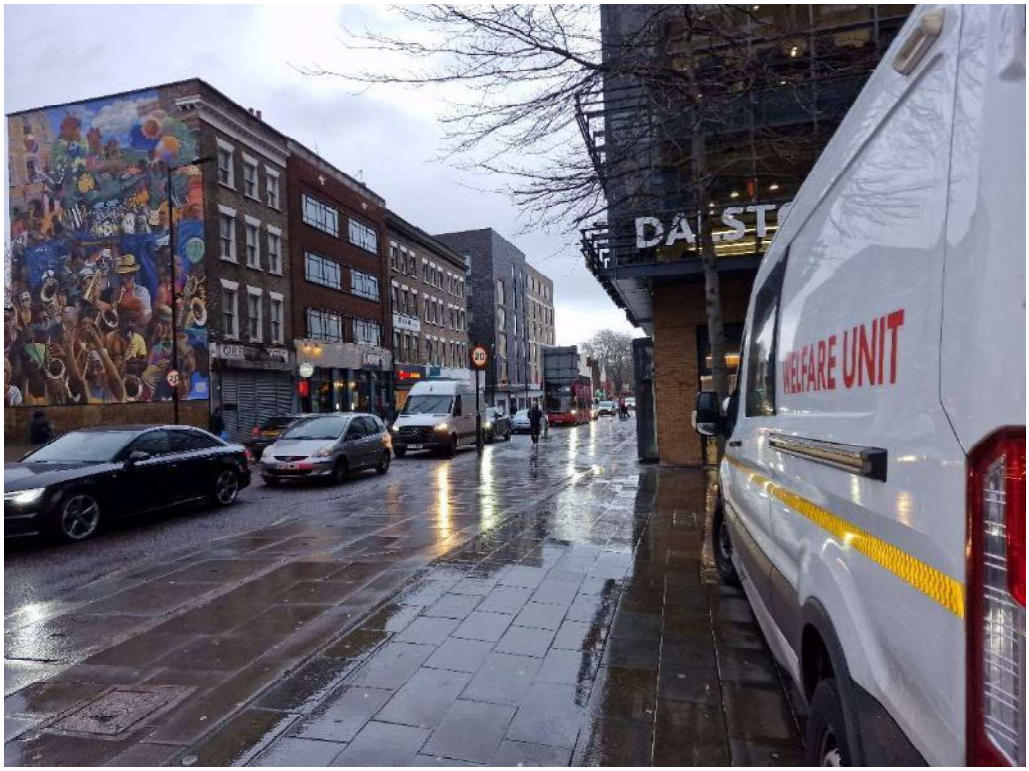
A BD21 assessment completed by Balfour Beatty Rail on behalf of HRE (BRB) in 2013 also found the cast iron girders (as well as certain sections of the steel deck) unsuitable for unrestricted traffic loading. The road over the structure is part of a bus route and there is regular HGV use as well. There also appears to be vehicles regularly parking on the pedestrian areas both north and south of the road, these were not for live loading as part of this assessment. BE4 does not require checks on accidental vehicle loading.

Supporting the northern cast iron section of the deck should be considered as a minimum, with complete infill of the whole structure recommended as the most appropriate solution. There are two already fractured cast iron girders identified and other potentially overstressed girders due to the significant dead loads within the pedestrianised northern section. The girders at the edge of the carriageway under a bus stop are also not adequate for unrestricted live loading and will also require support. Consideration will need to be given to the close proximity of buildings and the presence of manhole access into a water main from the former track bed when considering the infill. The restricted access will significantly limit options for supporting the deficient sections of the structure.

Appendix A. Photographs

1. Blocked north portal (girders 1 to 7 visible)

2. Blocked south portal (girder 41 visible at top of concrete wall)



3. Road approach looking east

4. Road approach looking west

5. View along structure looking north

6. General soffit view of north end cast iron girders (girder 18 at top of photo)

7. General soffit view of concrete encased steel girder section (girder 19 at top of photo)

8. Soffit view of concrete encased cast iron girders 36 to 39

9. Soffit view of RSJs between girders 40 and 41

10. Visible section of south edge girder 41

11. Concrete retaining wall at south end

12. West sidewall beneath concrete encased steel girders

13. West sidewall at north end

14. East sidewall at north end

15. Condition at girder 8 east bearing stone

16. Typical cast iron girder condition (girder 16 in photo)

17. Typical jack arch condition (between girders 14 and 15 shown)

18. Propping columns (girder 11 right, girder 12 left)

19. Spalling to jack arch between girders 18 and 19

20. Spalled concrete and corrosion at east end of girders 25 and 26

21. Spalling concrete along west thirdspan

22. Typical RSJ and channel section condition (girder 41 on left of photo)

23. Backfill behind concrete retaining wall

24. Cracking in surfacing above sidewall

25. Formation looking north

26. Formation looking south

27. Manhole within formation

Appendix B. Form AA

FORM 'AA' (BRIDGES) **GC/TP0356**

Appendix: 4

ELR/ Bridge No BOK1/283 Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

Bridge/Line Name: **Dalston Junction / Broad Street to Dalton West Junction**

ELR/Bridge No. **BOK1/283**

Brief Description of Existing Bridge:

Dimensions and condition are obtained from site measurements and inspection. (See Jacobs report "VAR9/7410 Assessment Programme – Assessment and Inspection Report – Bridge Ref.: "BOK1/283" – February 2024).

(a) Span Arrangement

The structure is a cut and cover tunnel lying on a slight curve. The square span between the side walls generally remains the same at 7.54m (24' – 9"). The overall length along the centreline is approximately 53m.

(b) Superstructure Type

The majority of the superstructure comprises cast iron girders which span between the sidewalls. The superstructure beneath Dalston Lane comprises 16 concrete encased steel girders. Two span square between the side walls, seven span skew between the side walls but parallel to the road and the remainder span between the side walls and the edge girders and skewed section.

Between the cast iron girders there are 9" thick brick jack arches with varying spans.

The deck between the concrete encased girders is formed from 9" thick concrete encasing 3" x 3" x ½" angles at 12" centres and a metal mesh 1" from the soffit.

At the south end of the tunnel there are 11 ¾" x 6" rolled joists placed at 3' – 8" centres. There were originally 4 ½" thick brick jack arches spanning between the joists. Most of the jack arches have been removed and metal sheets are now visible between the top flanges of the joists.

Two of the cast iron girders have been propped. Both girders had fractures when the railway was still in use. The existing drawings show that they were overbridged with RSJs and the locations of the fractures supported from above. They are now supported by columns formed from

two 8" x 3" channels welded together along the ends of the flanges at the locations of the fractures.

Refer to section 1.3 of the report for further details on the girders and structure arrangement.

(c) Substructure Type

The substructure comprises side walls constructed from brick. There are no longer parapets on the structure and the wingwalls have been completely buried.

(d) Planned highway works/modifications at this site

None.

(e) Road designation class and whether classed as a heavy load route

The structure carries a single lane carriageway with two marked lanes over the structure. There is a bus stop partially supported by the structure on the north side of the carriageway and another bus stop to the west of the structure on the south carriageway. The width of the surfaced carriageway is 10.5m over the tunnel. The remainder of the structure supports pedestrian areas but there are no barriers preventing vehicle loading.

Traffic flow across the bridge is high with regular HGV use and there is a bus route over the structure.

Assessment Criteria

(a) Loadings and Speed

The bridge is to be assessed for standard BE4 loading representative of 24 ton vehicles, with reduced loading being determined where this capacity is not reached.

(b) Codes to be used

BE4 – The Assessment of Highways Bridges for Construction and Use Vehicles, Ministry of Transport 1967 (with amendments to 1969)

BS 153: Parts 3B & 4: 1958 – Steel Girder Bridges, British Standards Institution (with amendments to 12 Sept. 1968)

(c) Proposed Method of Structural Analysis

FORM 'AA' (BRIDGES) **GC/TP0356**

Appendix: 4

ELR/ Bridge No BOK1/283 Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

Capacities of the elements will be calculated using estimates of reduced section sizes where corrosion is present. A general condition factor will not be applied.

Resistance capacities of the cast iron girders will be determined in accordance with BE4 Part I Clause 305(b)(ii). The capacity of the internal girders on the north side of the carriageway will not be enhanced by D/d as the embedment details of the girders are not known.

The concrete encased girders are assumed to be steel due to the likely date of construction. The capacities of the steel girders will be checked using the permissible stress given in BE4 Part I Clause 304(b).

All of the internal girders are considered to be fully restrained by the deck constructions, the effective lengths will therefore be taken as zero.

Loading will be applied by simple statics with the load train applied transversely and longitudinally for maximum effect at the girder location under consideration within the carriageway positioning limits as indicated in BE4 Part I Clause 302.

Determination of the adequacy of the jack arches will be based upon the empirical method described in Bridgeguard 3 Current Information Sheet No. 22 (Pro-forma for the empirical assessment of brick, masonry and concrete jack arches and associated ties).

The substructure will be assessed qualitatively.

FORM 'AA' (BRIDGES) **GC/TP0356**

Appendix: 4

ELR/ Bridge No BOK1/283 Issue: 1

Revision: B (Nov 2000)

APPROVAL IN PRINCIPLE FOR ASSESSMENT

Senior Civil Engineer's Comments

None

Proposed Category for Independent Check 1

Superstructure 1

Substructure 1

Name of Checker suggested if Cat 2 or 3 Not applicable

Category 1

The above assessment, with amendments shown, is approved in principle:

Signed [redacted]

Title Senior Civil Engineer

Date 09/02/2024

Category 2 and 3

The above assessment, with amendments shown, is approved in principle:

Signed .....

Title .....

Date .....

Signed .....

Title .....

Date .....

Appendix C. Form BA

FORM 'BA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A (Dec 2005)

ELR/ Bridge No BOK1/283

CERTIFICATION FOR ASSESSMENT CHECK

Assessment Group: **Jacobs UK Ltd**

Bridge/Line Name: **Dalston Lane / Broad Street to Dalston West Junction**

Category of Check: **1**

ELR/ Bridge No: **BOK1/283**

We certify that reasonable professional skill and care have been used in the assessment of the above structure with a view to securing that:

(1) It has been assessed in accordance with the Approval in Principle as recorded on the Form AA approved on 9th February 2024.

(2) It has been checked for compliance with the following principal British Standards, Codes of Practice, BRB (Residuary) Limited technical notes and Assessment standards:

- BE4 – The Assessment of Highway Bridges for Construction and Use Vehicles 1967 (with amendments to 1969)
- BS153: Parts 3B and 4 – Steel Girder Bridges (with amendments to 12th September 1968)

List any departures from the above and additional methods or criteria adopted, with reference and justification for their acceptance.

None

Category 1

Name	Signature	Date	
.....	[redacted]	.....	Assessor
.....		.....	Assessment Checker
.....		.....	Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

FORM 'BA' (BRIDGES) **GC/TP0356**

Appendix: 4

ELR/ Bridge No BOK1/283 Issue: 1

Revision: A (Dec 2005)

CERTIFICATION FOR ASSESSMENT CHECK

Category 2 and 3 (Note: Category 1 check must also be signed)

(a) Assessment

Name Signature Date

..... Assessor

..... Assessment Checker

..... Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

(b) Check

Name Signature Date

..... Assessor

..... Assessment Checker

..... Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

This Certificate is accepted by.. [redacted]

FORM 'BAA' (BRIDGES)

GC/TP0356
Appendix: 4
Issue: 1
Revision: A (Dec 2005)

ELR/ Bridge No BOK1/283

CERTIFICATION FOR ASSESSMENT CHECK

Notification of Assessment Check

Assessment Group	Jacobs UK Ltd
Bridge Name/Road No.	Dalston Lane / A104
Line Name	Broad Street to Dalston West Junction
ELR Code/Structure No.	BOK1/283

The above structure has been assessed and checked in accordance with Standards which are listed on the appended Form BA. A summary of the results of the assessment in terms of capacity and restrictions are as follows:-

STATEMENT OF CAPACITY

Concrete encased steel girders	Full C&U Loading* 24 tons GVW
Cast iron girders (carriageway)	8 ton axle load
Cast iron girder (pedestrian)	Fail dead loads
Jack Arches	Full C&U Loading* 24 tons GVW
Masonry Substructure	Full C&U Loading* (by qualitative assessment)

*The Motor Vehicles (Construction and Use) Regulations 1969

Recommended Loading Restrictions
Maximum axle weight of 8 tons.

Description of Structural Deficiencies and Recommended Strengthening
The cast iron girders at the north edge of the carriageway are not adequate for unrestricted live loads. There are also potentially overstressed girders due to just the imposed dead loads at the north end. Permanent support to the cast iron girders as a minimum should be considered a priority with complete infill of the structure recommended as the most appropriate solution.

Name	Signature	Date	
....	[redacted]	.....	Assessor
....		.....	Assessment Checker
....		.....	Authorised signatory of the firm of Consulting Engineers to whom Assessor/Checker is responsible.

FORM 'BAA' (BRIDGES) **GC/TP0356**

Appendix: 4

ELR/ Bridge No BOK1/283 Issue: 1

Revision: A (Dec 2005)

CERTIFICATION FOR ASSESSMENT CHECK

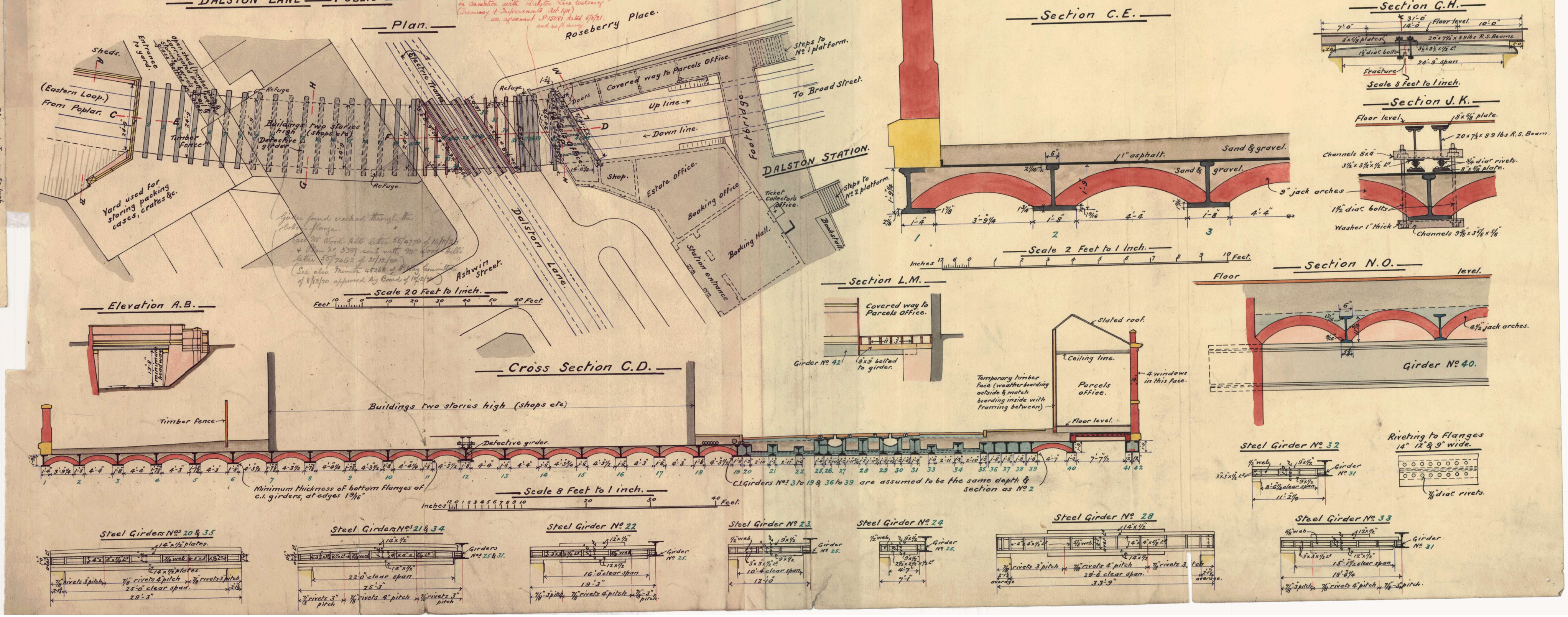
This Certificate is accepted by… [redacted]..

Appendix D. Historical Information

The following pages are North London Rly – City Extension Drawings and an LM&SR Road and Rail Traffic Act drawing.

North London Rly. — City Extension. — Bridge No. 283.

Dalston Lane — Public.



Plan.
Roseberry Place.
Sheds.
Entrance to yard.
(Eastern Loop.)
From Poplar.
Timber Fence.
Yard used for storing packing cases, crates &c.
Refuge.
Buildings two stories high (shops etc)
Defective girder
Electric Trams.
Dalston Lane.
Ashwin Street.
Covered way to Parcels Office.
Up line
Down line.
Footbridge.
To Broad Street.
Steps to No. 1 platform.
Steps to No. 2 platform.
Dalston Station.
Shop.
Estate office.
Booking office.
Booking Hall.
Station entrance
Ticket Collector's Office.
Bookstall.
Scale 20 Feet to 1 inch.
Elevation A.B.
Cross Section C.D.
Timber Fence
Buildings two stories high (shops etc)
Defective girder.
Minimum thickness of bottom flanges of C.I. girders, at edges 1 5/16"
C.I. Girders Nos. 3 to 19 & 36 to 39 are assumed to be the same depth & section as No. 2
Scale 8 Feet to 1 inch.
Section C.E.
1" asphalt.
Sand & gravel.
9" jack arches
Scale 2 Feet to 1 Inch.
Section G.H.
Floor level
20 x 7½ x 89 lbs R.S. Beams.
1⅛" diat. bolts
Fracture
Scale 8 Feet to 1 inch.
Section J.K.
Floor level.
20 x 7½ x 89 lbs R.S. Beam.
1½" diat. bolts.
Washer 1" thick
Section L.M.
Covered way to Parcels Office.
Girder No. 42
Section N.O.
Floor level.
Girder No. 40.
4½" jack arches.
Slated roof.
Ceiling line.
Parcels office.
Floor level.
4 windows in this face.
Temporary timber face (weatherboarding outside & match boarding inside with framing between)
Steel Girders Nos. 20 & 35
Steel Girders Nos. 21 & 34
Steel Girder No. 22
Steel Girder No. 23
Steel Girder No. 24
Steel Girder No. 28
Steel Girder No. 33
Steel Girder No. 32
Riveting to Flanges 14" 12" & 9" wide.

Stress in Tons per Sq. Inch.

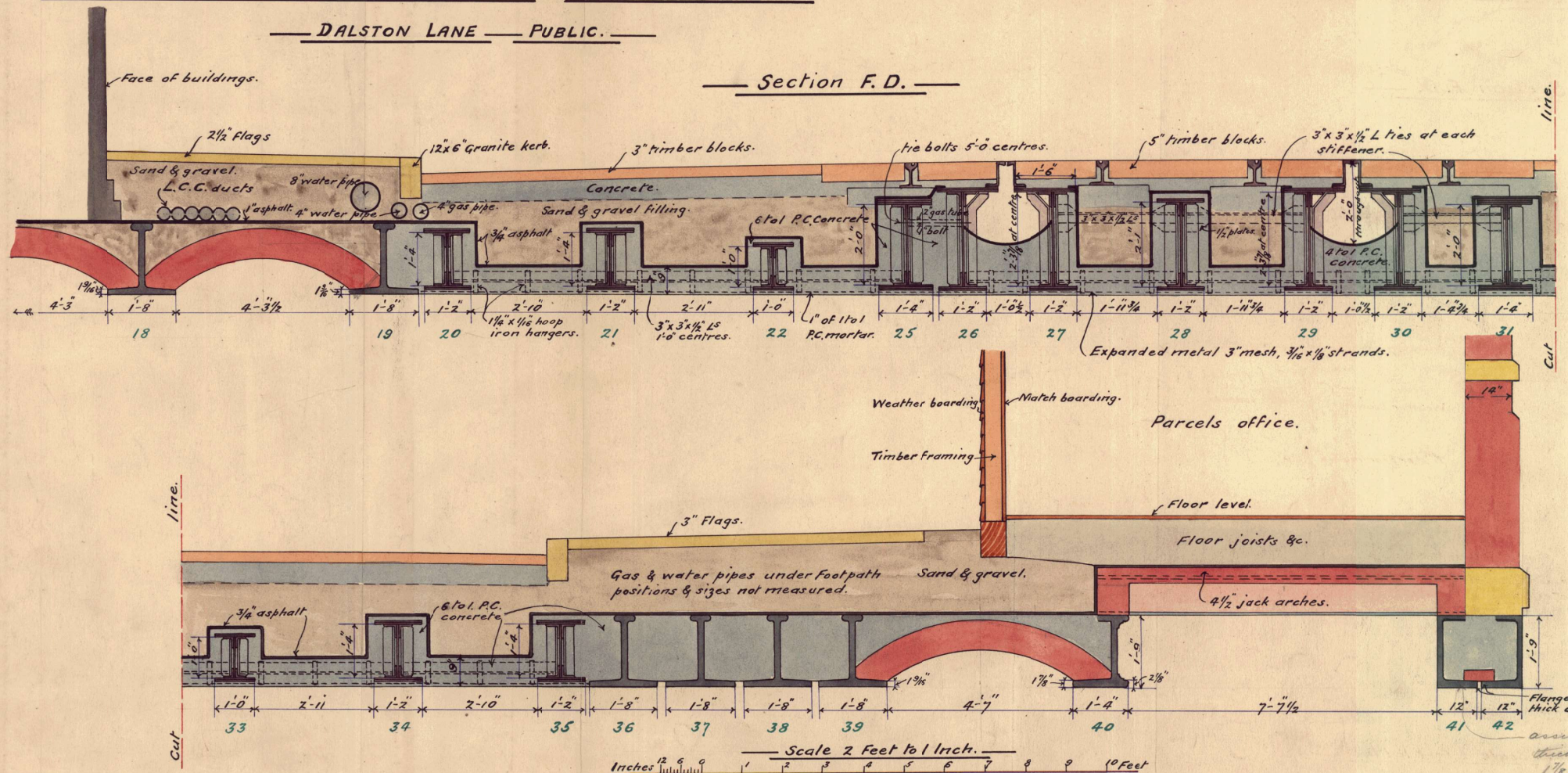
	Motor Vehicle & Trailer: 8 Tons on heaviest axle	6 Tons on heaviest axle	4 Tons on heaviest axle	Motor Vehicle & Trailer (8 tons on heaviest axle) & 56 lbs per Sq. Foot on Footpath	Moving Load of 140 lbs per Sq. Foot: on Parcels Office Floor & Footpath	on Parcels Office Floor & Covered Way	Moving Load of 140 lbs per Sq. Foot
C.I. Girder No. 1	1·90	1·83	1·76	—	—	—	1·77
3	1·62	—	—	—	—	—	1·60
19	—	—	—	1·34	—	—	1·26
40	—	—	—	—	2·18	—	—
41 & 42	—	—	—	—	—	2·68	—

Blue figures refer to folios.

North London Rly. City Extension. — Bridge No. 283.

Dalston Lane — Public.

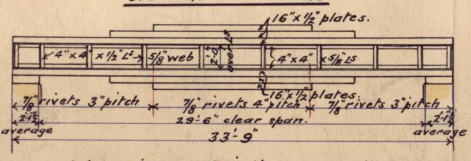
Section F.D.



Scale 2 Feet to 1 Inch.

Inches 12 6 0 1 2 3 4 5 6 7 8 9 10 Feet

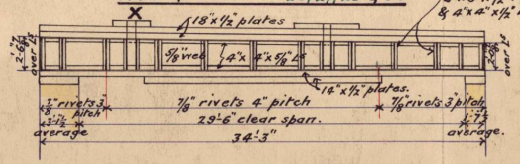
Steel Girder No. 25



Note:- Girder No. 31 is the same as No. 25 excepting that the position of stiffeners & girder connections are different.

Riveting to Flanges.

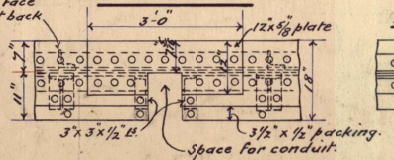
Steel Girders Nos. 26, 27, 29 & 30



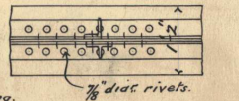
Scale 8 Feet to 1 Inch.

Inches 12 0 1 2 3 4 5 6 7 8 9 10 20 30 Feet

Plan at X

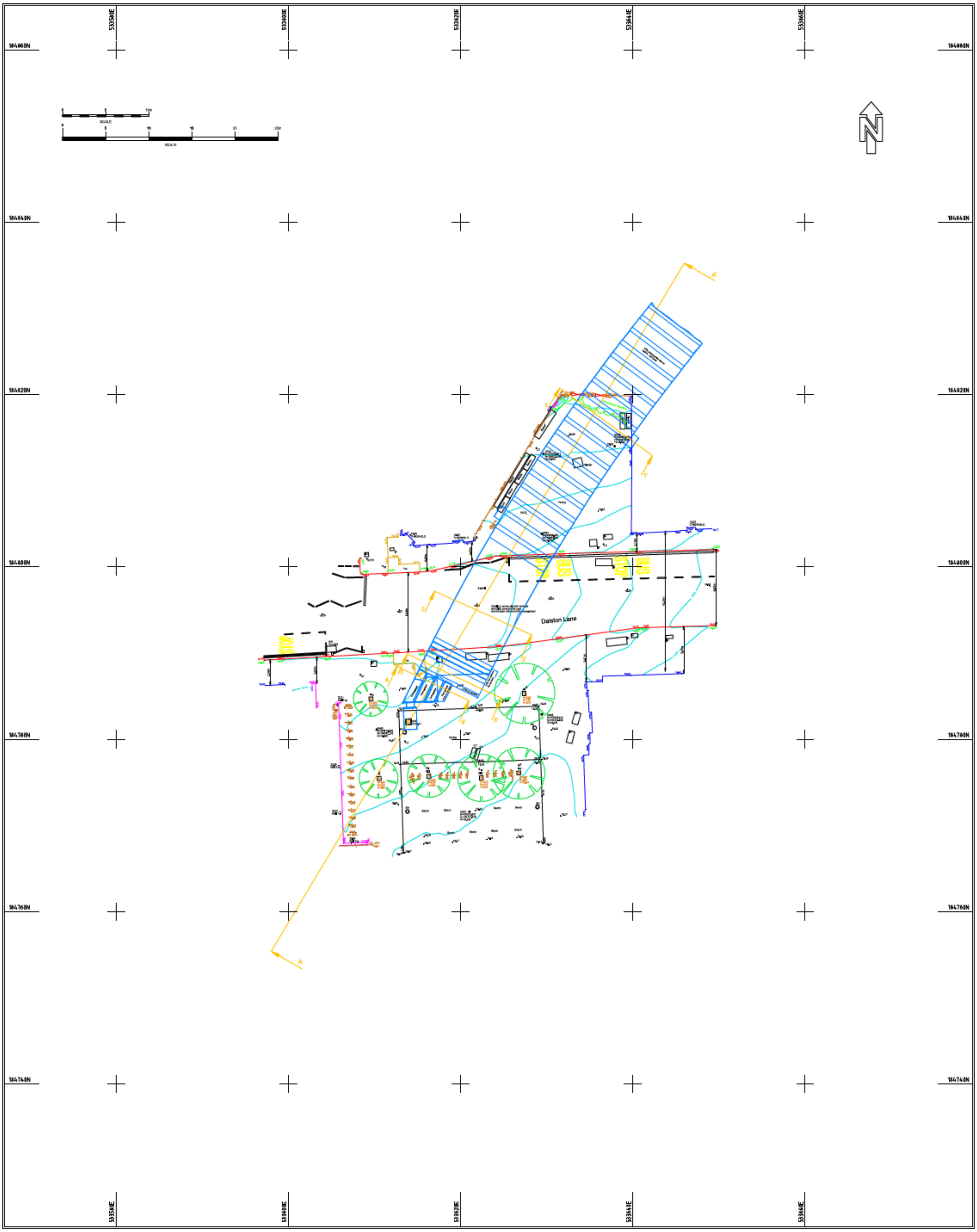


Riveting to Flanges.



Appendix E. Survey Sketches

The following drawings are from a topographical survey undertaken by Central Alliance on behalf on AMCO



ABBREVIATIONS

AC	Asbestos Cement	FS	Flag Staff	SA	Soakaway
ACU	Air Conditioning Unit	G	Gully	SC	Speed Camera
AR	Assumed Route	GPR	GPR Investigation	SF	Safety Force
AV	Air Valve	GV	Gas Valve	[illegible]	[illegible]
[illegible]	[illegible]	HR	Hand Rail	SL	Soffit Level
BD	Back Drop	IC	Inspection Cover	SP	Sign Post
BL	Bed Level	IL	Invert Level	SR	Steel Railings
BH	Borehole	IR	Iron Rail Fence	SS	Structure Support
Bk	Brick	KO	Kerb Outlet	ST	Stop Tap
BL	Basement Light	LB	Letter Box	Stn	Survey Station
BO	Bollard	LC	Lighting Column	SV	Stop Valve
[illegible]	[illegible]	LH	Lamp Hole	SVP	Soil Vent Pipe
BS	Bus Stop	LOR	Loss Of Reflection	SW	Stone Wall
BT	British Telecom Cover	LOS	Loss Of Signal	Tac	Tactile Paving
BWF	Barbed Wire Fence	M/C	Multiple Cables	TCB	Telephone Call Box
Cam	Camera	MH	Manhole Cover	TFR	Taken From Records
CAT	Catenary Level	Mkr	Marker Post	TH	Trial Hole/Pit
CB	Close Boarded Fence	MP	Multiple Positions	TOW	Top Of Wall
CC	Control Cabinet	NFI	No Further Information	TP	Telegraph Pole
[illegible]	[illegible]	NP	Name Plate	TS	Traffic Signals
CIF	Corrugated Iron Fence	NPV	No Pipes Visible	UTGA	Unable to Gain Access
CL	Cover Level	OSA	Off Survey Area	UTL	Unable to Locate
CL	Chain Link Fence	P	Post	UTR	Unable to Raise
Co	Concrete	PE	Polyethylene	UTS	Unable to Survey
CP	Catch Pit	PL	Plastic	UTT	Unable to Trace
CpL	Coping Level	PAL	Palisade Fence	VC	Vitrified Clay
CTV	Cable TV	PM	Parking Meter	VDP	Vehicle Detector Pads
CW	Concrete Wall	PRF	Post and Rail Fence	VP	Vent Pipe
[illegible]	[illegible]	[illegible]	[illegible]	VTP	Vertical Pipe
[illegible]	[illegible]	PWF	Post and Wire Fence	WL	Water Level
DSW	Dry Stone Wall	RE	Rodding Eye	WM	Water Meter
EB	Electricity Box	R	Riser	WMF	Wire Mesh Fence
EF	Electric Fence	RL	Rail Level	WO	Water Wash Out
EOT	End of Trace	RP	Reflector Post	WS	Window Sample
EP	Electricity Pole	RS	Road Sign	WV	Wheel Valve
ES	Earth Rod	RWP	Rain Water Pipe		
FFL	Finished Floor Level	RtW	Retaining Wall		
FH	Fire Hydrant	S	Stump		

TOPOGRAPHICAL LEGEND

- Building
- Building Canopy
- Building Overhead
- Surface Edge
- Road Edge
- Road Kerb Channel
- Banking
- Fence
- Wall
- Structure
- Structure Overhead
- Structure Underground
- Vegetation Extents
- Drainage Channel
- Contour Line
- Dimension

GRID: ORDNANCE SURVEY Related to OS Pseudo 1-1 with Origin at OAKL.	DATUM: ORDNANCE SURVEY Related to OS Network Reference Stations by VRS(RTK) observations.

CLIENT:
Amalgamated Construction Limited
Renew Holdings plc
3175 Century Way, Thorpe Park
Leeds LS15 8ZB

SITE LOCATION:
Dalston Lane
London E8 3DF

SURVEY TITLE:
Line and level survey

SURVEYED BY:	DATE:	DRAWING NUMBER:	
MK / RAC	Dec 23	2382364_P	
DRAWN BY:	DATE:	SCALE:	
LS / KS	Jan 23	1:200 @ A1	
APPROVED BY:	DATE:	SHEET NUMBER:	REV:
MC	Jan 23	1 of 3 A2 Port	

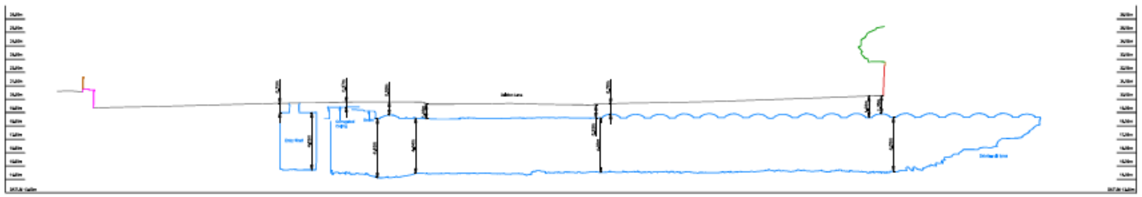
REV.	DETAILS	BY	DATE

CENTRAL ALLIANCE
GROUND ENGINEERING TECHNICAL SERVICES

RSK

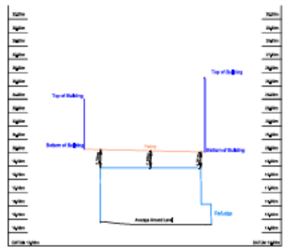
Tel: (0)1924 229899
Email: info@central-alliance.co.uk
Web: www.central-alliance.co.uk
Alliance House, South Park Way, Wakefield 41 Business Park, Wakefield, WF2 0XJ

LONG SECTION

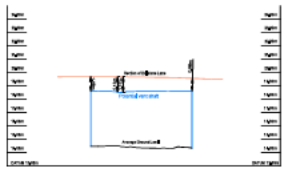


Section A - A' North to South

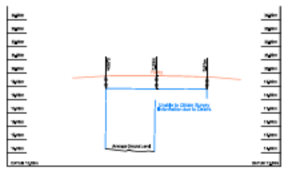
CROSS SECTIONS



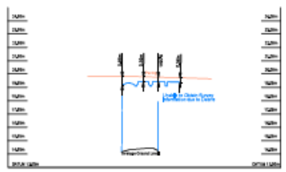
Section 1 - 1' West to East



Section 2 - 2' West to East



Section 3 - 3' West to East



Section 4 - 4' West to East

PROFILE LEGEND

- Building
- Ground
- Gate
- Fence
- Structure Underground
- Wall
- Vegetation Extents
- Dimension

ABBREVIATIONS

REV.	DETAILS	BY	DATE

GRID: ORDNANCE SURVEY Related to OS Pseudo fed with Origin at CAE

DATUM: ORDNANCE SURVEY Related to OS Network Reference Stations by VRS(RTK) observations.

CENTRAL ALLIANCE
GROUND ENGINEERING TECHNICAL SERVICES

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Alliance House, South Park Way, Wakefield 41 Business Park, Wakefield, WF2 0XJ

CLIENT:
Amalgamated Construction Limited
Renew Holdings plc
3175 Century Way, Thorpe Park
Leeds LS15 8ZB

SITE LOCATION:
Dalston Lane
London E8 3DF

SURVEY TITLE:
Line and level survey
Profiles

SURVEYED BY:	DATE:	DRAWING NUMBER:	
MK / RAC	Dec 23	2382364_P	
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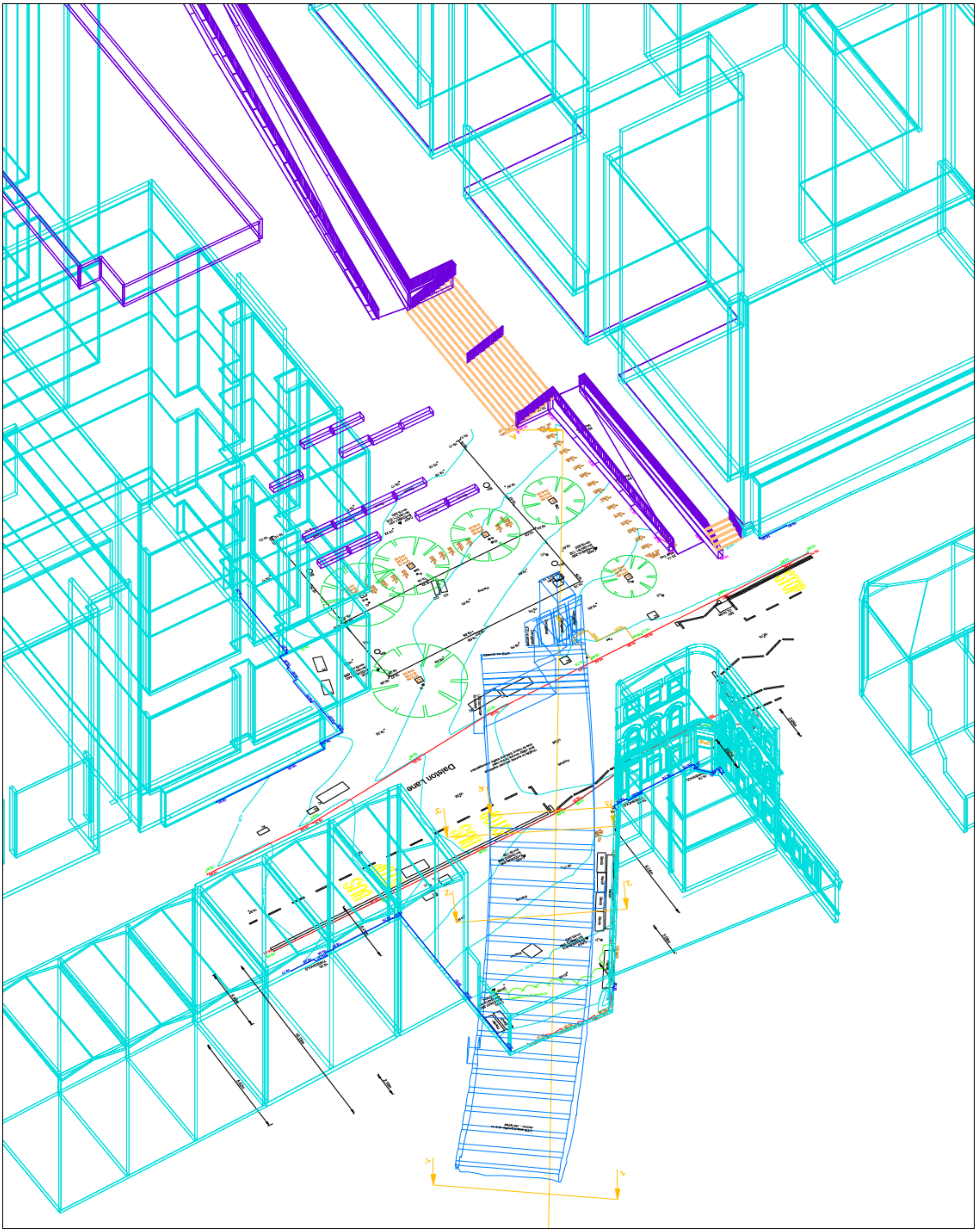
LS / KS	Jan 23	1:200 @ A1	
APPROVED BY:	DATE:	SHEET NUMBER:	REV:
MC	Jan 23	2 of 3 A1	



ABBREVIATIONS

AC	Asbestos Cement	FS	Flag Staff	SA	Soakaway
ACU	Air Conditioning Unit	G	Gully	SC	Speed Camera
AR	Assumed Route	GPR	GPR Inconclusive	SF	Safety Fence
AV	Air Valve	GV	Gas Valve	SI	Soul Iron
BB	Belisha Beacon	HR	Hand Rail	SL	Soffit Level
BD	Back Drop	IC	Inspection Cover	SP	Sign Post
BdL	Bed Level	IL	Invert Level	SR	Steel Railings
BH	Borehole	IRF	Iron Rail Fence	SS	Structure Support
Bk	Brick	KO	Kerb Outlet	ST	Stop Tap
BL	Basement Light	LB	Letter Box	Stn	Survey Station
BO	Bollard	LC	Lighting Column	SV	Stop Valve
Br	Brick	LH	Lamp Hole	SVP	Soil Vent Pipe
BS	Bus Stop	LOR	Loss Of Reflection	SW	Stone Wall
BT	British Telecom Cover	LOS	Loss Of Signal	Tac	Tactile Paving
BWF	Barbed Wire Fence	M/C	Multiple Cables	TCB	Telephone Call Box
Cam	Camera	MH	Manhole Cover	TFR	Taken From Records
CAT	Catenary Level	Mkr	Marker Post	TH	Trial Hole / Pit
CB	Close Boarded Fence	MP	Mic Positions	TOW	Top Of Wall
CC	Control Cabinet	NFI	No Further Information	TP	Telegraph Pole
CI	Cast Iron	NP	Name Plate	TS	Traffic Signals
CIF	Corrugated Iron Fence	NPV	No Pipes Visible	UTGA	Unable to Gain Access
CL	Cover Level	OSA	Off Survey Area	UTL	Unable to Locate
CLF	Chain Link Fence	P	Post	UTR	Unable to Raise
Co	Concrete	PB	Phonebox	UTS	Unable to Survey
CP	Catch Pit	PL	Planter	UTT	Unable to Trace
CpL	Coping Level	PL	Palisade Fence	VC	Vitrified Clay
CTV	Cable TV	PM	Parking Meter	VDP	Vehicle Detector Pads
CW	Concrete Wall	PRF	Post and Rail Fence	VP	Vent Pipe
D	Double	PWC	[illegible]	VTP	Vertical Pipe
DI	Dilapidated	PWF	Post and Wire Fence	WL	Water Level
DSW	Dry Stone Wall	RE	Rodding Eye	WM	Water Meter
EB	Electricity Box	R	Riser	WMF	Wire Mesh Fence
EF	Electric Fence	RL	Rail Level	WO	Water Wash Out
EOT	End of Trace	RP	Reflector Post	WS	Window Sample
EP	Electricity Pole	RS	Road Sign	WV	Wind Vane
ER	Earth Rod	RWP	Rain Water Pipe		
FFL	Finished Floor Level	RW	Retaining Wall		
FH	Fire Hydrant	S	Stump		

DISCLAIMER:

Building lines obtained by conventional survey represent the footprint of the building.
3D model shows general view of building facade as per LOD 2.

TOPOGRAPHICAL LEGEND

- Building 3D
- Structure 3D
- Building
- Building Canopy
- Building Overhead
- Surface Edge
- Road Edge
- Road Kerb Channel
- Banking
- Fence
- Wall
- Structure
- Structure Overhead
- Structure Underground
- Vegetation Extents
- Drainage Channel
- Contour Line
- Dimension

GRID: N/A
DATUM: N/A

CLIENT:
Amalgamated Construction Limited
Renew Holdings plc
3175 Century Way, Thorpe Park
Leeds LS15 8ZB

SITE LOCATION:
Dalston Lane
London E8 3DF

SURVEY TITLE:
Line and level survey
3D Perspective

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Wakefield, WF2 0XJ

Appendix F. Calculations

CALCULATION COVER SHEET

Jacobs
York

Project Title: HRE Assessment Programme			Calc. No.: 0451956
Job No:	B38380BA		File: VAR9/7410
Project Manager	[redacted]	Subject:	**BOK1/283**
Assessor			Dalston Lane, London
Project Group	31200		BE4 Assessment

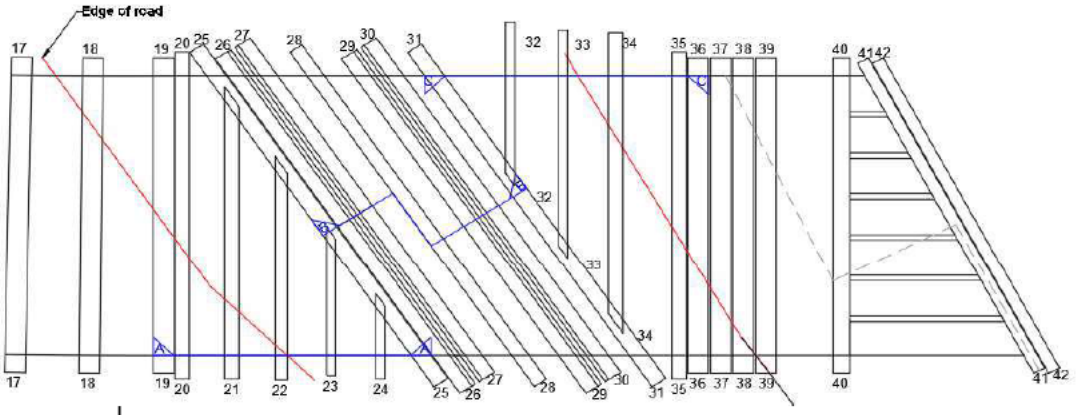
	Total Sheets	Made by	Date	Checked by	Date	Reviewed by	Date		
Original	116	[redacted]	Mar-25	[redacted]	Mar-25	[redacted]	Mar-25		
Rev									
Rev									
Rev									
Rev									
Rev									

Superseded by Calculation No. Date

For assessment criteria, refer to Approval in Principle (Form AA) document

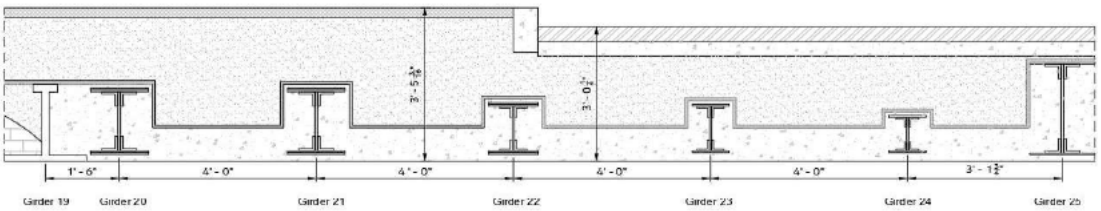
Jacobs				CALCULATION SHEET	
Office	York Office	**Page No.**	1	**Calc No.**	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	**Calcs by**		**Date**	
Section	Sketches	**Checker**		**Date**	

Girder layout at south end (under road)

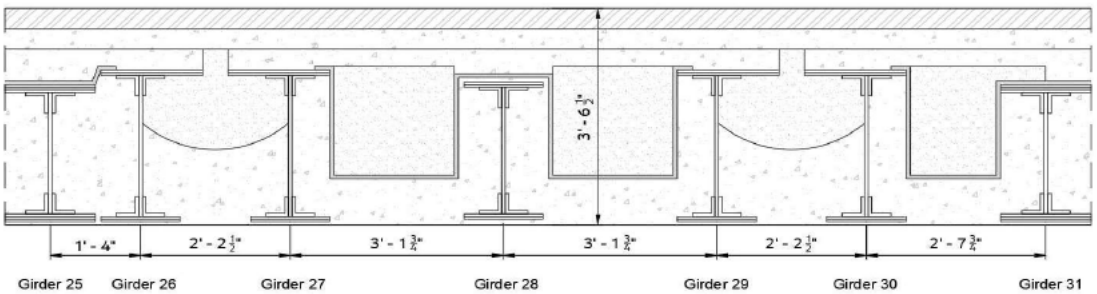


The following sections show the assumed deck make up based on the available historical information assuming voids have been filled with miscellaneous fill and the metal tramline rails removed.

Section A-A

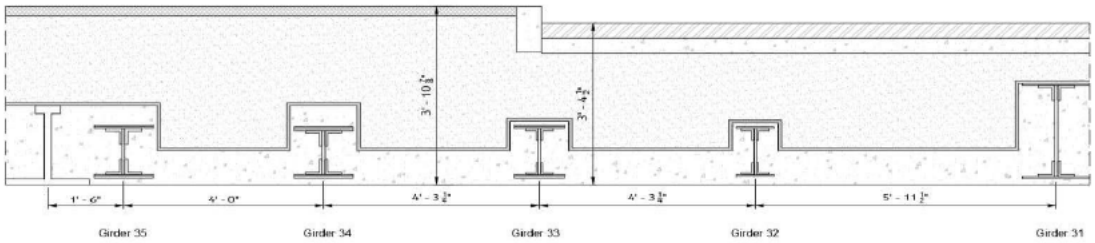


Section B-B



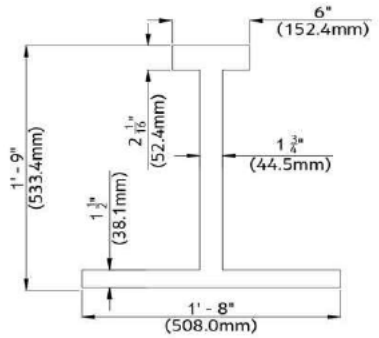
Jacobs	CALCULATION SHEET				
Office	York Office	**Page No.**	2	**Calc No.**	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	**Calcs by**		**Date**	
Section	Sketches	**Checker**		**Date**	

Section C-C



Jacobs			CALCULATION SHEET		
Office	York Office	Page No.	3	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Section Properties	Checker		Date	Mar-25

Cast Iron Internal Girders



Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	6.00	2.06	12.4	1.03	12.76	1779.57	4.39
Web	1.75	17.44	30.5	10.78	329.00	153.36	773.23
Flange	20.00	1.50	30.0	20.25	607.50	1566.86	5.63
		Net Area	72.9		949.26	3499.79	783.24

Depth of full section	D	= 21.00	in
Depth of web	dwe	= 17.44	in
Distance to NA from top of section	yt	= 13.02	in
Distance to NA from bottom of section	yb	= 7.98	in
Second moment of area of section	Ixx	= 4283.03	in⁴
Elastic section modulus (top flange)	Zxc	= 328.88	in³
Elastic section modulus (bott. flange)	Zxt	= 536.93	in³

Corroded section properties (3mm SL to soffit and edges of bottom flange)

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	6.00	2.06	12.4	1.03	12.76	1691.71	4.39
Web	1.75	17.44	30.5	10.78	329.00	115.09	773.23
Flange	19.76	1.38	27.3	20.19	551.44	1523.04	4.35
		Net Area	70.2		893.20	3329.84	781.96

Depth of full section	D	= 20.88	in
Depth of web	dwe	= 17.44	in
Distance to NA from top of section	yt	= 12.72	in
Distance to NA from bottom of section	yb	= 8.16	in
Second moment of area of section	Ixx	= 4111.81	in⁴
Elastic section modulus (top flange)	Zxc	= 323.17	in³
Elastic section modulus (bott. flange)	Zxt	= 503.98	in³

Jacobs		CALCULATION SHEET			
Office	York Office	Page No.	4	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	KD	Date	Mar-25
Section	Section Properties	Checker	JLR	Date	Mar-25

The girder will also be checked at third span.
Using linear interpolation to estimate the depth of the girder

Depth at support	=	16.625	in
Girder span	=	297	in
Depth at third span	=	19.5	in

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	6.00	2.06	12.4	1.03	12.76	1535.02	4.39
Web	1.75	15.94	27.9	10.03	279.78	127.42	590.36
Flange	20.00	1.50	30.0	18.75	562.50	1299.42	5.63
		Net Area	70.3		855.04	2961.86	600.37

Depth of full section	D	= 19.50	in
Depth of web	dwe	= 15.94	in
Distance to NA from top of section	yt	= 12.17	in
Distance to NA from bottom of section	yb	= 7.33	in
Second moment of area of section	Ixx	= 3562.23	in⁴
Elastic section modulus (top flange)	Zxc	= 292.74	in³
Elastic section modulus (bott. flange)	Zxt	= 485.89	in³

Corroded section properties

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	6.00	2.06	12.4	1.03	12.76	1457.28	4.39
Web	1.75	15.94	27.9	10.03	279.78	95.63	590.36
Flange	19.76	1.38	27.3	18.69	510.48	1265.84	4.35
		Net Area	67.6		803.01	2818.75	599.09

Depth of full section	D	= 19.38	in
Depth of web	dwe	= 15.94	in
Distance to NA from top of section	yt	= 11.88	in
Distance to NA from bottom of section	yb	= 7.50	in
Second moment of area of section	Ixx	= 3417.85	in⁴
Elastic section modulus (top flange)	Zxc	= 287.63	in³
Elastic section modulus (bott. flange)	Zxt	= 455.78	in³

Jacobs		CALCULATION SHEET			
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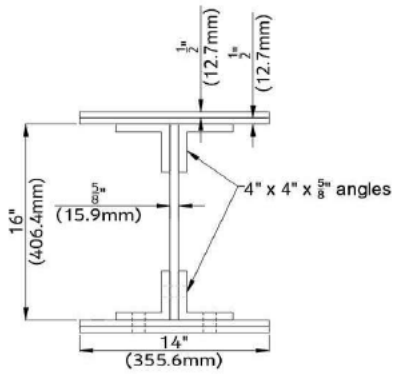
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Section Properties	Checker	[redacted]	Date	Mar-25

Girders 20, 21, 34 and 35 at Midspan



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	14.00	1.00	14.00	0.50	7.00	903.35	1.17
Angle H	8.63	0.63	5.39	1.31	7.08	281.02	0.18
Angle V	1.88	3.38	6.33	3.31	20.96	172.45	6.01
Web	0.63	8.00	5.00	9.00	45.00	1.09	26.67
Angle V	1.88	3.38	6.33	14.69	92.94	239.71	6.01
Angle H	8.63	0.63	5.39	16.69	89.96	358.48	0.18
Flange	14.00	1.00	14.00	17.50	245.00	1125.76	1.17
Rivets	-1.88	1.63	-3.05	17.19	-52.37	-228.22	-0.67
		Net Area	53.39		455.57	2853.64	40.69
		Gross Area	56.44				

Depth of full section	D	=	18.0	in
Depth of web panel	dw	=	16.0	in
Depth of web panel between ends of angles	dwe	=	8.0	in
Distance to NA from top of section	yt	=	8.5	in
Distance to NA from bottom of section	yb	=	9.5	in
Second moment of area of section	Ixx	=	2894.34	in⁴
Elastic section modulus (top flange)	Zxc	=	339.20	in³
Elastic section modulus (bott. flange)	Zxt	=	305.72	in³
Radius of Gyration	Rx	=	7.4	in

Girders 20 and 35 have a 12 in deep web plate at support
Girders 21 and 34 have a 11.5 in deep web plate at support

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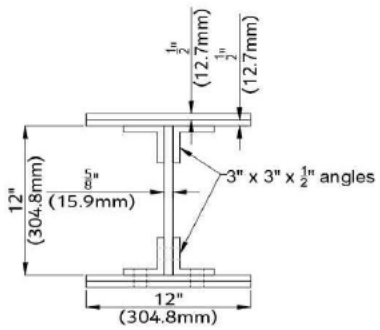
Section	Section Properties	Checker	[redacted]	Date	Mar-25

Girders 22 and 33



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	12.00	1.00	12.00	0.50	6.00	440.26	1.00
Angle H	6.63	0.50	3.31	1.25	4.14	93.30	0.07
Angle V	1.63	2.50	4.06	2.75	11.17	58.88	2.12
Web	0.63	6.00	3.75	7.00	26.25	0.74	11.25
Angle V	1.63	2.50	4.06	11.25	45.70	89.47	2.12
Angle H	6.63	0.50	3.31	12.75	42.23	127.04	0.07
Flange	12.00	1.00	12.00	13.50	162.00	578.45	1.00
Rivets	-1.88	1.50	-2.81	13.25	-37.27	-125.99	-0.53
		Net Area	39.69		260.23	1262.15	17.09
		Gross Area	42.50				

Depth of full section	D	=	14.0	in
Depth of web panel	dw	=	12.0	in
Depth of web panel between ends of angles	dwe	=	6.0	in
Distance to NA from top of section	yt	=	6.6	in
Distance to NA from bottom of section	yb	=	7.4	in
Second moment of area of section	Ixx	=	1279.24	in⁴
Elastic section modulus (top flange)	Zxc	=	195.09	in³
Elastic section modulus (bott. flange)	Zxt	=	171.87	in³
Radius of Gyration	Rx	=	5.7	in

Jacobs		CALCULATION SHEET			
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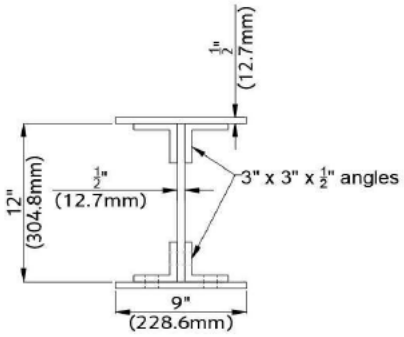
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Section Properties	Checker		Date	Mar-25

Girders 23 and 32



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	9.00	0.50	4.50	0.25	1.13	150.53	0.09
Angle H	6.50	0.50	3.25	0.75	2.44	90.73	0.07
Angle V	1.50	2.50	3.75	2.25	8.44	53.69	1.95
Web	0.50	6.00	3.00	6.50	19.50	0.65	9.00
Angle V	1.50	2.50	3.75	10.75	40.31	83.41	1.95
Angle H	6.50	0.50	3.25	12.25	39.81	125.59	0.07
Flange	9.00	0.50	4.50	12.75	57.38	202.99	0.09
Rivets	-1.88	1.00	-1.88	12.50	-23.44	-78.40	-0.16
		Net Area	24.13		145.56	629.19	13.07
		Gross Area	26.00				

Depth of full section	D	=	13.0	in
Depth of web panel	dw	=	12.0	in
Depth of web panel between ends of angles	dwe	=	6.0	in
Distance to NA from top of section	yt	=	6.0	in
Distance to NA from bottom of section	yb	=	7.0	in
Second moment of area of section	Ixx	=	642.26	in⁴
Elastic section modulus (top flange)	Zxc	=	106.45	in³
Elastic section modulus (bott. flange)	Zxt	=	92.20	in³
Radius of Gyration	Rx	=	5.2	in

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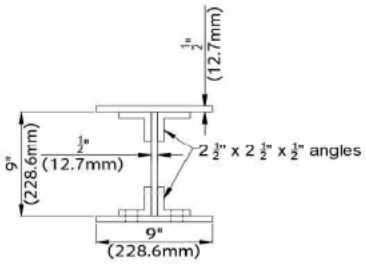
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Section Properties	Checker		Date	Mar-25

Girder 24



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	9.00	0.50	4.50	0.25	1.13	84.80	0.09
Angle H	5.50	0.50	2.75	0.75	2.06	40.57	0.06
Angle V	1.50	2.00	3.00	2.00	6.00	20.14	1.00
Web	0.50	4.00	2.00	5.00	10.00	0.33	2.67
Angle V	1.50	2.00	3.00	8.00	24.00	34.87	1.00
Angle H	5.50	0.50	2.75	9.25	25.44	59.69	0.06
Flange	9.00	0.50	4.50	9.75	43.88	119.77	0.09
Rivets	-1.88	1.00	-1.88	9.50	-17.81	-45.19	-0.16
		Net Area	20.63		94.69	314.99	4.81
		Gross Area	22.50				

Depth of full section	D	=	10.0	in
Depth of web panel	dw	=	9.0	in
Depth of web panel between ends of angles	dwe	=	4.0	in
Distance to NA from top of section	yt	=	4.6	in
Distance to NA from bottom of section	yb	=	5.4	in
Second moment of area of section	Ixx	=	319.80	in⁴
Elastic section modulus (top flange)	Zxc	=	69.66	in³
Elastic section modulus (bott. flange)	Zxt	=	59.12	in³
Radius of Gyration	Rx	=	3.9	in

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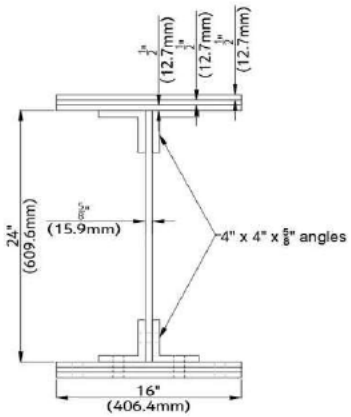
Girders 25 and 31 at Midspan



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	16.00	1.50	24.00	0.75	18.00	3519.76	4.50
Angle H	8.63	0.63	5.39	1.81	9.77	657.93	0.18
Angle V	1.88	3.38	6.33	3.81	24.13	518.02	6.01
Web	0.63	16.00	10.00	13.50	135.00	4.09	213.33
Angle V	1.88	3.38	6.33	23.19	146.73	674.92	6.01
Angle H	8.63	0.63	5.39	25.19	135.78	819.17	0.18
Flange	16.00	1.50	24.00	26.25	630.00	4302.89	4.50
Rivets	-1.88	2.13	-3.98	25.94	-103.34	-681.39	-1.50
		Net Area	77.45		996.06	9815.40	233.20
		Gross Area	81.44				

Depth of full section	D	=	27.0	in
Depth of web panel	dw	=	24.0	in
Depth of web panel between ends of angles	dwe	=	16.0	in
Distance to NA from top of section	yt	=	12.9	in
Distance to NA from bottom of section	yb	=	14.1	in
Second moment of area of section	Ixx	=	10048.60	in⁴
Elastic section modulus (top flange)	Zxc	=	781.37	in³
Elastic section modulus (bott. flange)	Zxt	=	710.66	in³
Radius of Gyration	Rx	=	11.4	in

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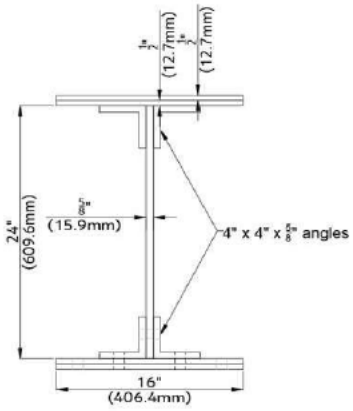
Girders 25 and 31 at first curtailment point



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	16.00	1.00	16.00	0.50	8.00	2267.59	1.33
Angle H	8.63	0.63	5.39	1.31	7.08	663.26	0.18
Angle V	1.88	3.38	6.33	3.31	20.96	523.15	6.01
Web	0.63	16.00	10.00	13.00	130.00	3.54	213.33
Angle V	1.88	3.38	6.33	22.69	143.57	669.10	6.01
Angle H	8.63	0.63	5.39	24.69	133.08	813.25	0.18
Flange	16.00	1.00	16.00	25.50	408.00	2743.74	1.33
Rivets	-1.88	1.63	-3.05	25.19	-76.74	-497.85	-0.67
		Net Area	62.39		773.94	7185.78	227.69
		Gross Area	65.44				

Depth of full section	D	=	26.0	in
Depth of web panel	dw	=	24.0	in
Depth of web panel between ends of angles	dwe	=	16.0	in
Distance to NA from top of section	yt	=	12.4	in
Distance to NA from bottom of section	yb	=	13.6	in
Second moment of area of section	Ixx	=	7413.48	in⁴
Elastic section modulus (top flange)	Zxc	=	597.63	in³
Elastic section modulus (bott. flange)	Zxt	=	545.30	in³
Radius of Gyration	Rx	=	10.9	in

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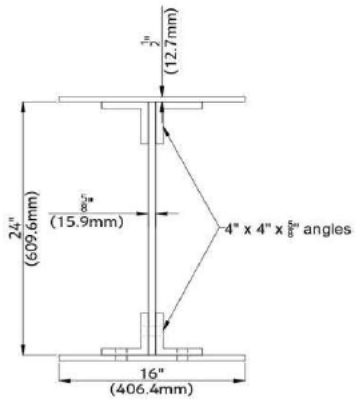
Girders 25 and 31 at second curtailment point



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	16.00	0.50	8.00	0.25	2.00	1098.48	0.17
Angle H	8.63	0.63	5.39	0.81	4.38	670.83	0.18
Angle V	1.88	3.38	6.33	2.81	17.80	530.44	6.01
Web	0.63	16.00	10.00	12.50	125.00	2.83	213.33
Angle V	1.88	3.38	6.33	22.19	140.41	660.90	6.01
Angle H	8.63	0.63	5.39	24.19	130.39	804.91	0.18
Flange	16.00	0.50	8.00	24.75	198.00	1307.05	0.17
Rivets	-1.88	1.13	-2.11	24.44	-51.55	-327.99	-0.22
		Net Area	47.33		566.42	4747.46	225.81
		Gross Area	49.44				

Depth of full section	D	=	25.0	in
Depth of web panel	dw	=	24.0	in
Depth of web panel between ends of angles	dwe	=	16.0	in
Distance to NA from top of section	yt	=	12.0	in
Distance to NA from bottom of section	yb	=	13.0	in
Second moment of area of section	Ixx	=	4973.27	in⁴
Elastic section modulus (top flange)	Zxc	=	415.55	in³
Elastic section modulus (bott. flange)	Zxt	=	381.62	in³
Radius of Gyration	Rx	=	10.3	in

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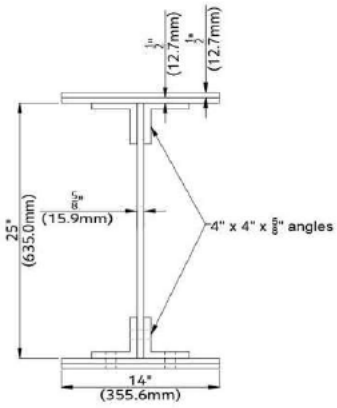
Girder 28 at Midspan



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	14.00	1.00	14.00	0.50	7.00	2133.57	1.17
Angle H	8.63	0.63	5.39	1.31	7.08	716.94	0.18
Angle V	1.88	3.38	6.33	3.31	20.96	575.02	6.01
Web	0.63	17.00	10.63	13.50	143.44	4.56	255.89
Angle V	1.88	3.38	6.33	23.69	149.90	743.94	6.01
Angle H	8.63	0.63	5.39	25.69	138.47	889.08	0.18
Flange	14.00	1.00	14.00	26.50	371.00	2610.44	1.17
Rivets	-1.88	1.63	-3.05	26.19	-79.79	-542.41	-0.67
		Net Area	59.02		758.05	7131.14	269.91
		Gross Area	62.06				

Depth of full section	D	=	27.0	in
Depth of web panel	dw	=	25.0	in
Depth of web panel between ends of angles	dwe	=	17.0	in
Distance to NA from top of section	yt	=	12.8	in
Distance to NA from bottom of section	yb	=	14.2	in
Second moment of area of section	Ixx	=	7401.05	in⁴
Elastic section modulus (top flange)	Zxc	=	576.18	in³
Elastic section modulus (bott. flange)	Zxt	=	522.86	in³
Radius of Gyration	Rx	=	11.2	in

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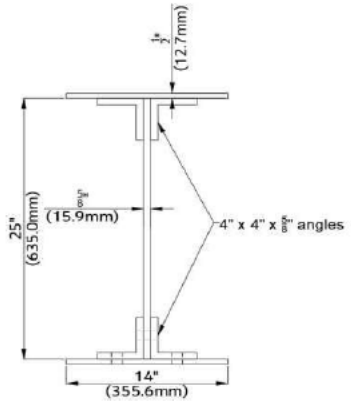
Girder 28 at curtailment point



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	14.00	0.50	7.00	0.25	1.75	1038.31	0.15
Angle H	8.63	0.63	5.39	0.81	4.38	727.44	0.18
Angle V	1.88	3.38	6.33	2.81	17.80	585.22	6.01
Web	0.63	17.00	10.63	13.00	138.13	3.46	255.89
Angle V	1.88	3.38	6.33	23.19	146.73	732.44	6.01
Angle H	8.63	0.63	5.39	25.19	135.78	877.47	0.18
Flange	14.00	0.50	7.00	25.75	180.25	1242.13	0.15
Rivets	-1.88	1.13	-2.11	25.44	-53.66	-356.95	-0.22
		Net Area	45.95		571.16	4849.52	268.32
		Gross Area	48.06				

Depth of full section	D	=	26.0	in
Depth of web panel	dw	=	25.0	in
Depth of web panel between ends of angles	dwe	=	17.0	in
Distance to NA from top of section	yt	=	12.4	in
Distance to NA from bottom of section	yb	=	13.6	in
Second moment of area of section	Ixx	=	5117.84	in⁴
Elastic section modulus (top flange)	Zxc	=	411.76	in³
Elastic section modulus (bott. flange)	Zxt	=	377.12	in³
Radius of Gyration	Rx	=	10.6	in

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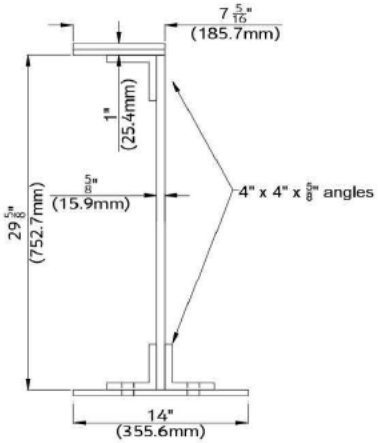
Girders 26, 27, 29 and 30

The girders will be checked at midspan, curtailment points of the additional bottom flange plate and the locations of the cut outs. It is assumed that the west end is the deeper end of the girder.

At west cutout and curtailment point



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	7.31	1.00	7.31	0.50	3.66	1842.40	0.61
Angle H	4.63	0.63	2.89	1.31	3.79	655.65	0.09
Angle V	1.25	3.38	4.22	3.31	13.97	719.62	4.00
Web	0.63	21.63	13.52	15.81	213.72	4.25	526.70
Angle V	1.88	3.38	6.33	28.31	179.17	902.08	6.01
Angle H	8.63	0.63	5.39	30.31	163.40	1047.45	0.18
Flange	14.00	0.50	7.00	30.88	216.13	1472.15	0.15
Rivets	-1.88	1.13	-2.11	30.56	-64.47	-424.71	-0.22
		Net Area	44.55		729.37	6218.90	537.52
		Gross Area	46.66				

Depth of full section	D	=	31.1	in
Depth of web panel	dw	=	29.6	in
Depth of web panel between ends of angles	dwe	=	21.6	in
Distance to NA from top of section	yt	=	16.4	in
Distance to NA from bottom of section	yb	=	14.8	in
Second moment of area of section	Ixx	=	6756.42	in⁴
Elastic section modulus (top flange)	Zxc	=	412.66	in³
Elastic section modulus (bott. flange)	Zxt	=	458.00	in³
Radius of Gyration	Rx	=	12.3	in

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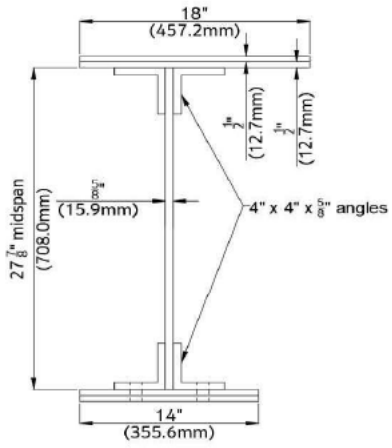
At midspan



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	18.00	1.00	18.00	0.50	9.00	2989.40	1.50
Angle H	8.63	0.63	5.39	1.31	7.08	785.93	0.18
Angle V	1.88	3.38	6.33	3.31	20.96	642.29	6.01
Web	0.63	19.88	12.42	14.94	185.55	29.86	408.90
Angle V	1.88	3.38	6.33	26.56	168.09	1098.50	6.01
Angle H	8.66	0.63	5.41	28.56	154.54	1246.02	0.18
Flange	14.00	1.00	14.00	29.38	411.25	3578.57	1.17
Rivets	-1.88	1.63	-3.05	29.06	-88.55	-748.67	-0.67
		Net Area	64.83		867.92	9621.91	423.26
		Gross Area	67.88				

Depth of full section	D	=	29.9	in
Depth of web panel	dw	=	27.9	in
Depth of web panel between ends of angles	dwe	=	19.9	in
Distance to NA from top of section	yt	=	13.4	in
Distance to NA from bottom of section	yb	=	16.5	in
Second moment of area of section	Ixx	=	10045.18	in⁴
Elastic section modulus (top flange)	Zxc	=	750.36	in³
Elastic section modulus (bott. flange)	Zxt	=	609.25	in³
Radius of Gyration	Rx	=	12.4	in

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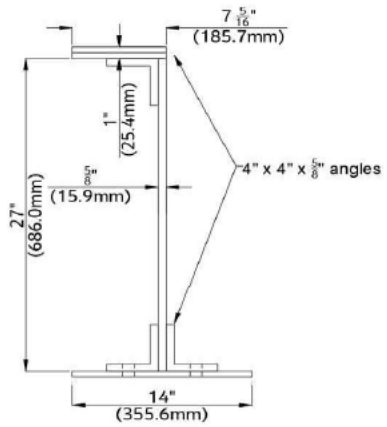
At east cutout



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	7.31	1.00	7.31	0.50	3.66	1540.64	0.61
Angle H	4.63	0.63	2.89	1.31	3.79	542.74	0.09
Angle V	1.25	3.38	4.22	3.31	13.97	577.75	4.00
Web	0.63	19.00	11.88	14.50	172.19	3.15	357.24
Angle V	1.88	3.38	6.33	25.69	162.55	720.78	6.01
Angle H	8.63	0.63	5.39	27.69	149.25	865.69	0.18
Flange	14.00	0.50	7.00	28.25	197.75	1226.15	0.15
Rivets	-1.88	1.13	-2.11	27.94	-58.93	-352.25	-0.22
		Net Area	42.91		644.24	5124.67	368.05
		Gross Area	45.02				

Depth of full section	D	=	28.5	in
Depth of web panel	dw	=	27.0	in
Depth of web panel between ends of angles	dwe	=	19.0	in
Distance to NA from top of section	yt	=	15.0	in
Distance to NA from bottom of section	yb	=	13.5	in
Second moment of area of section	Ixx	=	5492.72	in⁴
Elastic section modulus (top flange)	Zxc	=	365.81	in³
Elastic section modulus (bott. flange)	Zxt	=	407.32	in³
Radius of Gyration	Rx	=	11.3	in

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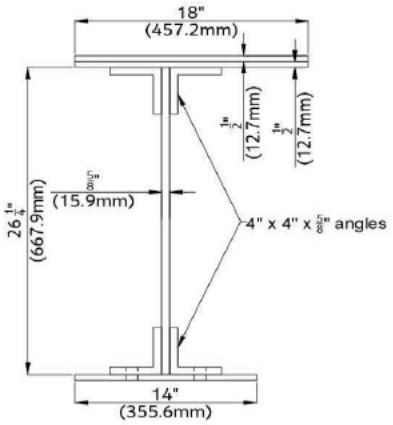
At east curtailment point



Rivets are 7/8" diameter, therefore rivet holes are 15/16" diameter

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Flange	18.00	1.00	18.00	0.50	9.00	708.10	1.50
Angle H	8.63	0.63	5.39	1.31	7.08	160.68	0.18
Angle V	1.88	3.38	6.33	3.31	20.96	75.74	6.01
Web	0.63	7.88	4.92	8.94	43.99	23.08	25.44
Angle V	1.88	3.38	6.33	14.56	92.15	384.06	6.01
Angle H	8.66	0.63	5.41	16.56	89.61	518.62	0.18
Flange	14.00	0.50	7.00	17.13	119.88	750.28	0.15
Rivets	-1.88	1.13	-2.11	16.81	-35.46	-212.65	-0.22
		Net Area	51.27		347.20	2407.91	39.22
		Gross Area	53.38				

Depth of full section	D	=	17.4	in
Depth of web panel	dw	=	15.9	in
Depth of web panel between ends of angles	dwe	=	7.9	in
Distance to NA from top of section	yt	=	6.8	in
Distance to NA from bottom of section	yb	=	10.6	in
Second moment of area of section	Ixx	=	2447.14	in⁴
Elastic section modulus (top flange)	Zxc	=	361.36	in³
Elastic section modulus (bott. flange)	Zxt	=	230.80	in³
Radius of Gyration	Rx	=	6.9	in

Effective Spans

BE4 303(a)

The effective span of a beam shall be taken as the distance between points of support.

303(a)(i)
303(a)(iv)

Where the beam is supported by other beams, the web of the supporting beam.
Where there are no bearing stiffeners and the beam rests directly on masonry, concrete or brick, the reaction shall be assumed to be distributed linearly from a maximum at the front edge of the support to zero at the back of the bearing area.

The effective span should be taken as the distance between the centroids of the bearing pressure diagrams.

The lengths of the bearing areas and steel girders has been taken from the North London Rly. City Extension drawing.

Cast Iron Girders

The length of the bearing areas on the existing drawings as 24 in

Clear span between sidewalls = 297 in

Effective span = 297 + (2/3)24
= 313.0 in

Girders 20 and 35

The length of the bearing areas are 25.5 in

The clear span is 300 in

Effective span = 300 + (2/3)25.5
= 317.0 in

Girders 21 and 34

These girders bear onto the sidewalls and girders 25 and 31 respectively.

Overall length = 303 in
Clear span between sidewall and girder 25/31 flange = 264 in
Length of bearing = 303 - 264 - (16/2)
= 31.0 in

Effective span = 264 + 8 + (31/3)
= 282.33 in

Girder 22

The girder bears onto a sidewall and girder 25

Overall length = 231 in
Clear span between sidewall and girder 25 flange = 192 in

Length of bearing = 231 - 192 - (16/2)
= 31.00 in

Effective Span = 192 + 8.00 + (31/3)
= 210.33 in

Girder 23

The girder bears onto a sidewall and girder 25

Overall length = 154 in
Clear span between sidewall and girder 25 flange = 124 in

Length of bearing = 154 - 124 - (16/2)
= 22.00 in

Effective Span = 124 + 8.00 + (22/3)
= 139.33 in

Girder 24

The girder bears onto a sidewall and girder 25

Overall length = 85 in
Clear span between sidewall and girder 25 flange = 55 in

Length of bearing = 85 - 55 - (16/2)
= 22.00 in

Effective Span = 55 + 8.00 + (22/3)
= 70.33 in

Girders 25, 28 and 31

The length of the bearing areas are 25.5 in

The clear span is 354 in

Effective span = 354 + (2/3)25.5
= 371.0 in

Girders 26, 27, 29 and 30

The lengths of the bearing are different at each end 37.5 in & 19.5 in

Clear span = 354 in

Effective span = 354 + (37.5/3) + (19.5/3)
= 373.0 in

Girder 32

The girder bears onto a sidewall and girder 31

Overall length = 134.25 in
Clear span between sidewall and girder 31 flange = 102.5 in

Length of bearing = 134.25 - 102.5 - (16/2)
= 23.75 in

Effective Span = 102.5 + 8 + (23.75/3)
= 118.42 in

Girder 33

The girder bears onto a sidewall and girder 31

Overall length = 222.25 in
Clear span between sidewall and girder 31 flange = 181.5 in

Length of bearing = 222.25 - 181.5 - (16/2)
= 32.75 in

Effective Span = 181.5 + 8 + (32.75/3)
= 200.42 in

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BE4

Dead Loads

Unit Weights of Materials

Material	lb/cu.ft
Steel	490
Cast Iron	450
Concrete	150
Brickwork	140
Masonry	144
Miscellaneous Fill	135
Macadam (tar)	144

1 ton	=	2240	lb
1 ft	=	12	in
1 sq.ft	=	144	sq.in
1 cu.ft	=	1728	cu.in

Self Weight

Gross midspan used for a conservative assessment

Area of steel girders increased by 12% to account for fixings

Cast Iron Girders

Area of girder	=	72.89	sq.in
Girder self weight UDL	(72.89/144) x 450 =	227.78	lb/ft
	=	0.102	ton/ft

Girders 20, 21, 34 and 35

Area of girder	56.44 x 1.12 =	63.21	sq.in
Girder self weight UDL	(63.21/144) x 490 =	215.09	lb/ft
	=	0.096	ton/ft

Girders 22 and 33

Area of girder	42.50 x 1.12 =	47.60	sq.in
Girder self weight UDL	(47.60/144) x 490 =	161.97	lb/ft
	=	0.072	ton/ft

Girders 23 and 32

Area of girder	26.00 x 1.12 =	29.12	sq.in
Girder self weight UDL	(29.12/144) x 490 =	99.09	lb/ft
	=	0.044	ton/ft

Girder 24

Area of girder	22.50 x 1.12 =	25.20	sq.in
Girder self weight UDL	(25.20/144) x 490 =	85.75	lb/ft
	=	0.038	ton/ft

Girders 25 and 31

Area of girder	81.44 x 1.12 =	91.21	sq.in
Girder self weight UDL	(91.21/144) x 490 =	310.37	lb/ft
	=	0.139	ton/ft

Girders 26, 27, 29 and 30

Area of girder	67.88 x 1.12	=	76.02	sq.in
Girder self weight UDL	(76.02/144) x 490	=	258.70	lb/ft
		=	0.115	ton/ft

Girder 28

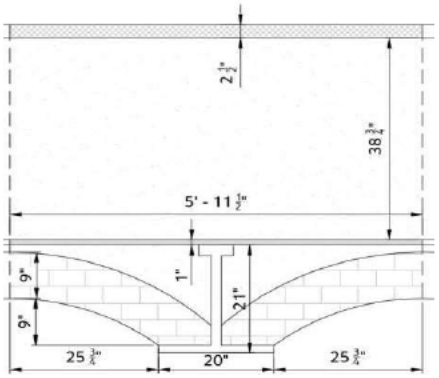
Area of girder	62.06 x 1.12	=	69.51	sq.in
Girder self weight UDL	(69.51/144) x 490	=	236.53	lb/ft
		=	0.106	ton/ft

Girders 1 to 7

The cover levels and deck make up are not known for these girders as there was no access into the Dalston Curve Garden at the north end of the tunnel at the time of the survey and inspection.

Girder 8

Girder 8 will be checked for dead loads as the survey found the fill depth to be the most onerous for the cast iron section.



Paving Stones

Width supported by girder		=	71.5	in
Depth of paving stones (assumed)		=	2.5	in
Area of paving stones	71.50 x 2.5	=	178.75	sq.in
Paving stones UDL	(178.75/144) x 144	=	178.75	lb/ft
		=	0.080	ton/ft

1" Asphalt Layer

Area of asphalt layer		=	71.5	sq.in
Asphalt layer UDL	(71.50/144) x 144	=	71.5	lb/ft
		=	0.032	ton/ft

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Jack Arch

Arch Barrel Thickness			darch=	9.00	in
Arch Barrel Rise			a=	9.00	in
Jack Arch Span			2b=	51.50	in
			b=	25.75	in
Jack Arch Radius	R(Intrados)	$(a^2+b^2)/2a$	=	41.34	in
	R(Extrados)	R(Intrados)+darch	=	50.34	in
$\sin\theta=(b/R(\text{Intrados}))$			θ=	38.53	°
Area of sector		$(2\theta/360) \times \pi \times R(\text{Intrados})^2$	=	1149.10	sq.in
Area of triangle		b(R(Intrados)-a)	=	832.67	sq.in
Area of segment		Area of sector - Area of triangle	Aseg =	316.42	sq.in
Area of jack arch		$(2\theta/360) \times \pi(R(\text{Extrados})^2 - R(\text{Intrados})^2)$	Aarch =	554.84	sq.in

Jack arch UDL	554.84/144 x 140	=	539.43	lb/ft
		=	0.241	ton/ft

Miscellaneous Fill

Area above asphalt layer	38.75 x 71.5	=	2770.6	sq.in
Area between jack arches and asphalt layer				
Total area	71.50 x (2.06 + 17.44)	=	1394.3	sq.in
Area of fill				
Total - area JA - area segment - area web - area top flange		=	480.09	sq.in

Miscellaneous Fill UDL	((480.09 + 2,770.63) / 144) x 135	=	3047.5	lb/ft
		=	1.361	ton/ft

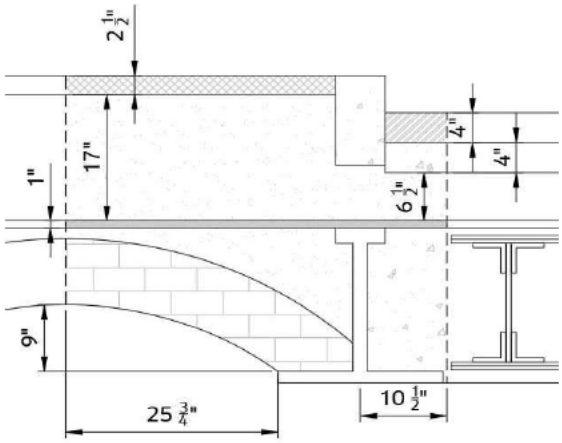
Total UDL		=	1.815	ton/ft

Girder 19

Girder 19 partially supports the carriageway and the pedestrian area to the north. It will be assumed the east half of the girder supports road and the west half supports footway.

The deck makeup of the road has been assumed based on the available historical information

The cross section below shows the girder at midspan.



Jack Arch

Arch Barrel Thickness			darch=	9.00	in
Arch Barrel Rise			a=	9.00	in
Jack Arch Span			2b=	51.50	in
			b=	25.75	in
Jack Arch Radius	R(Intrados)	$(a^2+b^2)/2a$	=	41.34	in
	R(Extrados)	R(Intrados)+darch	=	50.34	in
Sinθ=(b/R(Intrados))			θ=	38.53	°
Area of sector		$(2\theta/360) \times \pi \times R(Intrados)^2$	=	1149.10	sq.in
Area of triangle		b(R(Intrados)-a)	=	832.67	sq.in
Area of segment		Area of sector - Area of triangle	Aseg =	316.42	sq.in
Area of jack arch		$(2\theta/360) \times \pi(R(Extrados)^2 - R(Intrados)^2)$	Aarch =	554.84	sq.in

Jack arch UDL	554.84/144 x 140 x 1/2 =	269.71	lb/ft
	=	0.120	ton/ft

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Jack Arch Backing

The backing has been assumed as miscellaneous fill as indicated on the availble hisorical information as no intrusive investigations into the deck make up were undertaken as part of the inspection.

Girder spacing		=	71.50	in
Depth of fill		=	19.50	in
Area of fill	(71.5 x 19.5) - 554.84 - 316.42	=	522.99	sq.in
Jack Arch Backing UDL	(522.99/144) x 135 x 1/2	=	245.15	lb/ft
		=	0.109	ton/ft

Concrete Infill

Area	(7.5 x 2.0625) + (9.625 x 17.4375) + (0.5 x 1.5)	=	184.05	sq.in
Concrete Infill UDL	(184.05/144) x 150	=	191.72	lb/ft
		=	0.086	ton/ft

1" Asphalt Layer

Width supported by girder		=	46.25	in
Area of asphalt layer		=	46.25	sq.in
Asphalt layer UDL	(46.25/144) x 144	=	46.25	lb/ft
		=	0.021	ton/ft

Pedestrian Area

Width supported by girder		=	46.25	in
Depth of miscellaneous fill		=	17	in
Area of miscellaneous fill	46.25 x 17	=	786.25	sq.in
Miscellanoues fill UDL	(786.25/144) x 135	=	737.11	lb/ft
		=	0.329	ton/ft
Depth of paving stones (assumed)		=	2.5	in
Area of paving stones	46.25 x 2.5	=	115.63	sq.in
Paving stones UDL	(115.63/144) x 144	=	115.63	lb/ft
		=	0.052	ton/ft
Pedestrian section UDL		=	0.381	ton/ft

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Road

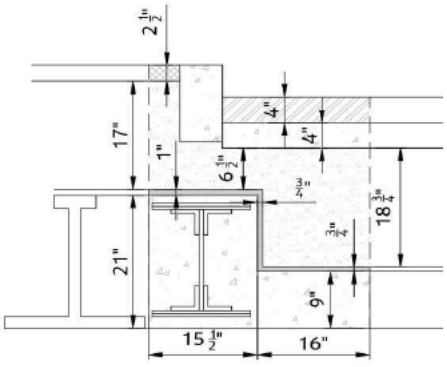
Width supported by girder		=	46.25	in
Depth of miscellaneous fill		=	6.5	in
Area of miscellaneous fill	46.25 x 6.5	=	300.63	sq.in
Miscellanoues fill UDL	(300.63/144) x 135	=	281.84	lb/ft
		=	0.126	ton/ft
Depth of concrete (assumed)		=	4	in
Area of concrete	46.25 x 4.0	=	185	sq.in
Concrete UDL	(185.00/144) x 150	=	192.71	lb/ft
		=	0.086	ton/ft
Depth of surfacing (assumed)		=	4	in
Area of surfacing	46.25 x 4.0	=	185	sq.in
Surfacing UDL	(185/144) x 144	=	185	lb/ft
		=	0.083	ton/ft
Road section UDL		=	0.294	ton/ft

UDL at east end = 0.631 ton/ft
UDL at west end = 0.717 ton/ft

Girder 20

Girder 20 also partially supports the pedestrian area at the west end.

The unit weight of the concrete slabs between the steel girders will be assumed as 157.5 lb/cu.ft to represent reinforced concrete.



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Concrete Encasement

Width of encasement		=	15.5	in
Depth of encasement		=	21	in
Area of encasement	(15.5 x 21.0) - 56.44	=	269.06	sq.in
Encasement UDL	(269.06/144) x 150	=	280.27	lb/ft
		=	0.125	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	16	in
Depth of slab		=	9	in
Area of slab		=	144	sq.in
Slab UDL	(144/144) x 157.5	=	157.5	lb/ft
		=	0.070	ton/ft

Asphalt layer

Area of asphalt layer	(15.5 x 1)+((13+15.25) x 0.75)	=	36.69	sq.in
Asphalt layer UDL	(36.69/144) x 144	=	36.69	lb/ft
		=	0.016	ton/ft

Pedestrian area

Width supported by girder		=	31.5	in
Area of miscellaneous fill	(17 x 31.5) + (15.25 x 12.25)	=	722.31	sq.in
Miscellaneous fill UDL	(722.31/144) x 135	=	677.17	lb/ft
		=	0.302	ton/ft
Area of slabs	31.50 x 2.50	=	78.75	sq.in
Slab UDL	(78.75/144) x 144	=	78.75	lb/ft
		=	0.035	ton/ft
Pedestrain area UDL		=	0.337	ton/ft

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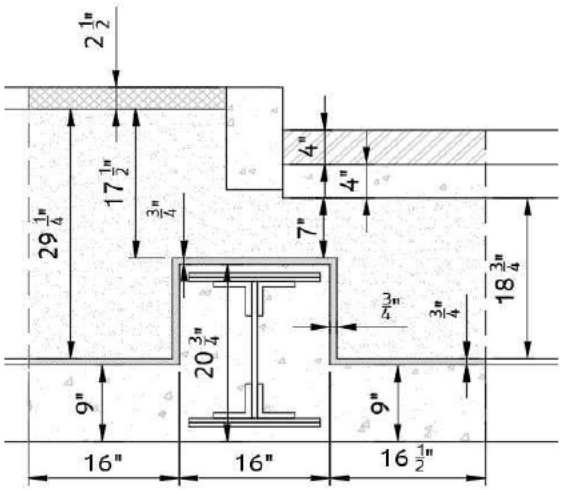
Road

Depth of surfacing		=	4	in
Area of surfacing	4 x 31.50	=	126	sq.in
Surfacing UDL	(126/144) x 144	=	126.0	lb/ft
		=	0.056	ton/ft
Depth of concrete		=	4	in
Area of concrete	4 x 31.50	=	126	sq.in
Concrete UDL	(126/144) x 150	=	131.3	lb/ft
		=	0.059	ton/ft
Miscellaneous fill area	(6.5 x 31.50) + (12.25 x 15.25)	=	391.56	sq.in
Miscellaneous fill UDL	(391.56/144) x 135	=	367.1	lb/ft
		=	0.164	ton/ft
Total road UDL		=	0.279	ton/ft

UDL at east end = 0.461 ton/ft
UDL at west end = 0.645 ton/ft

Girder 21

This girder carries a small portion of the pedestrian area at the west end.



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Concrete Encasement

Width of encasement		=	16	in
Depth of encasement		=	20.75	in
Area of encasement	(16.0 x 20.8) - 56.44	=	275.56	sq.in
Encasement UDL	(275.56/144) x 150	=	287.04	lb/ft
		=	0.128	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	32.5	in
Depth of slab		=	9	in
Area of slab		=	292.5	sq.in
Slab UDL	(293/144) x 157.5	=	319.92	lb/ft
		=	0.143	ton/ft

Asphalt layer

Area of asphalt layer	0.75 x (15.25+12.75+16+12.75+15.5)	=	54.19	sq.in
Asphalt layer UDL	(54.19/144) x 144	=	54.19	lb/ft
		=	0.024	ton/ft

Pedestrian Area

Width supported by girder		=	48.5	in
Area of miscellaneous fill	29.25(15.25+15.5)+(17.5 x 17.5)	=	1205.7	sq.in
Miscellaneous fill UDL	(1,205.69/144) x 135	=	1130.3	lb/ft
		=	0.505	ton/ft
Area of slabs	48.50 x 2.5	=	121.25	sq.in
Slab UDL	(121.25/144) x 144	=	121.25	lb/ft
		=	0.054	ton/ft
Pedestrain area UDL		=	0.559	ton/ft

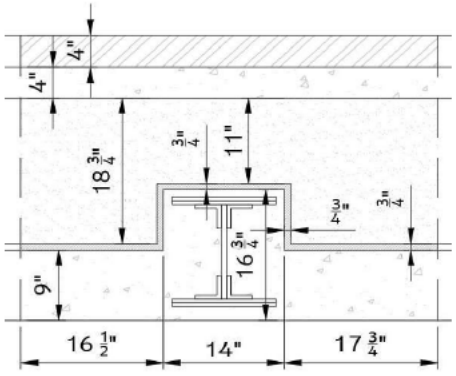
Road

Depth of surfacing		=	4	in
Area of surfacing	4 x 48.50	=	194	sq.in
Surfacing UDL	(194/144) x 144	=	194.0	lb/ft
		=	0.087	ton/ft
Depth of concrete		=	4	in
Area of concrete	4 x 48.50	=	194	sq.in
Concrete UDL	(194/144) x 150	=	202.1	lb/ft
		=	0.090	ton/ft
Miscellaneous fill area	18.75(15.25+15.5)+(7 x 17.5)	=	699.06	sq.in
Miscellaneous fill UDL	(699.06/144) x 135	=	655.4	lb/ft
		=	0.293	ton/ft
Total road UDL		=	0.469	ton/ft

UDL at east end	=	0.861	ton/ft
UDL at west end	=	0.950	ton/ft

Girder 22

The length of girder that supports the pedestrian area is negligible and it will therefore be assumed to carry the road for the full length.



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Concrete encasement

Width of encasement		=	14	in
Depth of encasement		=	16.75	in
Area of encasement	(14.0 x 16.8) - 42.50	=	192	sq.in
Encasement UDL	(192.00/144) x 150	=	200	lb/ft
		=	0.089	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	34.25	in
Depth of slab		=	9	in
Area of slab		=	308.25	sq.in
Slab UDL	(308/144) x 157.5	=	337.15	lb/ft
		=	0.151	ton/ft

Asphalt layer

Area of asphalt layer	0.75 x (15.5 + 8.5 + 14 + 8.5 + 17)	=	47.63	sq.in
Asphalt layer UDL	(47.63/144) x 144	=	47.63	lb/ft
		=	0.021	ton/ft

Surfacing

Width of surfacing suported by girder		=	48.25	in
Depth of surfacing		=	4	in
Area of surfacing		=	193	sq.in
Surfacing UDL	(193/144) x 144.0	=	193	lb/ft
		=	0.086	ton/ft

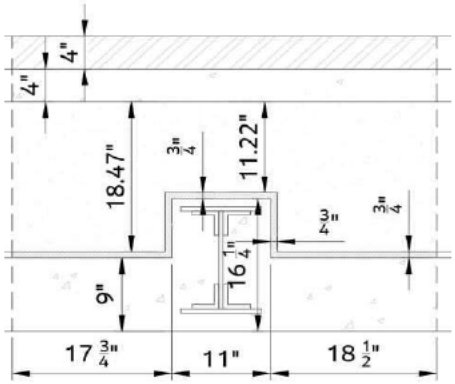
Concrete

Width of concrete suported by girder		=	48.25	in
Depth of concrete		=	4	in
Area of concrete		=	193	sq.in
Concrete UDL	(193/144) x 150.0	=	201.04	lb/ft
		=	0.090	ton/ft

Miscellaneous Fill

Miscellaneous fill area	18.75(15.75 + 17) + (11 x 15.5)	=	784.56	sq.in
Miscellaneous fill UDL	(784.56/144) x 135	=	735.5	lb/ft
		=	0.328	ton/ft
Total UDL on Girder 22		=	0.838	ton/ft

Girder 23



Concrete encasement

Width of encasement		=	11	in
Depth of encasement		=	16.25	in
Area of encasement	(11.0 x 16.3) - 26.00	=	152.75	sq.in
Encasement UDL	(152.75/144) x 150	=	159.11	lb/ft
		=	0.071	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	36.25	in
Depth of slab		=	9	in
Area of slab		=	326.25	sq.in
Slab UDL	(326/144) x 157.5	=	356.84	lb/ft
		=	0.159	ton/ft

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Asphalt layer

Area of asphalt layer	0.75(17+7.25+12.5+7.25+17.75)	=	46.31	sq.in
Asphalt layer UDL	(46.31/144) x 144	=	46.31	lb/ft
		=	0.021	ton/ft

Surfacing

Width of surfacing suported by girder		=	47.25	in
Depth of surfacing		=	4	in
Area of surfacing		=	189	sq.in
Surfacing UDL	(189/144) x 144.0	=	189	lb/ft
		=	0.084	ton/ft

Concrete

Width of concrete suported by girder		=	47.25	in
Depth of concrete		=	4	in
Area of concrete		=	189	sq.in
Concrete UDL	(189/144) x 150.0	=	196.88	lb/ft
		=	0.088	ton/ft

Miscellaneous Fill

Miscellaneous fill area	18.47(17+17.75) + (11.22 x 12.5)	=	782.08	sq.in
Miscellaneous fill UDL	(782.08/144) x 135	=	733.2	lb/ft
		=	0.327	ton/ft
Total UDL on Girder 23		=	0.795	ton/ft

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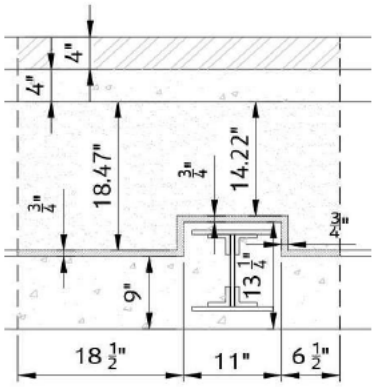
Girder 24

The distance between girder 24 and 25 will be taken as the average



Concrete encasement

Width of encasement		=	11	in
Depth of encasement		=	13.25	in
Area of encasement	(11.0 x 13.3) - 22.50	=	123.25	sq.in
Encasement UDL	(123.25/144) x 150	=	128.39	lb/ft
		=	0.057	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	25	in
Depth of slab		=	9	in
Area of slab		=	225	sq.in
Slab UDL	(225/144) x 157.5	=	246.09	lb/ft
		=	0.110	ton/ft

Asphalt layer

Area of asphalt layer	0.75(17.5+4.25+12.5+4.25+5.5)	=	33.00	sq.in
Asphalt layer UDL	(33.00/144) x 144	=	33.00	lb/ft
		=	0.015	ton/ft

Jacobs

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Surfacing

Width of surfacing suported by girder		=	36	in
Depth of surfacing		=	4	in
Area of surfacing		=	144	sq.in
Surfacing UDL	(144/144) x 144.0	=	144	lb/ft
		=	0.064	ton/ft

Concrete

Width of concrete suported by girder		=	36	in
Depth of concrete		=	4	in
Area of concrete		=	144	sq.in
Concrete UDL	(144/144) x 150.0	=	150	lb/ft
		=	0.067	ton/ft

Miscellaneous Fill

Miscellaneous fill area	18.47(17.75+5.75) + (14.22 x 12.5)	=	611.8	sq.in
Miscellaneous fill UDL	(611.80/144) x 135	=	573.6	lb/ft
		=	0.256	ton/ft
Total UDL on Girder 24		=	0.607	ton/ft

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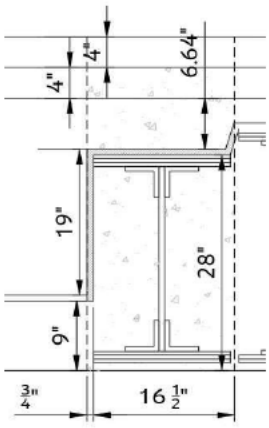
Girder 25



Fill depth at midspan taken

Concrete encasement

Width of encasement		=	16.5	in
Depth of encasement		=	28	in
Area of encasement	(16.5 x 28.0) - 81.44	=	380.56	sq.in
Encasement UDL	(380.56/144) x 150	=	396.42	lb/ft
		=	0.177	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	0.75	in
Depth of slab		=	9	in
Area of slab		=	6.75	sq.in
Slab UDL	(6.75/144) x 157.5	=	7.3828	lb/ft
		=	0.003	ton/ft

Asphalt layer

Area of asphalt layer	0.75(19.75+16.5)	=	27.19	sq.in
Asphalt layer UDL	(27.19/144) x 144	=	27.19	lb/ft
		=	0.012	ton/ft

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Surfacing

Width of surfacing suported by girder		=	17.25	in
Depth of surfacing		=	4	in
Area of surfacing		=	69	sq.in
Surfacing UDL	(69/144) x 144.0	=	69	lb/ft
		=	0.031	ton/ft

Concrete

Width of concrete suported by girder		=	17.25	in
Depth of concrete		=	10.64	in
Area of concrete		=	183.54	sq.in
Concrete UDL	(184/144) x 150.0	=	191.19	lb/ft
		=	0.085	ton/ft

Miscellaneous Fill

Miscellaneous fill area	19 x 6.5	=	123.5	sq.in
Miscellaneous fill UDL	(123.50/144) x 135	=	115.8	lb/ft
		=	0.052	ton/ft
Total UDL on Girder 25		=	0.499	ton/ft

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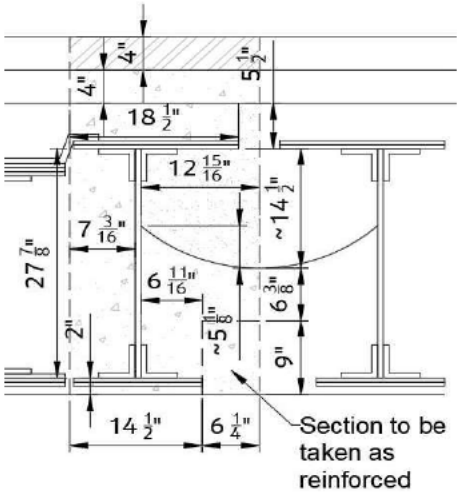
Girder 26

Section at midspan taken. Area of concrete between Girders 26 and 27 has been estimated from historical information.



Concrete 'slab'

Width of slab suported by girder		=	6.25	in
Depth of slab		=	9	in
Area of slab		=	56.25	sq.in
Slab UDL	(56/144) x 157.5	=	61.523	lb/ft
		=	0.027	ton/ft

Concrete Encasement

Area at top flange	(18.5 x 5.5) - 18.0	=	83.75	sq.in
Area at bottom flange	(14.5 x 2) - 14.0	=	15.00	sq.in
Area to left of web	(27.875 x 7.1875) - 0.625(8 + 6.75)	=	191.13	sq.in
Area between web and 'slab'	(6.6875 x 7) - 0.625(4+3.375)	=	42.20	sq.in
Area to right of web	(6.375 + 11.5)/2 x 12.9375	=	115.63	sq.in
Area of encasement		=	447.71	sq.in
Encasement UDL	(447.71/144) x 150	=	466.37	lb/ft
		=	0.208	ton/ft

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Miscellaneous Fill

Miscellaneous fill area		=	162.21	sq.in
Miscellaneous fill UDL	(162.21/144) x 135	=	152.1	lb/ft
		=	0.068	ton/ft

Surfacing

Width of surfacing suported by girder		=	20.75	in
Depth of surfacing		=	4	in
Area of surfacing		=	83	sq.in
Surfacing UDL	(83/144) x 144.0	=	83	lb/ft
		=	0.037	ton/ft

Concrete

Width of concrete suported by girder		=	20.75	in
Depth of concrete		=	4	in
Area of concrete		=	83	sq.in
Concrete UDL	(83/144) x 150.0	=	86.458	lb/ft
		=	0.039	ton/ft
Total UDL on Girder 26		=	0.495	ton/ft

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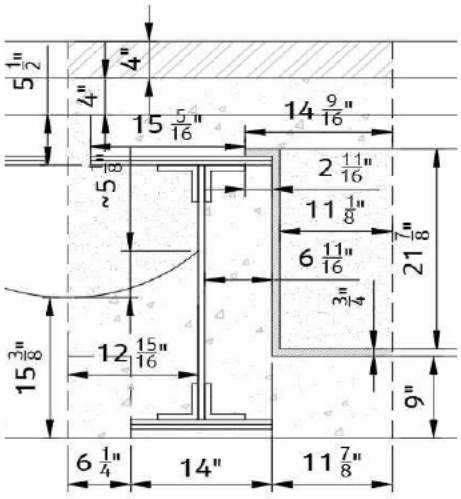
Girders 27 and 29



Concrete Encasement

Area at bottom flange	14 x 1	=	14.00	sq.in
Area to right of web	(6.6875 x 27.875) - 0.625(8+6.75)	=	177.2	sq.in
Area between web and 'slab'	(6.6875 x 7) - 0.625(4+3.375)	=	42.20	sq.in
Area to left of web	(6.375 + 11.5)/2 x 12.9375	=	115.63	sq.in
Area of encasement		=	349.03	sq.in
Encasement UDL	(349.03/144) x 150	=	363.57	lb/ft
		=	0.162	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	18.125	in
Depth of slab		=	9	in
Area of slab		=	163.13	sq.in
Slab UDL	(163/144) x 157.5	=	178.42	lb/ft
		=	0.080	ton/ft

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Surfacing

Width of surfacing suported by girder		=	32.125	in
Depth of surfacing		=	4	in
Area of surfacing		=	128.5	sq.in
Surfacing UDL	(129/144) x 144.0	=	128.5	lb/ft
		=	0.057	ton/ft

Concrete

Width of concrete suported by girder		=	32.125	in
Depth of concrete		=	4	in
Area of concrete above top flange		=	123.52	sq.in
Total area of concrete		=	252.02	sq.in
Concrete UDL	(252/144) x 150.0	=	262.52	lb/ft
		=	0.117	ton/ft

Asphalt layer

Area of asphalt layer	0.75(2.6875 + 21.875 + 11.875)	=	27.33	sq.in
Asphalt layer UDL	(27.33/144) x 144	=	27.33	lb/ft
		=	0.012	ton/ft

Miscellaneous Fill

Miscellaneous fill area		=	405.57	sq.in
Miscellaneous fill UDL	(405.57/144) x 135	=	380.2	lb/ft
		=	0.170	ton/ft
Total UDL on Girder 27		=	0.714	ton/ft

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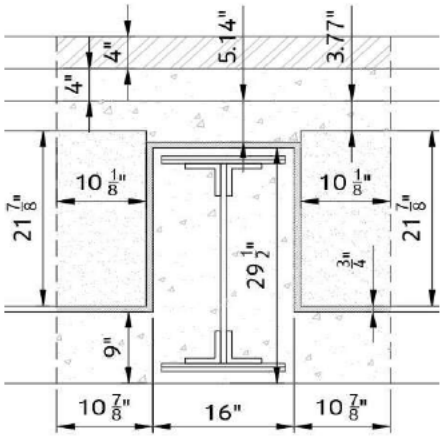
Girder 28



Concrete encasement

Width of encasement		=	16	in
Depth of encasement		=	29.5	in
Area of encasement	(16.0 x 29.5) - 62.06	=	409.94	sq.in
Encasement UDL	(409.94/144) x 150	=	427.02	lb/ft
		=	0.191	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	21.75	in
Depth of slab		=	9	in
Area of slab		=	195.75	sq.in
Slab UDL	(196/144) x 157.5	=	214.1	lb/ft
		=	0.096	ton/ft

Asphalt layer

Area of asphalt layer	0.75(10.125+20.5+17.5+20.5+10.125)	=	59.06	sq.in
Asphalt layer UDL	(59.06/144) x 144	=	59.06	lb/ft
		=	0.026	ton/ft

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Miscellaneous Fill

Miscellaneous fill area	2 x 10.125 x 21.875	=	442.97	sq.in
Miscellaneous fill UDL	(442.97/144) x 135	=	415.3	lb/ft
		=	0.185	ton/ft

Surfacing

Width of surfacing suported by girder		=	37.75	in
Depth of surfacing		=	4	in
Area of surfacing		=	151	sq.in
Surfacing UDL	(151/144) x 144.0	=	151	lb/ft
		=	0.067	ton/ft

Concrete

Width of concrete suported by girder		=	37.75	in
Depth of concrete		=	4	in
Area of concrete above top flange		=	166.29	sq.in
Total area of concrete		=	317.29	sq.in
Concrete UDL	(317/144) x 150.0	=	330.51	lb/ft
		=	0.148	ton/ft
Total UDL on Girder 28		=	0.819	ton/ft

Jacobs			CALCULATION SHEET		
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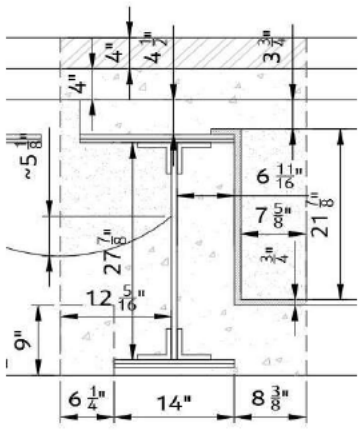
Girder 30



Concrete Encasement

Area at bottom flange	14 x 1	=	14.00	sq.in
Area to right of web	(6.6875 x 27.875) - 0.625(8+6.75)	=	177.2	sq.in
Area between web and 'slab'	(6.6875 x 7) - 0.625(4+3.375)	=	42.20	sq.in
Area to left of web	(6.375 + 11.5)/2 x 12.9375	=	115.63	sq.in
Area of encasement		=	349.03	sq.in
Encasement UDL	(349.03/144) x 150	=	363.57	lb/ft
		=	0.162	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	14.625	in
Depth of slab		=	9	in
Area of slab		=	131.63	sq.in
Slab UDL	(132/144) x 157.5	=	143.96	lb/ft
		=	0.064	ton/ft

Asphalt layer

Area of asphalt layer	0.75(2.6875 + 21.875 + 8.375)	=	24.70	sq.in
Asphalt layer UDL	(24.70/144) x 144	=	24.70	lb/ft
		=	0.011	ton/ft

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Miscellaneous Fill

Miscellaneous fill area		=	329	sq.in
Miscellaneous fill UDL	(329.00/144) x 135	=	308.4	lb/ft
		=	0.138	ton/ft

Surfacing

Width of surfacing suported by girder		=	28.625	in
Depth of surfacing		=	4	in
Area of surfacing		=	114.5	sq.in
Surfacing UDL	(115/144) x 144.0	=	114.5	lb/ft
		=	0.051	ton/ft

Concrete

Width of concrete suported by girder		=	28.625	in
Depth of concrete		=	4	in
Area of concrete above top flange		=	110.39	sq.in
Total area of concrete		=	224.89	sq.in
Concrete UDL	(225/144) x 150.0	=	234.26	lb/ft
		=	0.105	ton/ft
Total UDL on Girder 30		=	0.646	ton/ft

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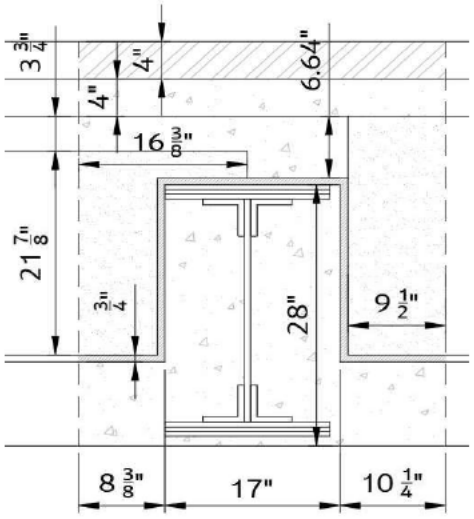
Girder 31

Girders 32, 33 and 34 bear onto Girder 31 at an angle.

The UDL on Girder 31 will be estimated using the following:



Concrete encasement

Width of encasement		=	17	in
Depth of encasement		=	28	in
Area of encasement	(17.0 x 28.0) - 81.44	=	394.56	sq.in
Encasement UDL	(394.56/144) x 150	=	411	lb/ft
		=	0.183	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	18.63	in
Depth of slab		=	9	in
Area of slab		=	167.63	sq.in
Slab UDL	(168/144) x 157.5	=	183.34	lb/ft
		=	0.082	ton/ft

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Asphalt layer

Area of asphalt layer		=	55.22	sq.in
Asphalt layer UDL	(55.22/144) x 144	=	55.22	lb/ft
		=	0.025	ton/ft

Miscellaneous Fill

Miscellaneous fill area		=	433.48	sq.in
Miscellaneous fill UDL remainder	(433.48/144) x 135	=	406.4	lb/ft
		=	0.181	ton/ft

Surfacing

Width of surfacing suported by girder		=	34.875	in
Depth of surfacing		=	4	in
Area of surfacing		=	139.5	sq.in
Surfacing UDL	(139.50/144) x 144.0	=	139.5	lb/ft
		=	0.062	ton/ft

Concrete

Width of concrete suported by girder		=	34.88	in
Depth of concrete		=	4	in
Area of concrete above top flange		=	126.15	sq.in
Area of concrete		=	265.65	sq.in
Concrete UDL	(265.65/144) x 150.0	=	276.71	lb/ft
		=	0.124	ton/ft
Total UDL		=	0.796	ton/ft

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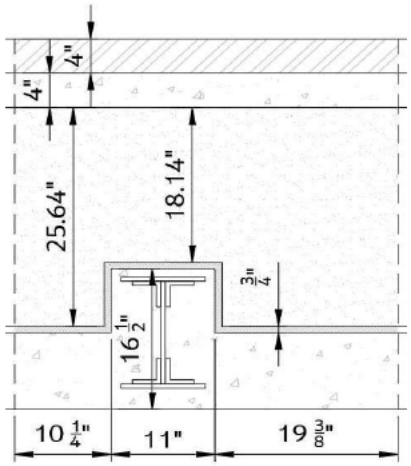
Girder 32



Concrete encasement

Width of encasement		=	11	in
Depth of encasement		=	16.5	in
Area of encasement	(11.0 x 16.5) - 26.00	=	155.5	sq.in
Encasement UDL	(155.50/144) x 150	=	161.98	lb/ft
		=	0.072	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	29.625	in
Depth of slab		=	9	in
Area of slab		=	266.63	sq.in
Slab UDL	(266.63/144) x 157.5	=	291.62	lb/ft
		=	0.130	ton/ft

Asphalt layer

Area of asphalt layer		=	41.72	sq.in
Asphalt layer UDL	(41.72/144) x 144	=	41.72	lb/ft
		=	0.019	ton/ft

Miscellaneous Fill

Miscellaneous fill area		=	947.88	sq.in

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Miscellaneous fill UDL (947.88/144) x 135 = 888.6 lb/ft
= 0.397 ton/ft

Surfacing

Width of surfacing suported by girder = 40.625 in
Depth of surfacing = 4 in

Area of surfacing = 162.5 sq.in

Surfacing UDL (163/144) x 144.0 = 162.5 lb/ft
= 0.073 ton/ft

Concrete

Width of concrete suported by girder = 40.625 in
Depth of concrete = 4 in

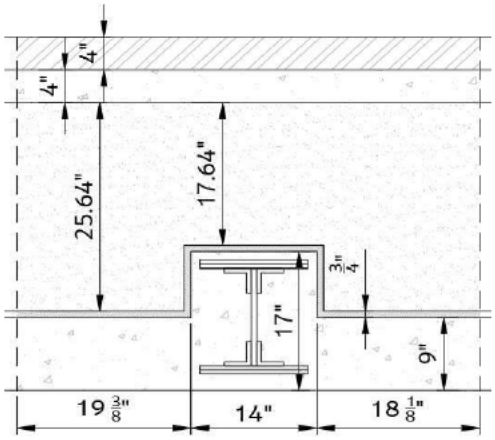
Area of concrete = 162.5 sq.in

Concrete UDL (162.50/144) x 150.0 = 169.27 lb/ft
= 0.076 ton/ft

Total UDL on Girder 32 = 0.810 ton/ft

Girder 33

The east end of the girder supports footway but the additional dead load will be negligible and therefore the deck makeup of the carriageway will be used.



Concrete encasement

Width of encasement		=	14	in
Depth of encasement		=	17	in
Area of encasement	(14.0 x 17.0) - 42.50	=	195.5	sq.in
Encasement UDL	(195.50/144) x 150	=	203.65	lb/ft
		=	0.091	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	37.5	in
Depth of slab		=	9	in
Area of slab		=	337.5	sq.in
Slab UDL	(337.50/144) x 157.5	=	369.14	lb/ft
		=	0.165	ton/ft

Asphalt layer

Area of asphalt layer		=	50.63	sq.in
Asphalt layer UDL	(50.63/144) x 144	=	50.63	lb/ft
		=	0.023	ton/ft

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Miscellaneous Fill

Miscellaneous fill area		=	1196.5	sq.in
Miscellaneous fill UDL	(1,196.46/144) x 135	=	1121.7	lb/ft
		=	0.501	ton/ft

Surfacing

Width of surfacing suported by girder		=	51.5	in
Depth of surfacing		=	4	in
Area of surfacing		=	206	sq.in
Surfacing UDL	(206/144) x 144.0	=	206	lb/ft
		=	0.092	ton/ft

Concrete

Width of concrete suported by girder		=	51.5	in
Depth of concrete		=	4	in
Area of concrete		=	206	sq.in
Concrete UDL	(206.00/144) x 150.0	=	214.58	lb/ft
		=	0.096	ton/ft
Total UDL on Girder 33		=	1.039	ton/ft

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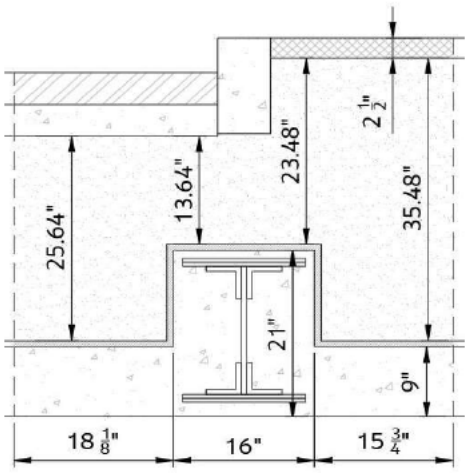
Girder 34

Girder 34 partially supports the carriageway and the footway to the south.
It will be assumed the west half of the girder supports road and the east half supports footway.

The cross section below shows the girder at midspan.



Concrete encasement

Width of encasement		=	16	in
Depth of encasement		=	21	in
Area of encasement	(16.0 x 21.0) - 56.44	=	279.56	sq.in
Encasement UDL	(279.56/144) x 150	=	291.21	lb/ft
		=	0.130	ton/ft

Concrete 'slab'

Width of slab suported by girder		=	33.875	in
Depth of slab		=	9	in
Area of slab		=	304.88	sq.in
Slab UDL	(304.88/144) x 157.5	=	333.46	lb/ft
		=	0.149	ton/ft

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Asphalt layer

Area of asphalt layer		=	55.41	sq.in
Asphalt layer UDL	(55.41/144) x 144	=	55.41	lb/ft
		=	0.025	ton/ft

Carriageway Area

Miscellaneous Fill

Miscellaneous fill area		=	1068.8	sq.in
Miscellaneous fill UDL	(1,068.80/144) x 135	=	1002.0	lb/ft
		=	0.447	ton/ft

Concrete

Width of concrete suported by girder		=	49.875	in
Depth of concrete		=	4	in
Area of concrete		=	199.5	sq.in
Concrete UDL	(199.50/144) x 150.0	=	207.81	lb/ft
		=	0.093	ton/ft

Surfacing

Width of surfacing suported by girder		=	49.875	in
Depth of surfacing		=	4	in
Area of surfacing		=	199.5	sq.in
Surfacing UDL	(200/144) x 144.0	=	199.5	lb/ft
		=	0.089	ton/ft

Footway Area

Miscellaneous Fill

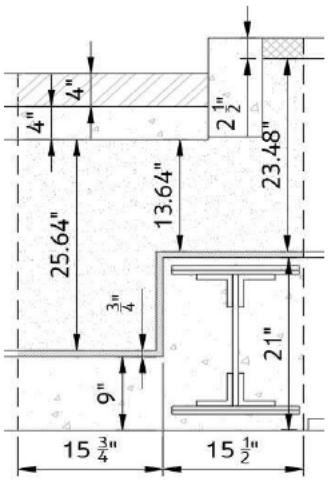
Miscellaneous fill area		=	1559.6	sq.in
Miscellaneous fill UDL	(1,559.57/144) x 135	=	1462.1	lb/ft
		=	0.653	ton/ft

Concrete slabs

Width of concrete suported by girder		=	49.875	in
Depth of concrete		=	2.5	in
Area of concrete		=	124.69	sq.in
Concrete UDL	(124.69/144) x 150.0	=	129.88	lb/ft
		=	0.058	ton/ft
UDL on Girder 34 under carriageway		=	1.029	ton/ft
UDL on Girder 34 under footway		=	1.110	ton/ft

Girder 35

Girder 35 partially supports the carriageway and the footway to the south.
It will be assumed the west half of the girder supports road and the east half supports footway.
The cross section below shows the girder at midspan.



Concrete encasement

Width of encasement		=	15.5	in
Depth of encasement		=	21	in
Area of encasement	(15.5 x 21.0) - 56.44	=	269.06	sq.in
Encasement UDL	(269.06/144) x 150	=	280.27	lb/ft
		=	0.125	ton/ft

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Concrete 'slab'

Width of slab suported by girder		=	15.75	in
Depth of slab		=	9	in
Area of slab		=	141.75	sq.in
Slab UDL	(141.75/144) x 157.5	=	155.04	lb/ft
		=	0.069	ton/ft

Asphalt layer

Area of asphalt layer		=	31.88	sq.in
Asphalt layer UDL	(31.88/144) x 144	=	31.88	lb/ft
		=	0.014	ton/ft

Carriageway Area

Miscellaneous Fill

Miscellaneous fill area		=	606.25	sq.in
Miscellaneous fill UDL	(606.25/144) x 135	=	568.4	lb/ft
		=	0.254	ton/ft

Concrete

Width of concrete suported by girder		=	31.25	in
Depth of concrete		=	4	in
Area of concrete		=	125	sq.in
Concrete UDL	(125.00/144) x 150.0	=	130.21	lb/ft
		=	0.058	ton/ft

Surfacing

Width of surfacing suported by girder		=	31.25	in
Depth of surfacing		=	4	in
Area of surfacing		=	125	sq.in
Surfacing UDL	(125/144) x 144.0	=	125	lb/ft
		=	0.056	ton/ft

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Footway Area

Miscellaneous Fill

Miscellaneous fill area		=	913.75	sq.in
Miscellaneous fill UDL	(913.75/144) x 135	=	856.6	lb/ft
		=	0.382	ton/ft

Concrete slabs

Width of concrete suported by girder		=	31.25	in
Depth of concrete		=	2.5	in
Area of concrete		=	78.125	sq.in
Concrete UDL	(78.13/144) x 150.0	=	81.38	lb/ft
		=	0.036	ton/ft
UDL on Girder 35 under carriageway		=	0.672	ton/ft
UDL on Girder 35 under footway		=	0.723	ton/ft

Dead Load Effects

The maximum bending moment and shear force in a beam with a UDL are given by:

Maximum Bending Moment $M_{max} = \frac{wl^2}{8}$

Maximum Shear Force $V_{max} = \frac{wl}{2}$

Girder 8

DL UDL = 1.815 ton/ft

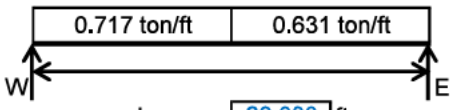
MDL = 154.33 ton.ft

VDL = 23.67 ton

L = 26.083 ft

Girder 19

The girder partially supports the pedestrian area to the north therefore assume the following:



L = 26.083 ft

RE = ((0.717 x 13.042 x 6.521)+(0.631 x 13.042 x 19.563)) / 26.083
= 8.50 ton

RW = (0.717 x 13.042) + (0.631 x 13.042) - 8.504
= 9.07 ton

Maximum moment occurs 12.649 ft from the west end

Mmax = 0.5 x 9.07 x 12.649
= 57.34 ton.ft

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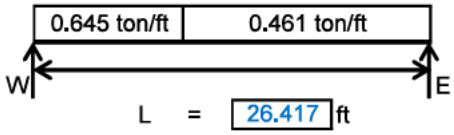
Girder 20

The girder partially supports the pedestrian are to the north therefore assume the following:



L = 26.417 ft

For west end UDL 10.583 ft
For east end UDL 15.833 ft

RE = ((0.645 x 10.583 x 5.292) + (0.461 x 15.833 x 18.500)) / 26.417
= 6.48 ton

RW = (0.645 x 10.583) + (0.461 x 15.833) - 6.48
= 7.65 ton

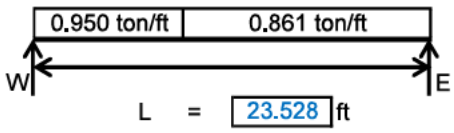
Maximum moment occurs 14.053 ft from the east end

Mmax = 0.5 x 6.48 x 14.053
= 45.56 ton.ft

Mmidspan = 45.40 ton.ft

Girder 21

The girder partially supports the pedestrian are to the north therefore assume the following:



L = 23.528 ft

For west end UDL 4.581 ft
For east end UDL 18.947 ft

RE = ((0.950 x 4.581 x 2.291) + (0.861 x 18.947 x 14.054)) / 23.528
= 10.16 ton

RW = (0.950 x 4.581) + (0.861 x 18.947) - 10.16
= 10.49 ton

Maximum moment occurs 11.81 ft from the east end

Mmax = 0.5 x 10.16 x 11.810
= 60.017 ton.ft

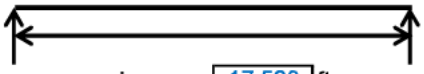
Mmidspan = 60.016 ton.ft

Girder 22

DL UDL = 0.838 ton/ft

MDL = 32.17 ton.ft

VDL = 7.34 ton



L = 17.528 ft

Girder 23

DL UDL = 0.795 ton/ft

MDL = 13.39 ton.ft

VDL = 4.61 ton

L = 11.611 ft

Girder 24

DL UDL = 0.607 ton/ft

MDL = 2.61 ton.ft

VDL = 1.78 ton

L = 5.861 ft

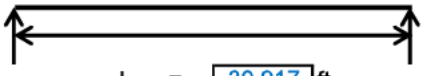
Girder 25

Imposed loads due to UDL

DL UDL = 0.499 ton/ft

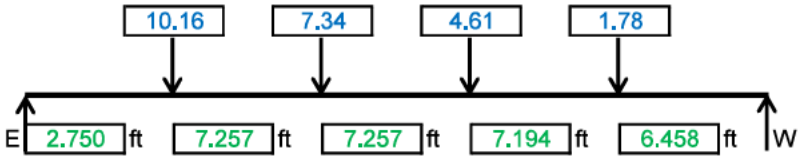
MUDL = 59.60 ton.ft

VUDL = 7.71 ton



L = 30.917 ft

Consider the following arrangement for the imposed dead loads from girders 21, 22, 23 and 24



Imposed loads due to girders

RW = ((10.16 x 2.750)+(7.34 x 10.007)+(4.61 x 17.265)+(1.78 x 24.459)) / 30.917
= 7.27 ton

RE = 10.16 + 7.34 + 4.61 + 1.78 - 7.27
= 16.63 ton

Maximum moment occurs 10.007 ft from the east end

Mmax = (16.63 x 2.750) + (6.47 x 7.257)
= 92.70 ton.ft

Combined imposed loads

RW = 14.98 ton
RE = 24.34 ton

Maximum moment occurs 13.713 from the east end

Mmax = 148.31 ton.ft

Moment at midspan = 147.44 ton.ft

The girder will also be checked at the curtailment points of the additional plates
The additional plates are 18' - 8" and 12' - 0" long, the plates therefore curtail
6.125 ft and 9.458 ft from each support

Shear at 6.125 ft = 24.34 - 10.16 - (0.499 x 6.125) (from E end)
= 11.13 ton

Moment = ((24.34 + 22.97) / 2) x 2.750) + ((12.81 + 11.126) / 2) x 3.375)
= 105.45 ton.ft

Shear at 9.458 ft = 24.34 - 10.16 - (0.499 x 9.46) (from E end)
= 9.46 ton

Moment = 105.45 + (((11.13 + 9.46) / 2) x 3.333)
= 139.76 ton.ft

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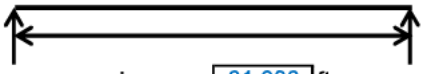
Girder 26

DL UDL = 0.495 ton/ft

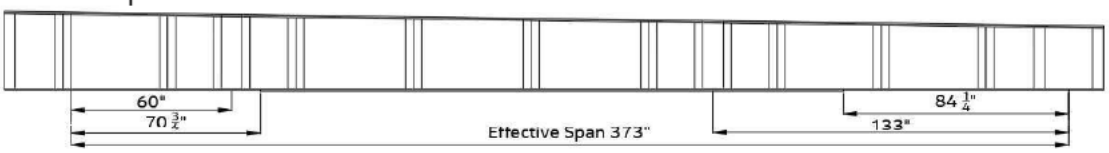
MDL = 59.75 ton.ft



VDL = 7.69 ton

L = 31.083 ft

Girder 26 will also be checked at the locations of the cut outs and curtailment points of the additional plates, see sketch below.



Shear at 5.00 ft = 7.69 - (0.495 x 5.00) (60")
= 5.21 ton

Moment = ((7.69 + 5.21) / 2) x 5.00
= 32.26 ton.ft

Shear at 5.90 ft = 7.69 - (0.495 x 5.90) (70.75")
= 4.77 ton

Moment = ((7.69 + 4.77) / 2) x 5.90
= 36.73 ton.ft

Shear at 7.02 ft = 7.69 - (0.495 x 7.02) (84.25")
= 4.22 ton

Moment = ((7.69 + 4.22) / 2) x 7.02
= 41.79 ton.ft

Shear at 11.08 ft = 7.69 - (0.495 x 11.08) (133")
= 2.21 ton

Moment = ((7.69 + 2.21) / 2) x 11.08
= 54.83 ton.ft

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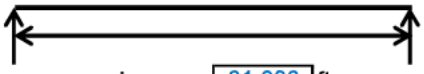
Girders 27 and 29

DL UDL = 0.714 ton/ft MDL = 86.22 ton.ft



VDL = 11.10 ton

L = 31.083 ft

Shear at 5.00 ft = 11.10 - (0.714 x 5.00) (60")
= 7.53 ton

Moment = ((11.10 + 7.53) / 2) x 5.00
= 46.56 ton.ft

Shear at 5.90 ft = 11.10 - (0.714 x 5.90) (70.75")
= 6.89 ton

Moment = ((11.10 + 6.89) / 2) x 5.90
= 53.01 ton.ft

Shear at 7.02 ft = 11.10 - (0.714 x 7.02) (84.25")
= 6.08 ton

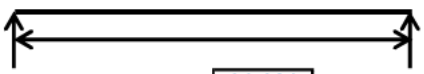
Moment = ((11.10 + 6.08) / 2) x 7.02
= 60.31 ton.ft

Shear at 11.08 ft = 11.10 - (0.714 x 11.08) (133")
= 3.18 ton

Moment = ((11.10 + 3.18) / 2) x 11.08
= 79.13 ton.ft

Girder 30

DL UDL = 0.646 ton/ft MDL = 78.08 ton.ft



VDL = 10.05 ton

L = 31.083 ft

Shear at 5.00 ft = 10.05 - (0.646 x 5.00) (60")
= 6.82 ton

Moment = ((10.05 + 6.82) / 2) x 5.00
= 42.16 ton.ft

Shear at 5.90 ft = 10.05 - (0.646 x 5.90) (70.75")
= 6.24 ton

Moment = ((10.05 + 6.24) / 2) x 5.90
= 48.00 ton.ft

Shear at 7.02 ft = 10.05 - (0.646 x 7.02) (84.25")
= 5.51 ton

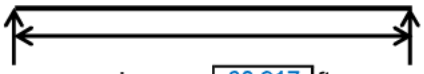
Moment = ((10.05 + 5.51) / 2) x 7.02
= 54.61 ton.ft

Shear at 11.08 ft = 10.05 - (0.646 x 11.08) (133")
= 2.88 ton

Moment = ((10.05 + 2.88) / 2) x 11.08
= 71.65 ton.ft

Girder 28

DL UDL = 0.819 ton/ft MDL = 97.80 ton.ft



VDL = 12.65 ton

L = 30.917 ft

The girder will also be checked at the curtailment point which is 6.333 ft from each end

Mx = ((12.65 + 7.47) / 2) x 6.333
= 63.72 ton.ft

Girder 32

DL UDL = 0.810 ton/ft

MDL = 9.86 ton.ft

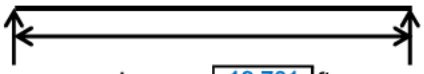
VDL = 4.00 ton

L = 9.868 ft

Girder 33

DL UDL = 1.039 ton/ft

MDL = 36.23 ton.ft

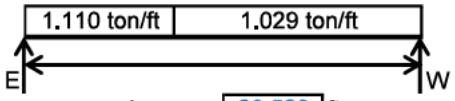


VDL = 8.68 ton

L = 16.701 ft

Girder 34

The girder partially supports the pedestrian area to the south therefore assume the following:



For east end UDL 7.111 ft

For west end UDL 16.417 ft

L = 23.528 ft

RW = ((1.110 x 7.111 x 3.556) + (1.029 x 16.417 x 15.319)) / 23.528

= 12.19 ton

RE = (1.110 x 7.111) + (1.029 x 16.417) - 12.19

= 12.59 ton

Maximum moment occurs 11.849 ft from the west end

Mmax = 0.5 x 12.19 x 11.849

= 72.22 ton.ft

Girder 31

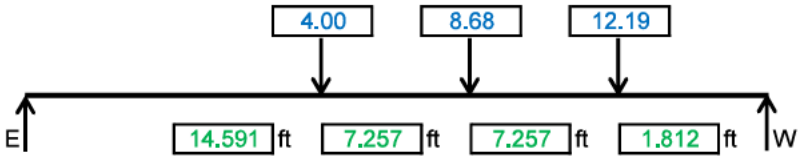
DL UDL = 0.796 ton/ft

MDL = 95.08 ton.ft

VDL = 12.30 ton

L = 30.917 ft

Consider the following arrangement for the imposed dead loads from girders 32, 33 and 34



Imposed loads due to girders

RW = ((4.00 x 14.591) + (8.68 x 21.848) + (12.19 x 29.105)) / 30.917
= 19.49 ton

RE = 4.00 + 8.68 + 12.19 - 19.49
= 5.37 ton

Maximum moment occurs 21.848 ft from the east end

Mmax = (5.37 x 14.591) + (1.37 x 7.257)
= 88.33 ton.ft

Combined imposed loads

RW = 31.80 ton
RE = 17.67 ton

Maximum moment occurs 17.184 from the east end

Mmax = 175.82 ton.ft
Moment at midspan = 174.64 ton.ft

The girder will also be checked at the curtailment points of the additional plates
The additional plates are 18' - 8" and 12' - 0" long, the plates therefore curtail
6.125 ft and 9.458 ft from each support

Shear at 6.125 ft = 31.80 - 12.19 - 4.87
= 14.73 ton (west end)

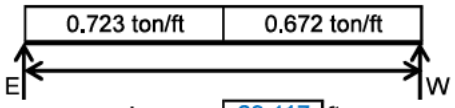
Moment = (((31.80 + 30.35) / 2) x 1.812) + (((18.16 + 14.73) / 2) x 4.313)
= 127.25 ton.ft

Shear at 9.458 ft = 17.67 - 7.53
= 10.15 ton (east end)

Moment = ((17.67 + 10.15) / 2) x 9.458
= 131.55 ton.ft

Girder 35

The girder partially supports the pedestrian area to the south therefore assume the following:



For east end UDL 13.208 ft
For west end UDL 13.208 ft

L = 26.417 ft

RW = ((0.723 x 13.208 x 6.604) + (0.672 x 13.208 x 19.813)) / 26.417
= 9.05 ton

RE = (0.723 x 13.208) + (0.672 x 13.208) - 9.05
= 9.39 ton

Maximum moment occurs 12.975 ft from the east end

Mmax = 0.5 x 9.39 x 12.975
= 60.89 ton.ft

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Live Loads

4 axle vehicle W = 24 ton

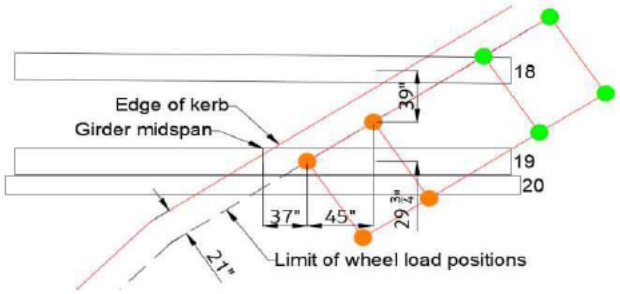
Axle	0.33W	0.167W
Axle Load (ton)	8	4
Wheel Load (ton)	4	2
Factored Load (ton)	5	2.5

2 axle vehicle W = 13 ton

Axle	0.7W	0.3W
Axle Load (ton)	9	4
Wheel Load (ton)	4.5	2
Factored Load (ton)	5.625	2.5

Girder 19

Consider the following arrangement for imposing the worst case bending at midspan
The wheel load between girders 18 and 19 will be distributed by simple statics.



= 0.33W axle
= 0.167W axle

Impact will be applied on the wheel acting directly on girder 19

Girder 19 will carry 57% of the second wheel load

L = 26.083 ft

Moment due to dead loads at 16.125 ft = 55.16 ton.ft
Maximum moment due to dead loads occurs 12.649 ft from the west end

RE = ((5 x 16.125) + (2.27 x 19.875)) / 26.083
= 4.82 ton

RW = 2.45 ton

Mmax = 2.45 x 16.125 M@12.649 = 2.45 x 12.649
= 39.49 ton.ft = 30.98 ton.ft

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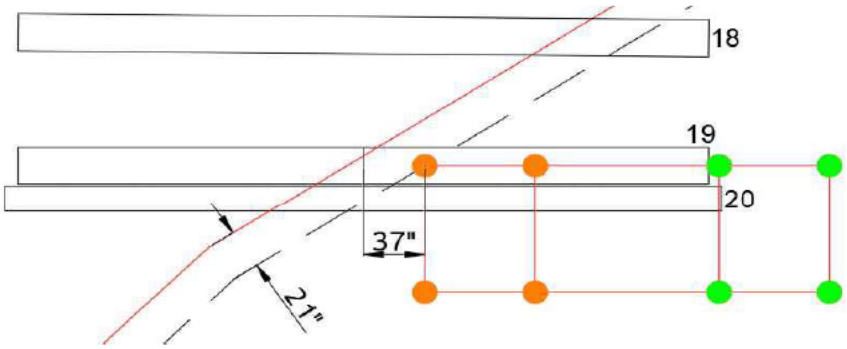
The following has been included as a check as the worst possible arrangement of a vehicle on the girder. With the bus stop at the east edge of the deck, there is a possiblilty of vehicles pulling around a stopped bus.



RE = ((5 x 16.125) + (4 x 20.625)) / 26.083
= 6.25 ton

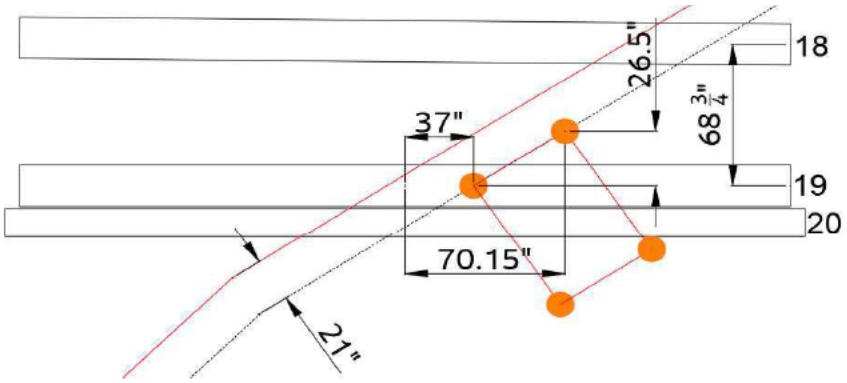
RW = 5 + 4 - 6.25
= 2.75 ton

Mmax = 2.75 x 16.125
= 44.28 ton.ft

M@12.649 = 2.75 x 12.649
= 34.74 ton.ft

BE4 Cl. 201

A check will also be done using twin 9 ton axles at 4ft spacing



RE = ((4.5 x 1.25 x 16.125) + (2.77 x 18.888)) / 26.083
= 5.48 ton

RW = 5.63 + 2.77 - 5.48
= 2.91 ton

Mmax = 2.91 x 16.125
= 46.93 ton.ft

M@12.649 = 2.91 x 12.649
= 36.82 ton.ft

Checking for a vehicle running parallel to the girder:

RE = (5.63 x 16.125) + (4.5 x 20.125)) / 26.083
= 6.95 ton

RW =
= 3.18 ton

Mmax = 3.18 x 16.125
= 51.21 ton.ft

M@12.649 = 3.18 x 12.649
= 40.17 ton.ft

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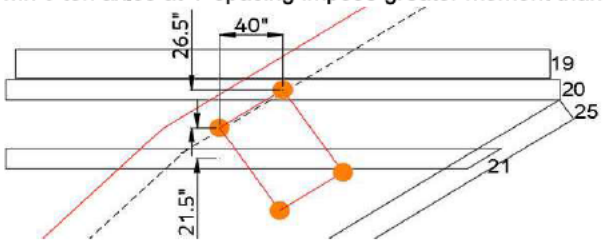
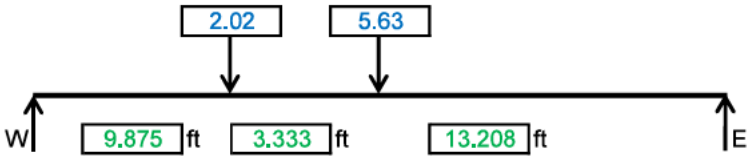
Girder 20

It will be assumed that a wheel load can act directly on the midspan of the girder
Twin 9 ton axles at 4' spacing impose greater moment than vehicle train in Fig 1(b)



L = 26.417 ft

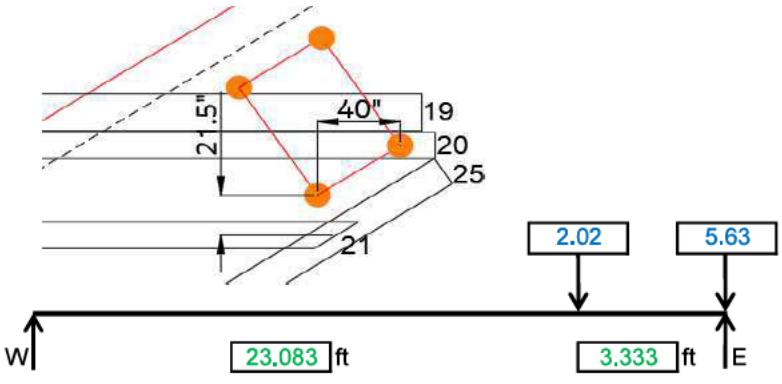


RE = ((2.02 x 9.875) + (5.6 x 13.208)) / 26.417
= 3.57 ton

RW = 2.02 + 5.6 - 3.57
= 4.07 ton

Maximum moment occurs at midspan
Mmax = (4.07 x 9.875) + (2.06 x 3.333)
= 47.10 ton.ft

Consider the following arrangement for imposing the worst case shear



RE = ((2.02 x 23.083) + (5.6 x 26.417)) / 26.417
= 7.39 ton

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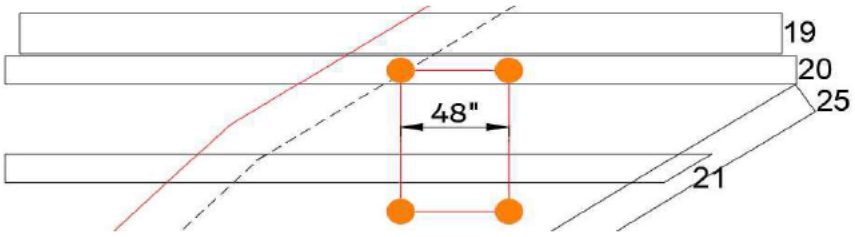
As for girder 19 the following has been included as a check for the worst possible loading case for bending



L = 26.417 ft

RE = ((5.63 x 13.208) + (4.5 x 17.208)) / 26.417
= 5.74 ton

RW = 5.63 + 4.5 - 5.74
= 4.38 ton

Maximum moment occurs at midspan
Mmax = (4.38 x 13.208)
= 57.87 ton.ft

Jacobs			CALCULATION SHEET		
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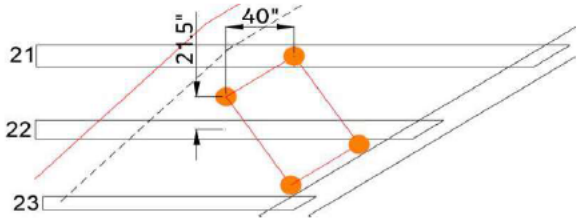
Girder 21

BE4 Cl 201

Consider the following arrangement for imposing the worst case bending moment.
A twin 9 ton axle at 4' spacing imposes greater moment than vehicle train in Fig 1(b)



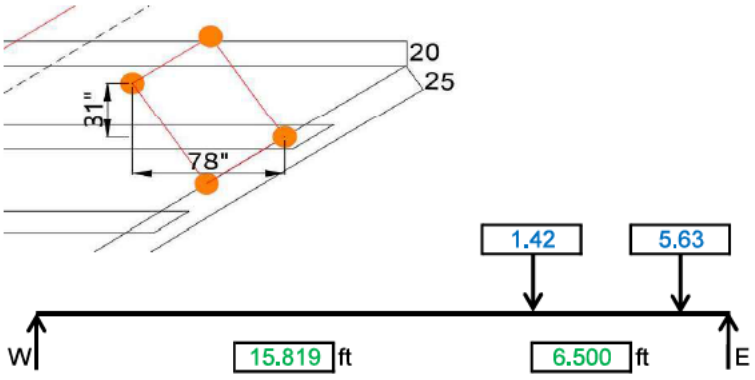
L = 23.528 ft

RE = ((2.02 x 8.431) + (5.0 x 11.764)) / 23.528
= 3.22 ton

RW = 2.02 + 5.0 - 3.22
= 3.79 ton

Maximum moment occurs at midspan
Mmax = 3.22 x 11.764
= 37.91 ton.ft

For the maximum imposed shear, consider the following arrangement



RE = ((1.42 x 15.819) + (5.63 x 22.319)) / 23.528
= 6.29 ton

Jacobs			CALCULATION SHEET		
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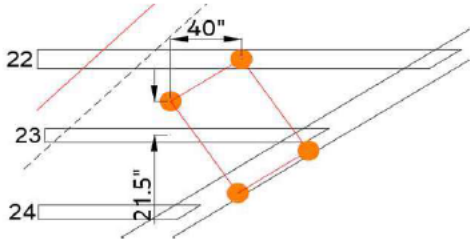
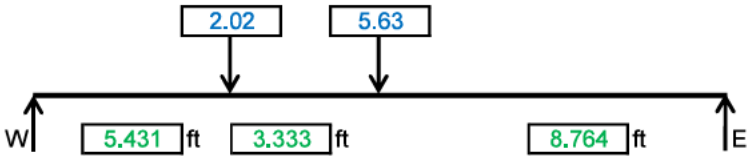
Girder 22

Consider the following arrangement for maximum imposed bending moment



L = 17.528 ft

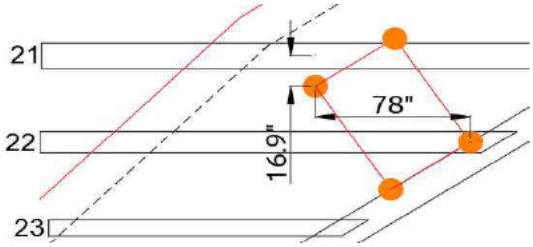


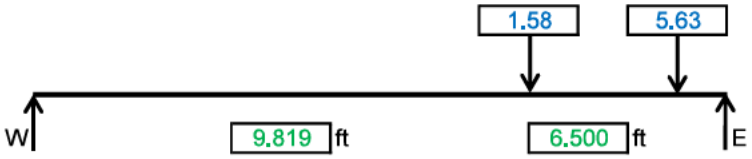
RE = ((2.02 x 5.431) + (5.63 x 8.764)) / 17.528
= 3.44 ton

RW = 2.02 + 5.63 - 3.44
= 4.20 ton

Maximum moment occurs at midspan
Mmax = 3.44 x 8.764
= 30.12 ton.ft

Consider the following arrangement for maximum imposed shear





RE = ((1.58 x 9.819) + (5.63 x 16.319)) / 17.528
= 6.12 ton

Jacobs		CALCULATION SHEET			
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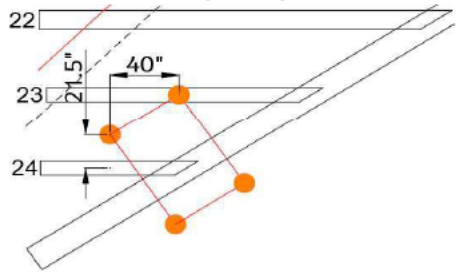
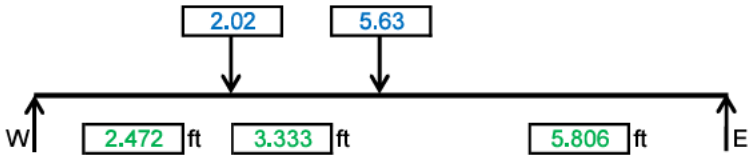
Girder 23

Consider the following arrangement for maximum imposed bending moment



L = 11.611 ft

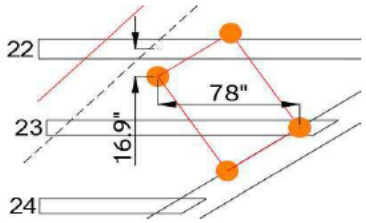


RE = ((2.02 x 2.472) + (5.63 x 5.806)) / 11.611
= 3.24 ton

RW = 2.02 + 5.63 - 3.24
= 4.40 ton

Maximum moment occurs at midspan
Mmax = 3.24 x 5.806
= 18.82 ton.ft

Consider the following arrangement for the maximum imposed shear



RE = ((1.58 x 3.903) + (5.63 x 10.403)) / 11.611
= 5.57 ton

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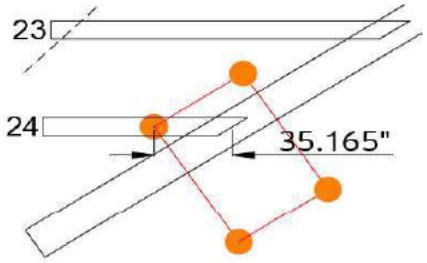
Girder 24

Consider the following arrangement for maximum imposed bending moment

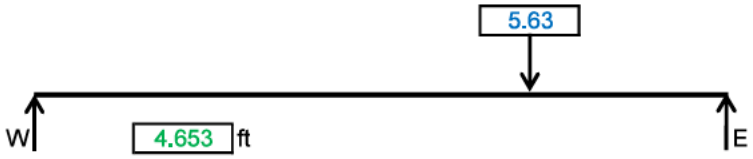


L = 5.861 ft

RE = RW = 5.63 / 2
= 2.81 ton

Maximum moment occurs at midspan
Mmax = 2.81 x 2.931
= 8.24 ton.ft

For maximum imposed shear



RE = (5.63 x 4.653) / 5.861
= 4.47 ton

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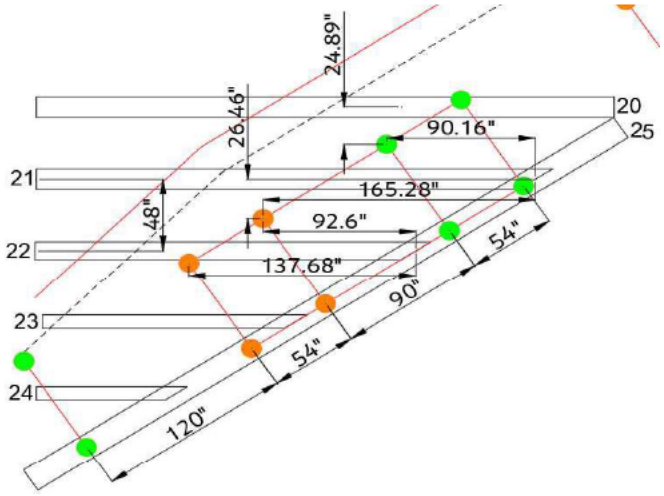
Girder 25

Consider the following arrangement for maximum imposed bending



Girder 22 imposed load

RE = ((4.00 x 6.054) + (2.76 x 9.506)) / 17.528

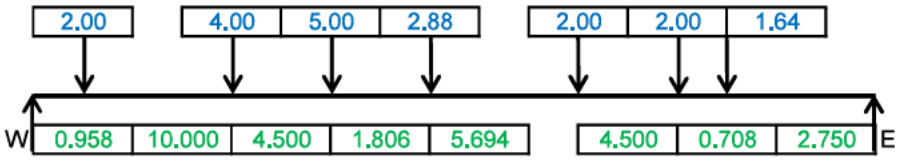
= 2.88 ton

Girder 21 imposed load

RE = ((2.24 x 9.754) + (1.04 x 16.014)) / 23.528

= 1.64 ton

L = 30.917 ft



RE = ((2x0.96)+(4x10.96)+(5x15.46)+(2.88x17.26)+(2x22.96)+(2x27.46) +(1.64x28.17))/30.92

= 10.338 ton

RW = 9.17 ton

Maximum moment occurs 15.458 ft from the west end (midspan)

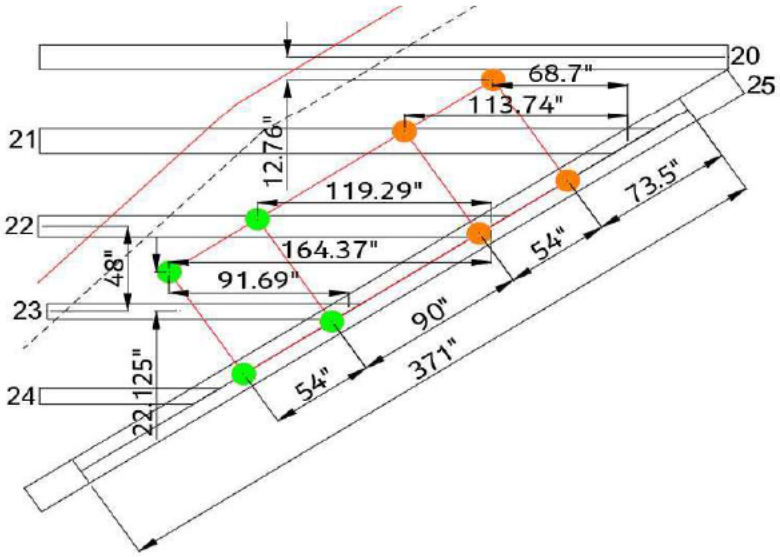
Mmax = (9.17 x 0.958) + (7.17 x 10.0) + (3.17 x 4.5)

= 94.82 ton.ft

The girder is also to be checked at the curtailment points of the additional plates

6.125 ft from east end

To impose the worst case loading, assume opposite direction of travel.



Girder 21 imposed load

RE = ((1.33 x 17.803) + (4.0 x 14.049))/23.528

= 3.39 ton

Girder 22 imposed load

RE = ((2.00 x 7.587) + (0.92 x 3.830)) / 17.528

= 1.07 ton

Girder 23 imposed loads

RE = (1.08 x 3.970) / 11.611

= 0.37 ton

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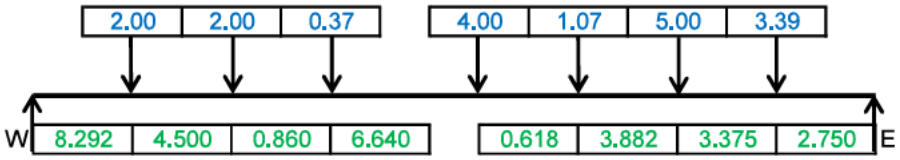
L = 30.917 ft



RE = ((2x8.29)+(2x12.79)+(0.37x13.65)+(4x20.29)+(1.07x20.91)+(5x24.79) +(3.39x28.17))/30.92

= 11.98 ton

RW = 5.85 ton

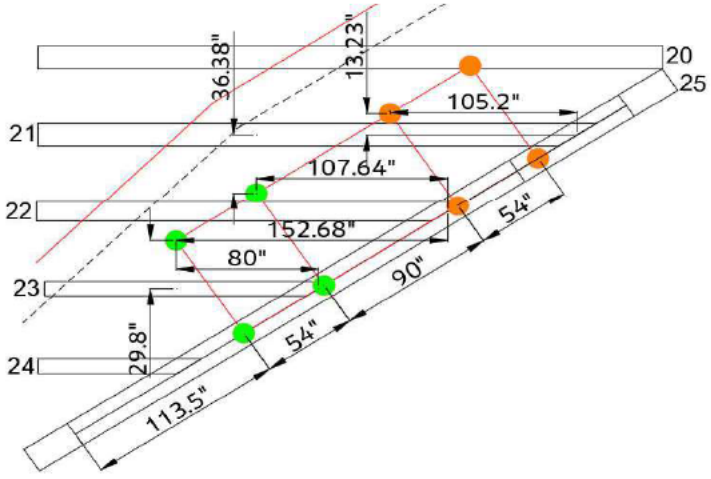
Moment at 6.125 ft = (11.98 x 2.750) + (8.58 x 3.375)

= 61.89 ton.ft

Shear at 6.125 ft = 11.98 - 3.39

= 8.58 ton

9.458 ft from the east end



As a conservative assessment it will be assumed that girder 21 will carry 100% of the wheel from axle 3 and girder 22 will carry 100% of the wheel from axle 2

Girder 21 imposed load

RE = (5.0 x 14.761) / 23.528

= 3.14 ton

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Girder 22 imposed load

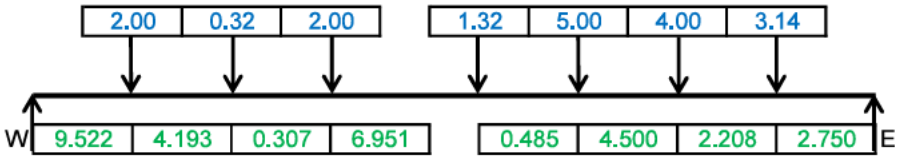
RE = ((2.0 x 8.558) + (1.24 x 4.804)) / 17.528

= 1.32 ton

Girder 23 imposed load

RE = (0.76 x 4.944) / 11.611

= 0.32 ton



RE = ((2.00x9.522)+(0.32x13.715)+(2.00x14.022)+(1.32x20.973)+(5.00x21.458)
+(4.00x25.958)+(3.14x28.167))/30.917

= 12.25 ton

RW = 5.53 ton

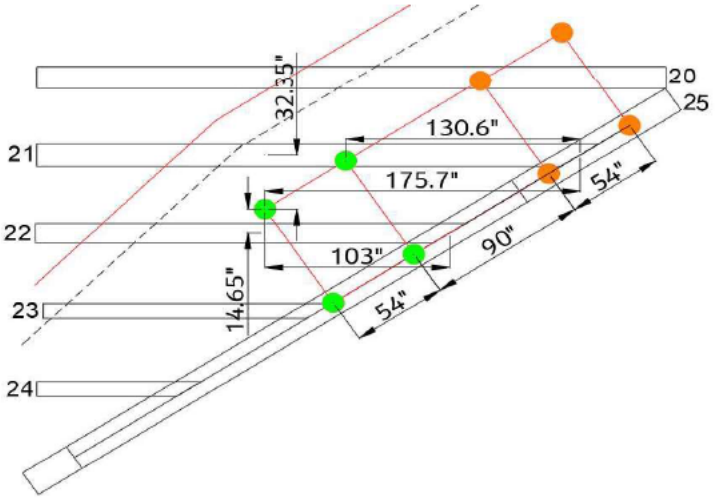
Moment at 9.458 ft = (12.25 x 2.750) + (9.11 x 2.208) + (5.11 x 4.500)

= 76.79 ton.ft

Shear at 9.458 ft = 12.25 - 3.14 - 4.00

= 5.11 ton

Consider the following arrangement for imposing the worst case shear



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Girder 21 imposed load

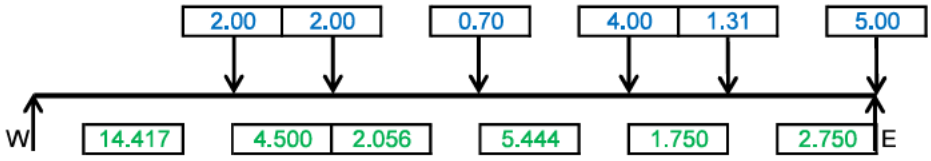
RE = ((2.0 x 12.644)+(0.62 x 8.886)) / 23.528

= 1.31 ton

Girder 22 imposed load

RE = (1.38 x 8.944) / 17.528

= 0.70 ton



RE = 12.244 ton

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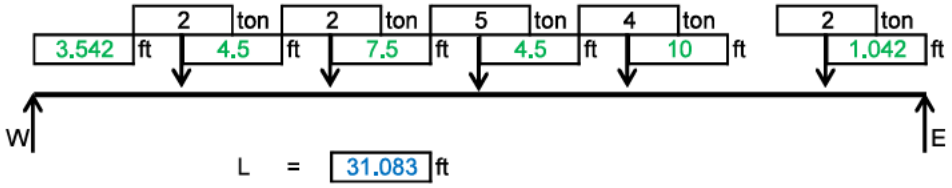
Girders 26, 27, 29 and 30

These girders will be assumed to carry a single row of wheel as a conservative assessment with no distribution of the loads.

Girders 26, 27, 29 and 30 all have the same effective span.

Consider the following arrangement for imposing the worst case bending



L = 31.083 ft

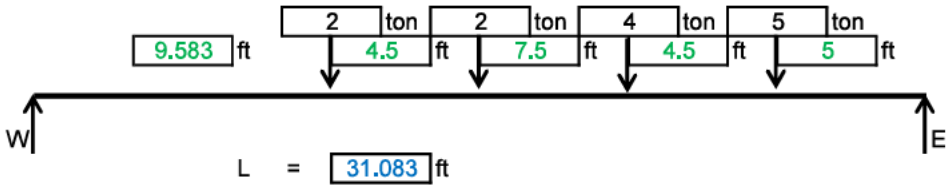
RE = ((2 x 3.542)+(2 x 8.042)+(5 x 15.542)+(4 x 20.042)+(2 x 30.042)) / 31.083
= 7.76 ton

RW = 2 + 2 + 5 + 4 + 2 - 7.76
= 7.24 ton

Mmax = (7.24 x 3.542) + (5.24 x 4.5)+(3.24 x 7.5)
= 73.56 ton.ft

The girders will also be checked at 5.00 ft 5.896 ft 7.021 ft and 11.083 ft from the supports

Consider the following arrangement for bending at 5.00 ft



L = 31.083 ft

RE = (2(9.583 + 14.083) + (4 x 21.583) + (5 x 26.083)) / 31.083
= 8.50 ton

Moment at 5ft = 8.50 x 5
= 42.48 ton.ft

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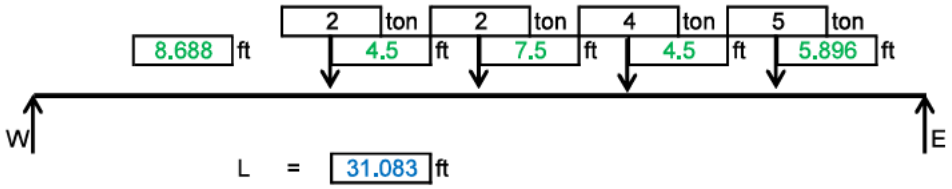
Consider the following arrangement for bending at 5.896 ft

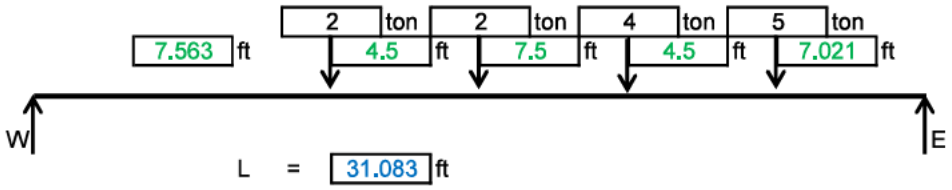


L = 31.083 ft

RE = (2(8.688 + 13.188) + (4 x 20.688) + (5 x 25.188)) / 31.083
= 8.12 ton

Moment = 8.12 x 6
= 47.88 ton.ft

Consider the following arrangement for bending at 7.021 ft

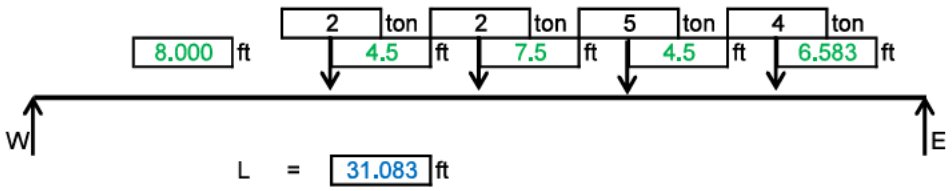


L = 31.083 ft

RE = (2(7.563 + 12.063) + (4 x 19.563) + (5 x 24.063)) / 31.083
= 7.65 ton

Moment = 7.65 x 7
= 53.72 ton.ft

Consider the following arrangement for bending at 11.083 ft

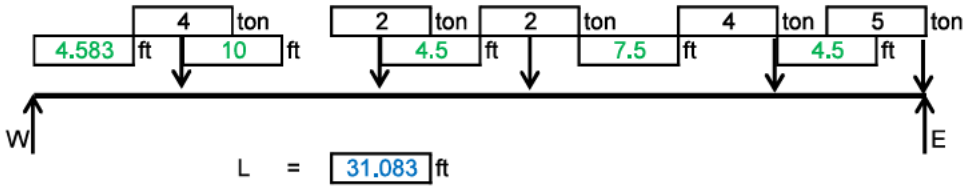


L = 31.083 ft

RE = (2(8.000 + 12.500) + (5 x 20.000) + (4 x 24.500)) / 31.083
= 7.69 ton

Moment = (7.69 x 6.583) + (3.69 x 4.5)
= 67.22 ton.ft

Consider the following arrangement for imposing the worst case shear
The east end will be checked as it is assumed this is the shallower end.

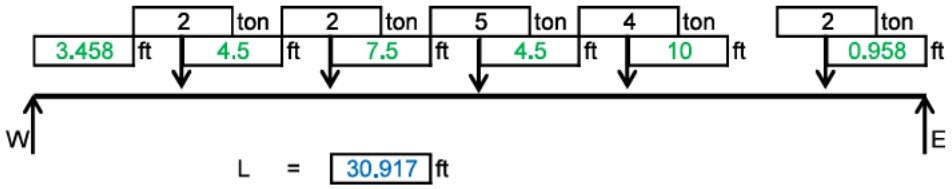


L = 31.083 ft

RE = (4(4.583 + 26.583) + 2(14.583 + 19.083) + (5 x 31.083)) / 31.083
= 11.18 ton

Girder 28

Girder 28 will also be assumed to carry a single line of wheel loads.
Consider the following arrangement for the worst case bending.



L = 30.917 ft

RE = ((2 x 3.458)+(2 x 7.958)+(5 x 15.458)+(4 x 19.958)+(2 x 29.958)) / 30.917
= 7.76 ton

RW = 2 + 2 + 5 + 4 + 2 - 7.76
= 7.24 ton

Mmax = (7.24 x 3.458) + (5.24 x 4.5)+(3.24 x 7.5)
= 72.94 ton.ft

Girder 28 is to be checked at the curtailment point 6.333 ft from the supports

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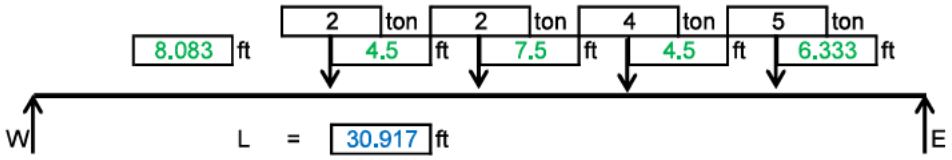
Consider the following arrangement for imposing the worst case bending.

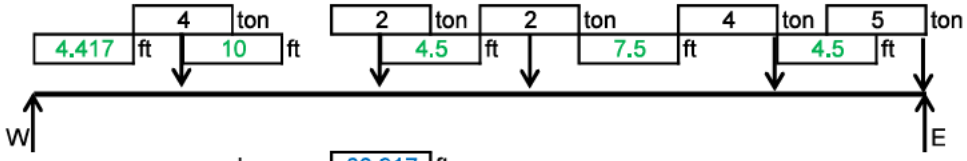


L = 30.917 ft

RE = (2(8.083 + 12.583) + (4 x 20.083) + (5 x 24.583)) / 30.917
= 7.91 ton

Moment = 7.91 x 6
= 50.10 ton.ft

Consider the following arrangement for imposing the worst case shear

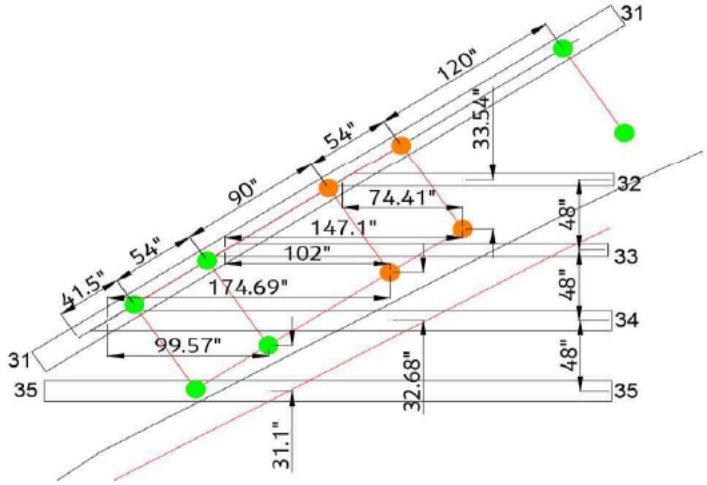


L = 30.917 ft

RE = (4(4.417 + 26.417) + 2(14.417 + 18.917) + (5 x 30.917)) / 30.917
= 11.15 ton

Girder 31

Girder 31 will be checked at the same locations as girder 25. The vehicle train will be assumed to run parallel to girder 31 for the worst case loading.
Consider the following arrangement for imposing the worst case bending at midspan



Girder 32 imposed load

RW = (2.80 x 3.667)/9.868

= 1.04 ton

Girder 33 imposed load

RW = ((2.80 x 18.658) + (3.40 x 22.417)) / 30.917

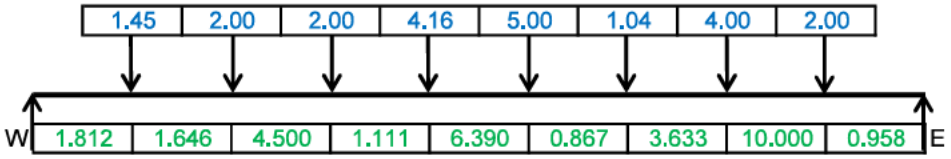
= 4.16 ton

Girder 34 imposed load

RW = ((1.30 x 15.230) + (1.60 x 8.970)) / 23.528

= 1.45 ton

L = 30.917 ft



RE = 9.61 ton

RW = 12.03 ton

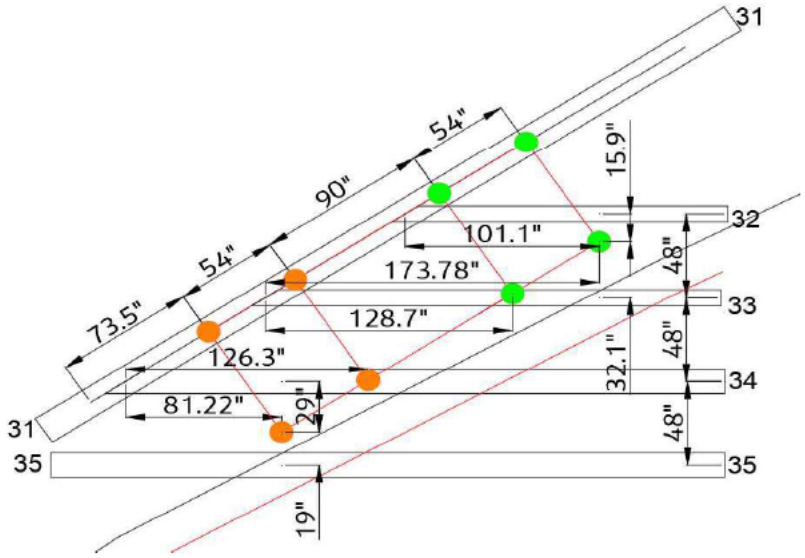
Maximum moment occurs 15.458 ft from the west end (midspan)

Mmax = 100.67 ton.ft

The girder is also to be checked at the curtailment points of the additional plates

6.125 ft from west end

To impose worst case loading assume opposite direction of travel.



Girder 32 imposed load

RW = (1.34 x 1.443) / 9.868

= 0.20 ton

Girder 33 imposed load

RW = ((0.66 x 2.218) + (2.00 x 5.976)) / 16.701

= 0.80 ton

Girder 34 imposed load

RW = ((4.00 x 13.003) + (1.98 x 16.759)) / 23.528

= 3.62 ton

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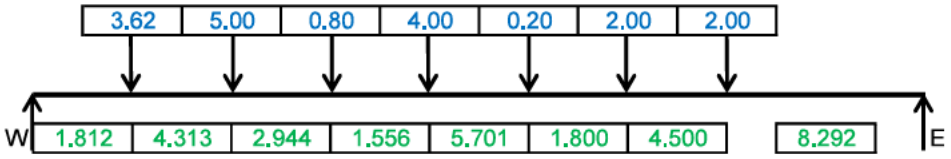


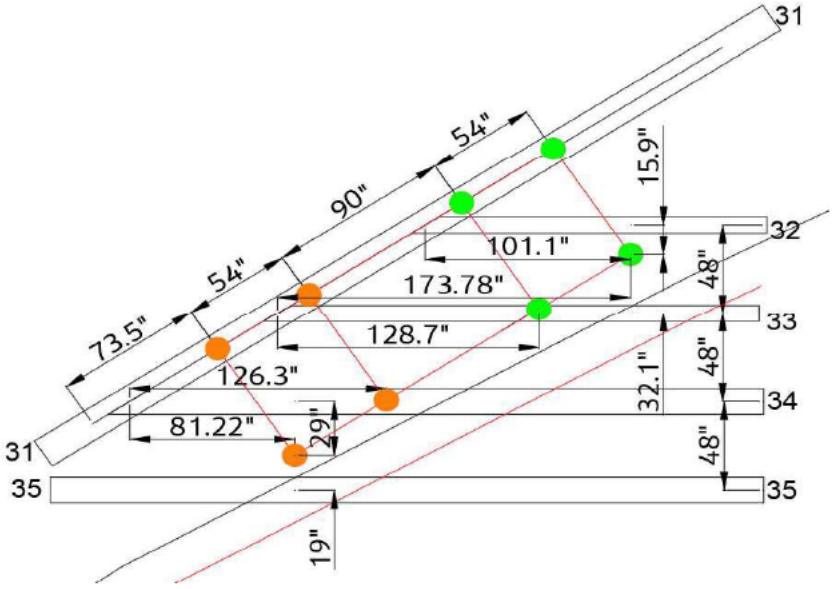
RE = 5.55 ton

RW = 12.07 ton

Moment at 6.125 ft = 58.30 ton.ft

Shear at 6.125 ft = 8.45 ton

9.458 ft from the east end



Girder 32 imposed load

RW = (1.02 x 2.417) / 9.868

= 0.25 ton

Girder 33 imposed load

RW = ((2.00 x 6.947) + (0.98 x 3.194)) / 16.701

= 1.02 ton

Girder 34 imposed load

RW = (5.00 x 13.977) / 23.528

= 2.97 ton

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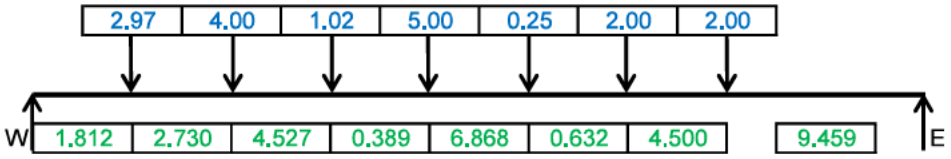


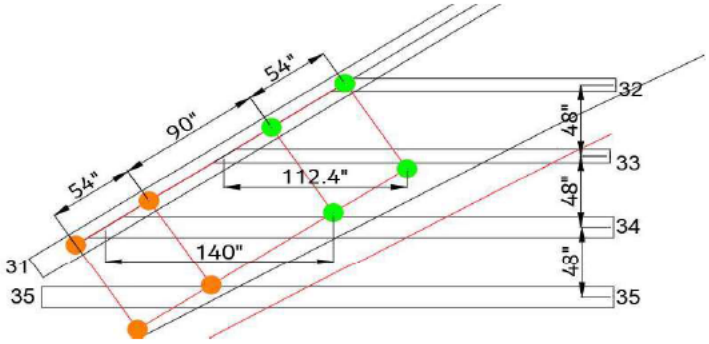
RE = 5.21 ton

RW = 12.03 ton

Moment at 9.458 ft = 71.03 ton.ft

Shear at 9.458 ft = 4.04 ton

Consider the following arrangement for imposing worst case shear at the west support



Girder 33 imposed load

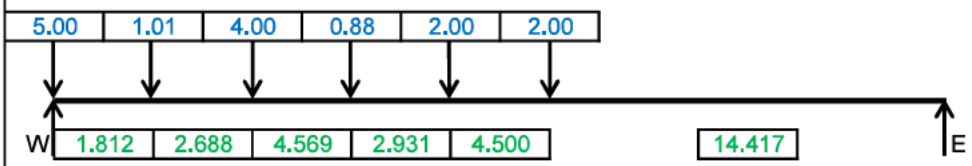
RW = (2 x 7.335) / 16.701

= 0.88 ton

Girder 34 imposed load

RW = (2 x 11.861) / 23.528

= 1.01 ton

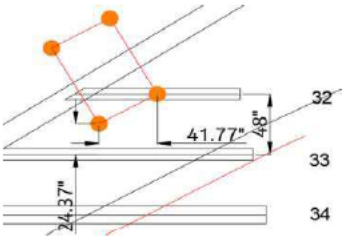


RW = 12.14 ton

Girders 32 to 35 will be checked the same way as 20 to 24 with the twin 9 ton axle which will impose greater loading on the girders than the 24ton vehicle train.

Girder 32

Consider the following arrangement for imposing the maximum bending

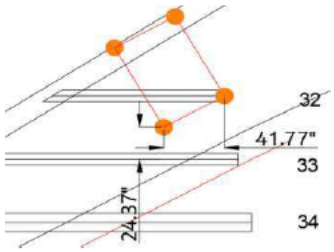


L = 9.868 ft

RE = ((5.63 x 4.934) + (2.28 x 1.453)) / 9.868
= 3.15 ton

Mmax = 15.537 ton.ft

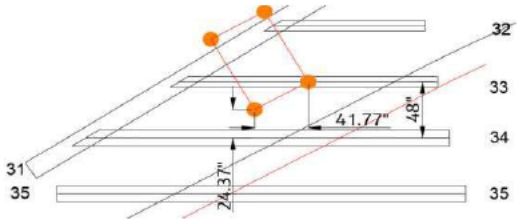
Consider the following arrangement for imposing the maximum shear



RE = ((5.63 x 9.8681) + (2.28 x 6.387)) / 9.868
= 7.10

Girder 33

Consider the following arrangement for imposing the maximum bending.

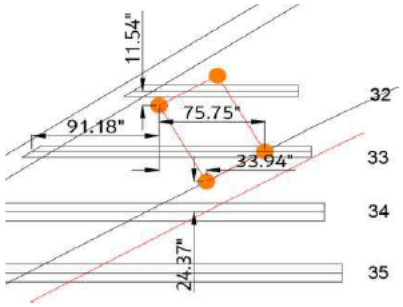


L = 16.701 ft

RE = ((5.63 x 8.351) + (2.28 x 4.870)) / 16.701
= 3.48 ton

Mmax = 29.05 ton.ft

Consider the following arrangement for imposing the maximum shear



RE = ((1.08 x 7.598) + (2.28 x 10.427) + (5.63 x 13.911)) / 16.701
= 6.60 ton

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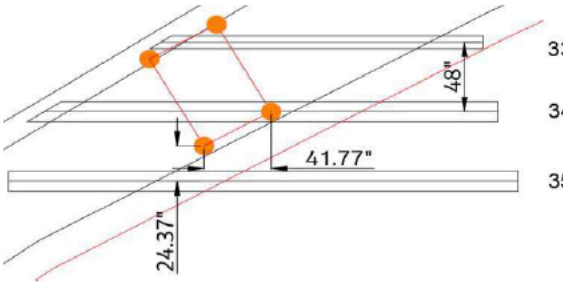
Girder 34

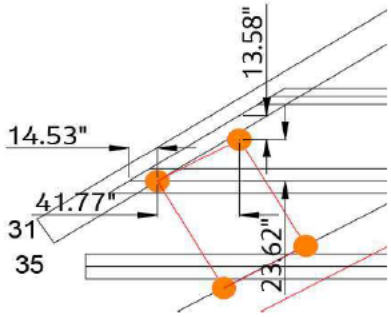


L = 23.528 ft

RE = ((5.63 x 11.764) + (2.28 x 8.283)) / 23.528
= 3.62 ton

Mmax = 42.55 ton.ft

Consider the following arrangement for imposing the maximum shear



RW = ((5.63 x 22.317) + (1.643 x 18.836)) / 23.528
= 6.65 ton

Girder 35 is the same arrangement as Girder 20 which will have greater imposed loads

Girder Capacities

The permissible stress in cast iron must not exceed 3 ton/sq.in in tension

The actual permissible tensile stress shall be based upon the ratio of dead to live load, and calculated from the equation: $5f_L + 2.2f_D = 8$ but shall in no case exceed 3 ton/sq.in

Where: f_L is the tensile bending stress due to live loads
f_D is the tensile bending stress due to dead loads

Girder 8

Girder 8 is being checked for dead loads only as the worst case imposed dead loads on the cast iron girders.

Imposed dead loads = 154.33 ton.ft

Zxt = 503.98 cu.in

Stress due to dead loads = 3.67 ton/sq.in

Girder does not have sufficient capacity for imposed dead loads.

Girder 19

Girder 19 will be checked at the locations of maximum moment due to dead loads and maximum moment due to live loads.

The following is a summary of the imposed live loads checked:

4 axle vehicle parallel to girder
Mmax due to live loads = 44.28 ton.ft
Mmax @ 12.649ft = 34.74 ton.ft

4 axle vehicle parallel to kerb
Mmax due to live loads = 39.49 ton.ft
Mmax @ 12.649ft = 30.98 ton.ft

Twin 9 ton axles parallel to girder
Mmax due to live loads = 51.21 ton.ft
Mmax @ 12.649ft = 40.17 ton.ft

Twin 9 ton axle parallel to kerb
Mmax due to live loads = 46.93 ton.ft
Mmax @ 12.649ft = 36.82 ton.ft

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The twin 9 ton axle arrangement is the more critical for all cases and will be used to check the capacity of the girder.

Maximum moment due to dead loads = 57.34 ton.ft
Moment due to live loads = 40.17 ton.ft

Zxt = 503.98 cu.in

fL = 0.96 ton/sq.in (for a vehicle parallel to the girder)
fD = 1.37 ton/sq.in

5fL = 4.78
2.2fD = 3.00

$5f_L + 2.2f_D$ = 7.79 ton/sq.in <8 therefore OK

Total imposed stress = 2.32 ton/sq.in <3 therefore OK

Girder 19 is suitable for the imposed loads at the point of maximum bending due to dead loads considering worst case live loads.

Moment due to dead loads = 55.16 ton.ft
Maximum moment due to live loads = 51.21 ton.ft

Zxt = 503.98 cu.in

fL = 1.22 ton/sq.in (for a vehicle parallel to the girder)
fD = 1.31 ton/sq.in

5fL = 6.10
2.2fD = 2.89

$5f_L + 2.2f_D$ = 8.99 ton/sq.in >8 not OK

Total imposed stress = 2.53 ton/sq.in <3 therefore OK

Girder 19 is not suitable for the imposed loads at the point of maximum bending due to live loads. This has been based upon assuming a vehicle could traverse the deck and line up the wheels parallel to the girder axis and directly above.

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Checking the girder for a vehicle traversing the deck remaining parallel to the kerb

Moment due to dead loads = 55.16 ton.ft
Maximum moment due to live loads = 46.93 ton.ft

Zxt = 503.98 cu.in

f_L = 1.12 ton/sq.in
f_D = 1.31 ton/sq.in

$5f_L$ = 5.59
$2.2f_D$ = 2.89

$5f_L + 2.2f_D$ = 8.48 ton/sq.in >8 not OK

Total imposed stress = 2.43 ton/sq.in <3 therefore OK

The girder is not suitable for the imposed live loads

Steel Girders

Bending Moment Capacity

The deck construction offers restraint to the top flanges of the girders against lateral torsional buckling, therefore capacity (μ) can be derived from the section modulus of the bottom flange.

$$\mu = P_{bt} \cdot Z_{xt}$$

Where:
Z_{xt} = Elastic section modulus (tension flange)
P_{bt} = Permissible stress in bending

The steel section of the structure was constructed in the early 1900s and therefore it will be assumed as Steel to B.S. 15 or B.S. 2762 for the purpose of determining the basic permissible stress.

BS153: Part 3B Table 3

The yield stress shall be taken as 15 ton/sq.in for all cases

BE4 Part I Cl. 304 (a)

The stresses for mild steel shall be as in BS 153, Part 3B, Table 1 Case II
Therefore the stresses shall be increased by 25%

d1 = the clear distance between the flange angles
t = the thickness of the web

d1/t will be less than 85 for all girders

Therefore basic permissible stress = 9.5 ton/sq.in
Permissible stress in bending = 11.875 ton/sq.in

Girders 20, 21, 34 and 35 at Midspan

Z_{xt} = 305.72 in³

μ = 3630.4 ton.in
= 302.54 ton.ft

Girders 22 and 33 at Midspan

Z_{xt} = 171.87 in³

μ = 2041 ton.in
= 170.08 ton.ft

Girders 23 and 32 at Midspan

Z_{xt} = 92.20 in³

μ = 1094.8 ton.in
= 91.24 ton.ft

Girder 24

Z_{xt} = 59.12 in³

μ = 702.08 ton.in
= 58.51 ton.ft

Girder 25 and 31

At Midspan

Z_{xt} = 710.66 in³

μ = 8439.1 ton.in
= 703.26 ton.ft

At first curtailment point

Z_{xt} = 545.30 in³

μ = 6475.5 ton.in
= 539.62 ton.ft

At second curtailment point

Z_{xt} = 381.62 in³

μ = 4531.7 ton.in
= 377.64 ton.ft

Girder 28

At Midspan

Z_{xt} = 522.86 in³

μ = 6208.9 ton.in
= 517.41 ton.ft

At Curtailment Point

Z_{xt} = 377.12 in³

μ = 4478.3 ton.in
= 373.19 ton.ft

Girders 26, 27, 29 and 30

At west cutout and curtailment point

Z_{xt} = 458.00 in³

μ = 5438.8 ton.in
= 453.23 ton.ft

At midspan

Z_{xt} = 609.25 in³

μ = 7234.8 ton.in
= 602.90 ton.ft

At east cutout

Z_{xt} = 407.32 in³

μ = 4836.9 ton.in
= 403.08 ton.ft

At east curtailment point

Z_{xt} = 230.80 in³

μ = 2740.7 ton.in
= 228.39 ton.ft

Shear Capacity

BS153 Part 4 Cl. 20 d (ii)

The effective sectional area for parts in shear is the product of the thickness of the web and the full depth of the web plate.

BS153 Part 3B Cl. 29 a

The calculated average shear stress, fq, on the effective sectional area of the web shall not exceed the value given in Table 3 or the value of Pq given by the following equation:

$$p_q = 6\left[1.3 - \frac{b/t}{250\left\{1 + 1/2\left(\frac{b}{a}\right)^2\right\}}\right]$$

Where:
a = the greater clear dimension of the web in a panel, not greater than 270t
b = the lesser clear dimension of the web in a panel, not greater than 180t

BS.153 Part 3B Table 3

Using a yield stress of 15 ton/sq.in for mild steel, the average shear stress shall not exceed 5.50 ton/sq.in (steel to BS 15 / BS 2762)

BE4 Part I Cl. 304(a)

The stresses for mild steel shall be as in BS153, Part 3B Case II
Therefore the allowable stresses shall be increased by 25% = 6.875 ton/sq.in

Girders 20 and 35

Taking dimensions from the historical drawings

t = 0.63 in

end panel width = 22.5 in (25.5 - 3)
height = 4.0 in (12 - 8)

270t = 168.75 in
Therefore a = 22.5 in

180t = 112.5 in
Therefore b = 4.0 in

pq = 7.65 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 12.00
= 51.563 ton

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Girders 21 and 34

t = 0.63 in

end panel width = 24.0 in (31 - 7)
height = 3.5 in (11.5 - 8)

270t = 168.75 in
Therefore a = 24.0 in

180t = 112.5 in
Therefore b = 3.5 in

p_q = 7.67 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 11.50
= 49.41 ton

Girder 22 and 33

t = 0.63 in

end panel width = 25.0 in (31 - 6)
height = 4.0 in (12 - 8)

270t = 168.75 in
Therefore a = 25.0 in

180t = 112.5 in
Therefore b = 4.0 in

p_q = 7.65 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 12.00
= 51.56 ton

Girder 23 and 32

t = 0.50 in

end panel width = 16.0 in (22 - 6)
height = 6.0 in (12 - 6)

270t = 135 in
Therefore a = 16.0 in

180t = 90 in
Therefore b = 6.0 in

p_q = 7.53 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.50 x 12.00
= 41.3 ton

Girder 24

t = 0.50 in

end panel width = 17.0 in (22 - 5)
height = 4.0 in (9 - 5)

270t = 135 in
Therefore a = 17.0 in

180t = 90 in
Therefore b = 4.0 in

p_q = 7.61 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.50 x 9.00
= 30.9 ton

Girders 25 and 31

The maximum clear dimension is not known so it will be assumed that the stresses in the web will not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 24.00
= 103.1 ton

Girders 26, 27, 29 and 30

The girders are deeper at one end and the stiffener spacings also differ.

Deeper end

t = 0.63 in dw = 30.875 in

end panel width = 15.0 in
height = 22.9 in

270t = 168.75 in
Therefore a = 22.9 in

180t = 112.5 in
Therefore b = 15.0 in

p_q = 7.33 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 30.88
= 132.7 ton

Shallower end

t = 0.63 in dw = 24.875 in

end panel width = 22.0 in
height = 16.9 in

270t = 168.75 in
Therefore a = 22.0 in

180t = 112.5 in
Therefore b = 16.9 in

p_q = 7.30 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 24.88
= 106.9 ton

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Girder 28

t = 0.63 in dw = 25 in

end panel width = 4.0 in
height = 17.0 in

270t = 168.75 in
Therefore a = 17.0 in

180t = 112.5 in
Therefore b = 4.0 in

p_q = 7.65 tons/sq.in

Therefore the stresses in the web shall not exceed pbc = 6.88 ton/sq.in

Shear capacity = 6.88 x 0.63 x 25.00
= 107.4 ton

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Capacity Summary

Girder 20

Bending capacity = 302.54 ton.ft

Maximum imposed bending due to dead loads = 45.56 ton.ft
Imposed bending due to dead loads at midspan = 45.40 ton.ft

Maximum imposed bending due to live loads = 47.10 ton.ft
Imposed bending due to LL, vehicle parallel to girder = 57.87 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 51.56 ton

Shear due to dead loads at east support = 6.48 ton
Shear due to live loads at east support = 7.39 ton

Shear capacity is sufficient for 24 ton loading

Girder 21

Bending capacity = 302.54 ton.ft

Maximum imposed bending due to dead loads = 60.02 ton.ft
Maximum imposed bending due to live loads = 37.91 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 49.41 ton

Shear due to dead loads at east support = 10.16 ton
Shear due to live loads at east support = 6.29 ton

Shear capacity is sufficient for 24 ton loading

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Girder 22

Bending capacity = 170.08 ton.ft

Maximum imposed bending due to dead loads = 32.17 ton.ft
Maximum imposed bending due to live loads = 30.12 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 51.56 ton

Shear due to dead loads at east support = 7.34 ton
Shear due to live loads at east support = 6.12 ton

Shear capacity is sufficient for 24 ton loading

Girder 23

Bending capacity = 91.24 ton.ft

Maximum imposed bending due to dead loads = 13.39 ton.ft
Maximum imposed bending due to live loads = 18.82 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 41.25 ton

Shear due to dead loads at east support = 4.61 ton
Shear due to live loads at east support = 5.57 ton

Shear capacity is sufficient for 24 ton loading

Girder 24

Bending capacity = 58.51 ton.ft

Maximum imposed bending due to dead loads = 2.61 ton.ft
Maximum imposed bending due to live loads = 8.24 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 30.94 ton

Shear due to dead loads at east support = 1.78 ton
Shear due to live loads at east support = 4.47 ton

Shear capacity is sufficient for 24 ton loading

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Girder 25

Bending capacity at midspan = 703.26 ton.ft

Maximum moment due to dead loads = 148.31 ton.ft (at 13.713ft from E)
Moment at midspan due to dead loads = 147.44 ton.ft

Moment at midspan due to live loads = 94.82 ton.ft

Girder has sufficient capacity at midspan for 24 ton loading

Bending capacity with 1 curtailment plate = 539.62 ton.ft

Moment due to dead loads at first curtailment point = 139.76 ton.ft
Moment due to live loads at first curtailment point = 76.79 ton.ft

Girder has sufficient capacity at curtailment point for 24 ton loading

Bending capacity with no curtailment plate = 377.64 ton.ft

Moment due to dead loads at second curtailment point = 105.45 ton.ft
Moment due to live loads at second curtailment point = 61.89 ton.ft

Girder has sufficient capacity at curtailment point for 24 ton loading

Shear Capacity = 103.1 ton

Shear due to dead loads at east support = 24.34 ton
Shear due to live loads at east support = 12.24 ton

Shear capacity is sufficient for 24 ton loading

Girders 26, 27, 29 and 30

The dead loads for girders 27 and 29 will be used as they are the most onerous

Bending capacity at west cutout and curtailment point = 453.23 ton.ft

Bending due to dead loads = 53.01 ton.ft
Bending due to live loads = 47.88 ton.ft

Girder has sufficient bending capacity at the west cutout/curtailment point

Bending capacity at midspan = 602.90 ton.ft

Bending due to dead loads = 86.22 ton.ft
Bending due to live loads = 73.56 ton.ft

Girder has sufficient bending capacity at midspan

Bending capacity at east cutout = 403.08 ton.ft

Bending due to dead loads = 79.13 ton.ft
Bending due to live loads = 67.22 ton.ft

Girder has sufficient bending capacity at east cutout

Bending capacity at east curtailment point = 228.39 ton.ft

Bending due to dead loads = 60.31 ton.ft
Bending due to live loads = 53.72 ton.ft

Girder has sufficient bending capacity at east curtailment point

Shear capacity at east support = 106.9 ton

Shear due to dead loads at east support = 11.10 ton
Shear due to live loads at east support = 11.18 ton

Shear capacity is sufficient for 24 ton loading

Girder 28

Bending capacity at midspan = 517.41 ton.ft

Bending due to dead loads = 97.80 ton.ft
Bending due to live loads = 72.94 ton.ft

Girder has sufficient bending capacity at midspan

Bending capacity at curtailment point = 373.19 ton.ft

Bending due to dead loads = 63.72 ton.ft
Bending due to live loads = 50.10 ton.ft

Girder has sufficient bending capacity at curtailment point

Shear capacity at support = 107.4 ton

Shear due to dead loads = 12.65 ton
Shear due to live loads at east support = 11.15 ton

Shear capacity is sufficient for 24 ton loading

Girder 31

Bending capacity at midspan = 703.26 ton.ft

Maximum moment due to dead loads = 175.82 ton.ft (at 17.184ft from E)
Moment at midspan due to dead loads = 174.64 ton.ft

Moment at midspan due to live loads = 100.67 ton.ft

Girder has sufficient capacity at midspan for 24 ton loading

Bending capacity with 1 curtailment plate = 539.62 ton.ft

Moment due to dead loads at first curtailment point = 131.55 ton.ft
Moment due to live loads at first curtailment point = 71.03 ton.ft

Girder has sufficient capacity at curtailment point for 24 ton loading

Bending capacity with no curtailment plate = 377.64 ton.ft

Moment due to dead loads at second curtailment point = 127.25 ton.ft
Moment due to live loads at second curtailment point = 58.30 ton.ft

Girder has sufficient capacity at curtailment point for 24 ton loading

Shear Capacity = 103.1 ton

Shear due to dead loads at west support = 31.80 ton
Shear due to live loads at west support = 12.14 ton

Shear capacity is sufficient for 24 ton loading

Girder 32

Bending capacity = 91.24 ton.ft

Maximum imposed bending due to dead loads = 9.86 ton.ft
Maximum imposed bending due to live loads = 15.54 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 41.25 ton

Shear due to dead loads = 4.00 ton
Shear due to live loads at east support = 7.10 ton

Shear capacity is sufficient for 24 ton loading

Girder 33

Bending capacity = 170.08 ton.ft

Maximum imposed bending due to dead loads = 36.23 ton.ft
Maximum imposed bending due to live loads = 29.05 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 51.56 ton

Shear due to dead loads = 8.68 ton
Shear due to live loads at east support = 6.60 ton

Shear capacity is sufficient for 24 ton loading

Jacobs		CALCULATION SHEET			
Office	York Office	Page No.	109	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Girder Capacities	Checker	[redacted]	Date	Mar-25

Girder 34

Bending capacity = 302.54 ton.ft

Maximum imposed bending due to dead loads = 72.22 ton.ft
Maximum imposed bending due to live loads = 42.55 ton.ft

Bending capacity is sufficient for 24 ton loading

Shear capacity = 49.41 ton

Shear due to dead loads at west support = 12.19 ton
Shear due to live loads at west support = 6.65 ton

Shear capacity is sufficient for 24 ton loading

Results Summary Table

	Girder	Dead Loads		Live Loads		Total		Capacity	
		Bending	Shear	Bending	Shear	Bending	Shear	Bending	Shear
Support & midspan	20	45.56	6.48	57.87	7.39	103.43	13.87	302.54	51.563
Support & midspan	21	60.02	10.16	37.91	6.29	97.92	16.45	302.54	49.41
Support & midspan	22	32.17	7.34	30.12	6.12	62.29	13.47	170.08	51.56
Support & midspan	23	13.39	4.61	18.82	5.57	32.21	10.19	91.24	41.3
Support & midspan	24	2.61	1.78	8.24	4.47	10.85	6.25	58.51	30.9
Support & Mmax	25	148.31	16.63	94.82	12.24	243.13	28.88	703.26	103.1
Curtailment point	25	139.76	9.46	76.79	5.11	216.55	14.57	539.62	103.1
Curtailment point	25	105.45	11.13	61.89	8.58	167.35	19.71	377.64	103.1
Support & midspan	26	59.75	7.69	73.56	11.18	133.31	18.87	602.90	106.9
Cut out	26	54.83	2.21	67.22	3.69	122.05	5.89	403.08	*
Cut out	26	32.26	5.21	42.48	8.50	74.74	13.71	453.23	*
Curtailment point	26	41.79	4.22	53.72	7.65	95.50	11.87	228.39	*
Curtailment point	26	36.73	4.77	47.88	8.12	84.61	12.89	453.23	*
Support & midspan	27 & 29	86.22	11.10	73.56	11.18	159.79	22.27	602.90	106.9
Cut out	27 & 29	79.13	3.18	67.22	3.69	146.35	6.87	403.08	*
Curtailment point	27 & 29	60.31	6.08	53.72	7.65	114.02	13.73	228.39	*
Curtailment point	27 & 29	53.01	6.89	47.88	8.12	100.89	15.01	453.23	*
Cut out	27 & 29	46.56	7.53	42.48	8.50	89.04	16.02	453.23	*
Support & midspan	30	78.08	10.05	73.56	11.18	151.64	21.22	602.90	106.9
Cut out	30	71.65	2.88	67.22	3.69	138.87	6.57	403.08	*
Curtailment point	30	54.61	5.51	53.72	7.65	108.32	13.16	228.39	*
Curtailment point	30	48.00	6.24	47.88	8.12	95.88	14.36	453.23	*
Cut out	30	42.16	6.82	42.48	8.50	84.64	15.31	453.23	*
Support & midspan	28	97.80	12.65	72.94	11.15	170.74	23.80	517.41	107.4
Curtailment point	28	63.72	7.47	50.10	7.91	113.82	15.38	373.19	107.4
Support & midspan	31	174.64	31.80	100.67	12.14	275.30	43.94	703.26	103.1
Curtailment point	31	131.55	10.15	71.03	4.04	202.58	14.19	539.62	103.1
Curtailment point	31	127.25	14.73	58.30	8.45	185.54	23.18	377.64	103.1
Support & midspan	32	9.86	4.00	15.54	7.10	25.40	11.10	91.24	41.25
Support & midspan	33	36.23	8.68	29.05	6.60	65.28	15.28	170.08	49.41
Support & midspan	34	72.22	12.19	42.55	6.65	114.77	18.84	302.54	49.41
Support & midspan	35	Same as 20 which has greater imposed loading							

*Girder has sufficient shear capacity under the worst case (shallowest end and greatest shear). Therefore the shear capacity at the cut outs and curtailment points has not been checked due to the uncertainty of the stiffener locations.

Jacobs		CALCULATION SHEET			
Office	York Office	Page No.	111	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Concrete Slab (Angle) Check	Checker	[redacted]	Date	Mar-25

Concrete Deck

The deck between the steel girders will be checked using a single wheel load.

Checking the 3" x 3" x 1/2" angles

Section	b	d	A	y	A·y	A(y-yt)²	Ixx
	in	in	in²	in	in³	in³	in⁴
Web	0.50	2.50	1.3	1.25	1.56	0.84	0.65
Flange	3.00	0.50	1.5	2.75	4.13	0.70	0.03
		Net Area	2.8		5.69	1.53	0.68

Depth of full section	D	=	3.00	in
Depth of web	dwe	=	2.50	in
Distance to NA from top of section	yt	=	2.07	in
Distance to NA from bottom of section	yb	=	0.93	in
Second moment of area of section	Ixx	=	2.22	in⁴
Elastic section modulus (top flange)	Zxc	=	1.07	in³
Elastic section modulus (bott. flange)	Zxt	=	2.38	in³

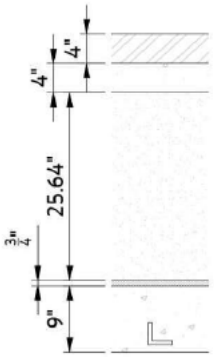
The section of the deck between girder 31 and 32 has the greatest span and will therefore impose the greatest loading on a single angle.

Taking the distance between the girders at the support as a conservative assessment

Span = 5.96 ft

Distanace between girders = 4.92 ft

Material	lb/cu.ft
Steel	490
Concrete	150
Miscellaneous Fill	135
Macadam (tar)	144



Self Weight (2.8/144) x (490/2240) = 0.0042 ton/ft

Concrete slab
Area = 105.25 in²
UDL = 0.049 ton/ft

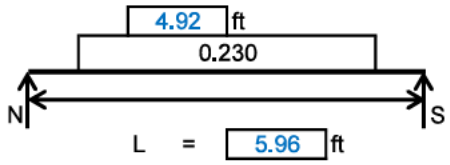
Bitumen Layer
Area = 9 in²
UDL = 0.004 ton/ft

Miscellaneous Fill
Area = 307.68 in²
UDL = 0.129 ton/ft

Concrete
Area = 48 in²
UDL = 0.022 ton/ft

Surfacing
Area = 48 in²
UDL = 0.021 ton/ft

Total UDL = 0.230 ton/ft
op09



Vmax = 0.56 ton

Mmax = (0.56 x 0.52) + (0.56 x 0.5 x 2.46)
= 0.99 ton.ft

The angle will be checked for a single wheel load. Consider the following for dispersal of the wheel load.

BE4 Cl 201

The maximum weight of 1 wheel is 5 ton

The approximate contact area for each wheel may be taken as 33 sq.in/ton and may be assumed as rectangular and equal to 1.4b²

Area of wheel load = 5 x 1.25 x 33
= 206.25 sq.in

b = 12.14 in
a = 16.99 in

Depth of fill to top of angle = 39.4 in

Length of dispersed sides A = 90.94 in = 7.578 ft
B = 95.79 in = 7.983 ft

Jacobs			CALCULATION SHEET		
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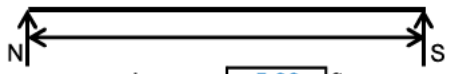
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Concrete Slab (Angle) Check	Checker	[redacted]	Date	Mar-25

Using the shorter side for a conservative assessment

The angle will carry 13% of the wheel load

Assuming the wheel load is dispersed evenly along the length of the angle

UDL = (6.25 x 0.13) / 5.958
= 0.138 ton/ft



L = 5.96 ft

Mmax = 0.61 ton.ft

Vmax = 0.41 ton

Capacity

Permissible stress in bending = 11.875 ton/sq.in

μ = 28.2 ton.in
= 2.35 ton.ft

Total imposed moment = 1.60 ton.ft

It will be assumed that stresses in the web will not exceed
pbc = 5.50 ton/sq.in

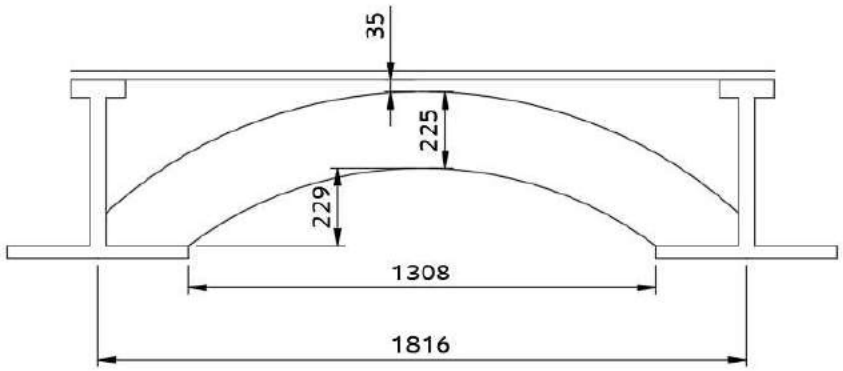
Shear capacity = 1.25 x 5.5
= 6.88 ton

Total imposed loads = 0.98 ton

Angle has sufficient capacity for imposed loads and therefore further checks considering the contribution of the concrete as well will not be undertaken.

Jacobs	CALCULATION SHEET				
Office	York	Page No.	114	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Jack Arches	Checker	[redacted]	Date	Mar-25

Jack Arch Assessment



Typical jack arch section from the cast iron section north of the road.

The jack arches are in fair condition. There is some minor spalling on isolated bricks and minor mortar loss throughout. Some softening of the mortar is expected due to the damp present across the structure soffit.

**Review of the adequacy of the jack arches and tie-rods will be based upon the empirical method described in Bridgeguard 3 Current Information Sheet No 22 (Pro-forma for the empirical assessment of brick, masonry and concrete jack arches and associated ties.)*

SECTION 1 Check for Compliance with 40T Configuration Requirements

					Compliant Yes/No
What is the maximum span of the arch? **Non-compliant if greater than 2.0m*			1.308	m	Yes
Do jack arches spring from bottom flanges of beams? **If not, non-compliant*			Yes		Yes
What is the beam spacing?	(web - web)	b =	1.816	m	
What is the rise of the arch?		r_c =	0.229	m	
Gross aspect ratio? **Non-compliant if b/r_c greater than 10*		b/r_c =	7.93		Yes
What is the arch barrel thickness? (include concrete fill above) How is thickness derived? From previous assessment calculations **Non-compliant if thickness is less than 220mm*		d =	225	mm	Yes

Jacobs			CALCULATION SHEET		
Office	York	Page No.	115	Calc No.	0451956
Job No. & Title	VAR9/7410 HRE Assessment Programme BOK1/283 BE4 Assessment	Calcs by	[redacted]	Date	Mar-25
Section	Jack Arches	Checker	[redacted]	Date	Mar-25

SECTION 2 Check for Deficency

Type No.	Deficency				Pass/ Fail
1	What is the backing material? Is it structural?				
	» Possibly concrete, if not well compacted fill thefore considered structural				
	Does the structural backing extend to at least the crown level of the arch extrados?		Yes		Pass
	*If not, fail				
	What is effective shear depth of deck?	D_s =	489	mm	
	» *arch rise*		229	mm	
	+ barrel thickness		225	mm	
	+ height of structural fill above crown of extrados		35	mm	
	Is $D_s \geq$ minimum requirement Fig1.	Fig1. Min =	393.92	mm	
	*Fail if $D_s <$ Fig 1 » 489 > 393.92				Pass
2	Do jack arches span longitudinally or transversely between longitudinal girders?		Transversely		
	For Longitunal spanning jack arches, ignore following questions on ties/lateral restraint and state N/A.				
	Are ties provided in edge bays of transverse spanning jack arches?		No		
	If yes, go to 3a/3b				
	If not, fail, unless edge bay is 'hard' (see 5)				
	End bays considered hard				Pass
3a	What is the cross sectional area of one tie?	A =	-	mm^2	
	(Allowing for corrosion losses)				
CI	What is the number of ties per beam length?	n =	-		
	What is the clear skew span?	L =	-	m	
	Specific area of tie (As) = ((n+1) x A) /L	A_s =	N/A	mm^2/m	
	Non-compliant if less than 260mm^2/m				
	What is the maximum tie spacing?	S =	-	m	
	Non compliant if greater than 3.0m for wrought iron/steel				N/A
3b	What is the cross sectional area of one tie?	A =	-	mm^2	
	(Allowing for coorsion losses)				
WI/	What is the number of ties per beam length?	n =	-		
ST	What is the clear skew span?	L =	-	m	
	Specific area of tie (As) = ((n+1) x A) /L	A_s =	N/A	mm^2/m	
	Non-compliant if less than 260mm^2/m				
	What is the maximum tie spacing?	S =	-	m	
	Non compliant if greater than 3.0m for wrought iron/steel				
4	Are ties located within crown of external arch?		No		
	If so, then fail CI or possible fail for wrought iron/steel				N/A
5	Does external bay construction provide alternative lateral restraint?				
	(ie not soft edge)		Yes		
	*If so, pass *If not, are ties provided in first Jack Arch bay?*				Pass
	If yes, treat as 3a (or 3b) Otherwise fail.				

Appendix G. Services Search Results

National One Call
Protecting People and Services in the UK

Online: www.national-one-call.co.uk
Call us: 0800 0853 865 (Mon-Fri, 9am-5pm)

Retriever Planning Pack

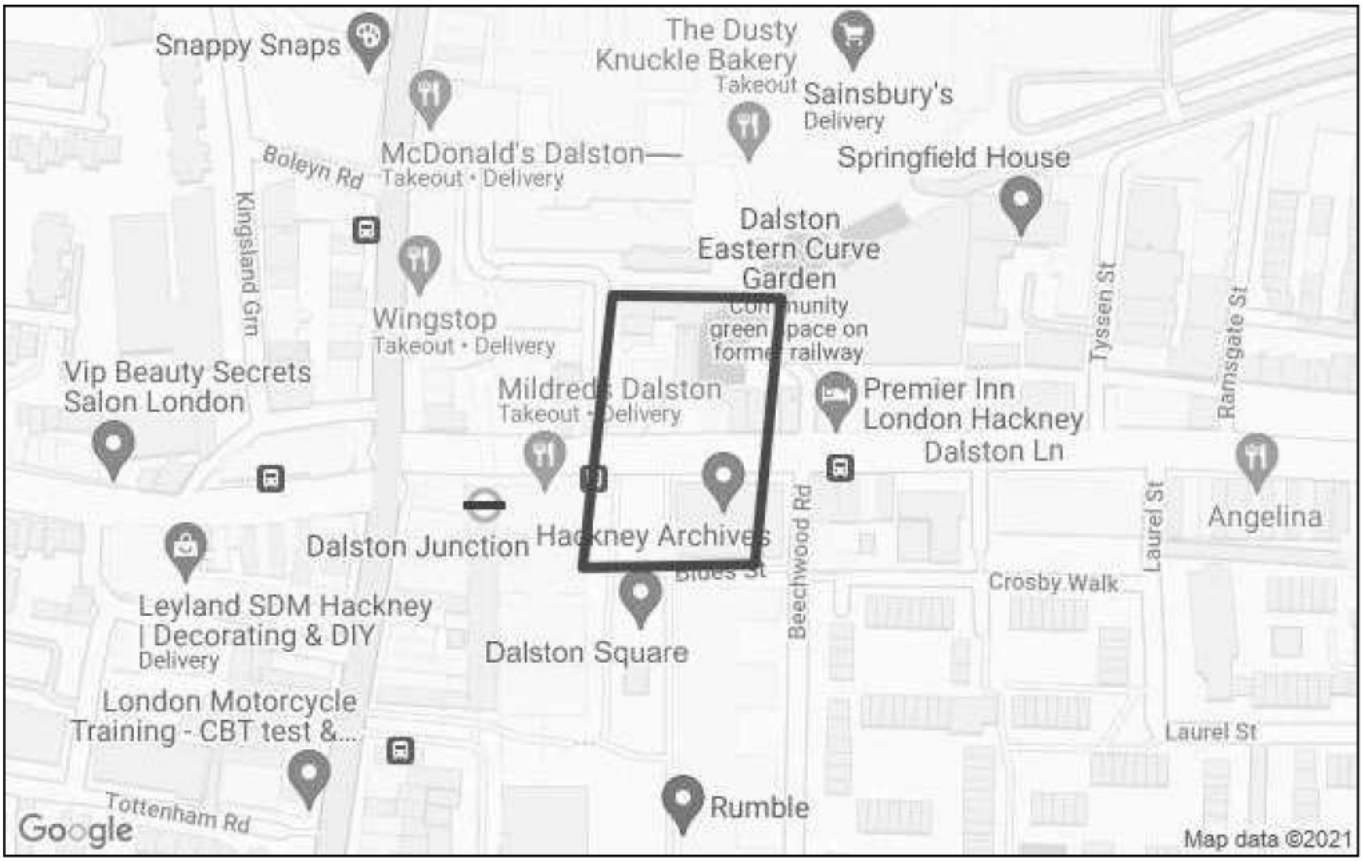
Jacobs UK Ltd

Enquiry Date	13/10/21	**Enquiry**	NOC/CTWSV456
Contact	[redacted]	**Service**	Retriever
Asset Owners	22	**Enquiry Status**	Complete
Price Status	Actual	**Payment Status**	Unpaid

Enquiry Specification		
Option	**What is it?**	**Selected**
Enquiry Type	Enquiry by National One Call	✔
Express	Emailing of Plans as they arrive	✖
Fusion Plan	Compile Plans into 1 Drawing	✖
Delivery	Delivery of Completed Pack by Email	✔

Enquiry Documentation		
Document	**What is it?**	**Included**
PlanToDig Enquiry	Details of Enquiry	✔
Asset Owner Contacts	List of Selected Asset Owners	✔
Text Responses	Instructions from Asset Owners	✔
CoRE	Certificate of Registered Enquiry	✔
Appendix A: Asset Owner Plans		
See Plans section Cover Page for Details		
Appendix B: Enquiry Accounting		
Invoice	Invoice for Enquiry	✔
For Guidance on PlanToDig		
View / download our PlanToDig Guide		

PlanToDig Enquiry			
Jacobs UK Ltd			
Date	13/10/21	**Enquiry**	NOC/CTWSV456
Contact	[redacted]	**Status**	Complete



Enquiry Site		
Dalston Ln, London E8 3DF		
Disused railway tunnel **(Public Street / Road)**		
OS Centre(Approx):533624,184860 (@5603 sq.mtrs)		
Work Intentions		
Intention	**Start**	**Duration**
Works Intended	2021-10-23	1 Day
Please send client waiver letter to all known service providers		
Enquiry is Complete		
Status: This Enquiry has Completed; you should now have all Responses from Asset Owners.		
Asset Owners: Charges from 22 Asset Owners have been Confirmed		
Timing: As Asset Owner Areas of Interest and Plans change frequently, please do not rely on Enquiries or Responses that are more than 30 days old.		
Content: Asset Owner responses should be considered `indicative only` until physically verified. Follow guidance in HSG(47)/NRSWA/CDM etc relating to services verification and excavation methods.		

Summary of Asset Owner Contacts for NOC/CTWSV456			
Enquiry Date	13/10/21	**Enquiry**	NOC/CTWSV456
Selected Contacts	22	**Closed**	22
Est. Charges	£202.67	**Act. Charges**	£134.47

Contact List				
Asset Owner	**Status**	**Txt**	**Est.**	**Act.**
Affected by Enquiry				
Asset Owner				
E S Pipelines Ltd	Closed		-	-
Electricity				
UK Power Networks (Operations) Ltd	Closed		£41.67	£41.67
Gas				
Cadent (National Grid Gas)	Closed		-	-
Multi-utility				
Brookfield Utilities UK (was GTC	Closed		-	-
Pipeline				
Linesearch (Pipeline search service)	Closed	**T**	-	-
Telecommunications				
BT Openreach	Closed		-	-
Virgin Media	Closed		£43.00	£43.00
Water / Sewerage				
Thames Water	Closed	**T**	£49.80	£49.80
See Response Text				
Electricity				
Utility Assets Ltd	Closed	**T**	-	-
Not Affected				
Asset Owner				
Zayo Group UK Ltd	Closed	**T**	-	-
Electricity				
National Grid Transmission Electricity	Closed		-	-
SSE Networks (Electricity)	Closed		£15.00	-
Gas				
National Grid Transmission (Gas)	Closed		-	-
Multi-utility				
Cofely District Energy	Closed	**T**	-	-
Telecommunications				
BSkyB Telecommunications Services Ltd	Closed	**T**	-	-
CityFibre	Closed	**T**	-	-
Colt Telecoms	Closed	**T**	-	-
Instalcom	Closed	**T**	-	-
Telia Sonera	Closed	**T**	-	-
Trafficmaster Ltd	Closed	**T**	-	-
Verizon Business	Closed	**T**	-	-
Vodafone Limited	Closed	**T**	£53.20	-

Contact Comments

Some Asset Owners provide guidance / notes when making their Response - in the interests of safety, these should be provided to any Site Operatives along with any Plans.

Asset Owner	Comments
Affected by Enquiry	
Pipeline	
Linesearch (Pipeline search service)	Cadent Gas, ES Pipelines, UK Power Networks and Zayo UK in Zone of Interest
Water / Sewerage	
Thames Water	OSS/12/1395325.Your Reference: NOC/CTWSV456.Site Address Supplied: Dalston Lane, London, E8 3DF. Thank you for placing your order with Thames Water Property Searches.? Please see the attached file for further details regarding your case. Yours faithfully Customer Service TeamThames Water Property Searches
See Response Text	
Electricity	
Utility Assets Ltd	Thank you for recently contacting Utility Assets plant record department. We will check whether we have any plant present at your site and contact you within 5 - 7 working days ONLY if we own any plant in the vicinity. If we do not reply, we do not have any apparatus in the area of your works. However, PLEASE TAKE CARE when excavating around electricity cables in the event that not all cables present may be accurately shown. We recommend you use detecting equipment to map the site before excavating and fully comply with HSG47. DO NOT assume that a cable is dead if you don`t have a record of its presence. The cable must be treated as live unless PROVEN DEAD by the cable owner. In case of emergency please contact your local electricity distribution company.
Not Affected	
Asset Owner	
Zayo Group UK Ltd	Having examined our records, we can confirm that ZAYO GROUP UK LTD has no owned apparatus within the searcharea of your enquiry detailed in the reference/location provided.
Multi-utility	
Cofely District Energy	We can confirm that, based on the details provided to us, we have no buried plant or equipment in the identified area.
Telecommunications	

BSkyB Telecommunications Services Ltd	Please be advised that Sky Telecommunications Services Ltd will not be affected by your proposal.
CityFibre	Title: NOC/CTWSV456Comment:Please find attached a plan of the area of your interest that may contain plant which may be affected by your proposed works.The validity of this response is 6 weeks, after such time a new enquiry would need to be made.
Colt Telecoms	We can confirm that Colt Technology Services do not have apparatus near the above location as presented on your submitted plan
Instalcom	We can confirm that Lumen Technologies (formerly CenturyLink Communications UK Limited, Level 3, Global Crossing (Uk) Ltd, Global Crossing PEC, Fibernet UK Ltd and Fibrespan Ltd) do not have any apparatus within the indicated works area.
Telia Sonera	Our client?s apparatus, Telia Carrier, is not located within the vicinity of the above reference and we therefore haveno further interest in this current location
Trafficmaster Ltd	I can confirm that Trafficmaster does not have equipment installed within the boundary of the works.
Verizon Business	We have reviewed your plans and have determined that Verizon (Formally known as MCI WorldCom, MFS) has no apparatus in the areas concerned.
Vodafone Limited	Please accept this email as confirmation that Vodafone: Fixed does not have apparatus within the vicinity of your proposed works

Asset Owner Plans Cover
Plans received from Asset Owners will be sent to you by email; these may require specialist printers, sometimes up to A0.
Plans may be accompanied by Disclaimers / Instructions etc. which will be contained in the Asset Owner Comments document. These Comments are often as important as the plans themselves as they give direction and context to the plan.
Treat All Plans as `Indicative` until physically verified.
Sometimes an Asset Owner may have provided a Plan even if they considered that they are `Not Affected`.
It is also possible that an Asset Owner has responded as `Affected` but is unable to provide a Plan of their services; this will be stated in the Asset Owner Comments.
Ensure that Asset Owner Comments accompany Plans

Certificate of Registered Enquiry (CoRE)

Enquiry Date	13/10/21	**Enquiry**	NOC/CTWSV456
Work Intention	Works Intended	**Site Type**	Public Street / Road

Asset Owners Contacted	
A CoRE is issued on completion of a PlanToDig Enquiry, when all Responses have been received from the selected Asset Owners. Due to risk of changes to Asset Owner presences / their Area of Interest (AoI), and the probability of changes to plans and service presences, an Enquiry should only be considered `good` for 30 days following Enquiry Date.	
Asset Owner	**Comments**
Affected by Enquiry	
Asset Owner	
E S Pipelines Ltd	
Electricity	
UK Power Networks (Operations) Ltd	
Gas	
Cadent (National Grid Gas)	
Multi-utility	
Brookfield Utilities UK (was GTC	
Pipeline	
Linesearch (Pipeline search service)	✔
Telecommunications	
BT Openreach	
Virgin Media	
Water / Sewerage	
Thames Water	✔
See Response Text	
Electricity	
Utility Assets Ltd	✔
Not Affected	
Asset Owner	
Zayo Group UK Ltd	✔
Electricity	
National Grid Transmission Electricity	
SSE Networks (Electricity)	
Gas	
National Grid Transmission (Gas)	
Multi-utility	

Cofely District Energy	✔
Telecommunications	
BSkyB Telecommunications Services Ltd	✔
CityFibre	✔
Colt Telecoms	✔
Instalcom	✔
Telia Sonera	✔
Trafficmaster Ltd	✔
Verizon Business	✔
Vodafone Limited	✔

Rev	Revision Note	Date	Drawn by	Approved
1-0	Original drawing Original design	25/09/15	DC	JR
1-1	Duct & chamber route amended.	12/10/15	DC	JCC
1-2	Offsite duct and meetme chamber amended.	12/11 /15	DC	JCC
1-3	Title block logo amended.	12/02 /17	DC	DC
1-4	PIA Asslaid data added. as per Leanne Gough JPID :39167:	29/14/05	DWA	N/A

DALE WATLING 29.10.2020

APPROVED FOR CONSTRUCTION

FIRS SITE

N

0 5 10 20 30 40
meters

NORTH 'CORE A'

0,0 CSP MDU-R: A003068
1,2 MDU-R: A003069
3,4 MDU-R: A003070

NORTH 'CORE B'

0,0 CSP MDU-R: A003071
1,2 MDU-R: A003072
3,4 MDU-R: A003073
5,6 MDU-R: A003074
7,8 MDU-R: A003075
9,10 MDU-R: A003076
11,12 MDU-R: A003077

SOUTH 'CORE A'

0,0 CSP MDU-R: A002445
1,2 MDU-R: A002446
3,4 MDU-R: A002447
5,6 MDU-R: A002448
7,8 MDU-R: A002449
9,10 MDU-R: A002450
11,12 IRS Head-End

SOUTH 'CORE B'

0,0 CSP MDU-R: A002451
1,2 MDU-R: A002452
3,4 MDU-R: A002453

1 x 100mm duct linking project N0017524-1

Offsite Duct Work

ONSITE MEET ME CHAMBER
E:533490
N:184903

OSCP Position
E:533565
N:184853

OSCP LOCATION

Approx. Distance 240m

BOLEYN ROAD
KINGSLAND HIGH STREET
STANBOROUGH PASSAGE
ABBOT STREET
ASHWIN STREET
KINGSLAND GREEN
Retail Unit 5
Retail Unit 4
Retail Unit 3
Retail Unit 2
Retail Unit 1
5 to 15
1 to 16
15 to 17
18 to 24
3 to 13
Bank

THIS DRAWING SHOWS:
GTC LAYOUT

Drawing Scale : 1:200
O.S.REF : 533531,184896
Network Number : N0015586-1
Linked Networks :
Drawing Number : FN0015586-1_R1-4_1_of_6

Developer : Taylor Wimpey
Location : Dalston Western Curve
Kingsland High Street
Dalston, London, E8 2JS

SHEET SIZE A0

DALE WATLING 29.10.2020

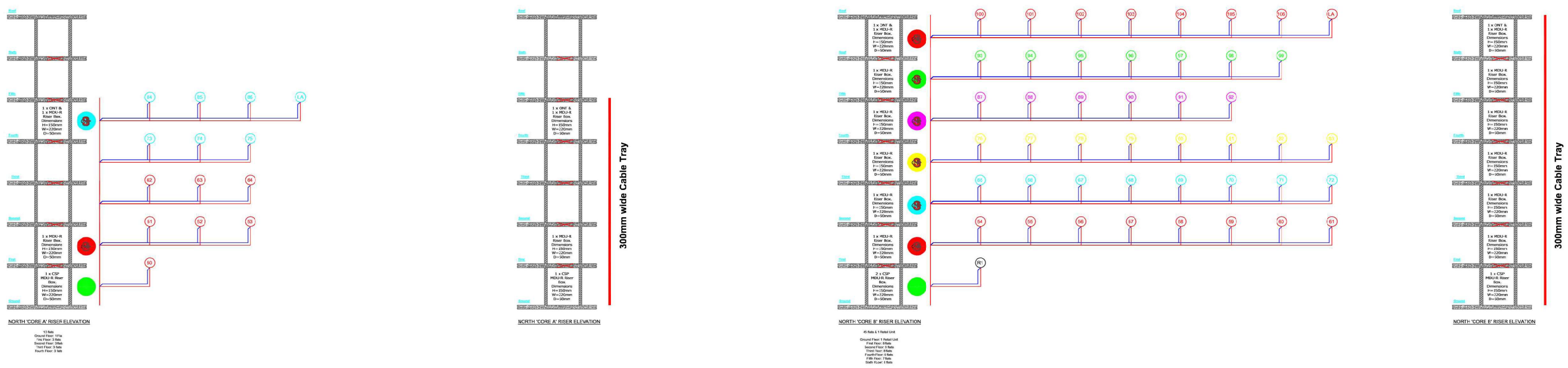
Rev	Revision Note	Date	Drawn by	Approved
1-0	Original drawing Original design	25/08/15	DC	JR
1-1	Duct & chamber route amended.	12/10/15	DC	JOC
1-2	Offsite duct and meetme chamber amended.	12/11/15	DC	JOC
1-3	Title block logo amended.	12/01/17	DC	DC
1-4	PIA As laid data added, as per Leanne Gough JPID: 391671	29/10/20	DWA	N/A

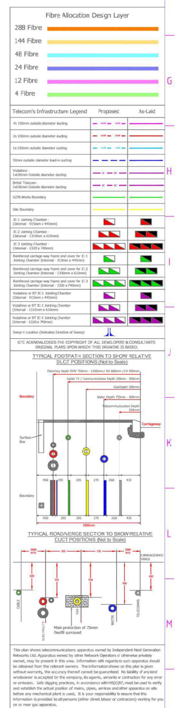
APPROVED FOR CONSTRUCTION

FIRS SITE

SOUTH CORE RISER ELEVATIONS

NORTH CORE RISER ELEVATIONS





This fibre network design has been carried out by :
INGN Design Engineer
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP
Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk

GIRS Reg. No: IUP 2000015/0017/001F

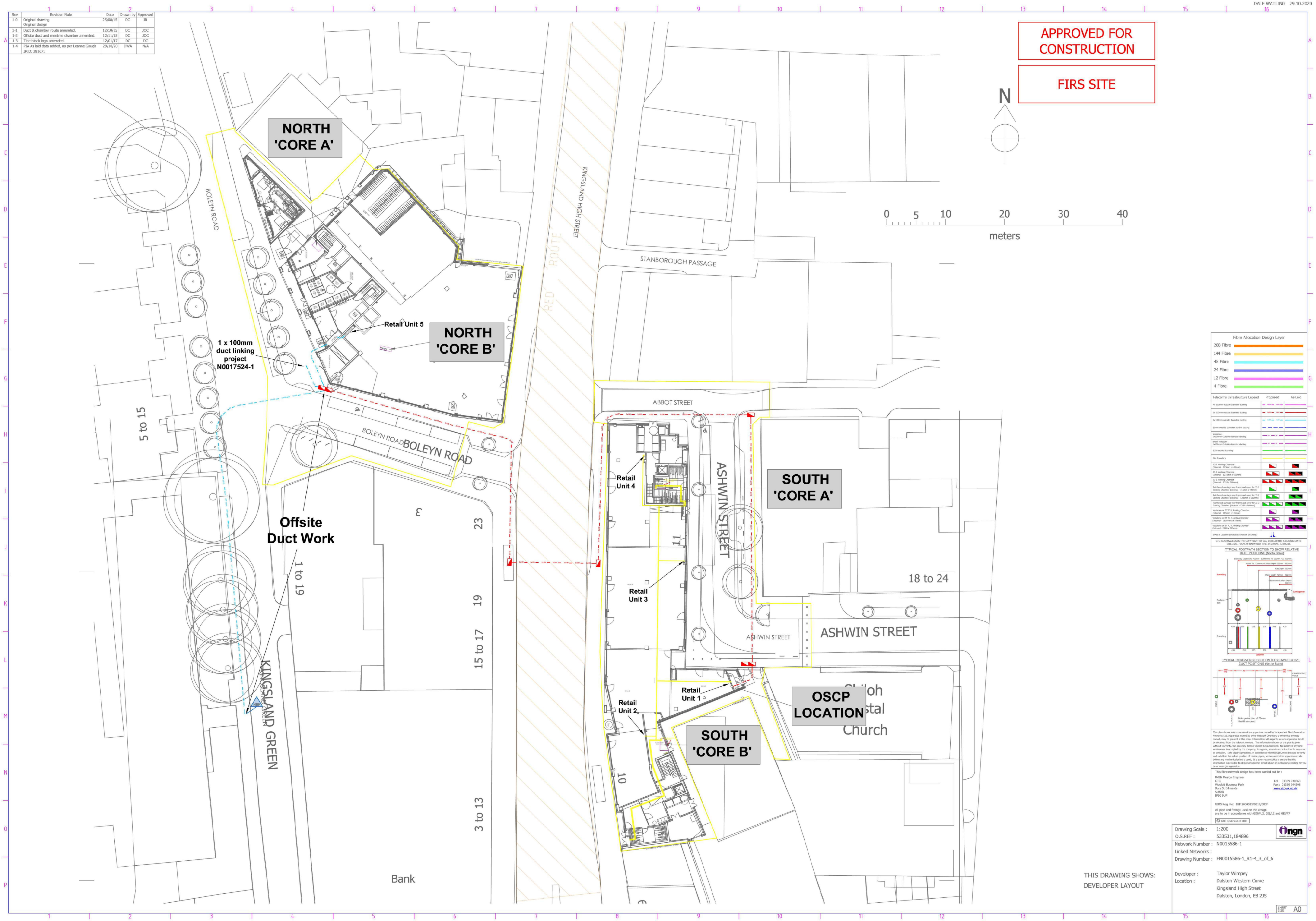
All pipe and fittings used on this design are to be in accordance with GIS/PL2, GIS/L2 and GIS/F7

THIS DRAWING SHOWS:
GTC LAYOUT

Drawing Scale : NTS
O.S.REF : 533531,184896
Network Number : N0015586-1
Linked Networks :
Drawing Number : FN0015586-1_R1-4_2_of_6

Developer : Taylor Wimpey
Location : Dalston Western Curve
Kingsland High Street
Dalston, London, E8 2JS

SHEET SIZE A0


DALE WATLING 29.10.2020
APPROVED FOR CONSTRUCTION
FIRS SITE
N
0 5 10 20 30 40
meters
NORTH 'CORE A'
NORTH 'CORE B'
Retail Unit 5
1 x 100mm duct linking project N0017524-1
BOLEYN ROAD
5 to 15
Offsite Duct Work
1 to 19
KINGSLAND GREEN
KINGSLAND HIGH STREET
RED ROUTE
STANBOROUGH PASSAGE
ABBOT STREET
BOLEYN ROAD
3
23
19
15 to 17
3 to 13
Bank
Retail Unit 4
Retail Unit 3
Retail Unit 2
Retail Unit 1
11
10
ASHWIN STREET
SOUTH 'CORE A'
18 to 24
SOUTH 'CORE B'
OSCP LOCATION
Church
Fibre Allocation Design Layer
288 Fibre
144 Fibre
48 Fibre
24 Fibre
12 Fibre
4 Fibre
Telecom's Infrastructure Legend
Proposed
As-Laid
TYPICAL FOOTPATH SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)
TYPICAL ROAD/VERGE SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)
This fibre network design has been carried out by :
INGN Design Engineer
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP
Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk
GIRS Reg. No: IUP 2000015/0017/001F
All pipe and fittings used on this design are to be in accordance with GIS/PL2, GIS/L2 and GIS/F7
© GTC Pipelines Ltd 2006
THIS DRAWING SHOWS: DEVELOPER LAYOUT
Drawing Scale : 1:200
O.S.REF : 533531,184896
Network Number : N0015586-1
Linked Networks :
Drawing Number : FN0015586-1_R1-4_3_of_6
Developer : Taylor Wimpey
Location : Dalston Western Curve
Kingsland High Street
Dalston, London, E8 2JS
SHEET SIZE A0

Rev	Revision Note	Date	Drawn by	Approved
1-0	Original drawing Original design	25/08/15	DC	JR
1-1	Duct & chamber route amended.	12/10/15	DC	JOC
1-2	Offsite duct and meetme chamber amended.	12/11/15	DC	JOC
1-3	Title block logo amended.	12/01/17	DC	DC
1-4	PIA As laid data added, as per Leanne Gough JPID: 391671	29/10/20	DWA	N/A

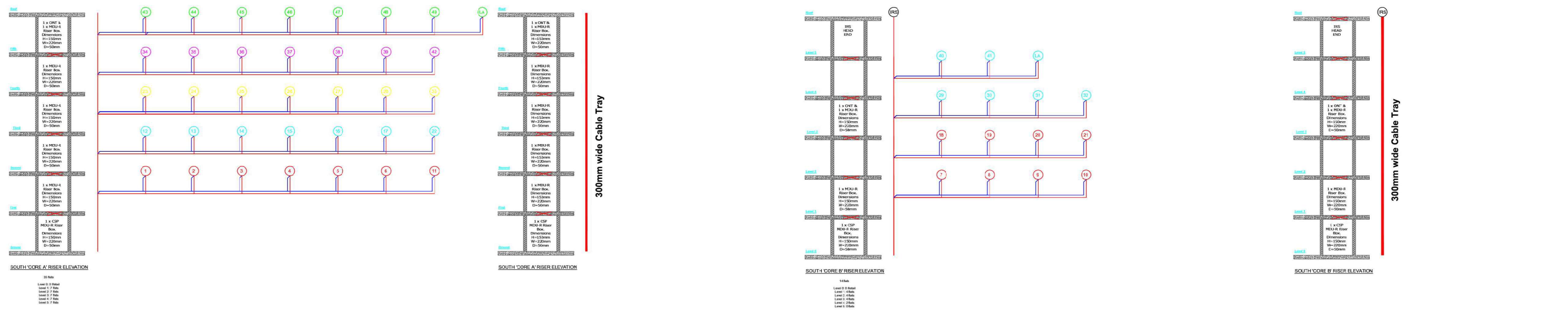
DALE WATLING 29.10.2020

Rev	Revision Note	Date	Drawn by	Approved
1-0	Original drawing Original design	25/08/15	DC	JR
1-1	Duct & chamber route amended.	12/10/15	DC	JOC
1-2	Offsite duct and meetme chamber amended.	12/11/15	DC	JOC
1-3	Title block logo amended.	12/01/17	DC	DC
1-4	PIA As laid data added, as per Leanne Gough JPID: 391671	29/10/20	DWA	N/A

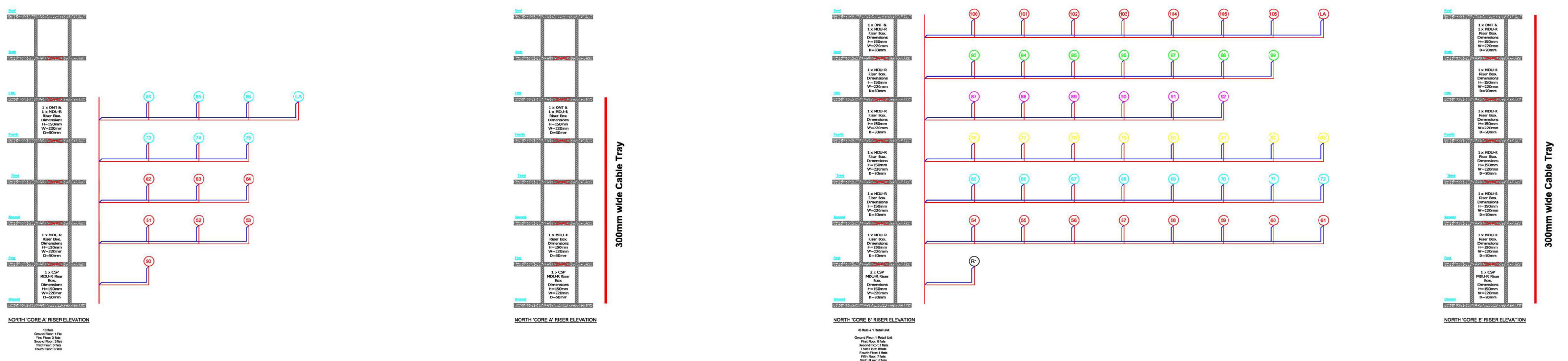
APPROVED FOR CONSTRUCTION

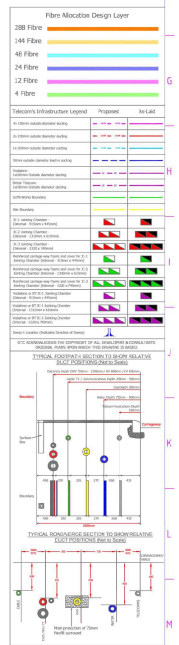
FIRS SITE

SOUTH CORE RISER ELEVATIONS



NORTH CORE RISER ELEVATIONS





This plan shows telecommunications apparatus owned by Independent Next Generation Networks Ltd. Apparatus owned by other Network Operators or otherwise privately owned, may be present in this area. Information with regards to such apparatus should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. No liability of any kind whatsoever is accepted by the company, its agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of mains, pipes, services and other apparatus on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near gas apparatus.

This fibre network design has been carried out by :

INGN Design Engineer
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP

Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk

GIRS Reg. No: IUP 2000015/0017/001F

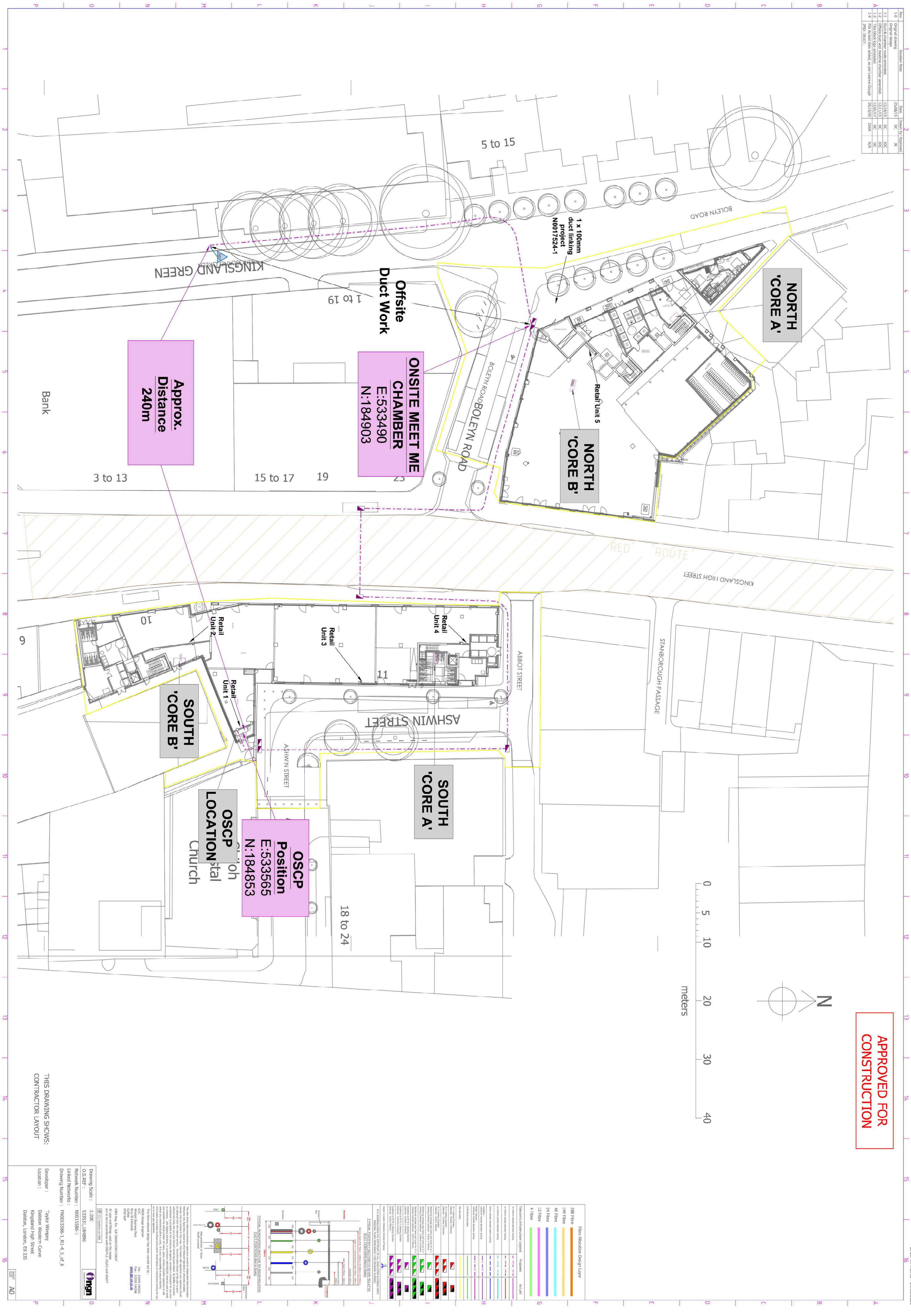
All pipe and fittings used on this design are to be in accordance with GIS/PL2, GIS/L2 and GIS/F7

THIS DRAWING SHOWS:
DEVELOPER LAYOUT

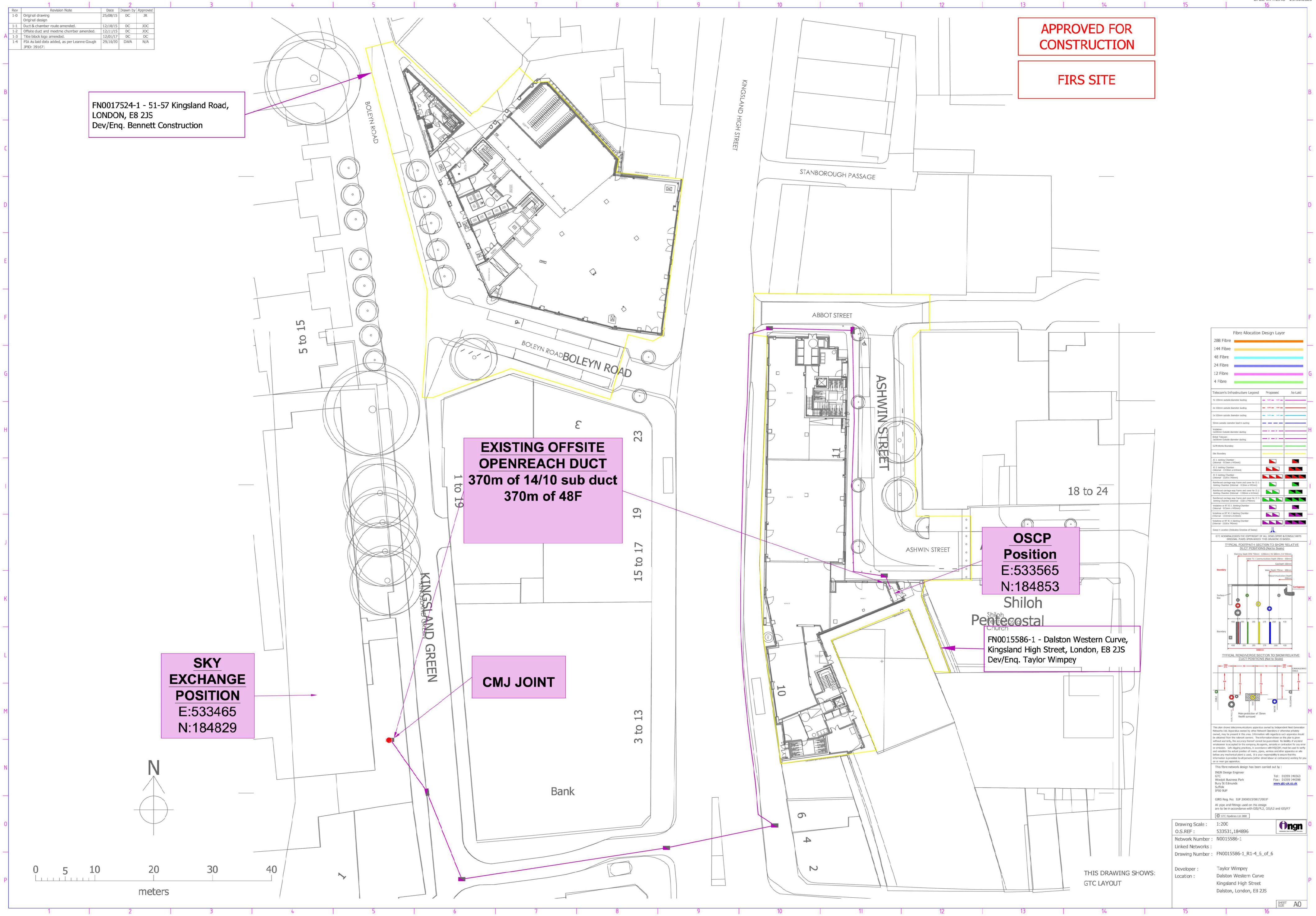
Drawing Scale : NTS
O.S.REF : 533531,184896
Network Number : N0015586-1
Linked Networks :
Drawing Number : FN0015586-1_R1-4_4_of_6

Developer : Taylor Wimpey
Location : Dalston Western Curve
Kingsland High Street
Dalston, London, E8 2JS

SHEET SIZE A0



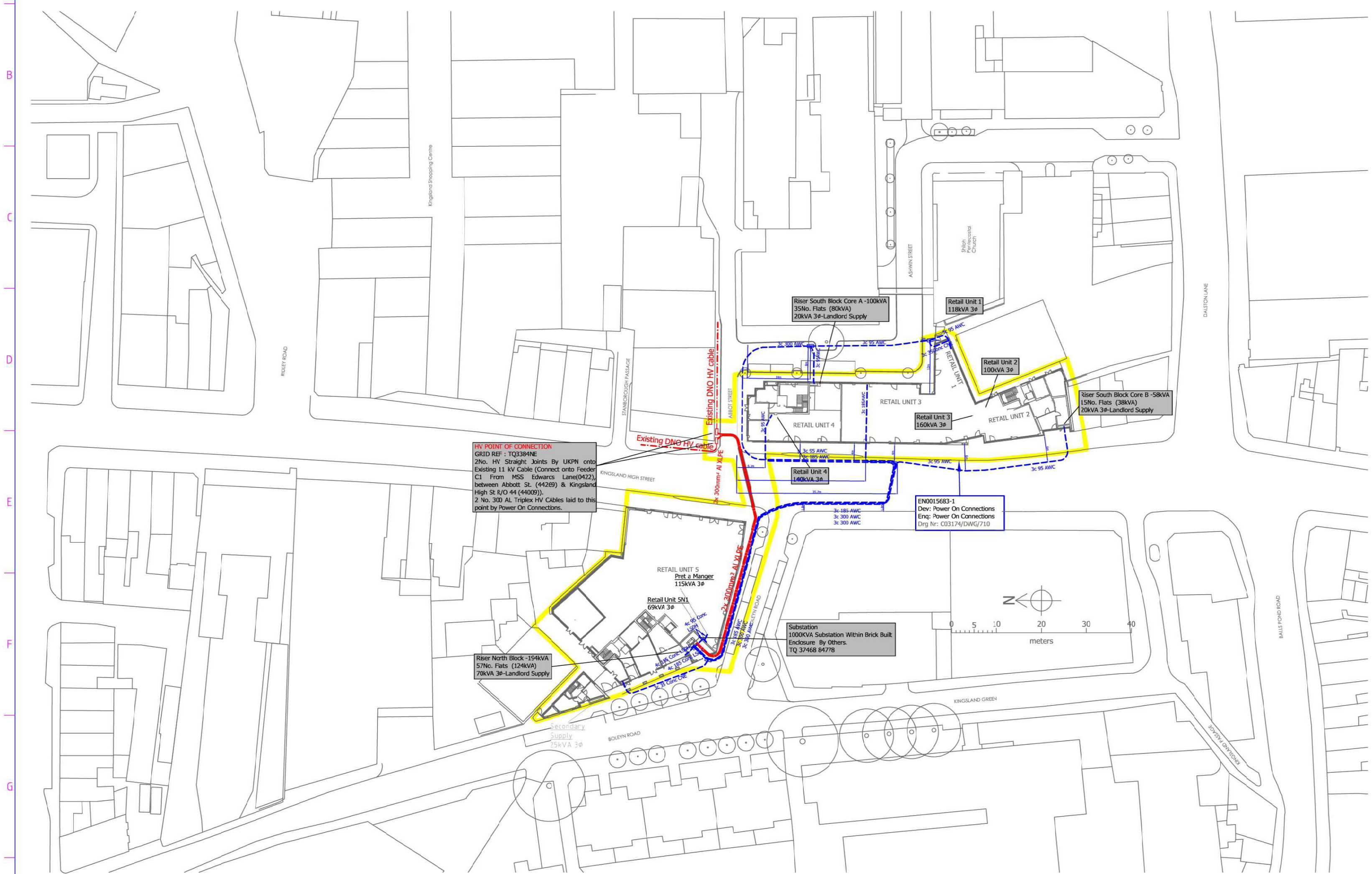
APPROVED FOR CONSTRUCTION
N
meters
0 5 10 20 30 40
NORTH 'CORE A'
NORTH 'CORE B'
SOUTH 'CORE A'
SOUTH 'CORE B'
ONSITE MEET ME CHAMBER E:533490 N:184903
OSCP Position E:533565 N:184853
OSCP LOCATION
Approx. Distance 240m
Offsite Duct Work
1 x 100mm duct linking project N0017524-1
KINGSLAND GREEN
KINGSLAND HIGH STREET
RED ROUTE
BOLEYN ROAD
ASHWIN STREET
ABBOT STREET
STANBOROUGH PASSAGE
Retail Unit 1
Retail Unit 2
Retail Unit 3
Retail Unit 4
Retail Unit 5
5 to 15
1 to 19
3 to 13
15 to 17
19
18 to 24
10
11
6
Bank
Church
THIS DRAWING SHOWS: CONTRACTOR LAYOUT
Drawing Scale : 1:200
O.S.REF : 533531,184896
Network Number : N0015586-1
Drawing Number : FN0015586-1_R1-4_5_of_6
Developer : Taylor Wimpey
Location : Dalston Western Curve, Kingsland High Street, Dalston, London, E8 2JS
DALE WATLING 29.10.2020



DALE WATLING 29.10.2020
APPROVED FOR CONSTRUCTION
FIRS SITE
FN0017524-1 - 51-57 Kingsland Road, LONDON, E8 2JS
Dev/Enq. Bennett Construction
BOLEYN ROAD
KINGSLAND HIGH STREET
STANBOROUGH PASSAGE
ABBOT STREET
ASHWIN STREET
5 to 15
EXISTING OFFSITE OPENREACH DUCT
370m of 14/10 sub duct
370m of 48F
1 to 19
23
19
15 to 17
3 to 13
11
18 to 24
OSCP Position
E:533565
N:184853
Shiloh
Pentecostal
FN0015586-1 - Dalston Western Curve, Kingsland High Street, London, E8 2JS
Dev/Enq. Taylor Wimpey
KINGSLAND GREEN
CMJ JOINT
SKY EXCHANGE POSITION
E:533465
N:184829
Bank
10
6
4
2
N
0 5 10 20 30 40
meters
Fibre Allocation Design Layer
288 Fibre
144 Fibre
48 Fibre
24 Fibre
12 Fibre
4 Fibre
Drawing Scale : 1:200
O.S.REF : 533531,184896
Network Number : N0015586-1
Linked Networks :
Drawing Number : FN0015586-1_R1-4_5_of_6
Developer : Taylor Wimpey
Location : Dalston Western Curve, Kingsland High Street, Dalston, London, E8 2JS
THIS DRAWING SHOWS: GTC LAYOUT
A0

PETER HART 06.04.2021

Rev	Revision Note	Date	Drawn by	Approved
1-7	LRC Data Added From LV 21742	21/10/16	MC	N/A
1-8	Incorrect LRC Data Amended From LV 16592	08/12/16	JL	N/A
1-9	Drawing Update: C03174/DWG/010/Rev7 Schematic Update: C03174/DWG/001/Rev5	06/04/17	JL	N/A
2-0	Schematic Updated: C03174-DWG-001-Rev6	03/05/17	GR	N/A
2-1	LRC Data Added From LV 25110 (BPID: 66627)	09/05/17	JJ	N/A
2-1	Schematic Updated: C03174-DWG-001-Rev7	06/07/17	CH	N/A
2-3	LRC Data Added From LV 28772 JPID101293	25/10/17	EWT	N/A
2-4	LRC Data Added From LV45617 JPID: 279674	14/10/19	SM	N/A
2-5	Updated Design: C03174-DWG-001 Rev 8	25/10/19	CH	N/A
2-6	Updated Drawing: C03174/DWG/010/Rev 8 Updated Schematic: C03174/DWG/001/Rev 9	13/03/20	CH	N/A
2-7	Updated Drawing: C03174/DWG/010/Rev 9 Updated Schematic: C03174/DWG/001/Rev 10	23/03/20	CH	N/A
2-8	LRC Data Added From LV58082 JPID: 443352	06/04/21	PH	N/A



Proposed HV Mains
All HV cables to be laid in pre-excavated trench to 600mm cover, provided by the developer (except A - B). Road crossings to be plastic 150mm rigiduct, at 750mm cover to the finished level.

Proposed LV Mains
All LV cables to be laid in pre-excavated trench to 450mm cover, provided by the developer (except A - B). Road crossings to be plastic rigiduct sized to accommodate the mains shown on this drawing, at 750mm cover to the finished level.

Harmonised Mains Cables - Phase Identification
For new colour convention mains, the connected phases will be shown as BR, BK, GY where **BR** = Brown (Red) / **BK** = Black (Yellow) / **GY** = Grey (Blue).

All services are to be ducted. Duct laid by the developer at 450mm cover to the finished level. Road crossings to be ducted with 150mm rigiduct.

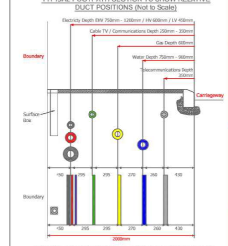
LEGEND

- 33kV cable - Proposed
- 33kV cable - Existing / Laid
- 11kV cable - Proposed
- 11kV cable Existing / Laid
- LV cable - Proposed
- LV cable - Existing / Laid
- Service cable
- Offsite Cable
- Offsite service
- Meter position
- Cable Joint - LV — Proposed / Laid
- Cable Joint - HV — Proposed / Laid
- 2 Way Link Box
- 4 Way Link Box
- Sub station (doors shown)
- Cable with duct
- LV Feeder Pillar
- Pot end & earth electrode - LV — Proposed / Laid
- Pot end & earth electrode - HV — Proposed / Laid
- Street lighting column
- Earth

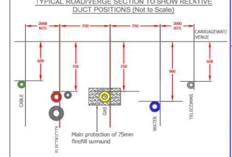
Cable Sizes	Duct Sizes
35mm service cable	38mm NJUG
Mains cables	150mm duct

ANY DEVIATION FROM THESE SIZES IS AT THE DEVELOPERS OWN RISK

TYPICAL FOOTPATH SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)



TYPICAL ROAD/VERGE SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)



This plan shows those cables owned by The Electricity Network Company Ltd. Electric cables owned by other operators or otherwise privately owned, may be present in this area. Information with regard to such cables should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. No liability of any kind whatsoever is accepted by the company, it's agents, servants or contractors for any error or ommision. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of cables, services and other equipment on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near electrical equipment.

This electrical network design has been carried out by :

Electricity Network Manager
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP

Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk

All cables and equipment used on this design are to be in accordance with G81 standards.

Drawing Scale : 1:500
O.S.REF : 533536, 184819
the electricity network co.
Network Number : N0015683-1
Project Number :
Drawing Number : EN0015683-1_R2-8_1_of_5 Entire Site

Developer : Power On Connections
Location : Dalston Curve, Kingsland High Street, Dalston, London, E8

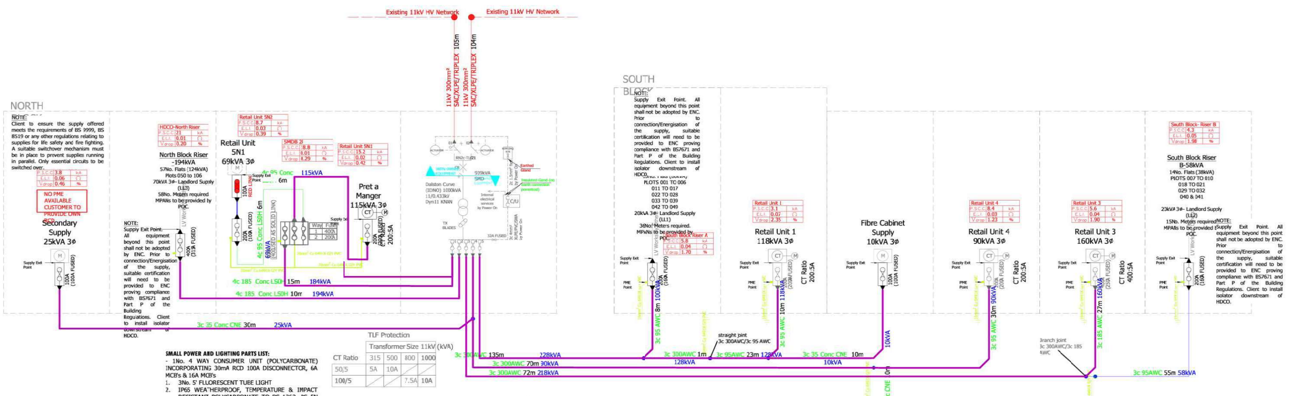
THIS DRAWING SHOWS:

GTC NETWORK

SHEET SIZE A1

PETER HART 06.04.2021

Rev	Revision Note	Date	Drawn by	Approved
1-7	LRC Data Added From LV 21742	21/10/16	MC	N/A
1-8	Incorrect LRC Data Amended From LV 16592	08/12/16	JL	N/A
1-9	Drawing Update: C03174/DWG/010/Rev7 Schematic Update: C03174/DWG/001/Rev5	06/04/17	JL	N/A
2-0	Schematic Updated: C03174-DWG-001-Rev6	03/05/17	GR	N/A
2-1	LRC Data Added From LV 25110 (BPID: 66627)	09/05/17	JJ	N/A
2-1	Schematic Updated: C03174-DWG-001-Rev7	06/07/17	CH	N/A
2-3	LRC Data Added From LV 28772 JPID101293	25/10/17	EWT	N/A
2-4	LRC Data Added From LV45617 JPID: 279674	14/10/19	SM	N/A
2-5	Updated Design: C03174-DWG-001 Rev 8	25/10/19	CH	N/A
2-6	Updated Drawing: C03174/DWG/010/Rev 8 Updated Schematic: C03174/DWG/001/Rev 9	13/03/20	CH	N/A
2-7	Updated Drawing: C03174/DWG/010/Rev 9 Updated Schematic: C03174/DWG/001/Rev 10	23/03/20	CH	N/A
2-8	LRC Data Added From LV58082 JPID: 443352	06/04/21	PH	N/A



SMALL POWER AND LIGHTING PARTS LIST:

- 1No. 4 WAY CONSUMER UNIT (POLYCARBONATE) INCORPORATING 30mA RCD 100A DISCONNECTOR, 6A MCB's & 16A MCB's

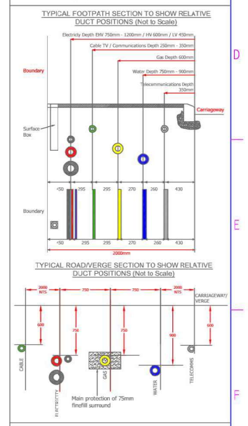
1. 3No. 5' FLUORESCENT TUBE LIGHT
2. IP65 WEATHERPROOF, TEMPERATURE & IMPACT RESISTANT POLYCARBONATE TO BS 1363, BS EN 60529 PARTS AS FOLLOWS:-
   - 1No. 30mA RCD 13 A 1 GANG 13 A DOUBLE SWITCHED SOCKET FOR POWERING TEST EQUIPMENT (TO BE LOCATED ON RHS OF SUBSTATION)
   - 1No. 1 GANG 2 WAY 20A SWITCH LOCATED ADJACENT TO PRIMARY OPENING LEAF OF DOUBLE DOORS
   - 1No. 1 GANG 13A UNSWITCHED FCU (TO BE LOCATED ON RHS OF SUBSTATION) FOR POWERING RTU
3. PLASTIC CONDUIT & CONNECTORS. METAL WORK NOT PERMITTED, EVEN WHEN EARTHED CORRECTLY IN ACCORDANCE WITH BS7671 AND PART P OF THE BUILDING REGULATIONS

TLF Protection

CT Ratio	Transformer Size 11kV (kVA)			
	315	500	800	1000
50/5	5A	10A		
100/5			7.5A	10A

Dalston Curve

Way	Fuse	Feeder Name
1	315A	Retail Unit 5N1 & Pret a Manger
2	400A	North Block Riser
3	400A	South Block Riser B & Retail Unit 3
4	400A	Retail Unit 4 & Secondary
5	355A	South Block Riser A, Retail Unit 1 & Fibre Hub



This electrical network design has been carried out by :

Electricity Network Manager
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP

Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk

All cables and equipment used on this design are to be in accordance with G81 standards.

THIS DRAWING SHOWS:

SCHEMATIC

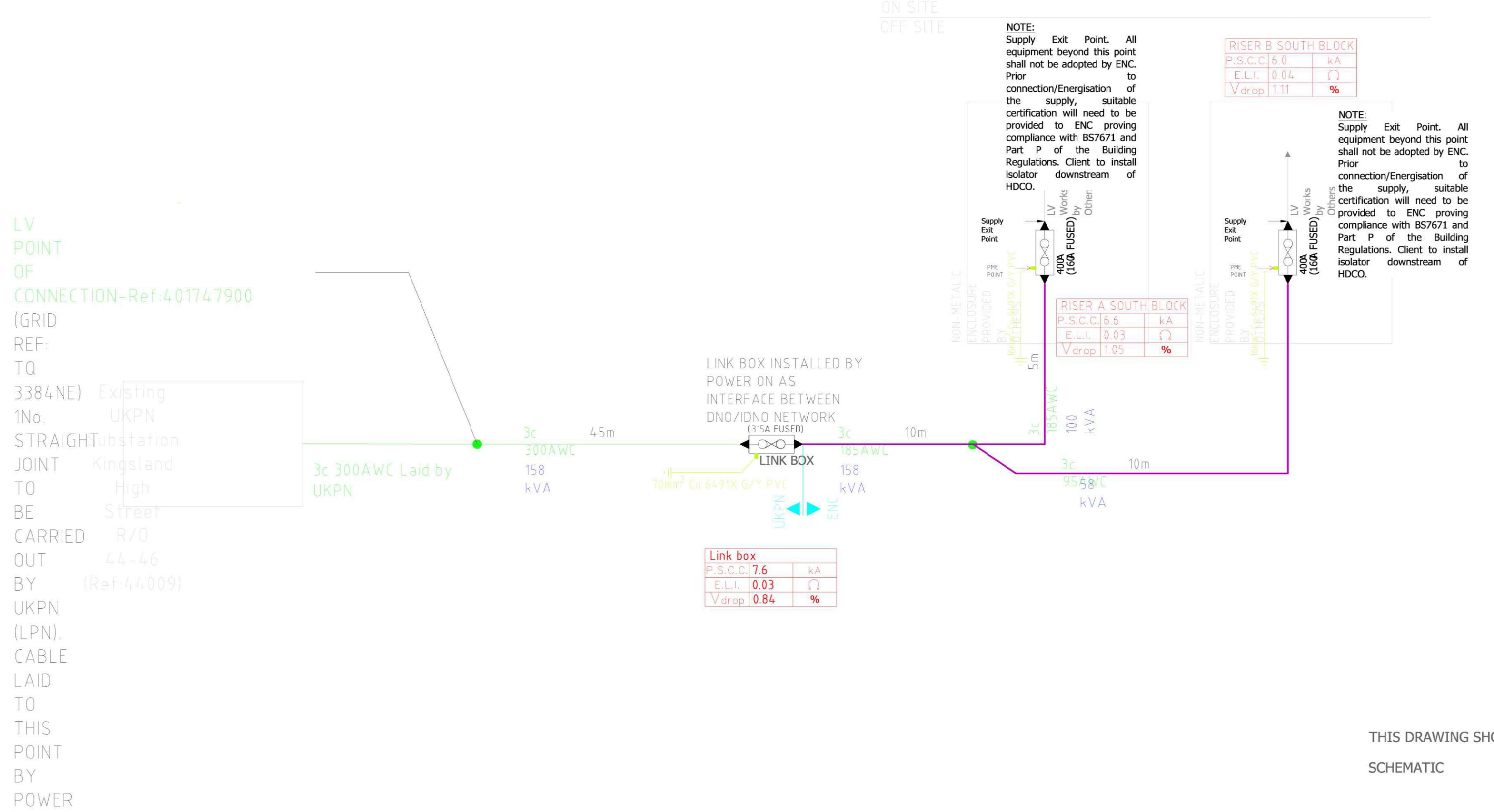
Drawing Scale :	NTS
O.S.REF :	533536, 184819
Network Number :	N0015683-1
Project Number :	
Drawing Number :	EN0015683-1_R2-8_3_of_5 Schematic 1
Developer :	Power On Connections
Location :	Dalston Curve, Kingsland High Street, Dalston, London, E8

enc the electricity network co

SHEET SIZE A1

PETER HART 06.04.2021

Rev	Revision Note	Date	Drawn by	Approved
1-7	LRC Data Added From LV 21742	21/10/16	MC	N/A
1-8	Incorrect LRC Data Amended From LV 16592	08/12/16	JL	N/A
1-9	Drawing Update: C03174/DWG/010/Rev7 Schematic Update: C03174/DWG/001/Rev5	06/04/17	JL	N/A
2-0	Schematic Updated: C03174-DWG-001-Rev6	03/05/17	GR	N/A
2-1	LRC Data Added From LV 25110 (BPID: 66627)	09/05/17	JJ	N/A
2-1	Schematic Updated: C03174-DWG-001-Rev7	06/07/17	CH	N/A
2-3	LRC Data Added From LV 28772 JPID101293	25/10/17	EWT	N/A
2-4	LRC Data Added From LV45617 JPID: 279674	14/10/19	SM	N/A
2-5	Updated Design: C03174-DWG-001 Rev 8	25/10/19	CH	N/A
2-6	Updated Drawing: C03174/DWG/010/Rev 8 Updated Schematic: C03174/DWG/001/Rev 9	13/03/20	CH	N/A
2-7	Updated Drawing: C03174/DWG/010/Rev 9 Updated Schematic: C03174/DWG/001/Rev 10	23/03/20	CH	N/A
2-8	LRC Data Added From LV58082 JPID: 443352	06/04/21	PH	N/A

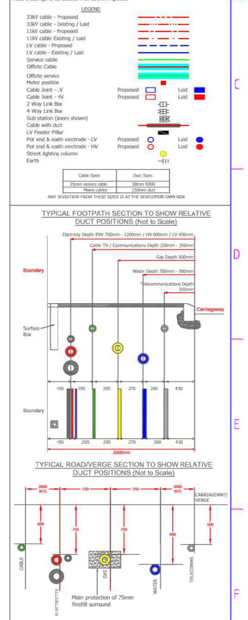


Proposed HV Mains
All HV cables to be laid in pre-excavated trench to 900mm cover, provided by the developer (except A - B). Road crossings to be plastic 150mm Ridgiduct, at 750mm cover to the finished level.

Proposed LV Mains
All LV cables to be laid in pre-excavated trench to 450mm cover, provided by the developer (except A - B). Road crossings to be plastic ridgiduct sized to accomodate the mains shown on this drawing, at 750mm cover to the finished level.

Harmonised Mains Cables - Phase Identification
For new colour convention mains, the connected phases will be shown as BR, BK, GY where BR = Brown (Red) / BK = Black (Yellow) / GY = Grey (Blue).

All services are to be ducted. Duct laid by the developer at 450mm cover to the finished level. Road crossings to be ducted with 150mm ridgiduct.



This plan shows those cables owned by The Electricity Network Company Ltd. Electric cables owned by other operators or otherwise privately owned, may be present in this area. Information with regard to such cables should be obtained from the relevant owners. The information shown on this plan is given without warranty, the accuracy thereof cannot be guaranteed. No liability of any kind whatsoever is accepted by the company, it's agents, servants or contractors for any error or omission. Safe digging practices, in accordance with HS(G)47, must be used to verify and establish the actual position of cables, services and other equipment on site before any mechanical plant is used. It is your responsibility to ensure that this information is provided to all persons (either direct labour or contractors) working for you on or near electrical equipment.

This electrical network design has been carried out by :

Electricity Network Manager
GTC
Woolpit Business Park
Bury St Edmunds
Suffolk
IP30 9UP

Tel : 01359 240363
Fax : 01359 244398
www.gtc-uk.co.uk

All cables and equipment used on this design are to be in accordance with G81 standards.

THIS DRAWING SHOWS:

SCHEMATIC

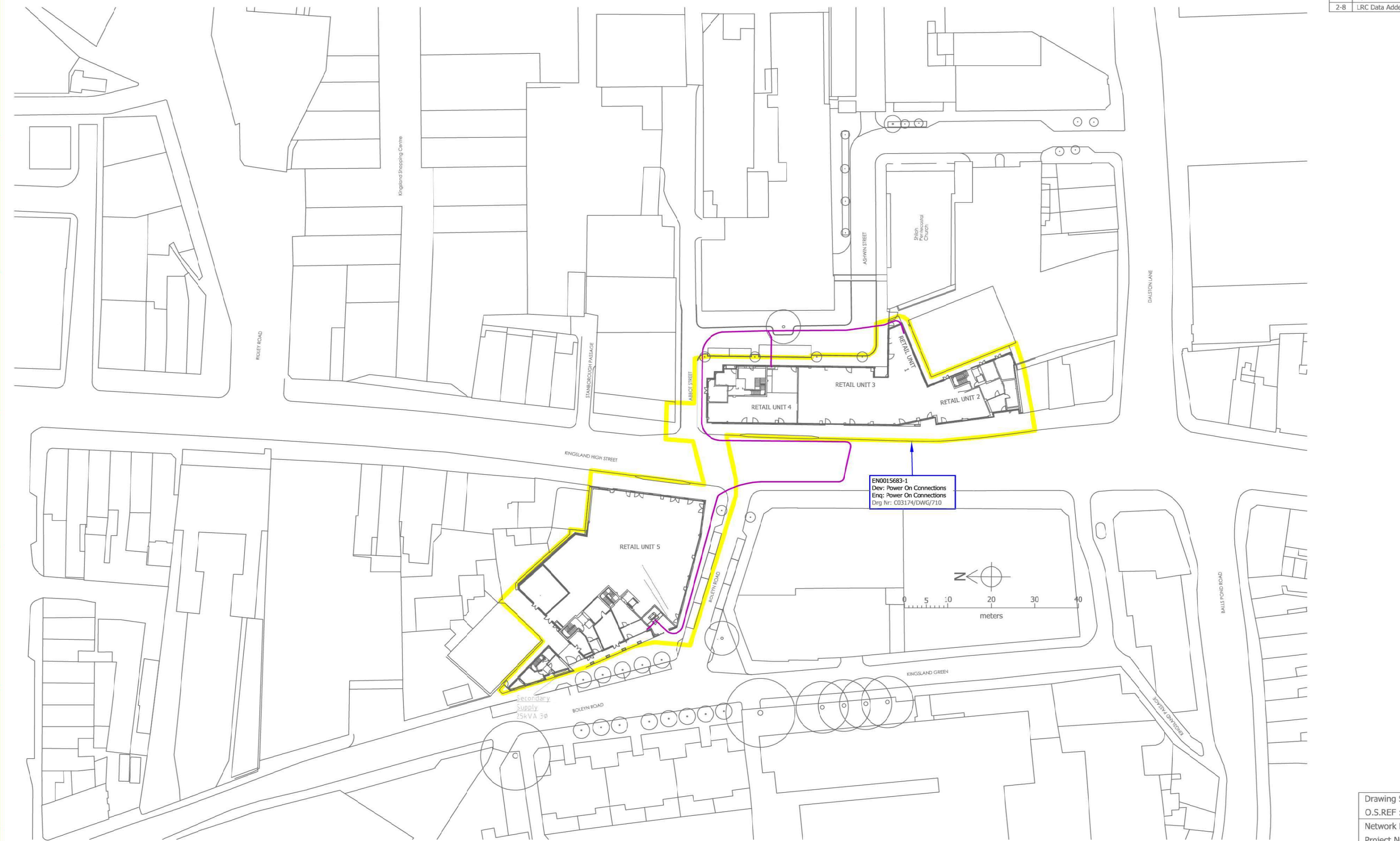
Drawing Scale :	NTS
O.S.REF :	533536, 184819
Network Number :	N0015683-1
Project Number :	
Drawing Number :	EN0015683-1_R2-8_4_of_5 Schematic 2
Developer :	Power On Connections
Location :	Dalston Curve, Kingsland High Street, Dalston, London, E8

enc the electricity network co.

SHEET SIZE A1

PETER HART 06.04.2021

Rev	Revision Note	Date	Drawn by	Approved
1-7	LRC Data Added From LV 21742	21/10/16	MC	N/A
1-8	Incorrect LRC Data Amended From LV 16592	08/12/16	JL	N/A
1-9	Drawing Update: C03174/DWG/010/Rev7 Schematic Update: C03174/DWG/001/Rev5	06/04/17	JL	N/A
2-0	Schematic Updated: C03174-DWG-001-Rev6	03/05/17	GR	N/A
2-1	LRC Data Added From LV 25110 (BPID: 66627)	09/05/17	JJ	N/A
2-1	Schematic Updated: C03174-DWG-001-Rev7	06/07/17	CH	N/A
2-3	LRC Data Added From LV 28772 JPID101293	25/10/17	EWT	N/A
2-4	LRC Data Added From LV45617 JPID: 279674	14/10/19	SM	N/A
2-5	Updated Design: C03174-DWG-001 Rev 8	25/10/19	CH	N/A
2-6	Updated Drawing: C03174/DWG/010/Rev 8 Updated Schematic: C03174/DWG/001/Rev 9	13/03/20	CH	N/A
2-7	Updated Drawing: C03174/DWG/010/Rev 9 Updated Schematic: C03174/DWG/001/Rev 10	23/03/20	CH	N/A
2-8	LRC Data Added From LV58082 JPID: 443352	06/04/21	PH	N/A



Proposed HV Mains
All HV cables to be laid in pre-excavated trench to 600mm cover, provided by the developer (except A - B). Road crossings to be plastic 150mm rigiduct, at 750mm cover to the finished level.

Proposed LV Mains
All LV cables to be laid in pre-excavated trench to 450mm cover, provided by the developer (except A - B). Road crossings to be plastic rigiduct sized to accomodate the mains shown on this drawing, at 750mm cover to the finished level.

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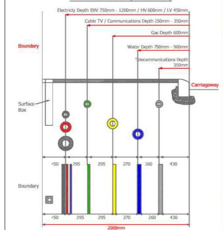
LEGEND

- 33kV cable - Proposed
- 33kV cable - Existing / Laid
- 11kV cable - Proposed
- 11kV cable Existing / Laid
- LV cable - Proposed
- LV cable - Existing / Laid
- Service cable
- Offsite Cable
- Offsite service
- Meter position
- Cable Joint - LV — Proposed / Laid
- Cable Joint - HV — Proposed / Laid
- 2 Way Link Box
- 4 Way Link Box
- Sub station (doors shown)
- Cable with duct
- LV Feeder Pillar
- Pot end & earth electrode - LV — Proposed / Laid
- Pot end & earth electrode - HV — Proposed / Laid
- Street lighting column
- Earth

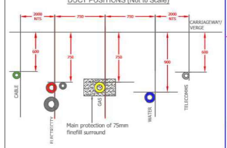
Cable Sizes	Duct Sizes
35mm service cable	38mm NJUG
Mains cables	150mm duct

ANY DEVIATION FROM THESE SIZES IS AT THE DEVELOPERS OWN RISK

TYPICAL FOOTPATH SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)



TYPICAL ROAD/VERGE SECTION TO SHOW RELATIVE DUCT POSITIONS (Not to Scale)



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Drawing Scale : 1:500
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enc the electricity network co.

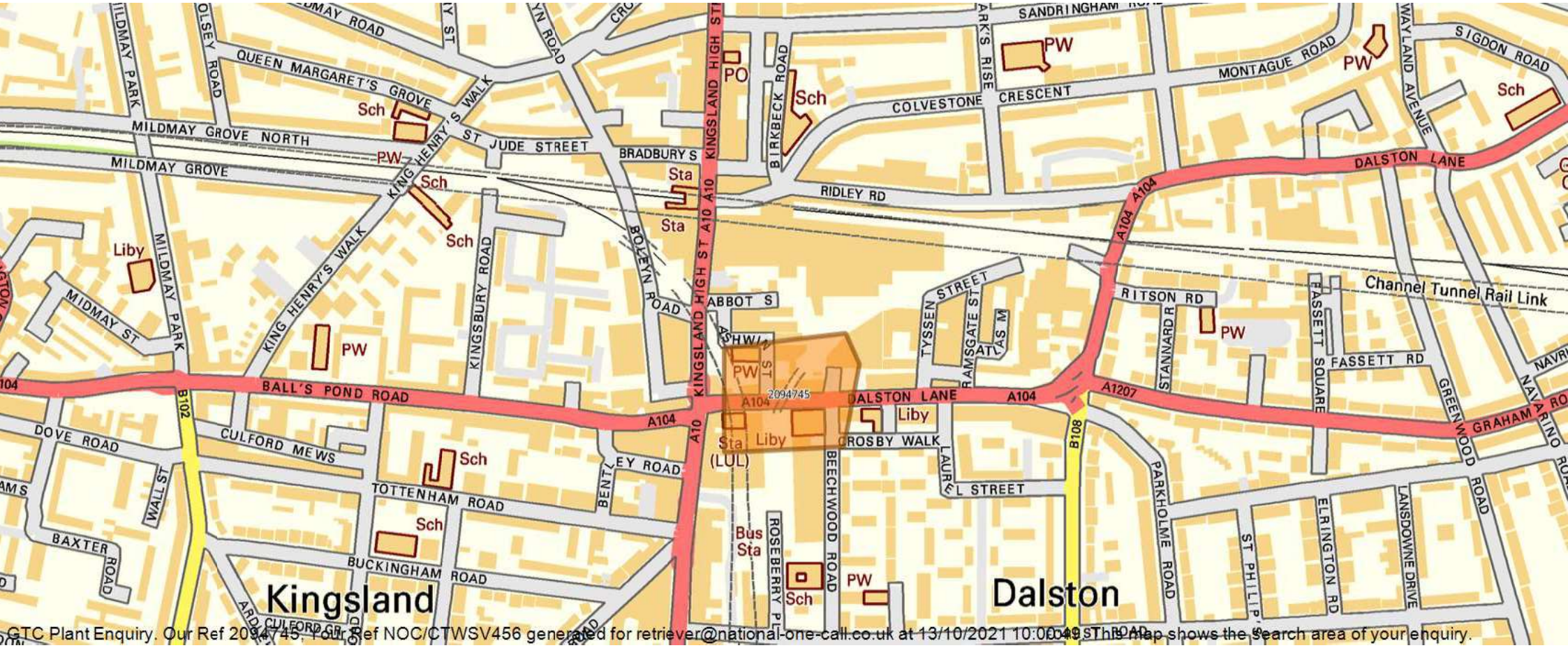
Network Number : N0015683-1
Project Number :
Drawing Number : EN0015683-1_R2-8_5_of_5 LRC

Developer : Power On Connections
Location : Dalston Curve, Kingsland High Street, Dalston, London, E8

THIS DRAWING SHOWS:

LRC

SHEET SIZE A1



openreach

Our Ref: Ref shown on map

Date of issue: shown on map

email: nnhc@openreach.co.uk

Dear Customer,

NR & SW ACT 1991 – PROPOSED WORKS AT: Dalston Ln, London.

Prior to commencement of work: For free onsite guidance and accurate up to date location of BT Apparatus please contact our Plant Protection Service by the following methods:-

Email the Click Before You Dig Team CBYD@openreach.co.uk
Visit the Click Before You Dig Website www.openreach.co.uk/cbyd

Thank you for your request of **NOC/CTWSV456** describing the above proposals.

Enclosed are copies of our drawings marked up to show the approximate locations of BT apparatus in the immediate vicinity of your works. It is intended for general guidance only. No guarantee is given of its accuracy.

The drawings are valid for 90 days from the date of issue and should not be relied upon after this time period has expired.

When planning excavation work or other works near to BT apparatus, please be mindful our apparatus may exist at various depths and may deviate from the marked route.

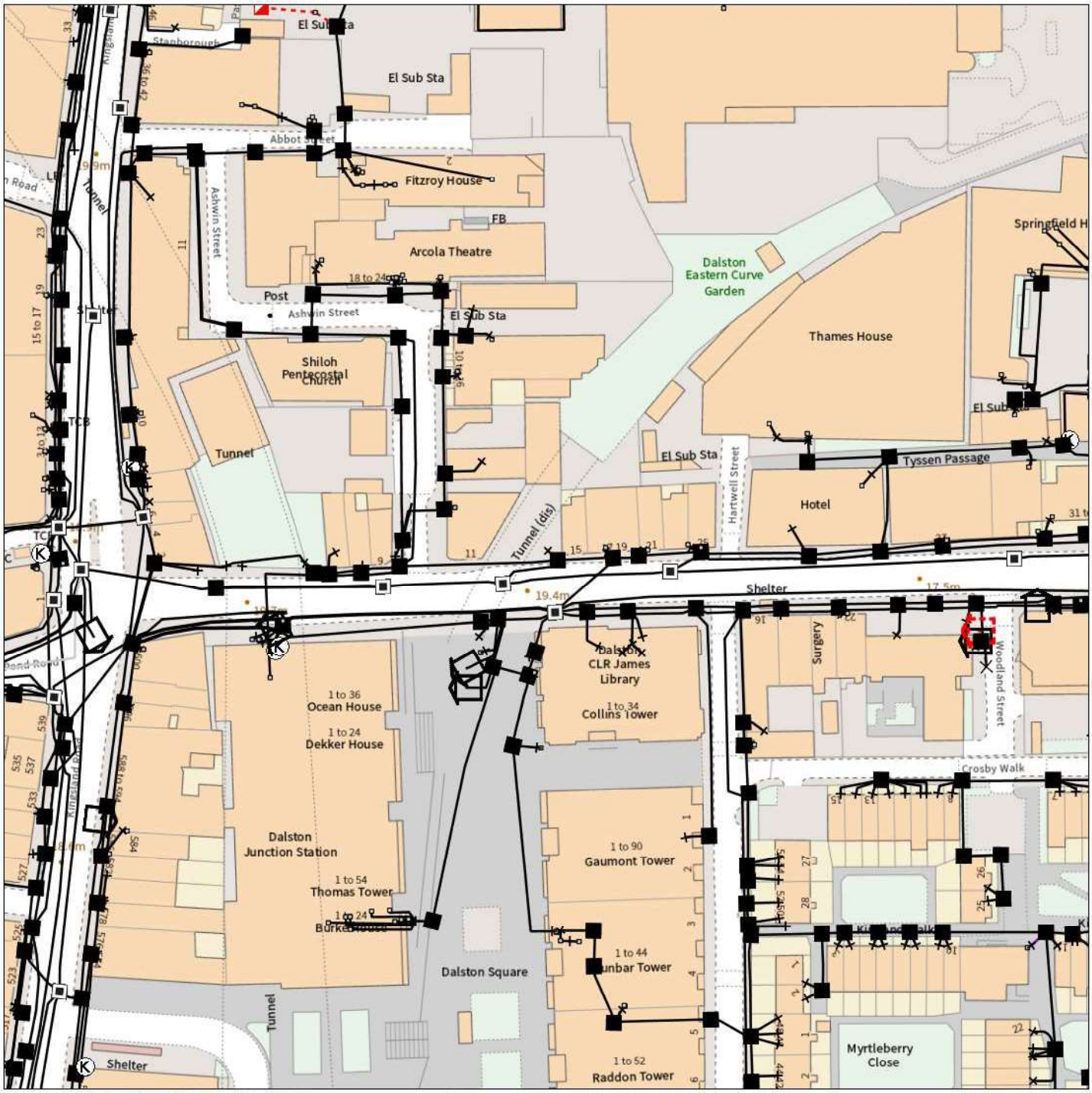
To avoid damage it is recommended that mechanical excavators or borers are not used within 600mm of BT apparatus. If scaffolding is erected, please ensure that our equipment is not enclosed, blocked, covered or otherwise obstructed by the scaffolding.

In the event of BT apparatus being in the area of your works we recommend that your plant/vehicle crossing is either resited, or apply for a budget estimate by submitting detailed plans to our Network Relocation Team at https://www.ournetwork.openreach.co.uk/altering-our-network.aspx

Yours faithfully,

Julie Cullum
NNHC & MBE Manager

Maps by email Plant Information Reply



IMPORTANT WARNING

Information regarding the location of BT apparatus is given for your assistance and is intended for general guidance only. No guarantee is given of its accuracy. It should not be relied upon in the event of excavations or other works being made near to BT apparatus which may exist at various depths and may deviate from the marked route.

openreach

CLICK BEFORE YOU DIG

FOR PROFESSIONAL FREE ON SITE ASSISTANCE PRIOR TO COMMENCEMENT OF EXCAVATION WORKS INCLUDING LOCATE AND MARKING SERVICE

email cbyd@openreach.co.uk

ADVANCE NOTICE REQUIRED
(Office hours: Monday - Friday 08.00 to 17.00)
www.openreach.co.uk/cbyd

Accidents happen

If you do damage any Openreach equipment please let us know by calling 0800 023 2023 (opt 1 + opt 1) and we can get it fixed ASAP

KEY TO BT SYMBOLS

	Planned	Live
PCP		
Pole		
Box		
Manhole		
Cabinet		

Change Of State	+	Hatchings	
Split Coupling	×	Built	
Duct Tee	▲	Planned	
Building		Inferred	
Kiosk	K	Duct	

Other proposed plant is shown using dashed lines.
BT Symbols not listed above may be disregarded.
Existing BT Plant may not be recorded.
Information valid at time of preparation. Maps are only valid for 90 days after the date of publication.

	Pending Add	In Place	Pending Remove	Not In Use
Power Cable				
Power Duct				N/A

BT Ref : EJD09575R
Map Reference : (centre) TQ3363584806
Easting/Northing : (centre) 533635,184806
Issued : 13/10/2021 09:58:07

WARNING: IF PLANNED WORKS FALL INSIDE HATCHED AREA IT IS ESSENTIAL BEFORE PROCEEDING THAT YOU CONTACT THE NATIONAL NOTICE HANDLING CENTRE. PLEASE SEND E-MAIL TO: nnhc@openreach.co.uk

Date: 13/10/2021
LinesearchbeforeUdig ref: 23548644
Your ref: NOC/CTWSV456

Dear Sir/Madam,

Your planned works may proceed with caution.

We have received a notification from the LinesearchbeforeUdig (LSBUD) platform regarding your plans to carry out works. Based on the information you provided:

Although there are Cadent gas pipes in the area you're planning to work, you can proceed with your planned work with caution and in line with the guidance. This outcome is based on the information you gave us. If your plans change, or you are unable to work to the guidance please let us know as soon as possible so we can work with you to find a solution.

If your works are being carried out in an easement, please ensure that you contact us to obtain formal, signed written consent which will only be provided following consultation with our plant protection team.

Please find enclosed a copy of our plans for the area and ensure you follow our key guidance document Specification for Safe Working in the Vicinity of Cadent Assets.

What you need to do

BEFORE carrying out any work you must:

- Carefully read the guidance documents and maps showing the location of our gas apparatus.
- Contact the landowner and ensure any proposed works in private land do not infringe on Cadent's legal rights (i.e. easements or other rights). If the works are in the road or footpath, the relevant local authority should be contacted.
- Ensure that all persons, including direct labour and contractors, working for you on or near Cadent apparatus follow the requirements of the HSE Guidance Notes HSG47 'Avoiding danger from underground services'. This guidance can be downloaded free of charge at www.hse.gov.uk
- In line with the guidance, verify and establish the actual position of gas mains, pipes, services and other apparatus on site before any activities are undertaken.

DURING any work you must:

- Comply with all guidance and any further guidance from our specialist team.
- Ensure that access to Cadent apparatus is maintained at all times.
- Prevent the placing of heavy construction plant, equipment, materials or the passage of heavy vehicles over Cadent apparatus unless specifically agreed with us in advance.
- Exercise extreme caution if slab (mass) concrete is encountered during excavation works as this may be protecting or supporting Cadent apparatus.
- Maintain appropriate clearances between gas apparatus and the position of other buried plant.

This outcome is valid for 28 days from the date of this letter. If your work, or the location, date or nature of the work you're doing changes, you must submit another enquiry.

If you need any further information or have any questions about this letter, please contact us at plantprotection@cadentgas.com or on **0800 688 588** quoting your reference at the top of this letter.

Your responsibilities and obligations

It is your responsibility to ensure that the information you have given us is accurate. You must also share all relevant documents, including the guidance notes, with anyone who carries out work on your behalf.

This assessment solely relates to Cadent gas pipes. It doesn't include:

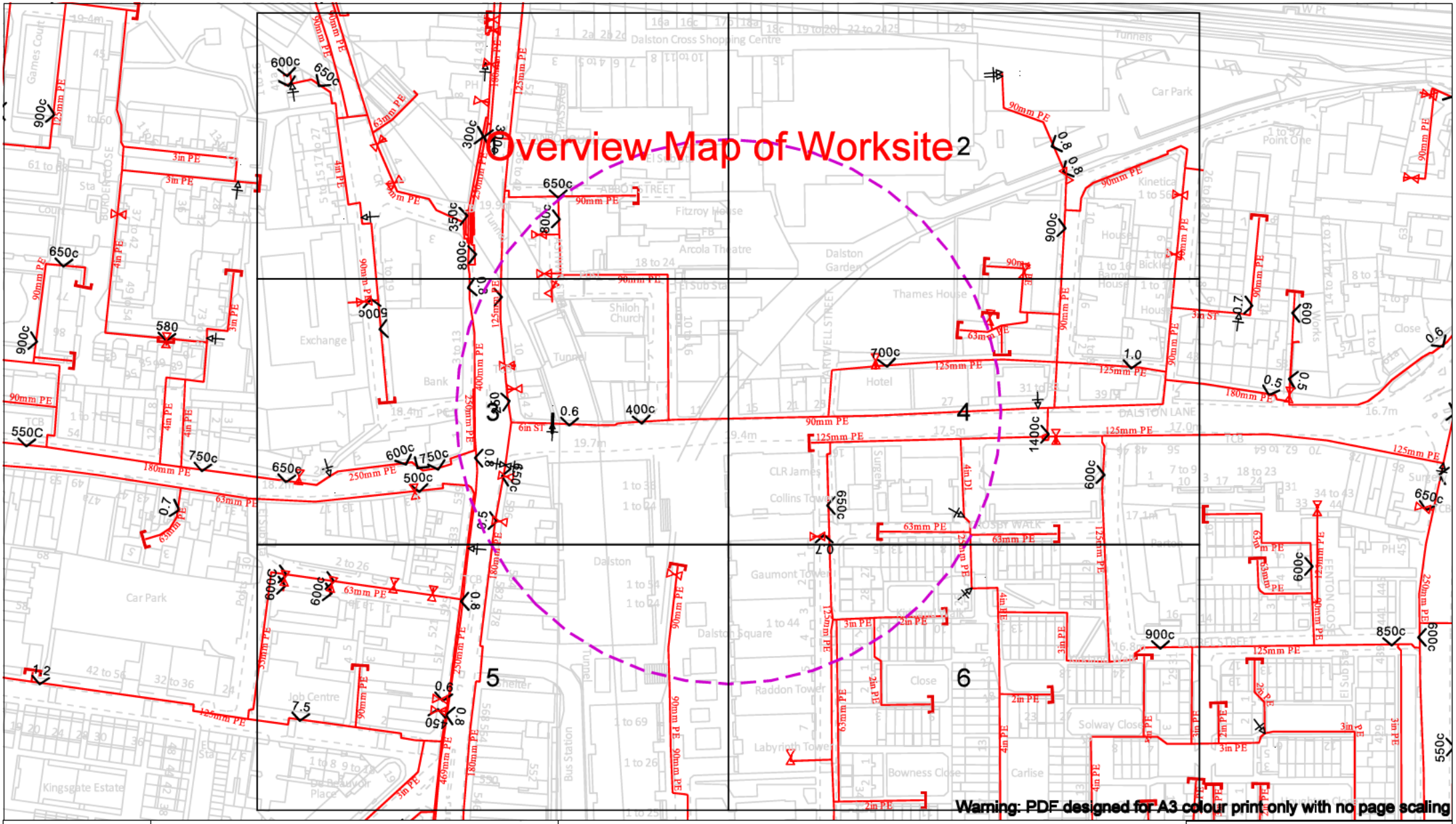
- Cadent's legal interest (easements or other rights) in the land which restricts activity near Cadent's pipes in private land. You must get details of any such restrictions from the landowner in the first instance and if in doubt contact us on **0800 688 588** or at
- Gas service pipes and related apparatus.
- Recently installed apparatus.
- Apparatus owned by other organisations such as other gas distribution networks, local electricity companies and other utilities.

It is your responsibility to consider whether the points above are relevant to you and whether they could be affected by your proposed work.

This letter does not constitute any formal agreement or consent for any proposed development work either generally or related to Cadent's easements or other rights, or any planning or building regulations applications.

Cadent Gas Ltd or their agents, servants or contractors do not accept any liability for any losses arising under or in connection with this information. This limit on liability applies to all and any claims in contract, tort (including negligence), misrepresentation (excluding fraudulent misrepresentation), breach of statutory duty or otherwise. This limit on liability does not exclude or restrict liability where prohibited by the law nor does it supersede the express terms of any related agreements.

Kind Regards,
Plant Protection Team
T: 0800 688 588
plantprotection@cadentgas.com



View extent: 200m, 115m

Date Requested: 13/10/2021
Job Reference: 23548644
Site Location: 533635 184805
Requested by:
Mr Brian McMaster
Your Scheme/Reference:
NOC/CTWSV456

Scale: 1:1538 (When plotted at A3)

IMPORTANT NOTICES

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In case of an emergency call 0800 111 999

Dig Sites

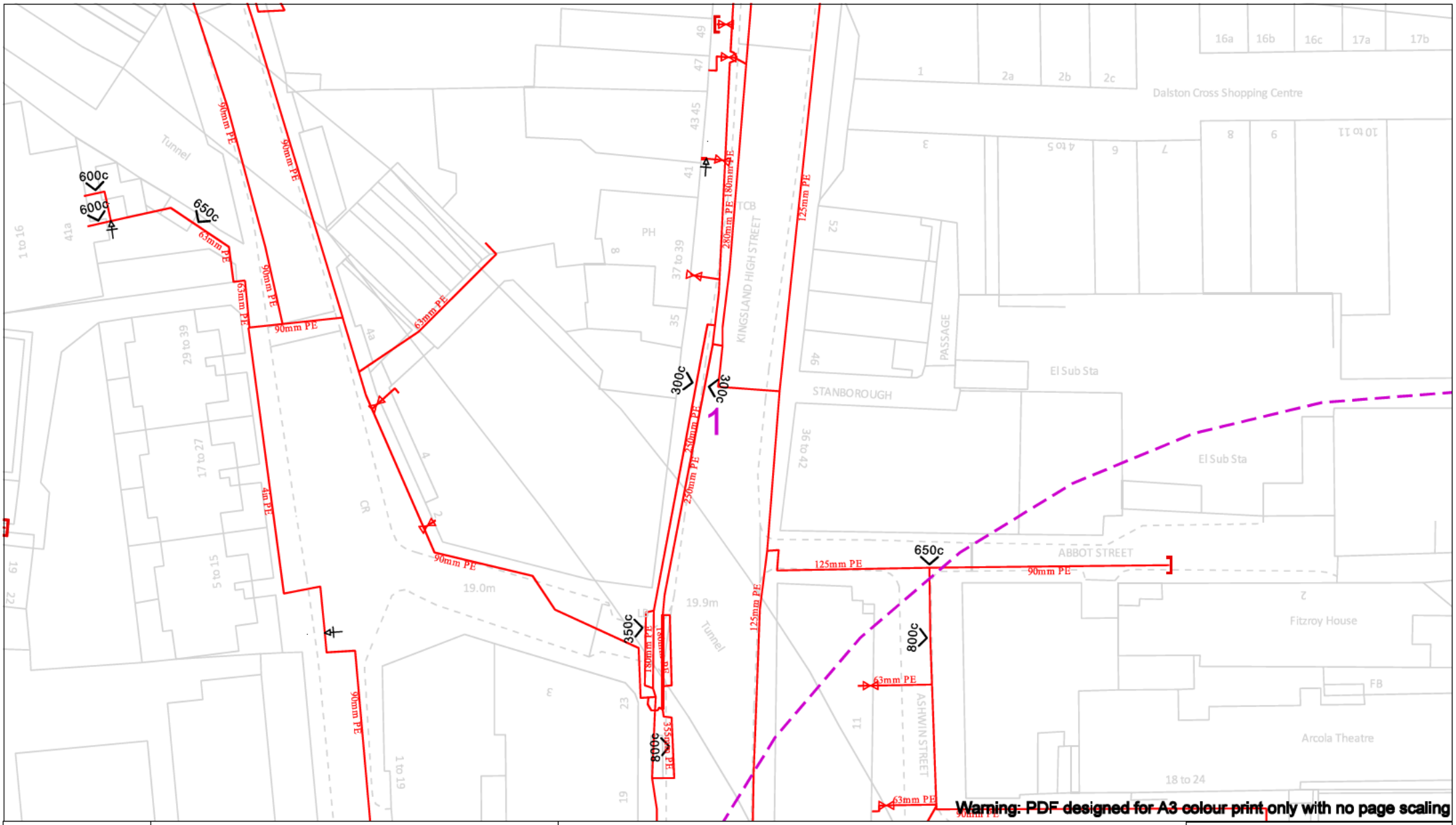
Area:

Line:

LP Mains
MP Mains
IP Mains
LHP Mains

Valve
Depth of cover
Syphon
Diameter Change
Material Change
Out of Standard Service

Cadent
Your Gas Network



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Date Requested: 13/10/2021
Job Reference: 23548644
Site Location: 533635 184805
Requested by:
Mr Brian McMaster
Your Scheme/Reference:
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Scale: 1:500 (When plotted at A3)

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50m

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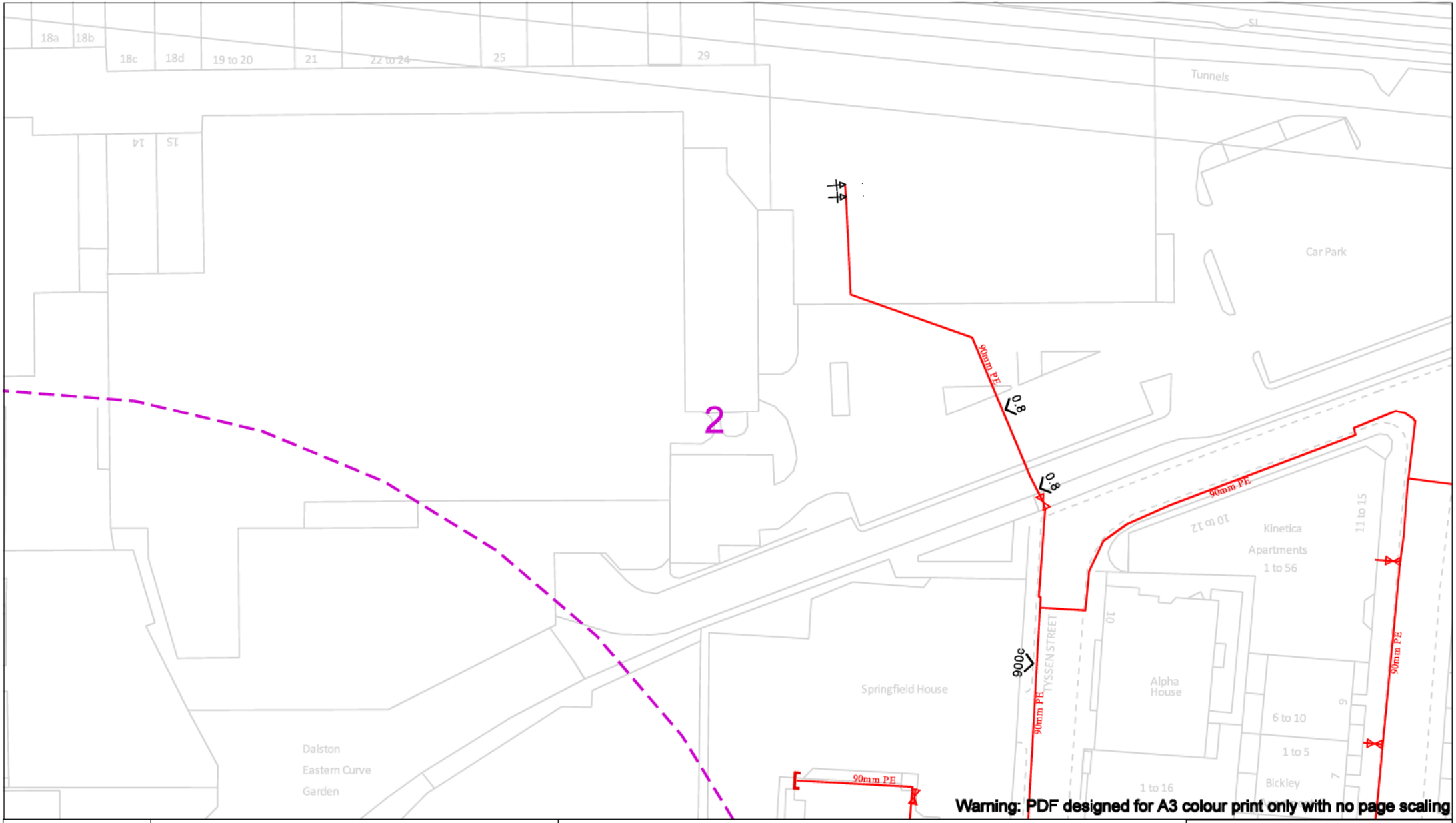

Warning: PDF designed for A3 colour print only with no page scaling

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Site Location: 533635 184805
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NOC/CTWSV456

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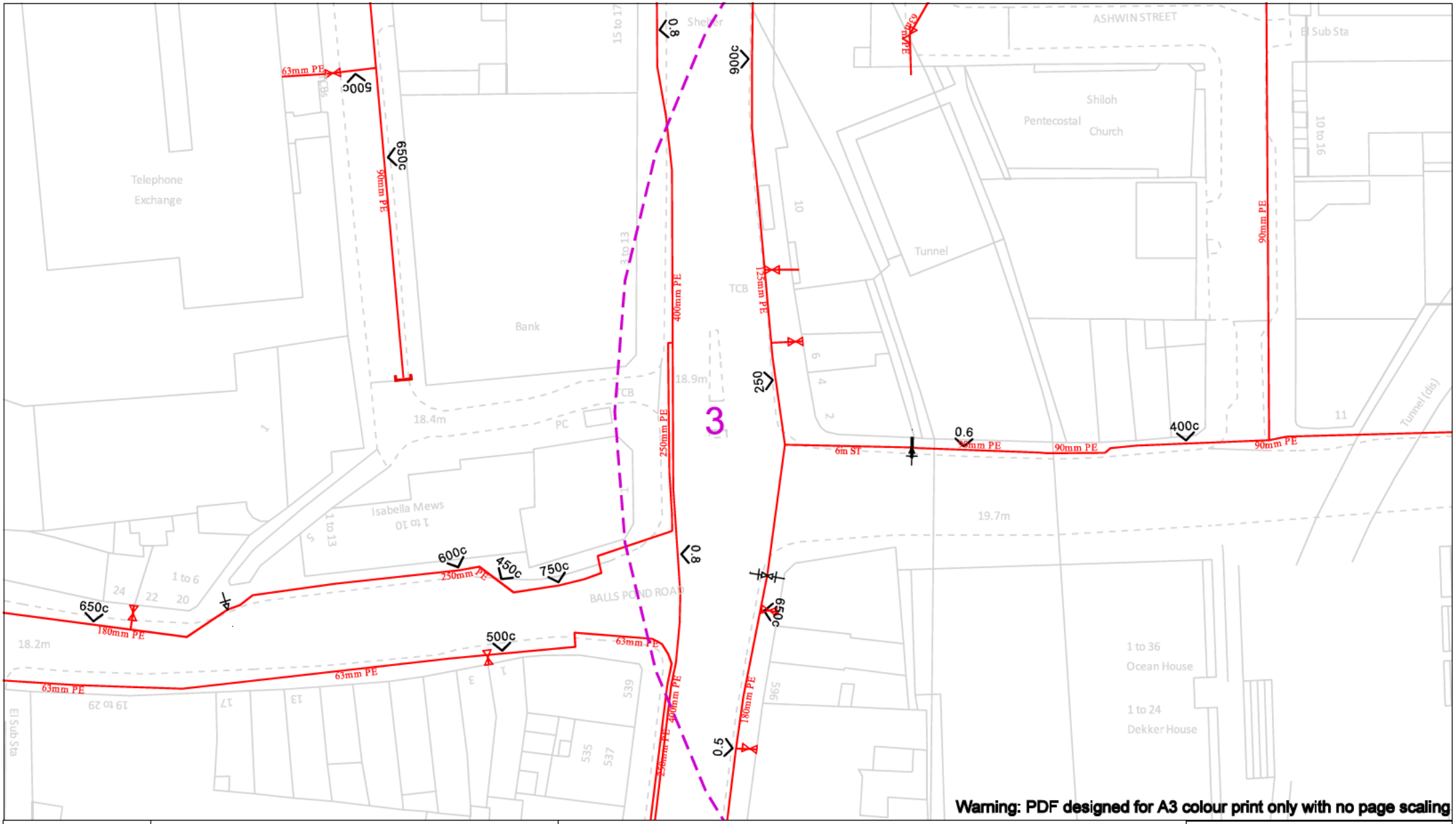

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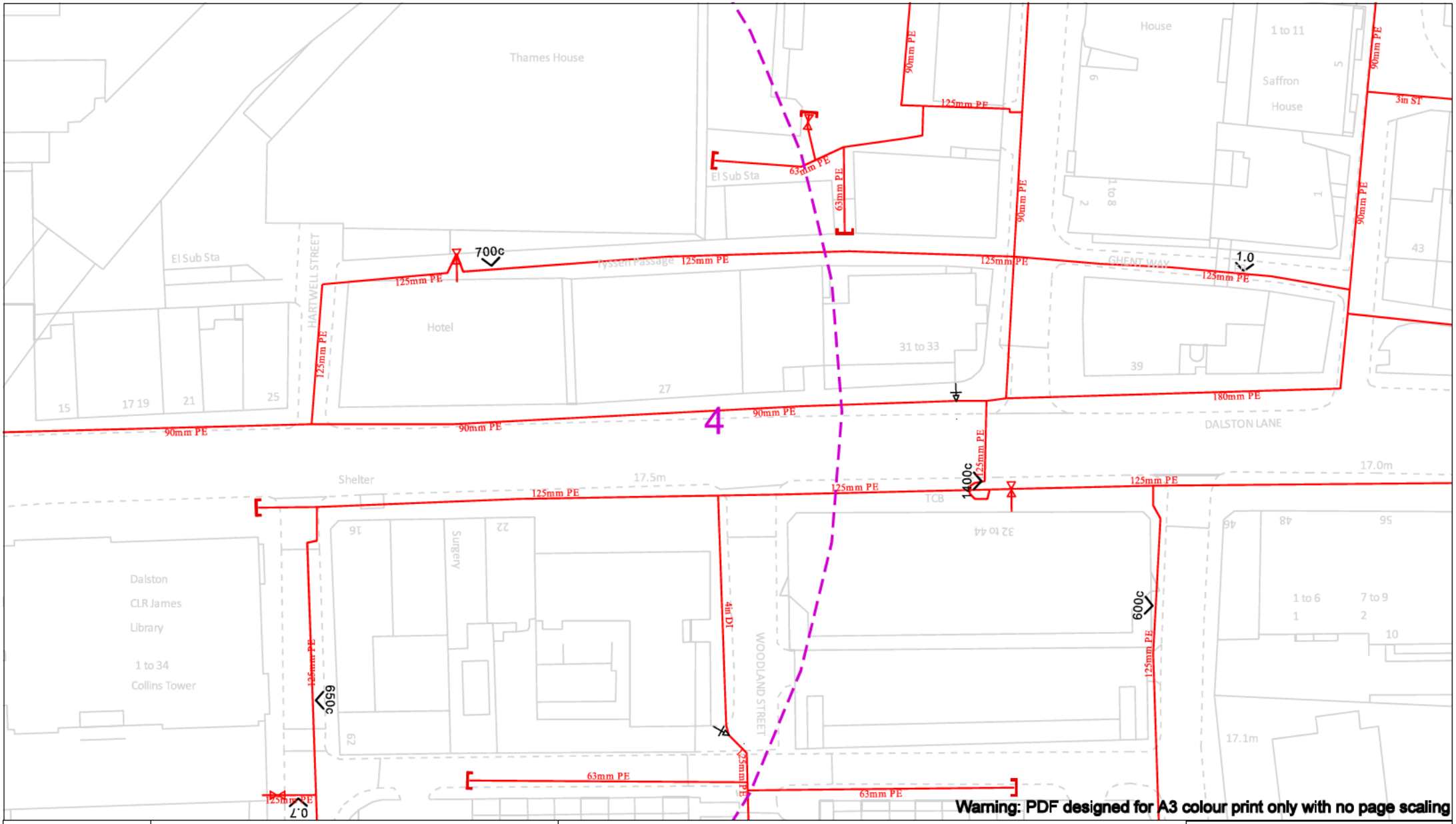

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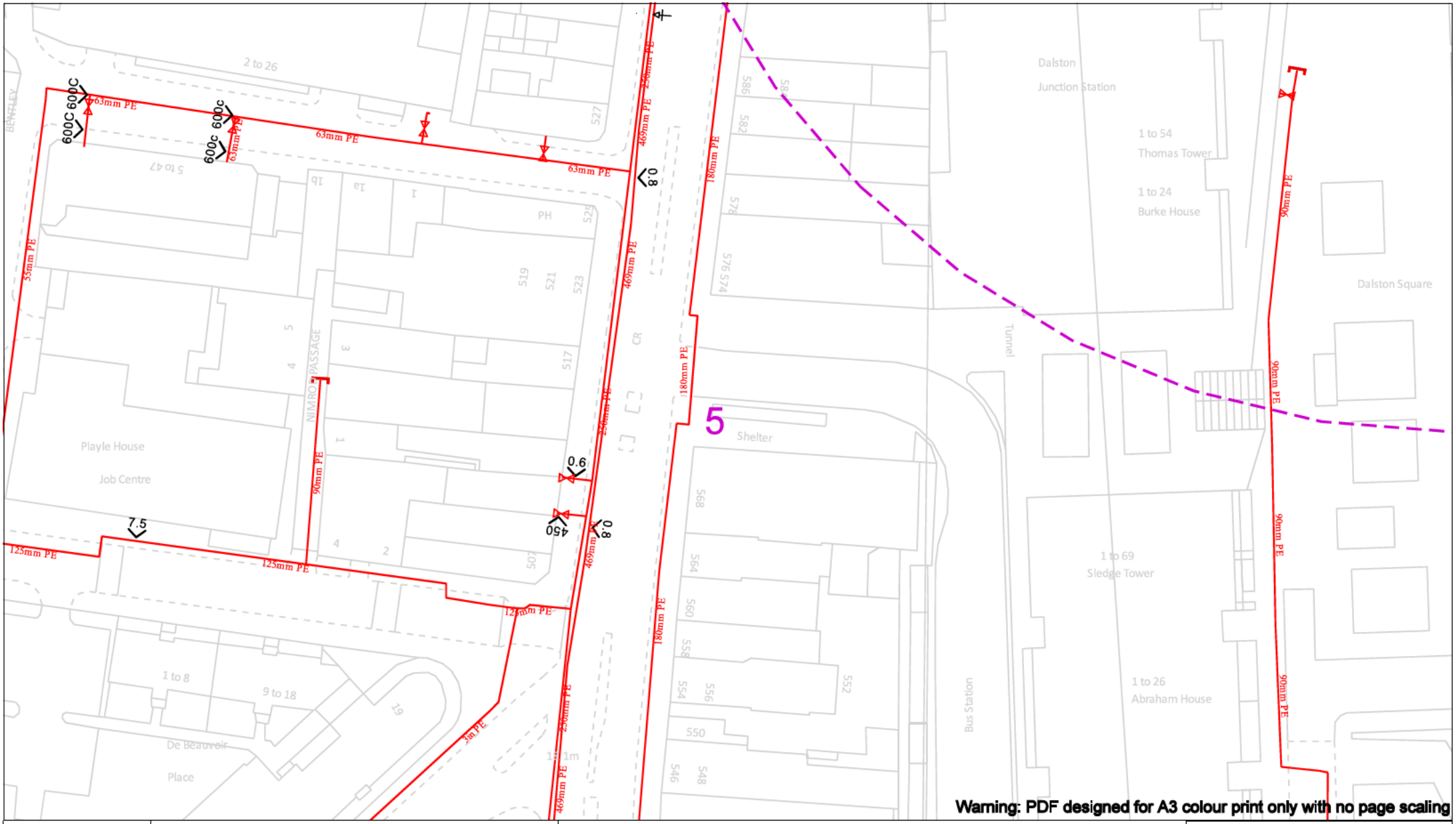

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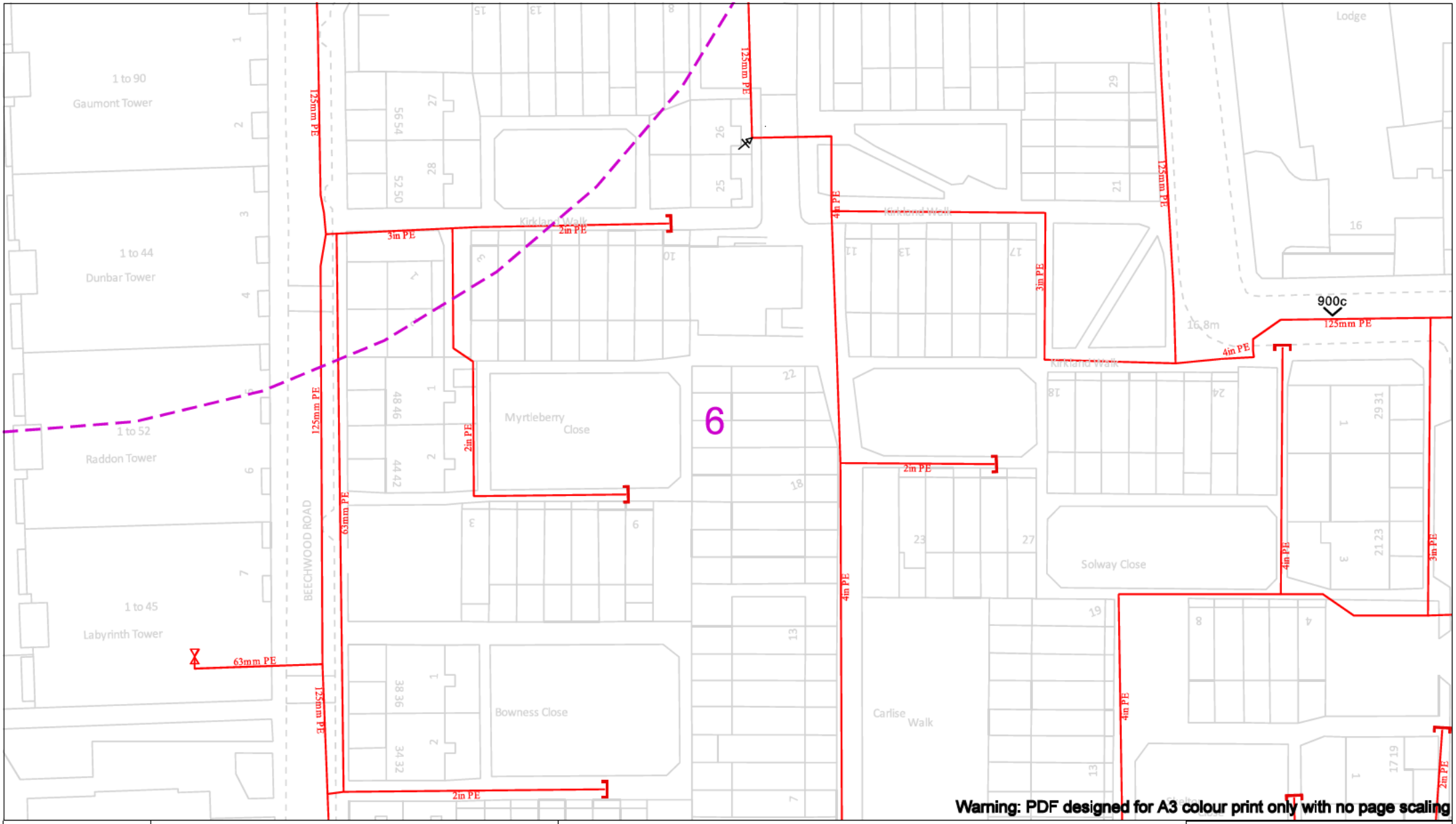

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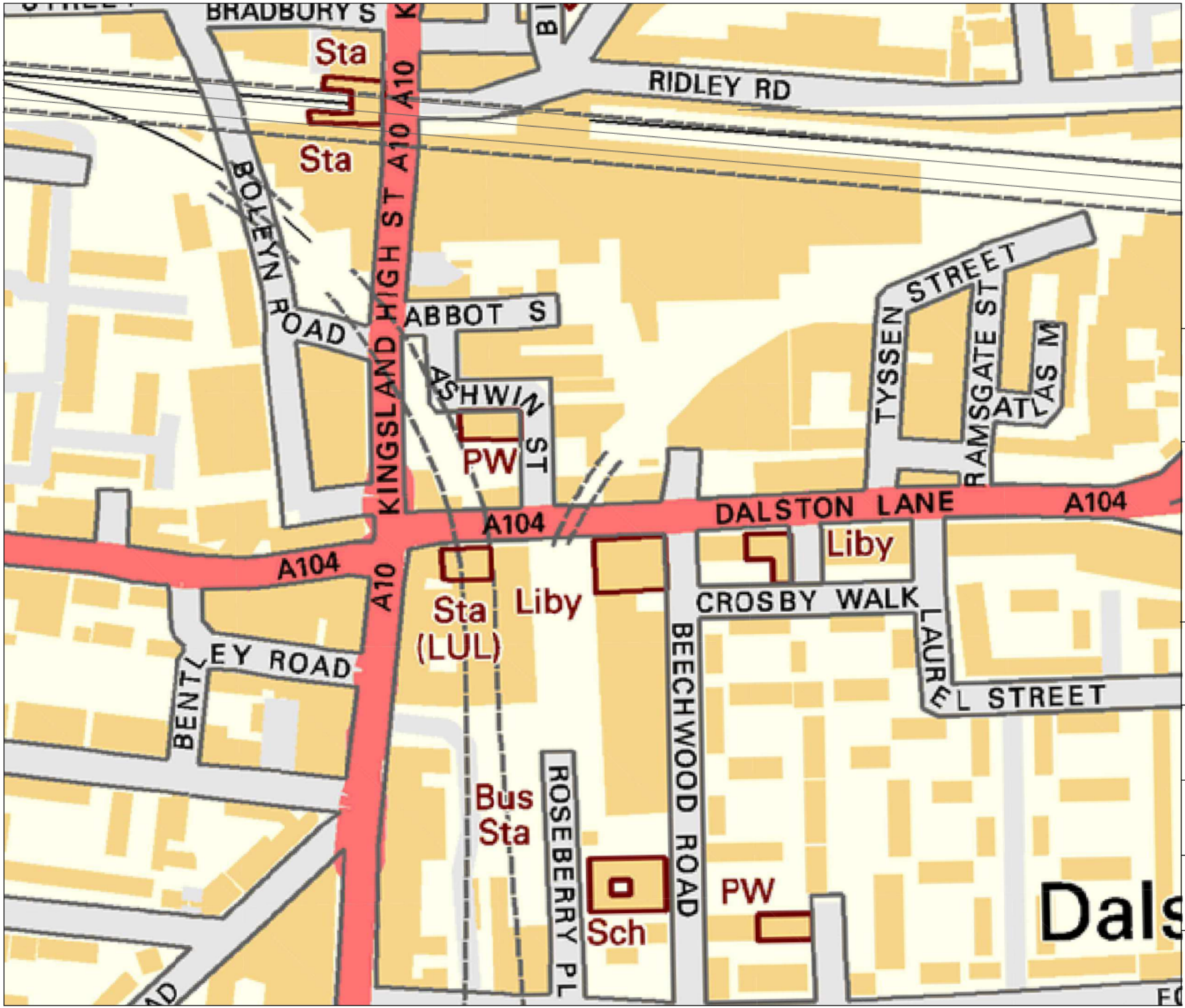
Cadent
Your Gas Network



bitmap_layout select_raster

LEGEND

EXISTING PLANT

EXISTING PLANT

bitmap_layout select_raster

Head Office
CityFibre Holdings Ltd
15 Bedford Street,
London,
WC2E 9HE

Tel: 0845 293 0774
Web: www.cityfibre.com

Asset Office
CityFibre Holdings Ltd,
Rutherford House,
Birchwood,
Warrington,
WA3 6ZH

Email: asset.team@cityfibre.com

Project

Plant Enquiry

Drawing

Existing Plant

Drawn by:

smallworld

Date: 13/10/2021

Drawing No.

CFH_EP_000001

Revision

001

Scale: 1:2500

A4

0m 20m 40m 60m 80m 100m

N

13/10/2021

LinesearchbeforeUdig Ref: 23548644
Your Ref: NOC/CTWSV456

Dear Sir/Madam,

Further to your enquiry received on 13/10/2021 08:57:57 AM please find attached the ESP Utilities Group (ESP) response to your enquiry.

If your proposed work site was found to be in the vicinity of ESP plant, project drawing as laid extracts for these sites are enclosed (not to scale) for your information which show the approximate location of the ESP gas/electric network close to the area of interest.

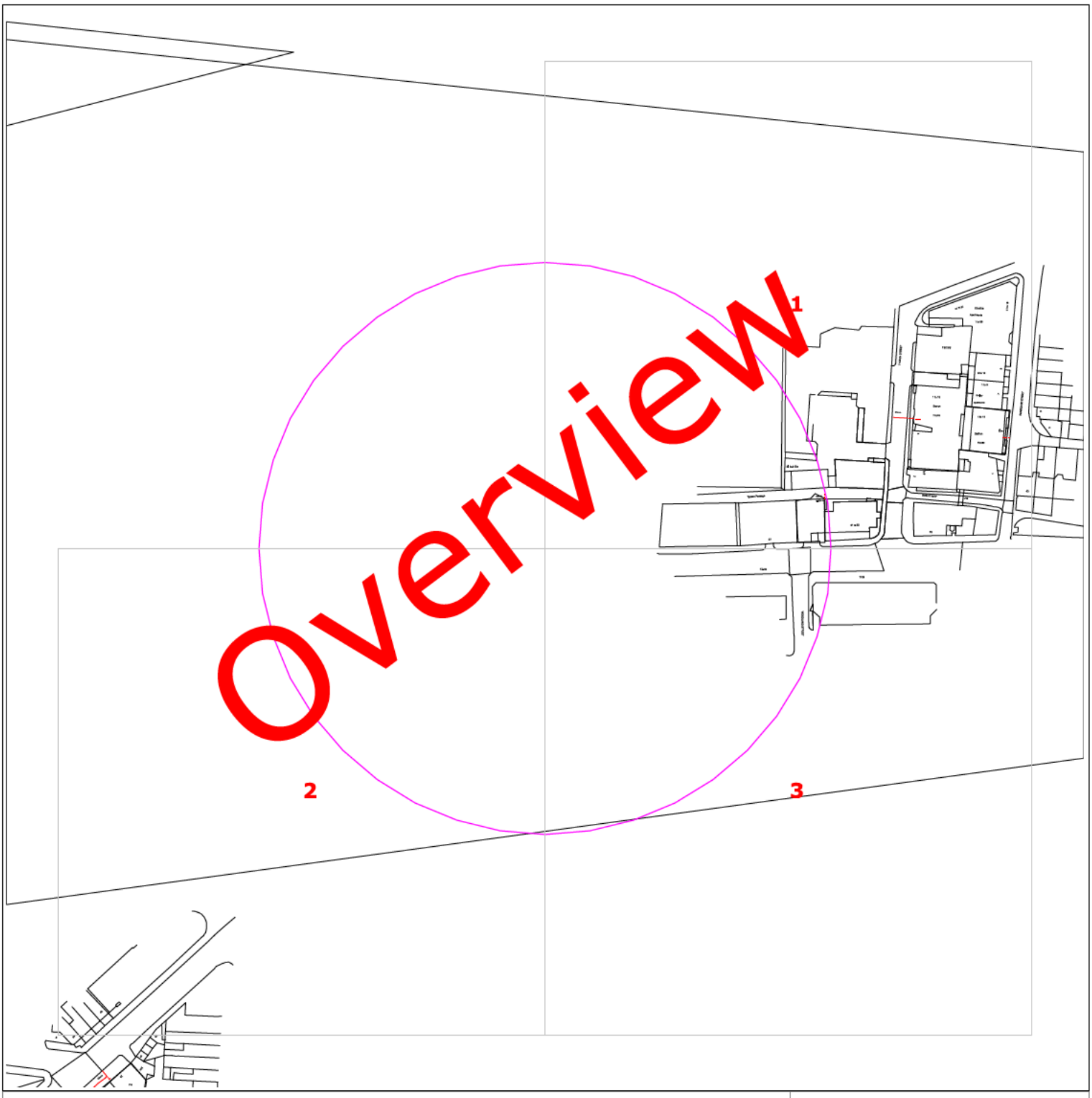
As your plans for the proposed work develop you are required to keep ESP regularly updated about the extent and nature of your proposed works in order for us to fully establish whether any additional precautionary or diversionary works are necessary to protect our gas network.

Arrangements can be set in place so that one of our representatives can meet on site (date to be agreed) and we will be happy to discuss the impact of your proposals on the gas network once we have received the details.

ESP are continually constructing new gas and electricity networks and this notification is valid for 90 days from the date of this letter. If your proposed works start after this period of time, please re-submit your linesearchbeforeUdig enquiry.

Yours sincerely,

ESP Utilities Group Ltd



Date Requested: 13/10/2021

Requested by: Brian McMaster

Job Reference: 23548644

Company: PlanToDig

Your Scheme/Reference: NOC/CTWSV456

Key for Mains & Service Pipework

- Existing LP mains or services operating up to 75 millibar gauge
- Existing MP mains or services operating between 75 millibar and 2 bar gauge
- Existing IP mains or services operating between 2 bar and 7 bar gauge

ESP UTILITIES GROUP

ESP Utilities Group Ltd
Bluebird House
Mole Business Park
Leatherhead
Surrey
KT22 7BA
Phone: 01372 587500
Email: PlantResponses@espug.com

Dig Sites:

Area Line

Approx scale on A4 paper: 1:1000
(excluding Overview map)

Date Requested: 13/10/2021

Requested by: Brian McMaster

Company: PlanToDig

Job Reference: 23548644

Your Scheme/Reference: NOC/CTWSV456

Key for Mains & Service Pipework

Existing LP mains or services operating up to 75 millibar gauge

Existing MP mains or services operating between 75 millibar and 2 bar gauge

Existing IP mains or services operating between 2 bar and 7 bar gauge

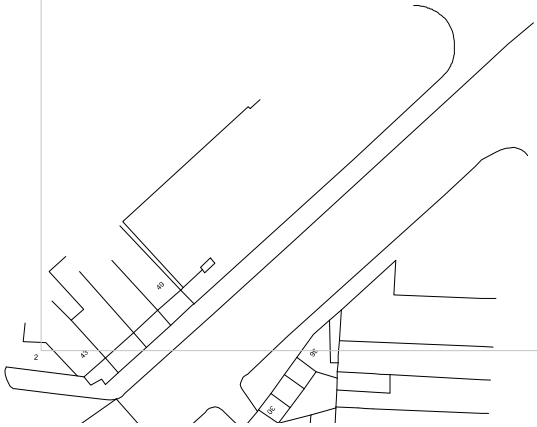
Whilst ESP Utilities Group Ltd (ESP) try to ensure the asset information we provide is accurate, the information is provided Without Prejudice and ESP accept no liability for claims arising from any inaccuracy, omissions or errors contained in this response. The actual position of underground services must be verified and established on site before any mechanical plant is used. Authorities and contractors will be held liable for the full cost of repairs to ESP apparatus and all claims made against them by Third parties as a result of any interference or damage.

ESP Utilities Group Ltd
Bluebird House
Mole Business Park
Leatherhead
Surrey
KT22 7BA
Phone: 01372 587500
Email: PlantResponses@espug.com

Dig Sites:

Area Line

Approx scale on A4 paper: 1:1000
(excluding Overview map)



Date Requested: 13/10/2021

Requested by: Brian McMaster

Company: PlanToDig

Job Reference: 23548644

Your Scheme/Reference: NOC/CTWSV456

Key for Mains & Service Pipework

Existing LP mains or services operating up to 75 millibar gauge

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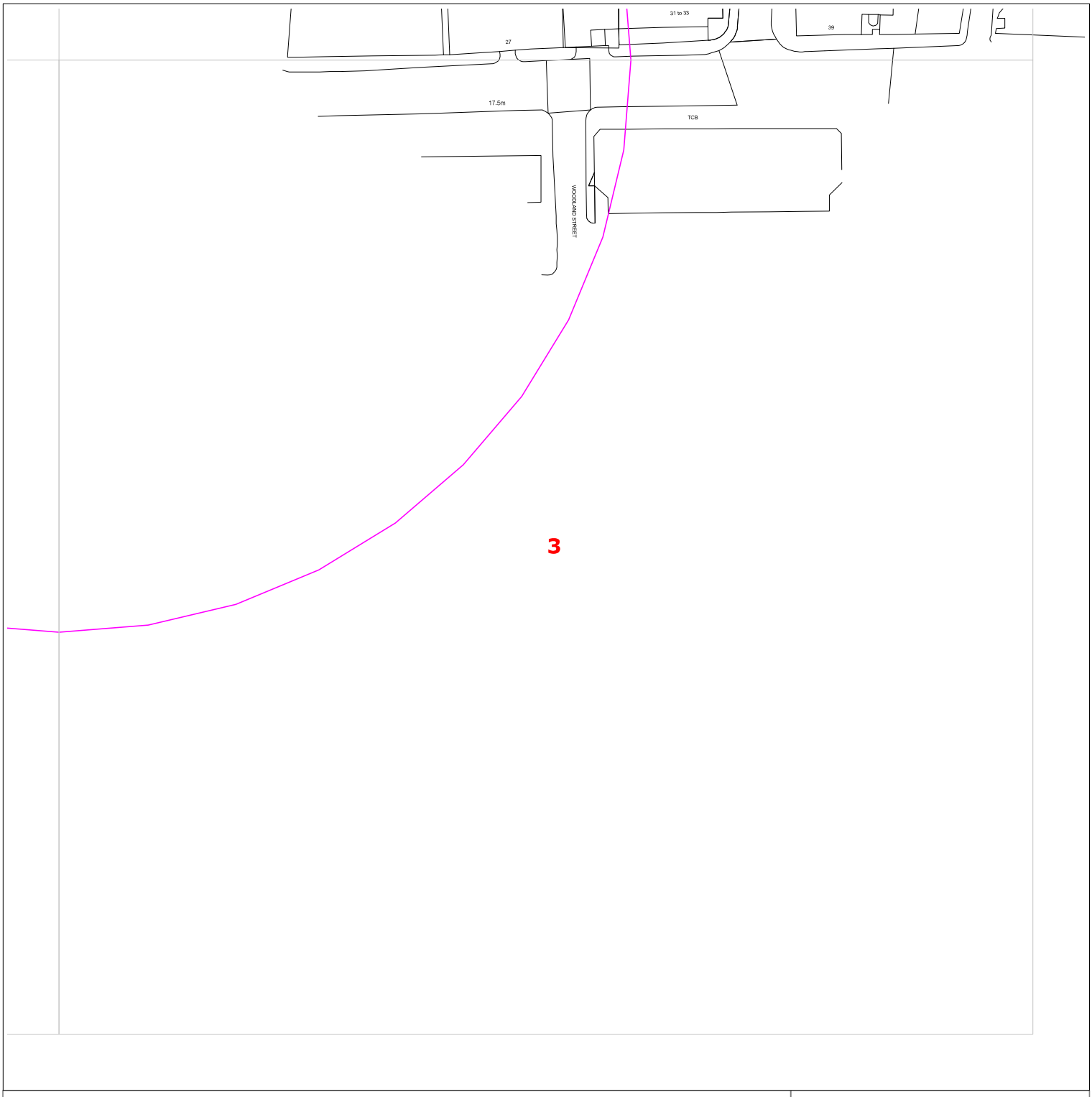

Date Requested: 13/10/2021

Requested by: Brian McMaster

Company: PlanToDig

Job Reference: 23548644

Your Scheme/Reference: NOC/CTWSV456

Key for Mains & Service Pipework

Existing LP mains or services operating up to 75 millibar gauge

Existing MP mains or services operating between 75 millibar and 2 bar gauge

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Bluebird House
Mole Business Park
Leatherhead
Surrey
KT22 7BA
Phone: 01372 587500
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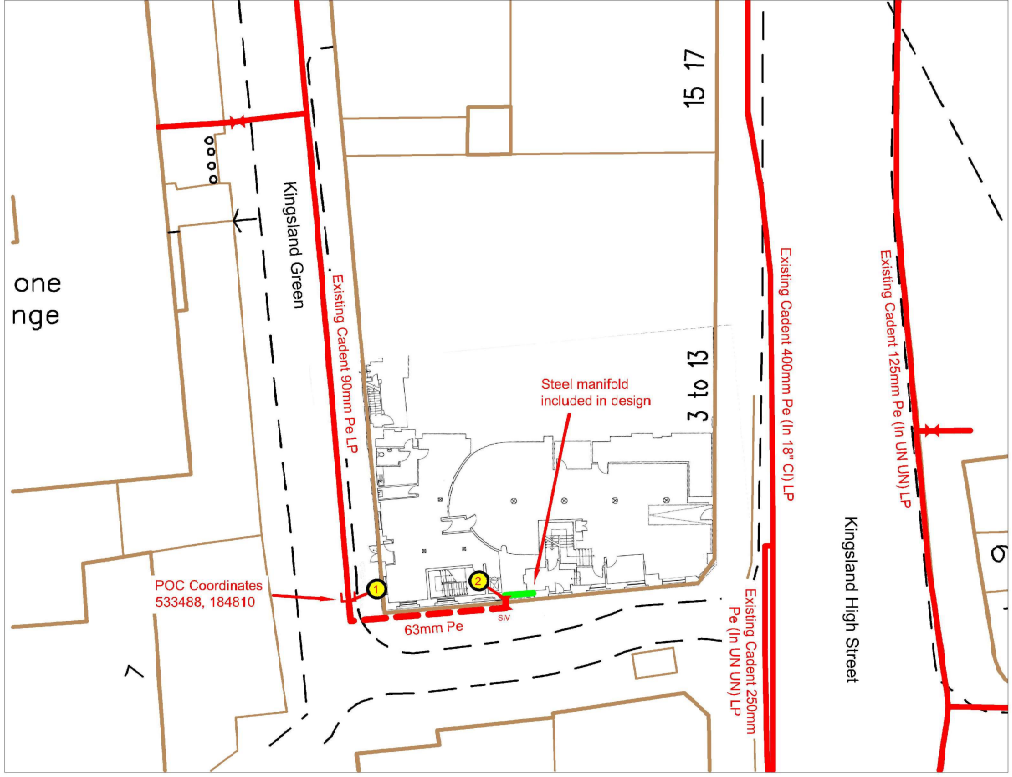
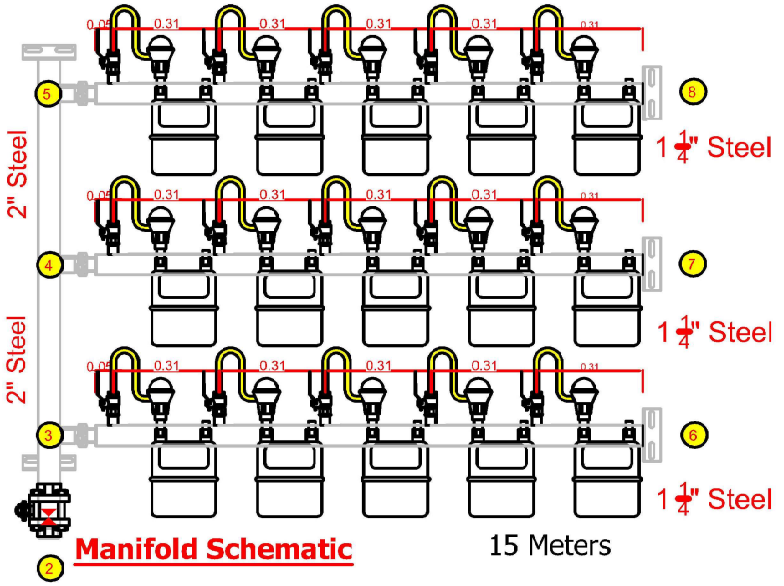
Dig Sites:

Area Line

Approx scale on A4 paper: 1:1000
(excluding Overview map)





Manifold Schematic

2" steel riser with 1 $\frac{1}{4}$" steel laterals and 50mm long $\frac{3}{4}$" steel offtakes for each meter.
ALLOW FURTHER ½ METRE ABOVE HEIGHT SHOWN FOR METER INSTALLATION
Design as per NP14 tables A.6 & B.4.

IIV to be fitted inside building close to point of entry to building.
Alternatively a building entry tee with an integral valve operable only by a special key.

Please refer to table *Supporting Above Ground Network Pipelines* on this drawing for pipe support spacing.

Network Design:

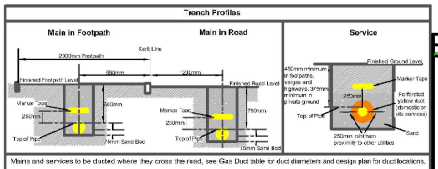
Mains Design Pressure and Velocity	LP		MP
Source Pressure	23 mBar		m3ar
Peak Flow	12.7 m3/hr		m3/hr
Maximum Velocity	4.36 m/s	On combi test	m/s
Minimum Pressure	22.71 mBar	On combi test	m3ar
Pressure Drop	0.29 mBar		0 m3ar

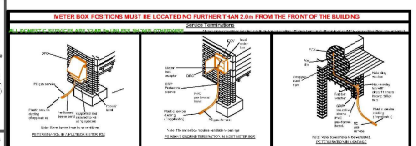
Connection	
Parent Main Operator	Cadent
Parent Main Dia	90mm
Parent Main Material	Pe
Connection	63mm top outlet service tee
POC Coordinates	533488, 184810
Downstream Main	63mm Pe

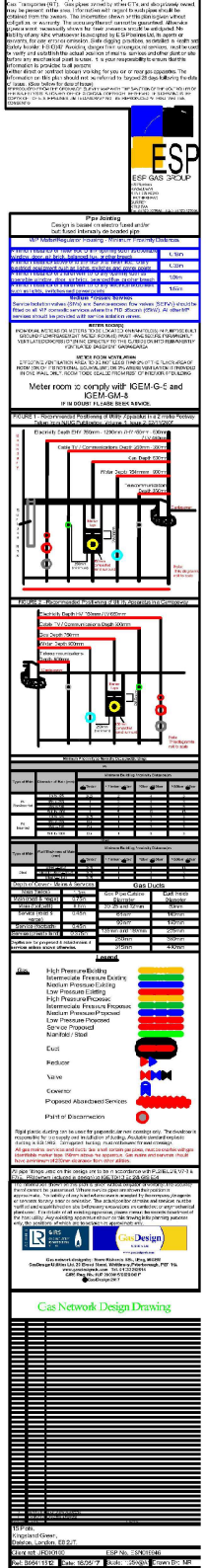
Mains Lengths (m) and Diameters Pe				
LP		MP	IP	
63mm	16	63mm	63mm	
90mm		90mm	90mm	
125mm		125mm	125mm	
180mm		180mm	180mm	
250mm		250mm	250mm	
315mm		315mm	315mm	
355mm		355mm	355mm	

Steel			
LP		MP	IP
1.25"	5.1		
2"	1.3		

Meterbox Types: Manifold







Asset location search

Property Searches

National One Call Plan To Dig
Mill Place
1Mill Road Industrial Estate
WEST LOTHIAN
EH49 7TL

Search address supplied Dalston Lane
London
E8 3DF

Your reference NOC/CTWSV456

Our reference ALS/ALS Standard/2021_4521701

Search date 13 October 2021

Knowledge of features below the surface is essential for every development

The benefits of this knowledge not only include ensuring due diligence and avoiding risk, but also being able to ascertain the feasibility of any development.

Did you know that Thames Water Property Searches can also provide a variety of utility searches including a more comprehensive view of utility providers' assets (across up to 35-45 different providers), as well as more focused searches relating to specific major utility companies such as National Grid (gas and electric).

Contact us to find out more.

Thames Water Utilities Ltd
Property Searches, PO Box 3189, Slough SL1 4WW
DX 151280 Slough 13

searches@thameswater.co.uk
www.thameswater-propertysearches.co.uk

0800 009 4540

Asset location search

Property Searches

Search address supplied: Dalston Lane, London, E8 3DF

Dear Sir / Madam

An Asset Location Search is recommended when undertaking a site development. It is essential to obtain information on the size and location of clean water and sewerage assets to safeguard against expensive damage and allow cost-effective service design.

The following records were searched in compiling this report: - the map of public sewers & the map of waterworks. Thames Water Utilities Ltd (TWUL) holds all of these.

This searchprovides maps showing the position, size of Thames Water assets close to the proposed development and also manhole cover and invert levels, where available.

Please note that none of the charges made for this report relate to the provision of Ordnance Survey mapping information. The replies contained in this letter are given following inspection of the public service records available to this company. No responsibility can be accepted for any error or omission in the replies.

You should be aware that the information contained on these plans is current only on the day that the plans are issued. The plans should only be used for the duration of the work that is being carried out at the present time. Under no circumstances should this data be copied or transmitted to parties other than those for whom the current work is being carried out.

Thames Water do update these service plans on a regular basis and failure to observe the above conditions could lead to damage arising to new or diverted services at a later date.

Contact Us

If you have any further queries regarding this enquiry please feel free to contact a member of the team on 0800 009 4540, or use the address below:

Thames Water Utilities Ltd
Property Searches
PO Box 3189
Slough
SL1 4WW

Email: searches@thameswater.co.uk
Web: www.thameswater-propertysearches.co.uk

Asset location search

Property Searches

Waste Water Services

Please provide a copy extract from the public sewer map.

Enclosed is a map showing the approximate lines of our sewers. Our plans do not show sewer connections from individual properties or any sewers not owned by Thames Water unless specifically annotated otherwise. Records such as "private" pipework are in some cases available from the Building Control Department of the relevant Local Authority.

Where the Local Authority does not hold such plans it might be advisable to consult the property deeds for the site or contact neighbouring landowners.

This report relates only to sewerage apparatus of Thames Water Utilities Ltd, it does not disclose details of cables and or communications equipment that may be running through or around such apparatus.

The sewer level information contained in this response represents all of the level data available in our existing records. Should you require any further Information, please refer to the relevant section within the 'Further Contacts' page found later in this document.

For your guidance:

- The Company is not generally responsible for rivers, watercourses, ponds, culverts or highway drains. If any of these are shown on the copy extract they are shown for information only.
- Any private sewers or lateral drains which are indicated on the extract of the public sewer map as being subject to an agreement under Section 104 of the Water Industry Act 1991 are not an 'as constructed' record. It is recommended these details be checked with the developer.

Clean Water Services

Please provide a copy extract from the public water main map.

Enclosed is a map showing the approximate positions of our water mains and associated apparatus. Please note that records are not kept of the positions of individual domestic supplies.

For your information, there will be a pressure of at least 10m head at the outside stop valve. If you would like to know the static pressure, please contact our Customer Centre on 0800 316 9800. The Customer Centre can also arrange for a full flow and pressure test to be carried out for a fee.

Asset location search

Property Searches

For your guidance:

- Assets other than vested water mains may be shown on the plan, for information only.
- If an extract of the public water main record is enclosed, this will show known public water mains in the vicinity of the property. It should be possible to estimate the likely length and route of any private water supply pipe connecting the property to the public water network.

Payment for this Search

A charge will be added to your suppliers account.

Asset location search

Property Searches

Further contacts:

Waste Water queries

Should you require verification of the invert levels of public sewers, by site measurement, you will need to approach the relevant Thames Water Area Network Office for permission to lift the appropriate covers. This permission will usually involve you completing a TWOSA form. For further information please contact our Customer Centre on Tel: 0845 920 0800. Alternatively, a survey can be arranged, for a fee, through our Customer Centre on the above number.

If you have any questions regarding sewer connections, budget estimates, diversions, building over issues or any other questions regarding operational issues please direct them to our service desk. Which can be contacted by writing to:

Developer Services (Waste Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

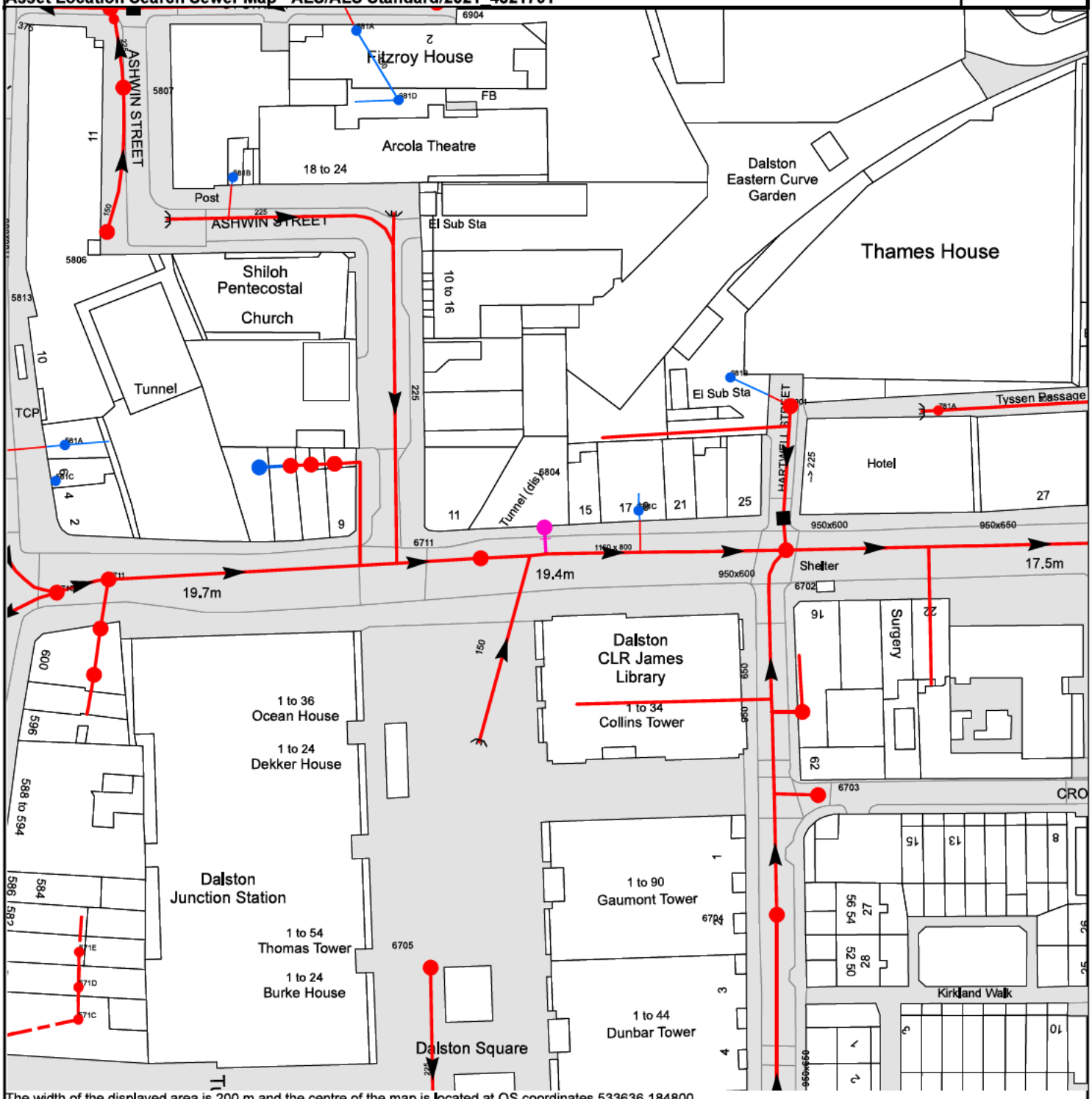
Clean Water queries

Should you require any advice concerning clean water operational issues or clean water connections, please contact:

Developer Services (Clean Water)
Thames Water
Clearwater Court
Vastern Road
Reading
RG1 8DB

Tel: 0800 009 3921
Email: developer.services@thameswater.co.uk

Asset Location Search Sewer Map - ALS/ALS Standard/2021_4521701



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 533636,184800

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
6704	17.28	12.94
6702	18.23	12.53
6801	17.82	14.37
67YV	n/a	n/a
6703	17.13	15.12
781A	n/a	n/a
581C	n/a	n/a
571G	n/a	n/a
571C	n/a	n/a
571D	n/a	n/a
571E	n/a	n/a
57YQ	n/a	n/a
57XZ	n/a	n/a
5711	n/a	n/a
6705	17.81	14.93
6711	n/a	n/a
6804	19.54	n/a
681C	n/a	n/a
58WV	n/a	n/a
58XY	n/a	n/a
58XX	n/a	n/a
58XU	n/a	n/a
581A	n/a	n/a
681B	n/a	n/a
5806	19.77	19.35
581B	n/a	n/a
681D	n/a	n/a
5807	19.16	n/a
681A	n/a	n/a
5808	18.89	14.12

ALS Sewer Map Key

Public Sewer Types (Operated & Maintained by Thames Water)

Foul: A sewer designed to convey waste water from domestic and industrial sources to a treatment works.

Surface Water: A sewer designed to convey surface water (e.g. rain water from roofs, yards and car parks) to rivers or watercourses.

Combined: A sewer designed to convey both waste water and surface water from domestic and industrial sources to a treatment works.

- Trunk Surface Water
- Trunk Foul
- Storm Relief
- Trunk Combined
- Vent Pipe
- Bio-solids (Sludge)
- Proposed Thames Surface Water Sewer
- Proposed Thames Water Foul Sewer
- Gallery
- Foul Rising Main
- Surface Water Rising Main
- Combined Rising Main
- Sludge Rising Main
- Proposed Thames Water Rising Main
- Vacuum

Sewer Fittings

A feature in a sewer that does not affect the flow in the pipe. Example: a vent is a fitting as the function of a vent is to release excess gas.

- Air Valve
- Dam Chase
- Fitting
- Meter
- Vent Column

Operational Controls

A feature in a sewer that changes or diverts the flow in the sewer. Example: A hydrobrake limits the flow passing downstream.

- Control Valve
- Drop Pipe
- Ancillary
- Weir

End Items

End symbols appear at the start or end of a sewer pipe. Examples: an Undefined End at the start of a sewer indicates that Thames Water has no knowledge of the position of the sewer upstream of that symbol, Outfall on a surface water sewer indicates that the pipe discharges into a stream or river.

- Outfall
- Undefined End
- Inlet

Other Symbols

Symbols used on maps which do not fall under other general categories

- Public/Private Pumping Station
- Change of characteristic indicator (C.O.C.I.)
- Invert Level
- Summit

Areas

Lines denoting areas of underground surveys, etc.

- Agreement
- Operational Site
- Chamber
- Tunnel
- Conduit Bridge

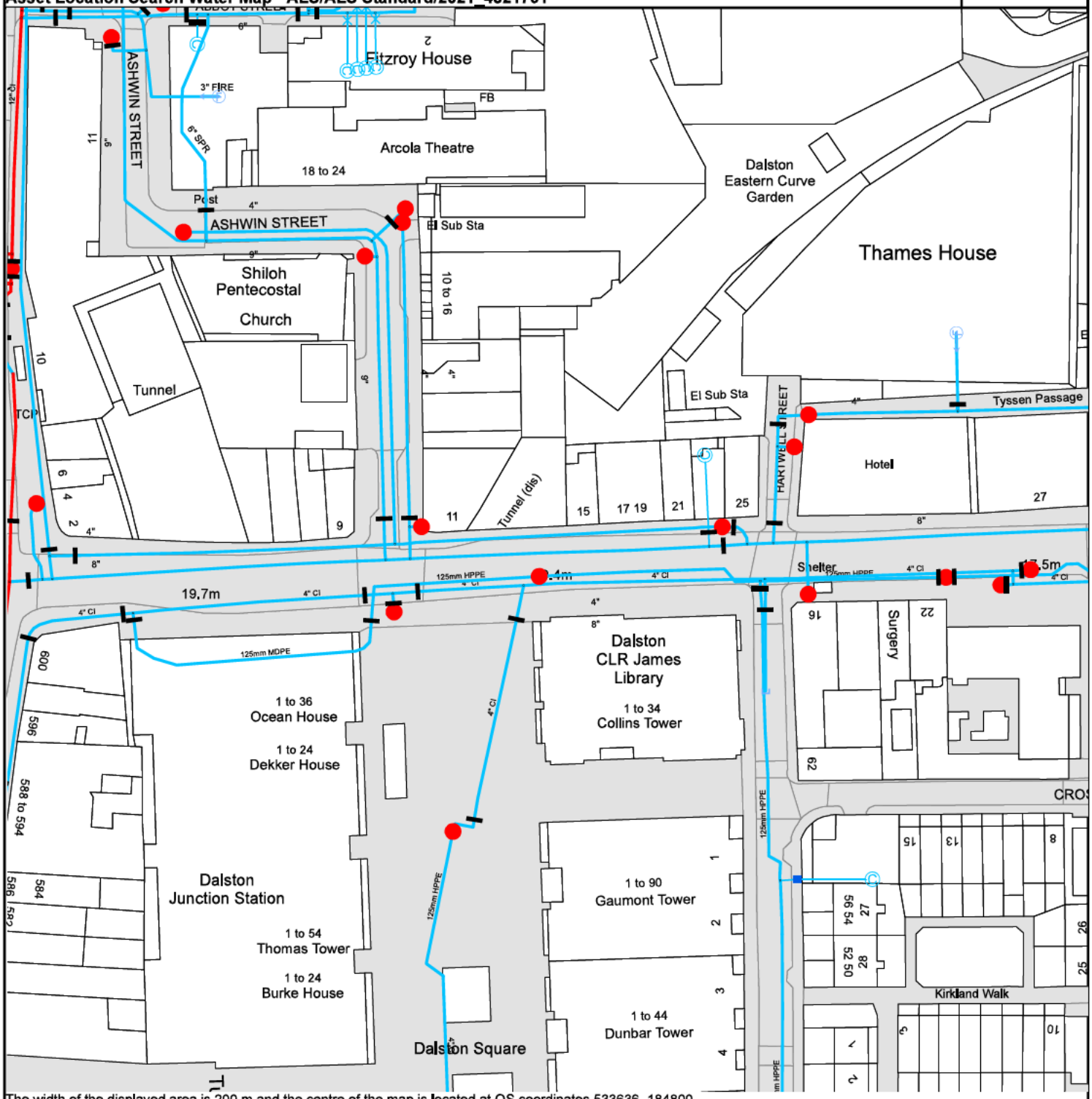
Other Sewer Types (Not Operated or Maintained by Thames Water)

- Foul Sewer
- Surface Water Sewer
- Combined Sewer
- Gulley
- Culverted Watercourse
- Proposed
- Abandoned Sewer

Notes:

1) All levels associated with the plans are to Ordnance Datum Newlyn.
2) All measurements on the plans are metric.
3) Arrows (on gravity fed sewers) or flecks (on rising mains) indicate direction of flow.
4) Most private pipes are not shown on our plans, as in the past, this information has not been recorded.
5) 'na' or '0' on a manhole level indicates that data is unavailable.
6) The text appearing alongside a sewer line indicates the internal diameter of the pipe in millimetres. Text next to a manhole indicates the manhole reference number and should not be taken as a measurement. If you are unsure about any text or symbology present on the plan, please contact a member of Property Searches on 0800 009 4540.

Asset Location Search Water Map - ALS/ALS Standard/2021_4521701



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 533636, 184800.

ALS Water Map Key

Water Pipes (Operated & Maintained by Thames Water)

4"

Distribution Main: The most common pipe shown on water maps. With few exceptions, domestic connections are only made to distribution mains.

16"

Trunk Main: A main carrying water from a source of supply to a treatment plant or reservoir, or from one treatment plant or reservoir to another. Also a main transferring water in bulk to smaller water mains used for supplying individual customers.

3" SUPPLY

Supply Main: A supply main indicates that the water main is used as a supply for a single property or group of properties.

3" FIRE

Fire Main: Where a pipe is used as a fire supply, the word FIRE will be displayed along the pipe.

3" METERED

Metered Pipe: A metered main indicates that the pipe in question supplies water for a single property or group of properties and that quantity of water passing through the pipe is metered even though there may be no meter symbol shown.

Transmission Tunnel: A very large diameter water pipe. Most tunnels are buried very deep underground. These pipes are not expected to affect the structural integrity of buildings shown on the map provided.

Proposed Main: A main that is still in the planning stages or in the process of being laid. More details of the proposed main and its reference number are generally included near the main.

PIPE DIAMETER	DEPTH BELOW GROUND
Up to 300mm (12")	900mm (3')
300mm - 600mm (12" - 24")	1100mm (3' 8")
600mm and bigger (24" plus)	1200mm (4')

Valves

- General Purpose Valve
- Air Valve
- Pressure Control Valve
- Customer Valve

Hydrants

- Single Hydrant

Meters

- Meter

End Items

Symbol indicating what happens at the end of a water main.

- Blank Flange
- Capped End
- Emptying Pit
- Undefined End
- Manifold
- Customer Supply
- Fire Supply

Operational Sites

- Booster Station
- Other
- Other (Proposed)
- Pumping Station
- Service Reservoir
- Shaft Inspection
- Treatment Works
- Unknown
- Water Tower

Other Symbols

- Data Logger

Other Water Pipes (Not Operated or Maintained by Thames Water)

Other Water Company Main: Occasionally other water company water pipes may overlap the border of our clean water coverage area. These mains are denoted in purple and in most cases have the owner of the pipe displayed along them.

Private Main: Indiates that the water main in question is not owned by Thames Water. These mains normally have text associated with them indicating the diameter and owner of the pipe.

Terms and Conditions

All sales are made in accordance with Thames Water Utilities Limited (TWUL) standard terms and conditions unless previously agreed in writing.

1. All goods remain in the property of Thames Water Utilities Ltd until full payment is received.
2. Provision of service will be in accordance with all legal requirements and published TWUL policies.
3. All invoices are strictly due for payment 14 days from due date of the invoice. Any other terms must be accepted/agreed in writing prior to provision of goods or service, or will be held to be invalid.
4. Thames Water does not accept post-dated cheques-any cheques received will be processed for payment on date of receipt.
5. In case of dispute TWUL`s terms and conditions shall apply.
6. Penalty interest may be invoked by TWUL in the event of unjustifiable payment delay. Interest charges will be in line with UK Statute Law 'The Late Payment of Commercial Debts (Interest) Act 1998'.
7. Interest will be charged in line with current Court Interest Charges, if legal action is taken.
8. A charge may be made at the discretion of the company for increased administration costs.

A copy of Thames Water's standard terms and conditions are available from the Commercial Billing Team (cashoperations@thameswater.co.uk).

We publish several Codes of Practice including a guaranteed standards scheme. You can obtain copies of these leaflets by calling us on 0800 316 9800

If you are unhappy with our service you can speak to your original goods or customer service provider. If you are not satisfied with the response, your complaint will be reviewed by the Customer Services Director. You can write to her at: Thames Water Utilities Ltd. PO Box 492, Swindon, SN38 8TU.

If the Goods or Services covered by this invoice falls under the regulation of the 1991 Water Industry Act, and you remain dissatisfied you can refer your complaint to Consumer Council for Water on 0121 345 1000 or write to them at Consumer Council for Water, 1st Floor, Victoria Square House, Victoria Square, Birmingham, B2 4AJ.

Ways to pay your bill

Credit Card	**BACS Payment**	**Telephone Banking**	**Cheque**
Call **0800 009 4540** quoting your invoice number starting CBA or ADS / OSS	Account number **90478703** Sort code **60-00-01** A remittance advice must be sent to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW.** or email **ps.billing@thameswater.co.uk**	By calling your bank and quoting: Account number **90478703** Sort code **60-00-01** and your invoice number	Made payable to '**Thames Water Utilities Ltd**' Write your Thames Water account number on the back. Send to: **Thames Water Utilities Ltd., PO Box 3189, Slough SL1 4WW** or by DX to **151280 Slough 13**

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations) Limited

Our Ref: 23548644 Your Ref: NOC/CTWSV456

Wednesday, 13 October 2021

Brian McMaster
1 Mill Place Mill Road Ind Est Linlithgow Bridge
Linlithgow
West Lothian
EH49 7TL

Dear Brian McMaster

Thank you for contacting us regarding UK Power Networks equipment at the above site. I have enclosed a copy of our records which show the electrical lines and/or electrical plant. I hope you find the information useful.

I have also enclosed a fact sheet which contains important information regarding the use of our plans and working around our equipment. Safety around our equipment is our number one priority so please ensure you have completed all workplace risk assessments before you begin any works.

Should your excavation affect our Extra High Voltage equipment (6.6 KV, 22 KV, 33 KV or 132 KV), please contact us to obtain a copy of the primary route drawings and associated cross sections.

If you have any further queries do not hesitate to contact us.

Plan Provision
0800 056 5866

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations) Limited

This information is made available to you on the terms set out below. If you do not accept the terms of use set out in this fact sheet please do not use the plans and return them to UK Power Networks.

1. UK Power Networks does not warrant that the information provided to you is correct. You rely upon it at your own risk.

2. UK Power Networks does not exclude or limit its liability if it causes the death of any person or causes personal injury to a person where such death or personal injury is caused by its negligence.

3. Subject to paragraph 2 UK Power Networks has no liability to you in contract, in tort (including negligence), for breach of statutory duty or otherwise how for any loss, damage, costs, claims, demands, or expenses that you or any third party may suffer or incur as a result of using the information provided whether for physical damage to property or for any economic loss (including without limitation loss of profit, loss of opportunity, loss of savings, loss of goodwill, loss of business, loss of use) or any special or consequential loss or damage whatsoever.

4. The information about UK Power Networks electrical plant and/or electric lines provided to you belongs to and remains the property of UK Power Networks. You must not alter it in any respect.

5. The information provided to you about the electrical plant and/or electric lines depicted on the plans may NOT be a complete record of such apparatus belonging to UK Power Networks. The information provided relates to electric lines and/or electrical plant belonging to UK Power Networks that it believes to be present but the plans are not definitive: other electric lines and/or electrical plant may be present and that may or may not belong to UK Power Networks.

6. Other apparatus not belonging to UK Power Networks is not shown on the plan. It is your responsibility to make your own enquiries elsewhere to discover whether apparatus belonging to others is present. It would be prudent to assume that other apparatus is present.

7. You are responsible for ensuring that the information made available to you is passed to those acting on your behalf and that all such persons are made aware of the contents of this letter.

8. Because the information provided to you may not be accurate, you are recommended to ascertain the presence of UK Power Networks electric lines and/or electrical plant by the digging of trial holes. Trial holes should be dug by hand only.

   Excavations must be carried out in line with the Health and Safety Executive guidance document HSG 47. We will not undertake this work. A copy of HSG 47 can be obtained from the Health and Safety Executives website.

   All electric lines discovered must be considered LIVE and DANGEROUS at all times and must not be cut, resited, suspended, bent or interfered with unless specially authorised by UK Power Networks.

   The electric line and electrical plant belonging to UK Power Networks remains so even when made dead and abandoned and any such electric line and/or electrical plant exposed shall be reported to UK Power Networks.

   Where your works are likely to affect our electric lines and/or electrical plant an estimate of the price of any protective /diversionary works can be prepared by UK Power Networks Branch at Metropolitan House, Darkes Lane, Potters Bar, Herts. , EN6 1AG, telephone no. 0845 2340040

Registered Office:
Newington House
237 Southwark Bridge Road
London SE1 6NP

Registered in England and Wales No: 3870728

Company:
UK Power Networks (Operations)
Limited

9 Any work near to any overhead electricity lines must be carried out by you in accordance with the Health and Safety Executive guidance document GS6 and the Electricity at Work Regulations.

The GS6 Recommendations may be purchased from HSE Books or downloaded from the Energy Networks Association's website.

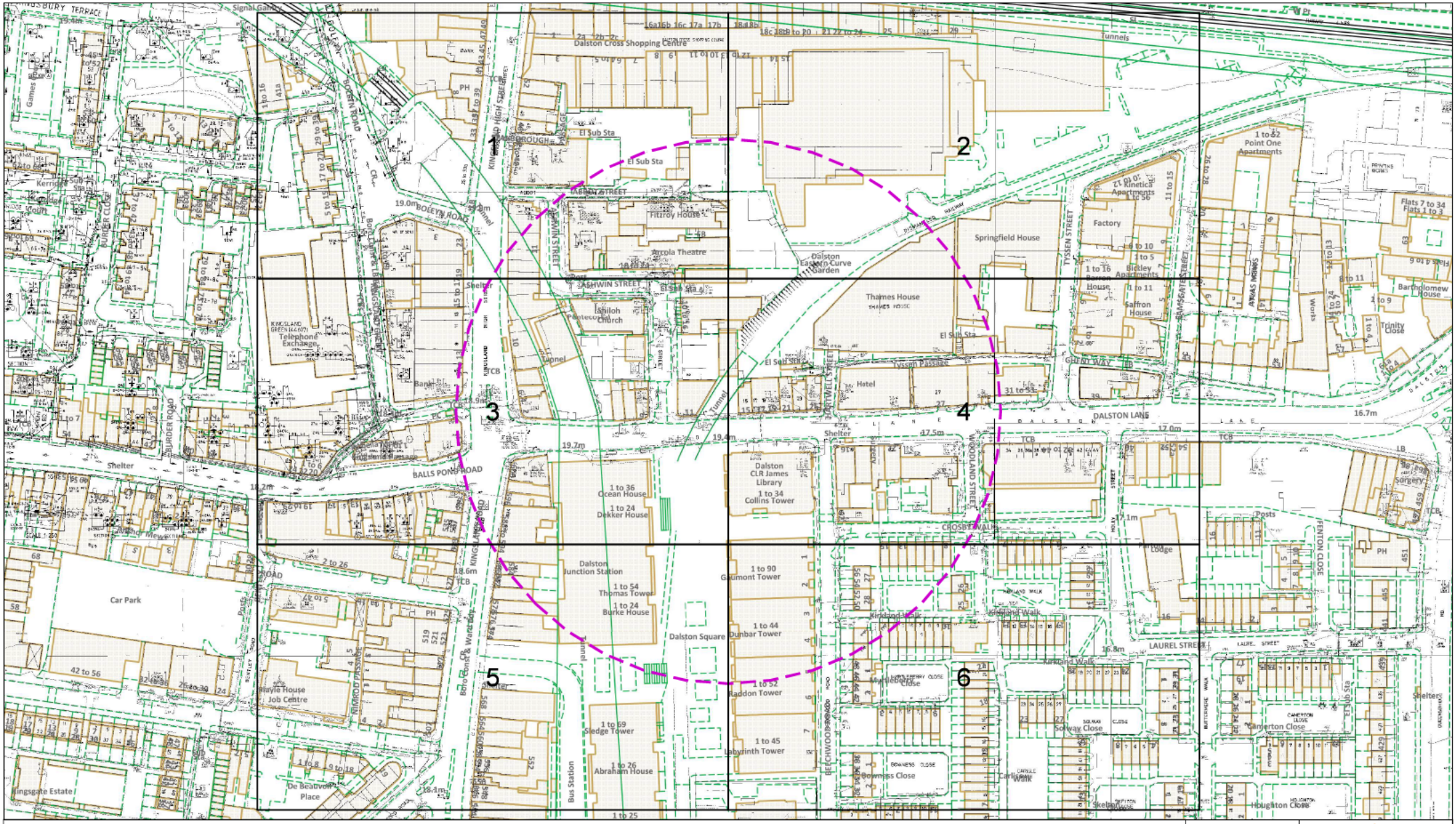
If given a reasonable period of prior notice UK Power Networks will attend on site without charge to advise how and where "goal posts" should be erected. If you wish to use this service, in the first instance please telephone: 0845 6014516 between 08:30 and 17:00 Monday to Friday.

10. You are responsible for the security of the information provided to you. It must not be given, sold or made available upon payment of a fee to a third party.

11. If in carrying out work on land in, on, under or over which is installed an electric line and/or electrical plant that belongs to UK Power Networks you and/or anyone working on your behalf damages (however slightly) that apparatus you must inform immediately UK Power Networks by our emergency 24 hour three digit telephone number **105** providing;

- your name, address and telephone number;
- the date, time and place at which such damage was caused;
- a description of the electric line and/or electrical plant to which damage was caused;
- the name of the person whom it appears to you is responsible for that damage;
- the nature of the damage.

12. The expression "UK Power Networks" includes UK Power Networks (EPN) plc, UK Power Networks (LPN) plc, UK Power Networks (SEPN) plc, UK Power Networks and any of their successors and predecessors in title.



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Date Requested: 13/10/2021
Job Reference: 23548644
Site Location: 533401 184630
Requested by:
Mr Brian McMaster
Your Scheme/Reference:
NOC/CTWSV456

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UK Power Networks

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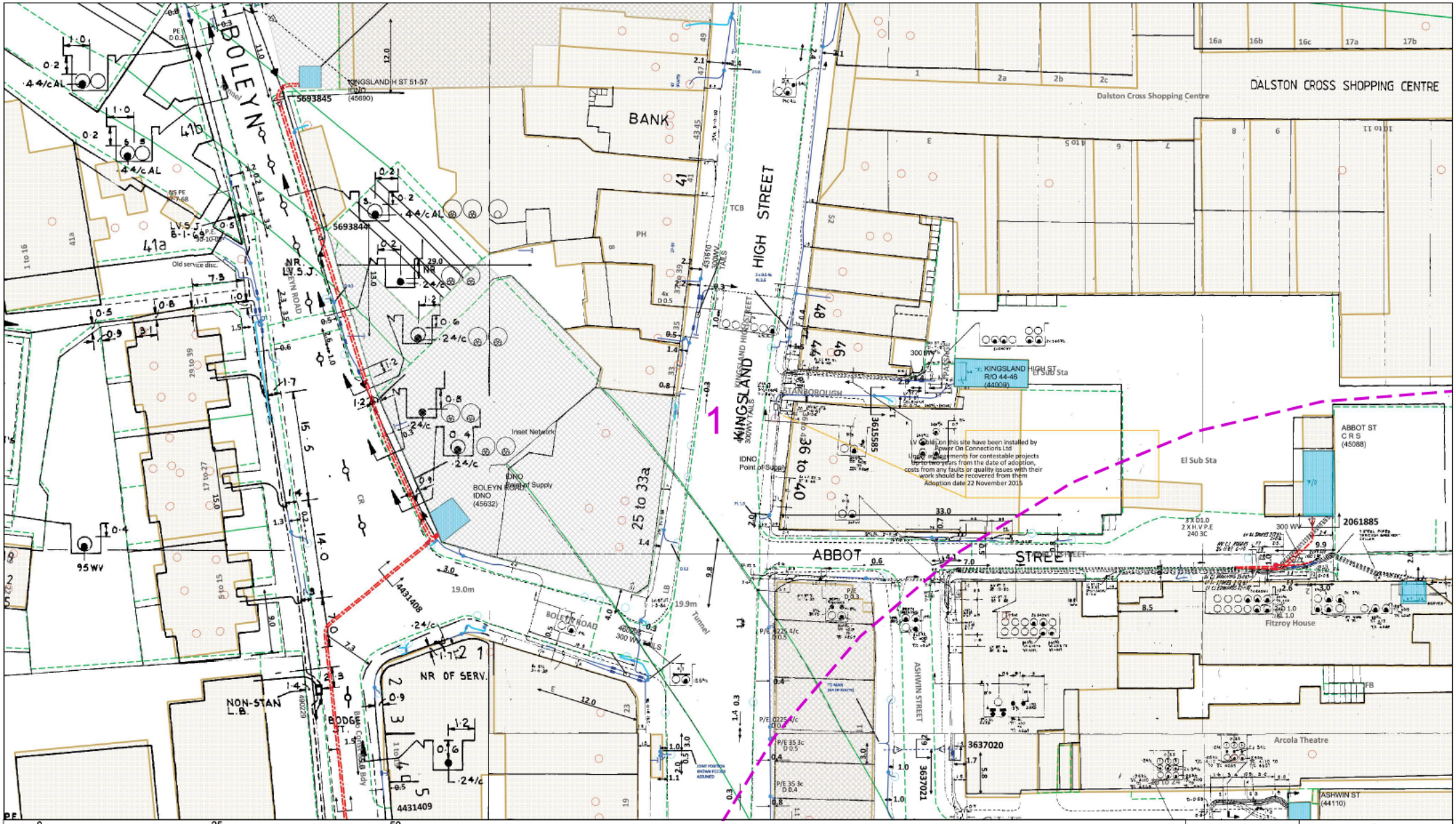

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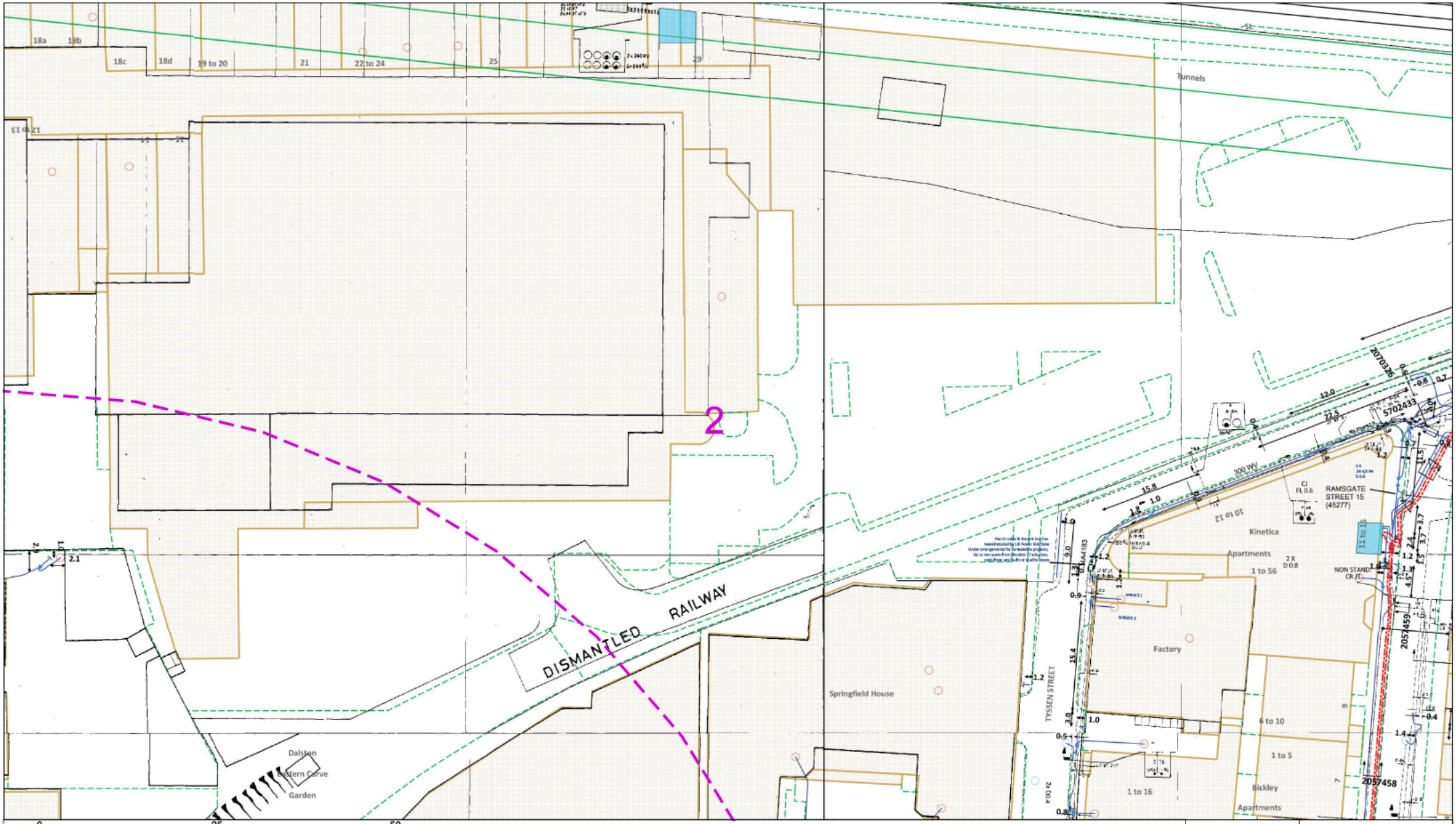

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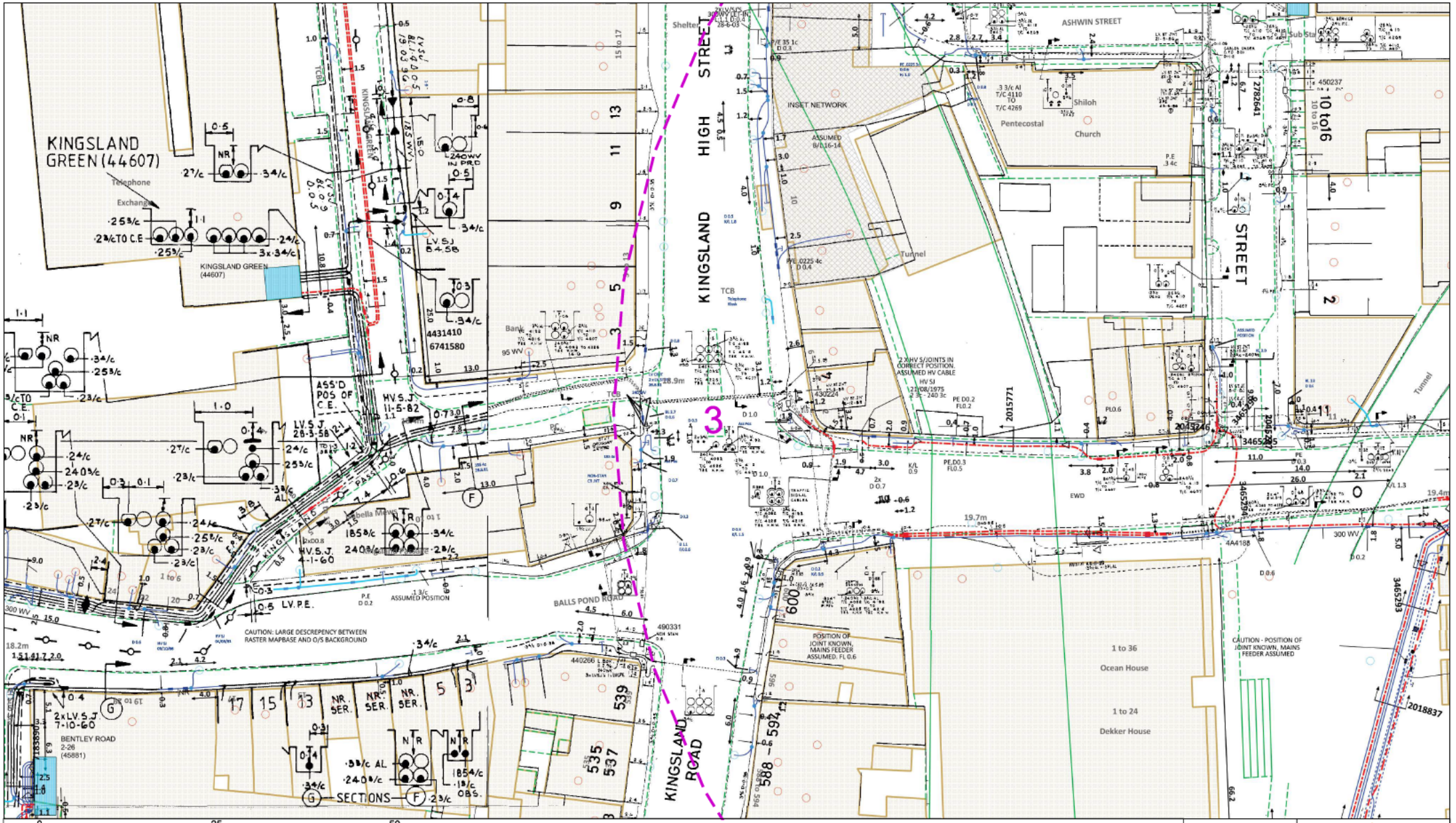

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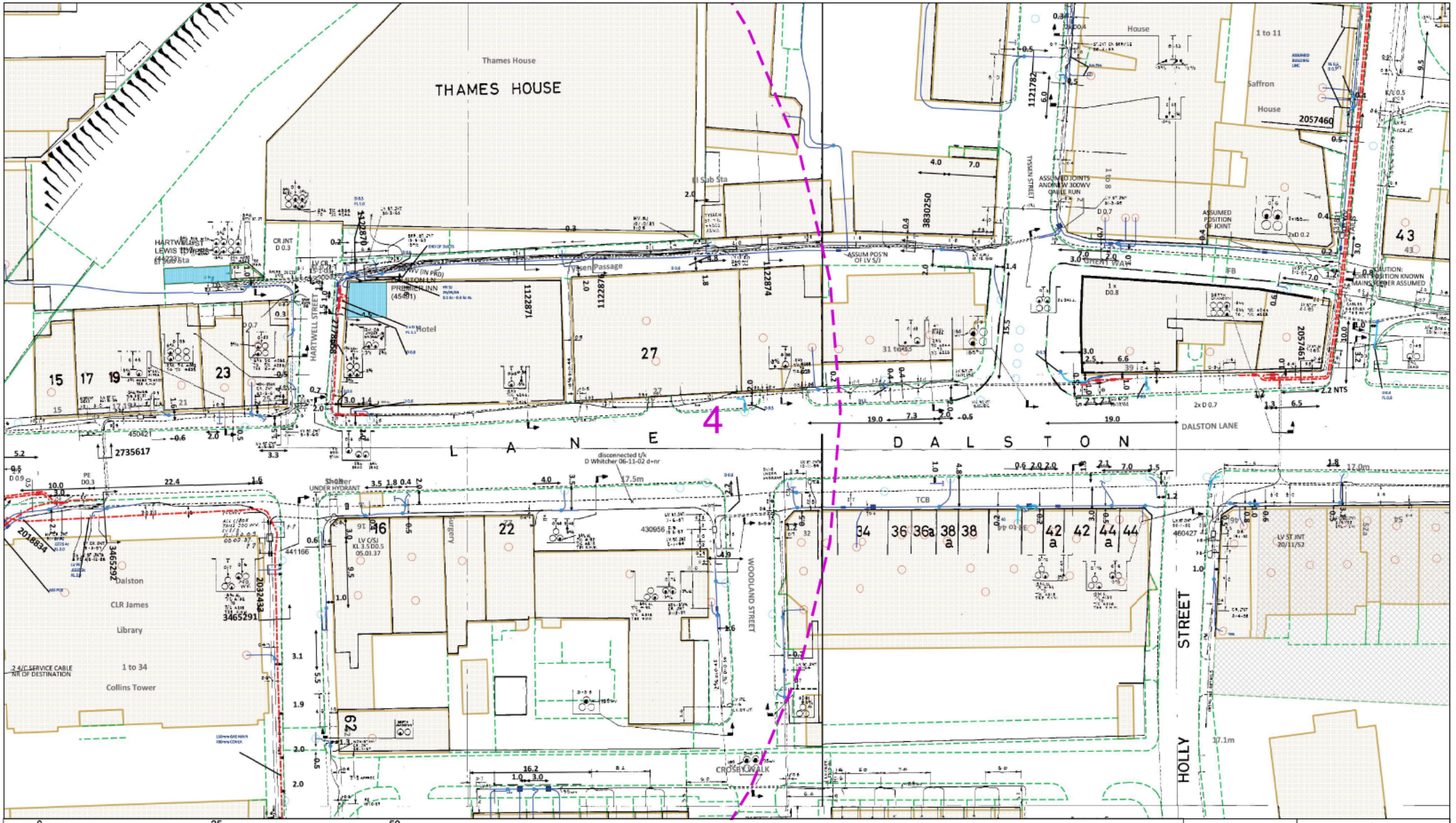

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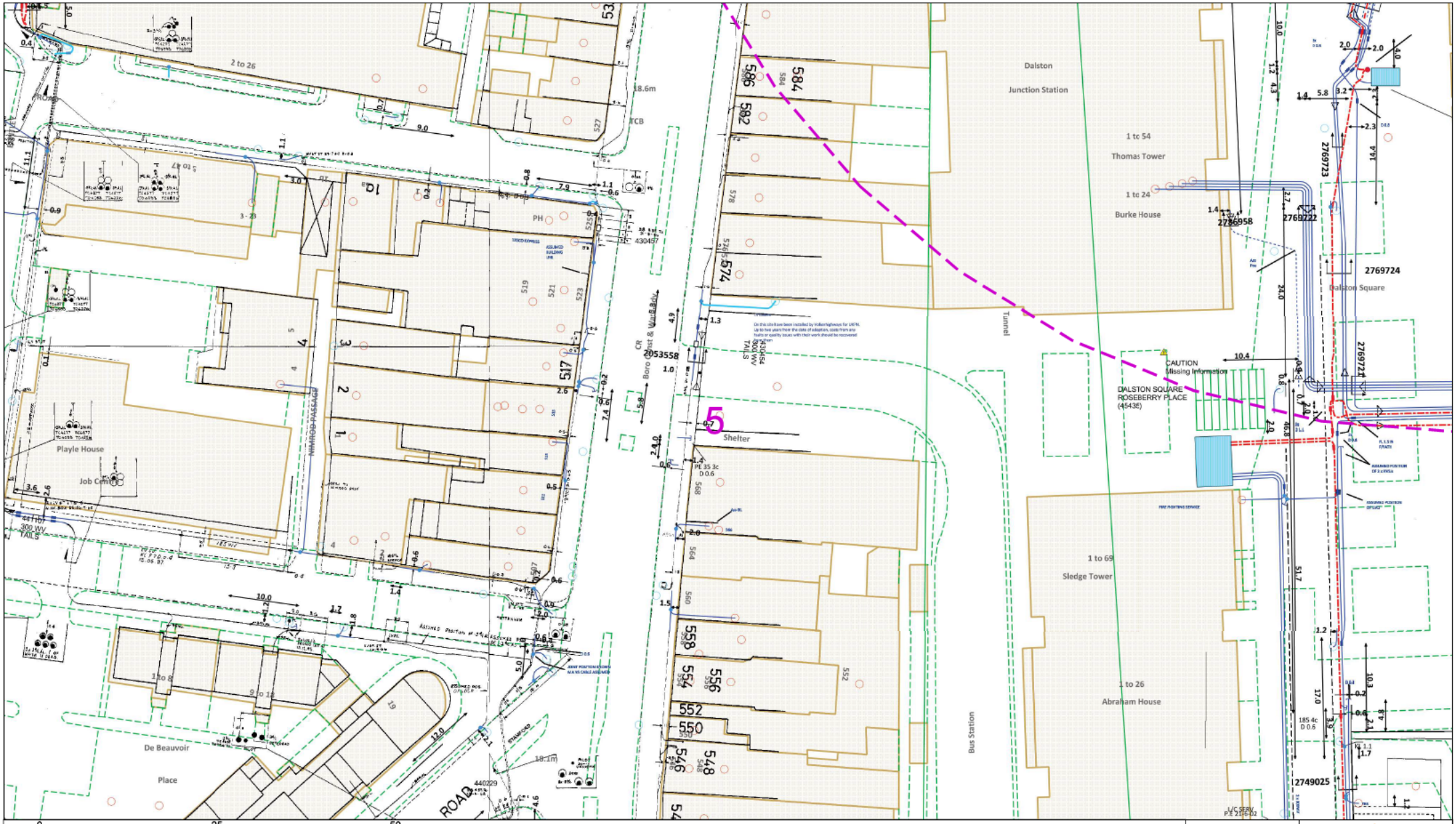

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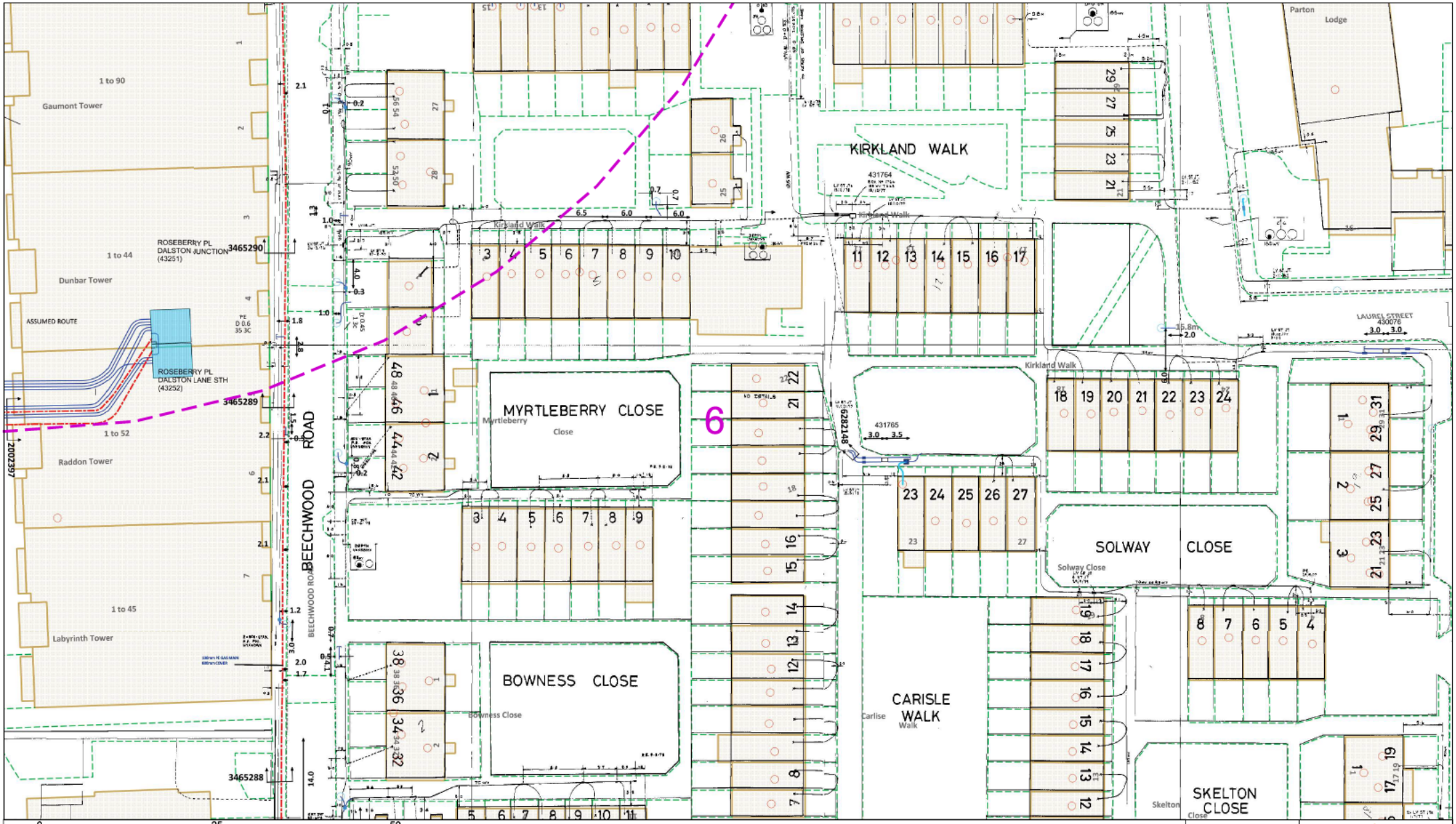

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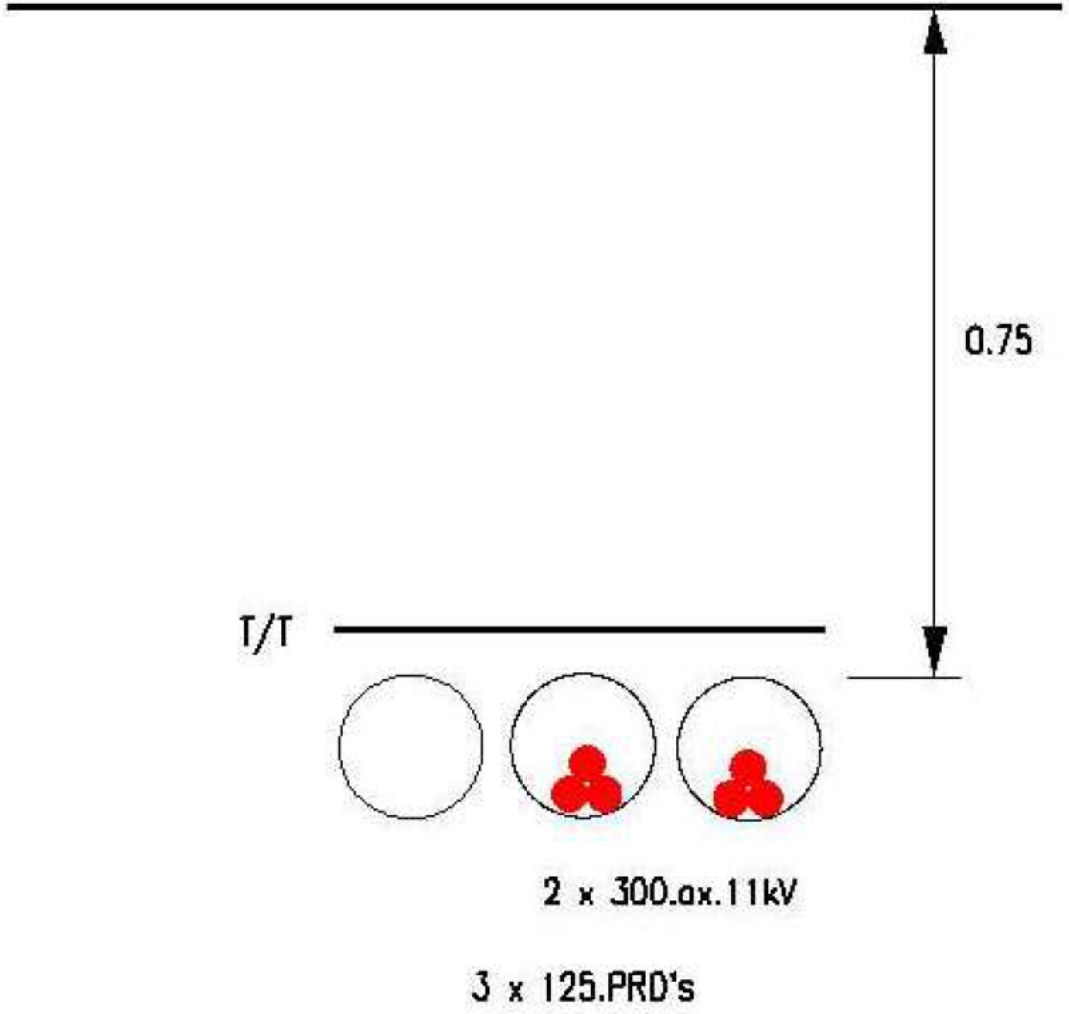
Cross Section : 4431409



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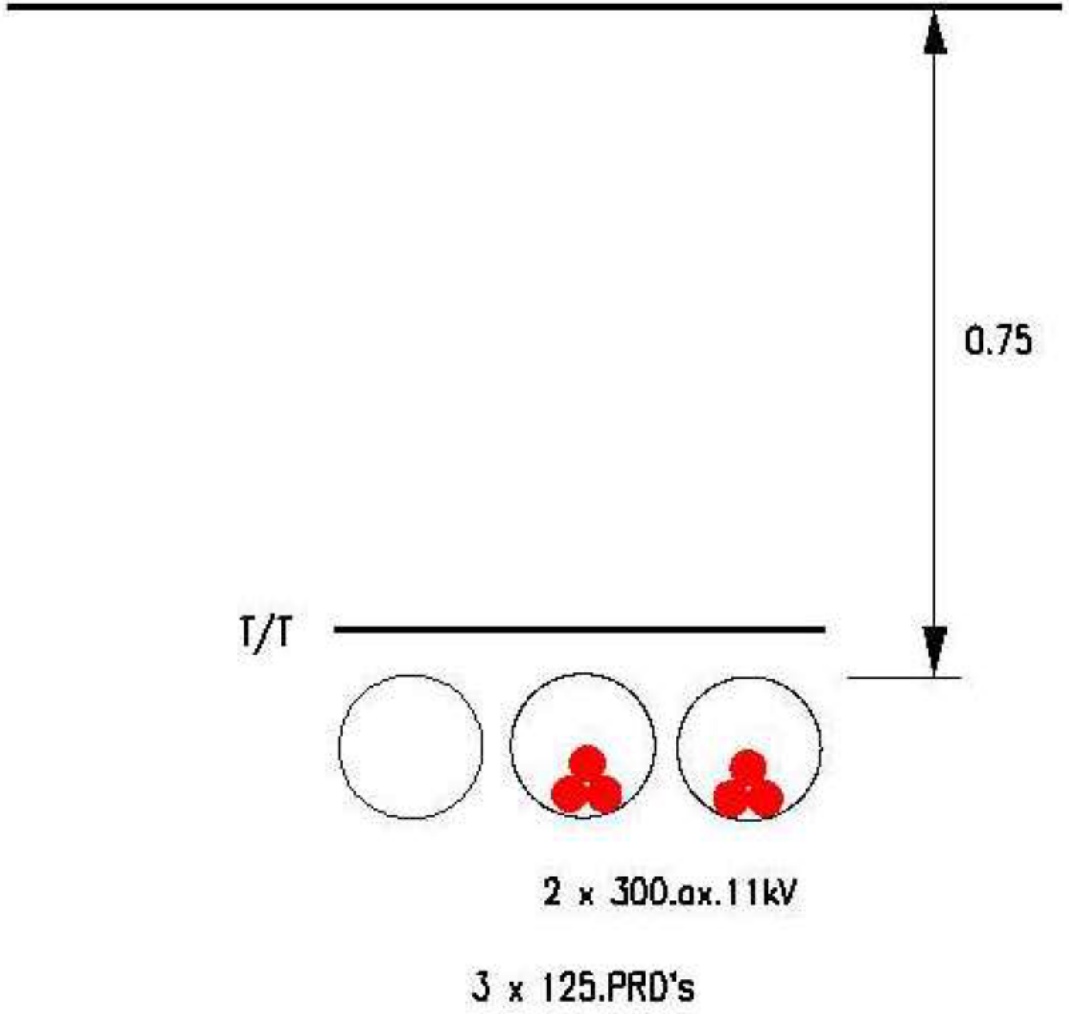

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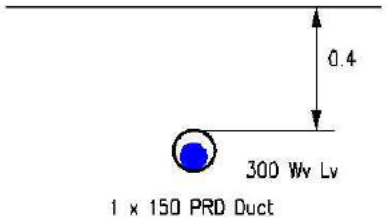
Cross Section : 6741580



Cross Section
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Cross Section : 2061885

1 – 240 3/c TO T/C 4009, TEE T/C 4269.
2 – 240WV TO T/C 4269.
3 – 240WV TO T/C 4269, TEE
4 – 240WV TO T/C 4009.
5 – 240WV TO T/C 4269, TEE

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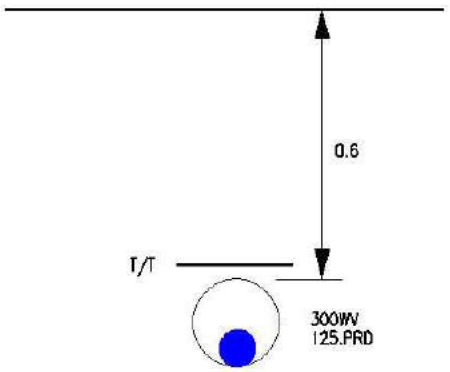
Cross Section : 3615585



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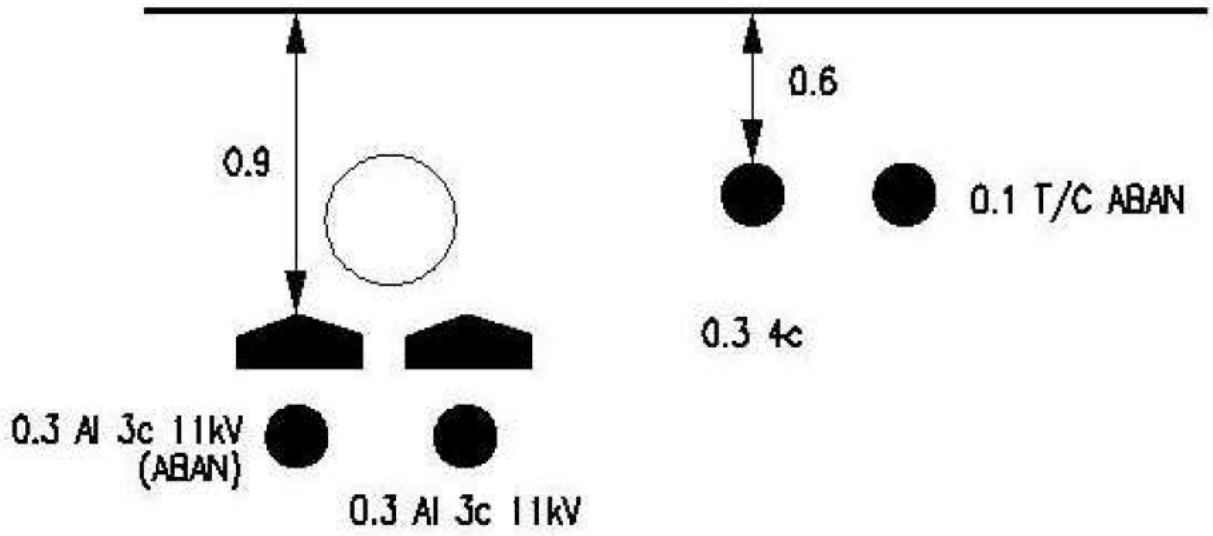
Cross Section : 3637020



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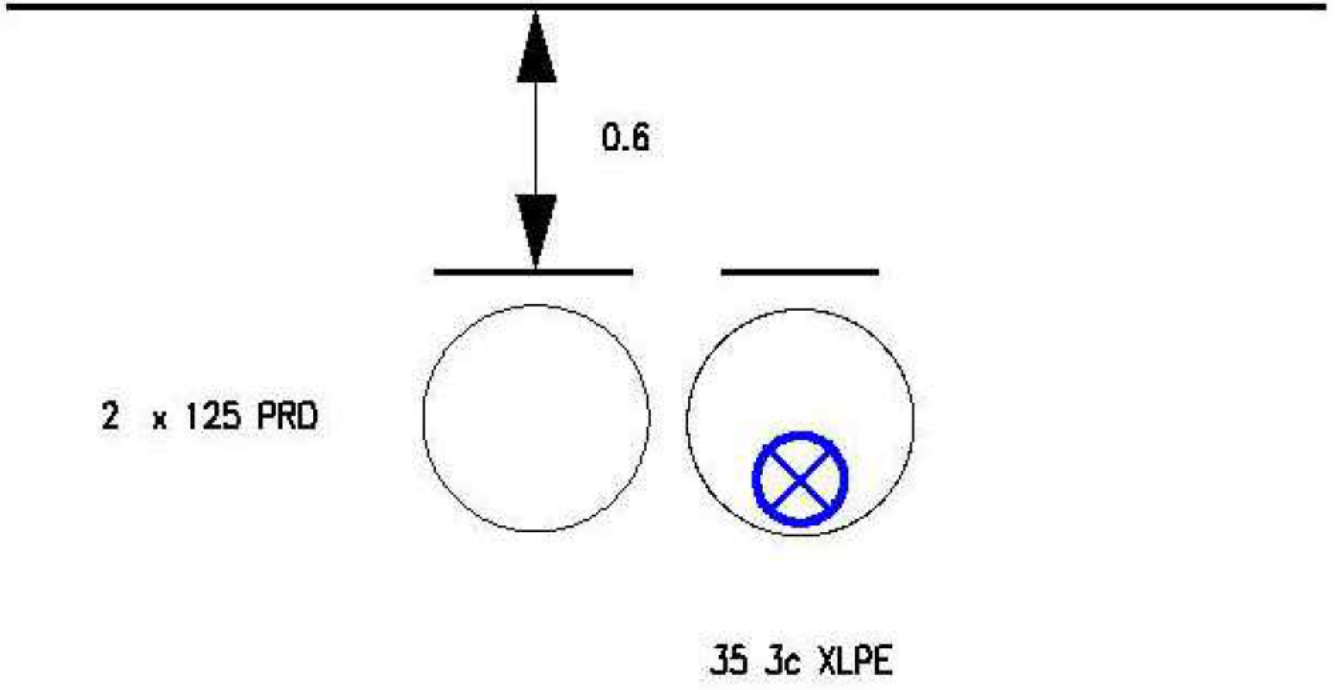
Cross Section : 3637021



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Cross Section : 2782641

Cross Section
2782641

74c

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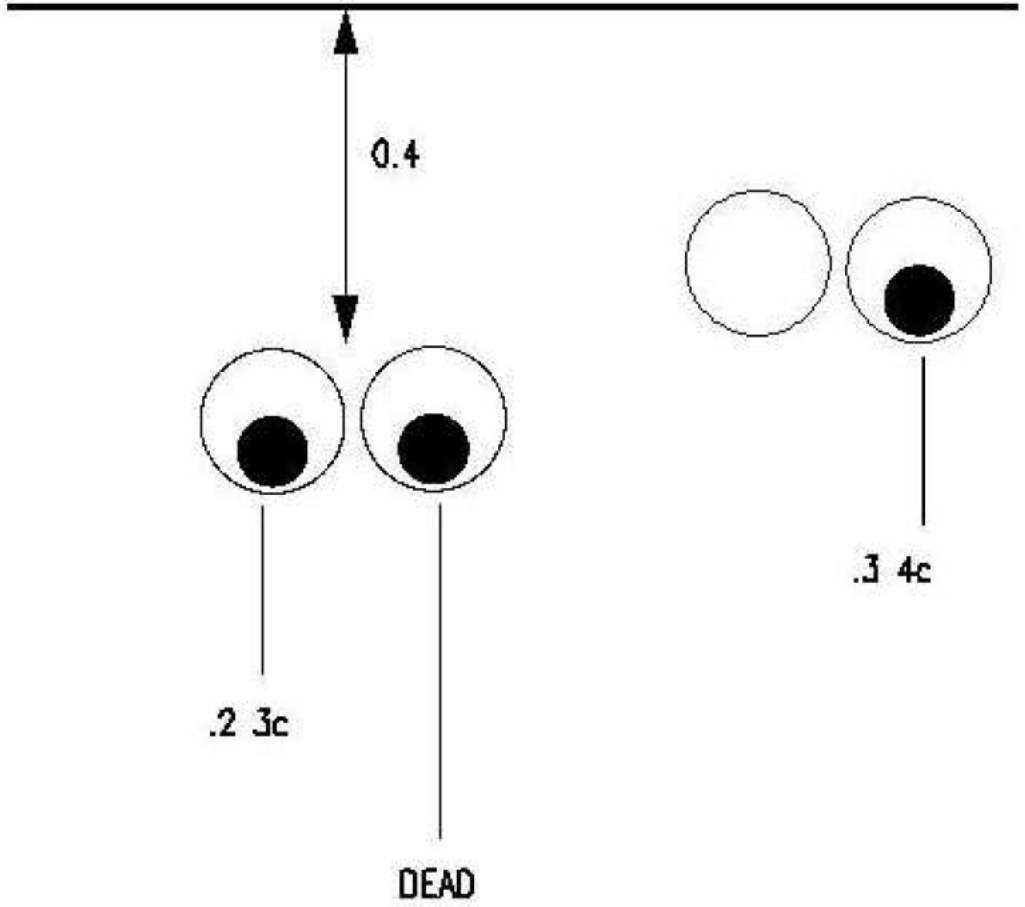
Cross Section : 2045247



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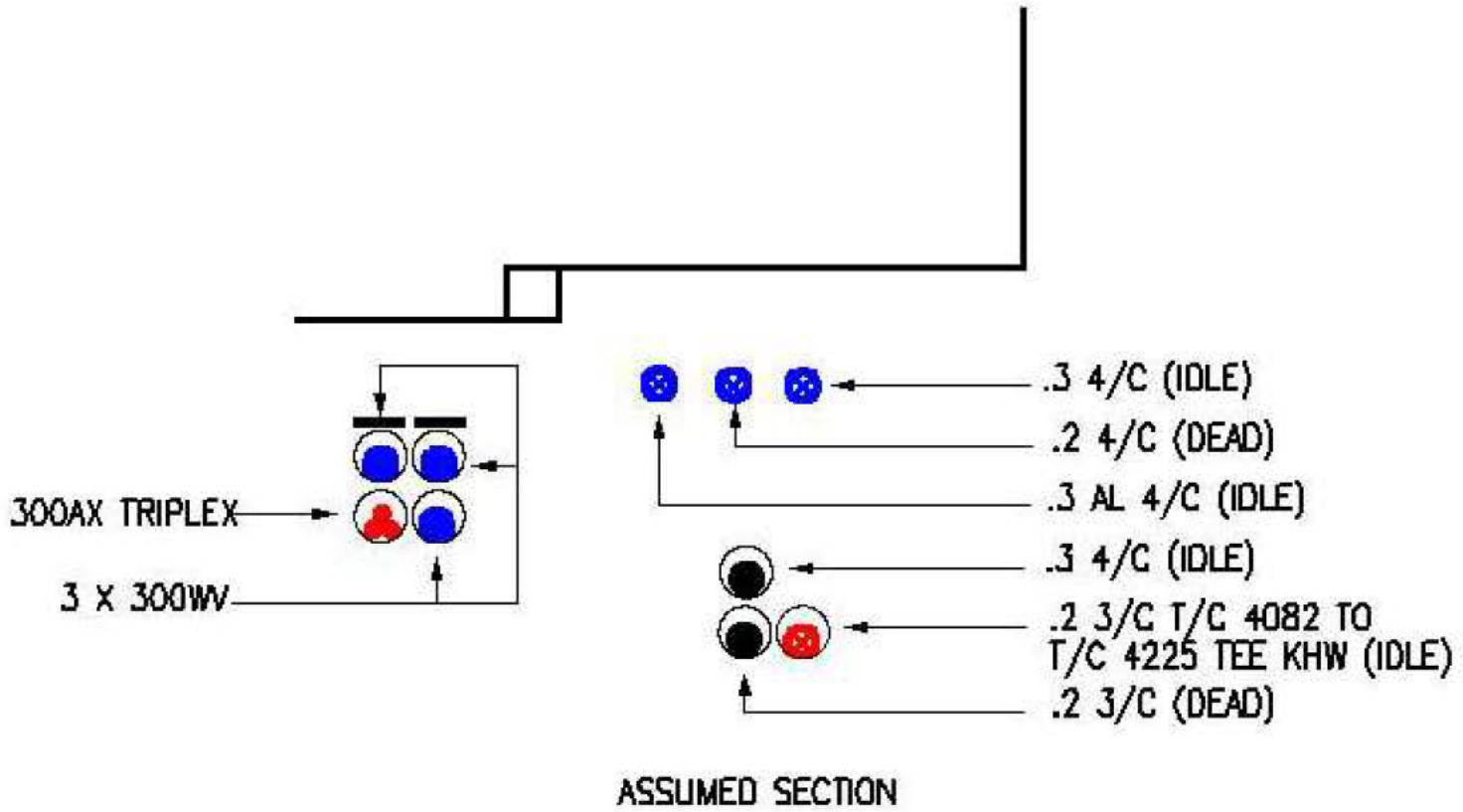
Cross Section : 2018836



ASSUMED SECTION

Cross Section
2018836

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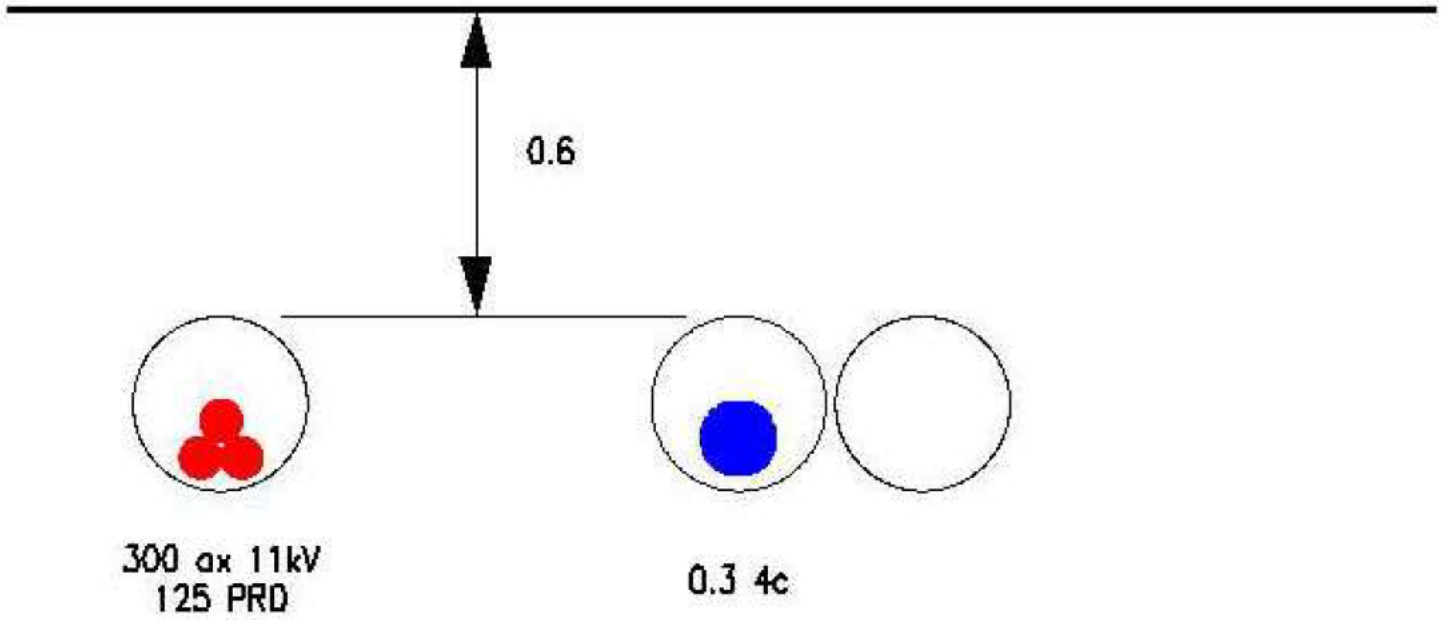
Cross Section : 3465293



Cross Section
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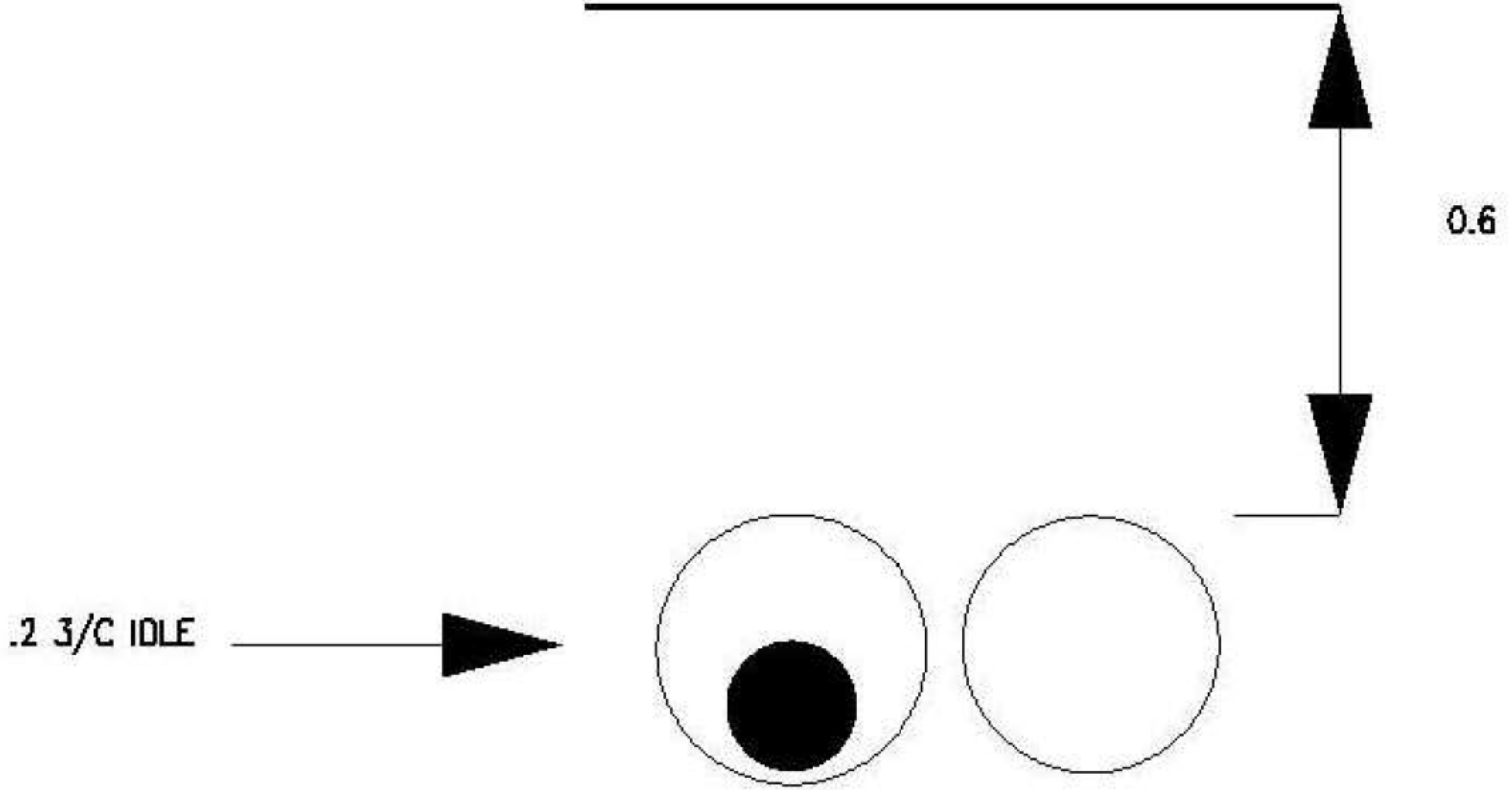
Cross Section : 2018834



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EMERGENCY - If you damage a cable or line
Phone 0800 783 8838 (24hrs)
URGENTLY

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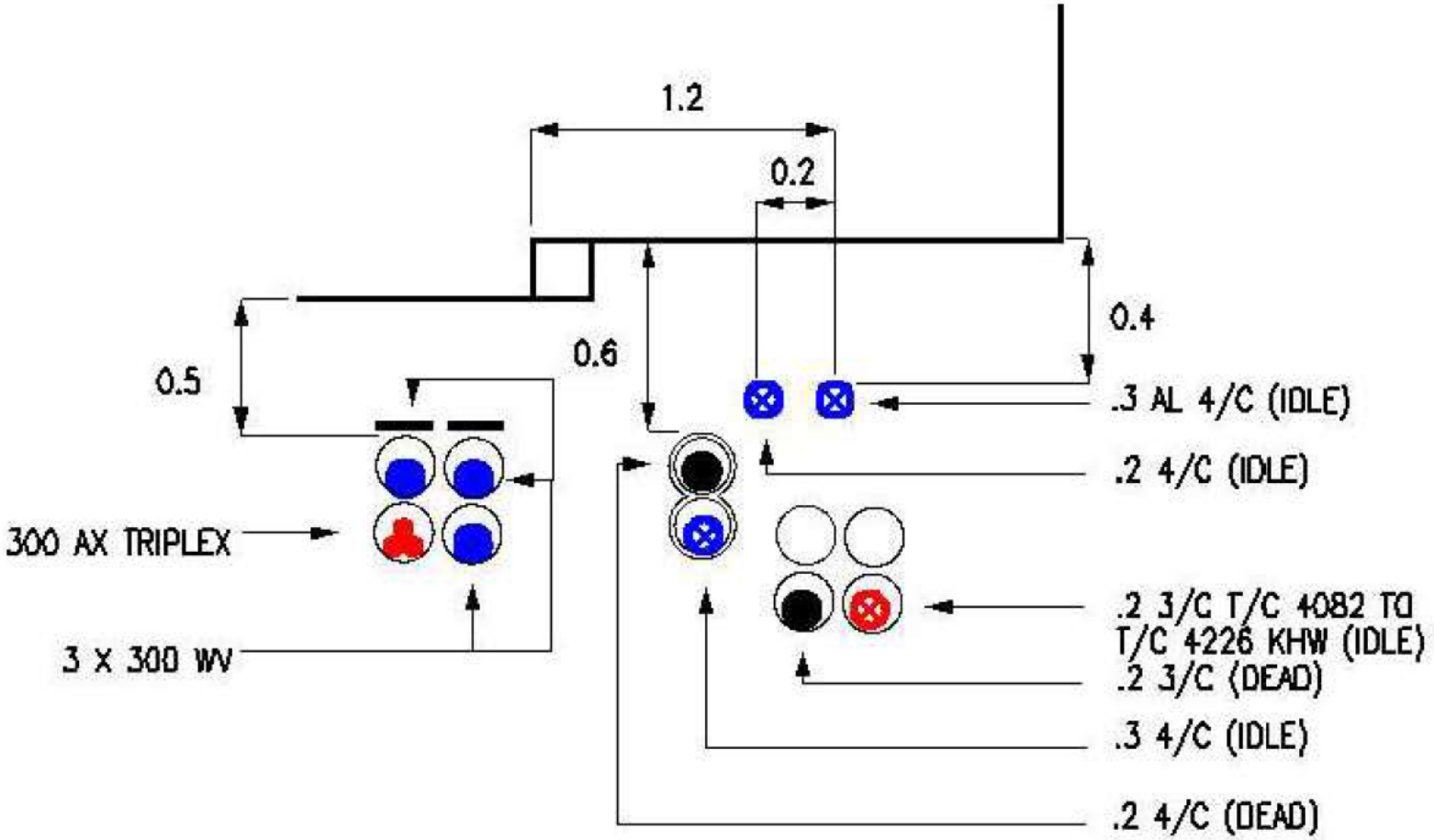
Cross Section : 2018835



Cross Section 2018835

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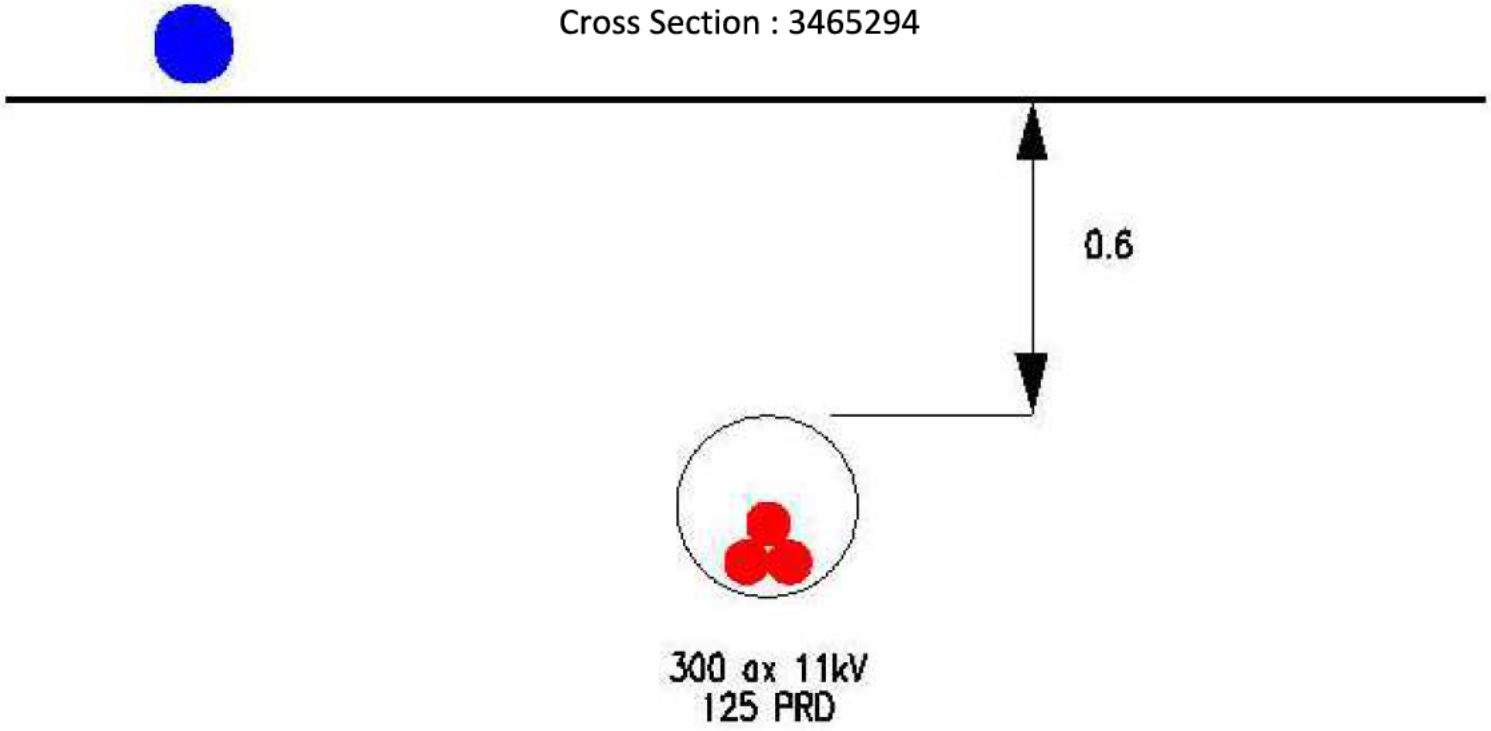
Cross Section : 3465294



Cross Section
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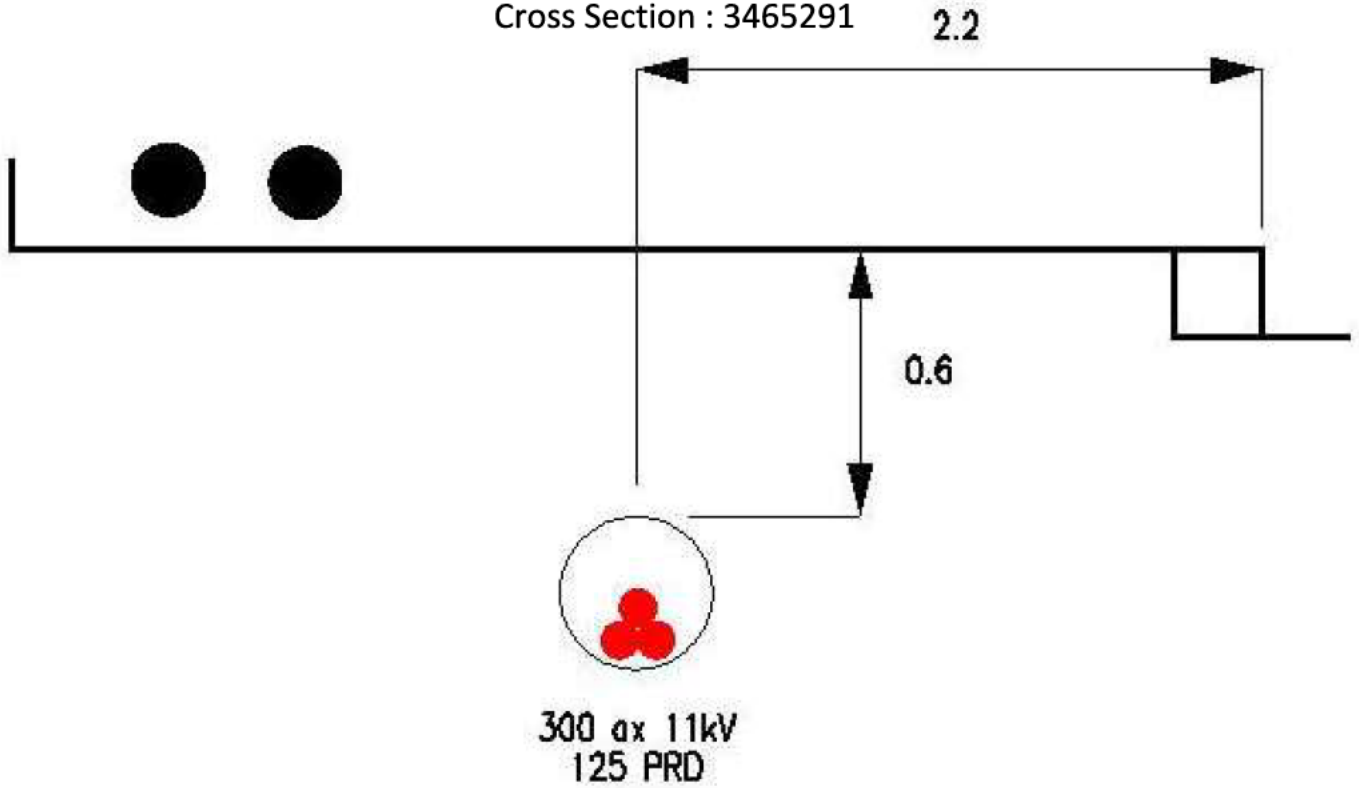

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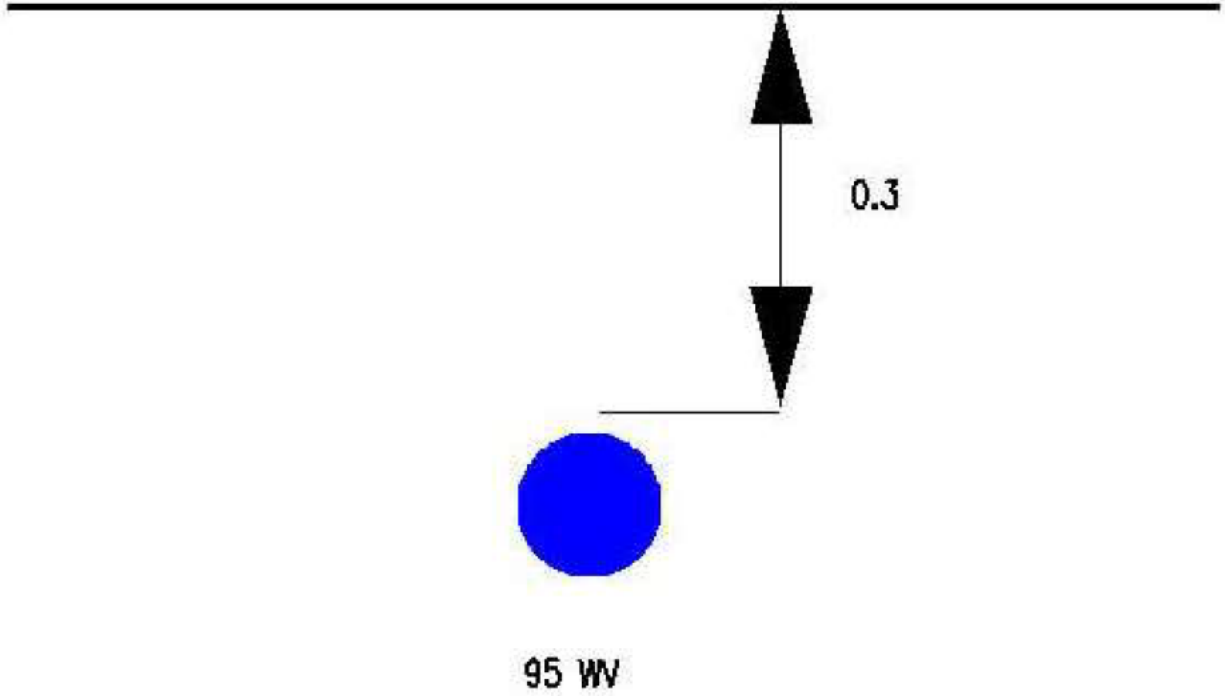
Cross Section : 2032433



Cross Section
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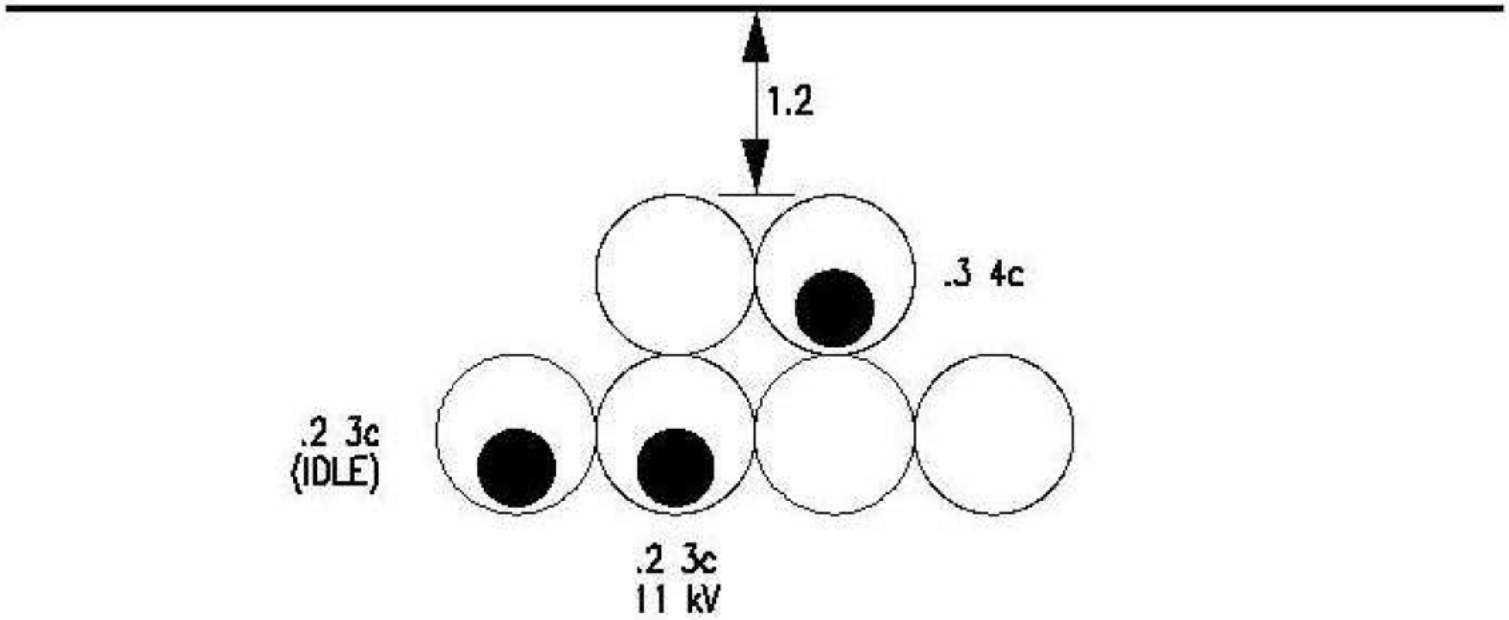
Cross Section : 2735617



Cross Section
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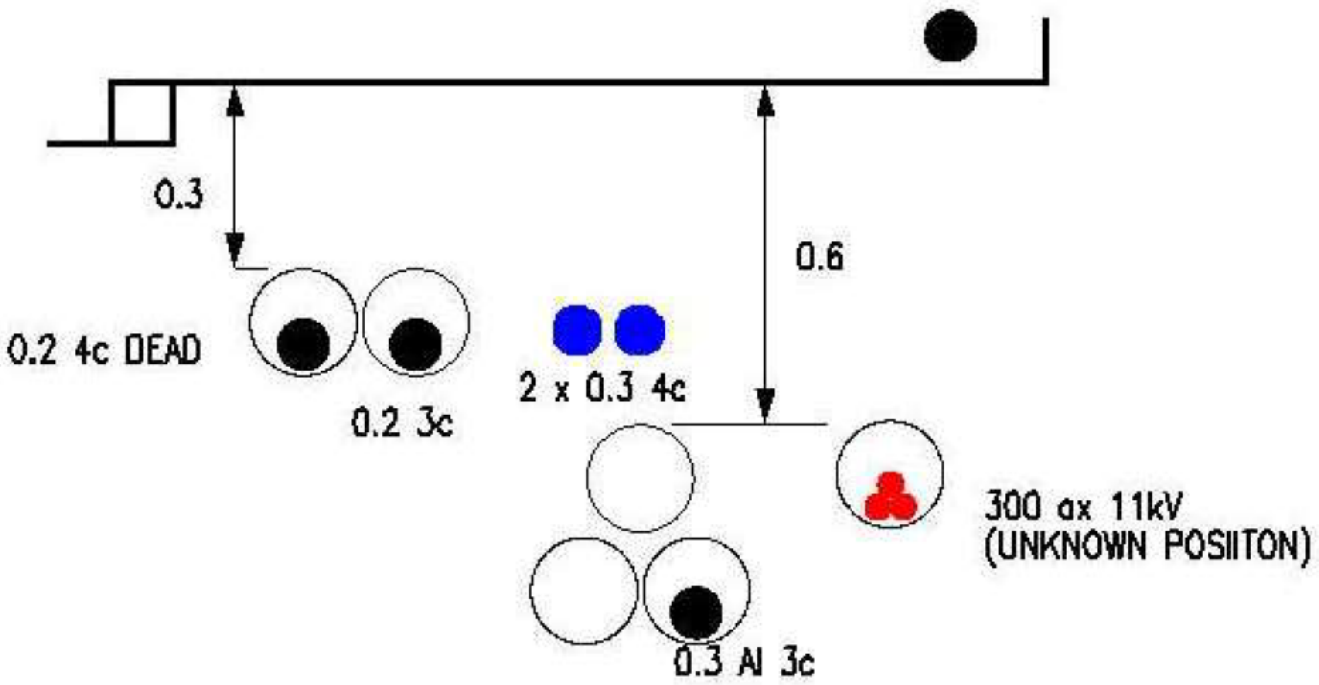
Cross Section : 3465292



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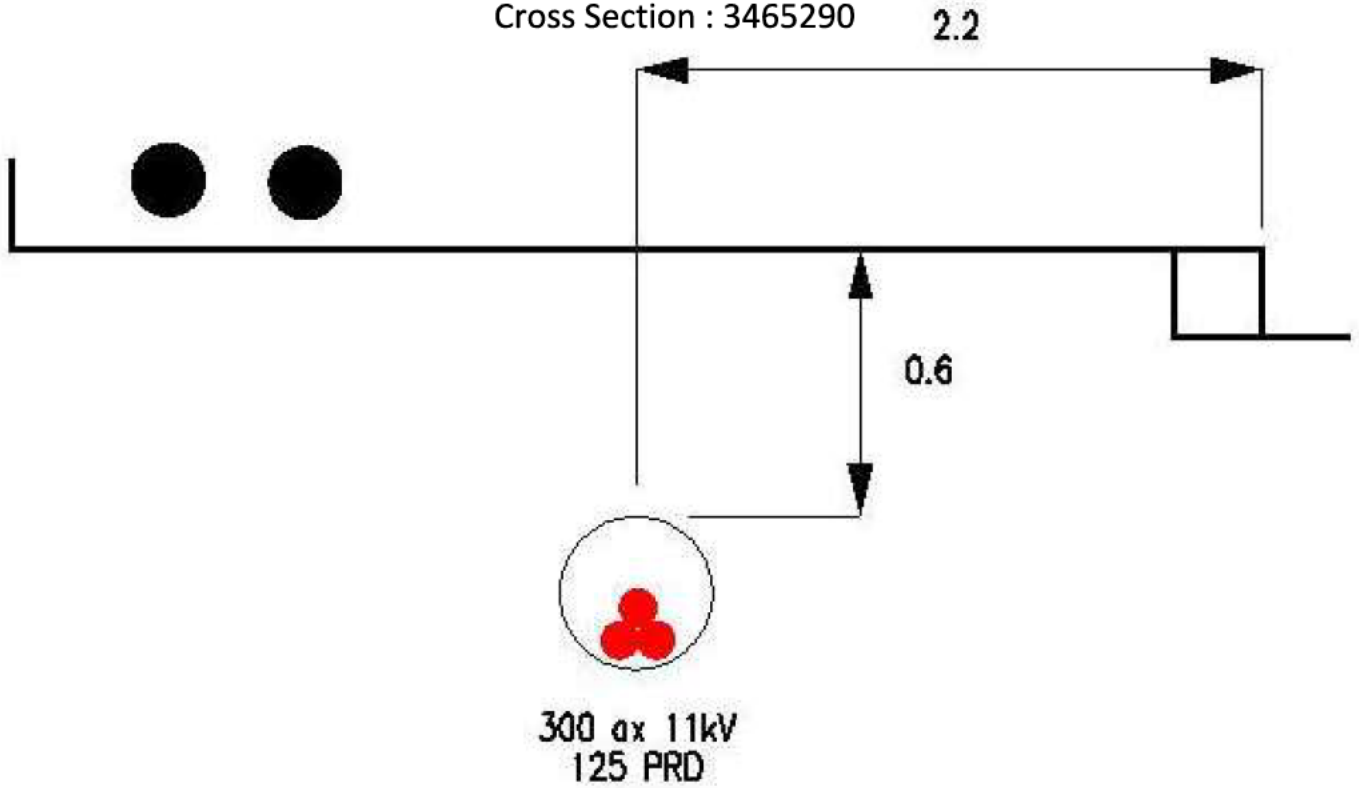

Cross Section
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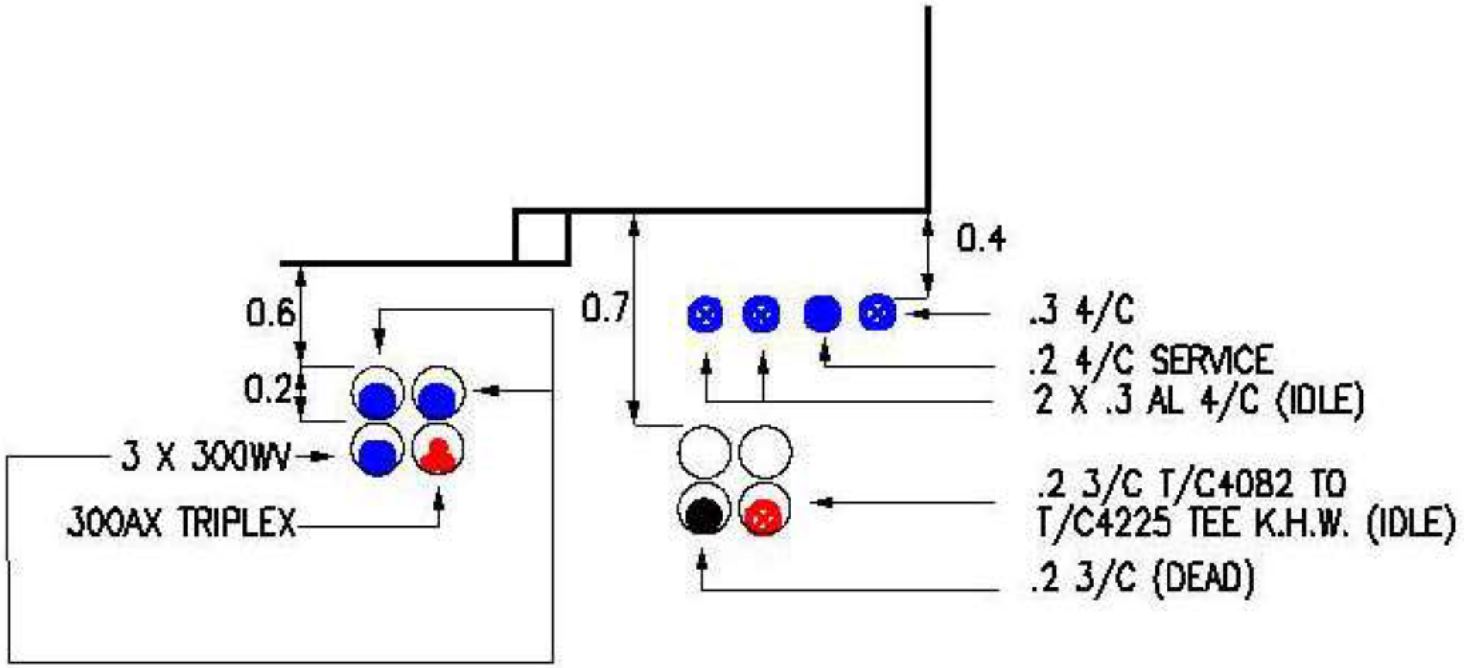
Cross Section : 2018838



Cross Section
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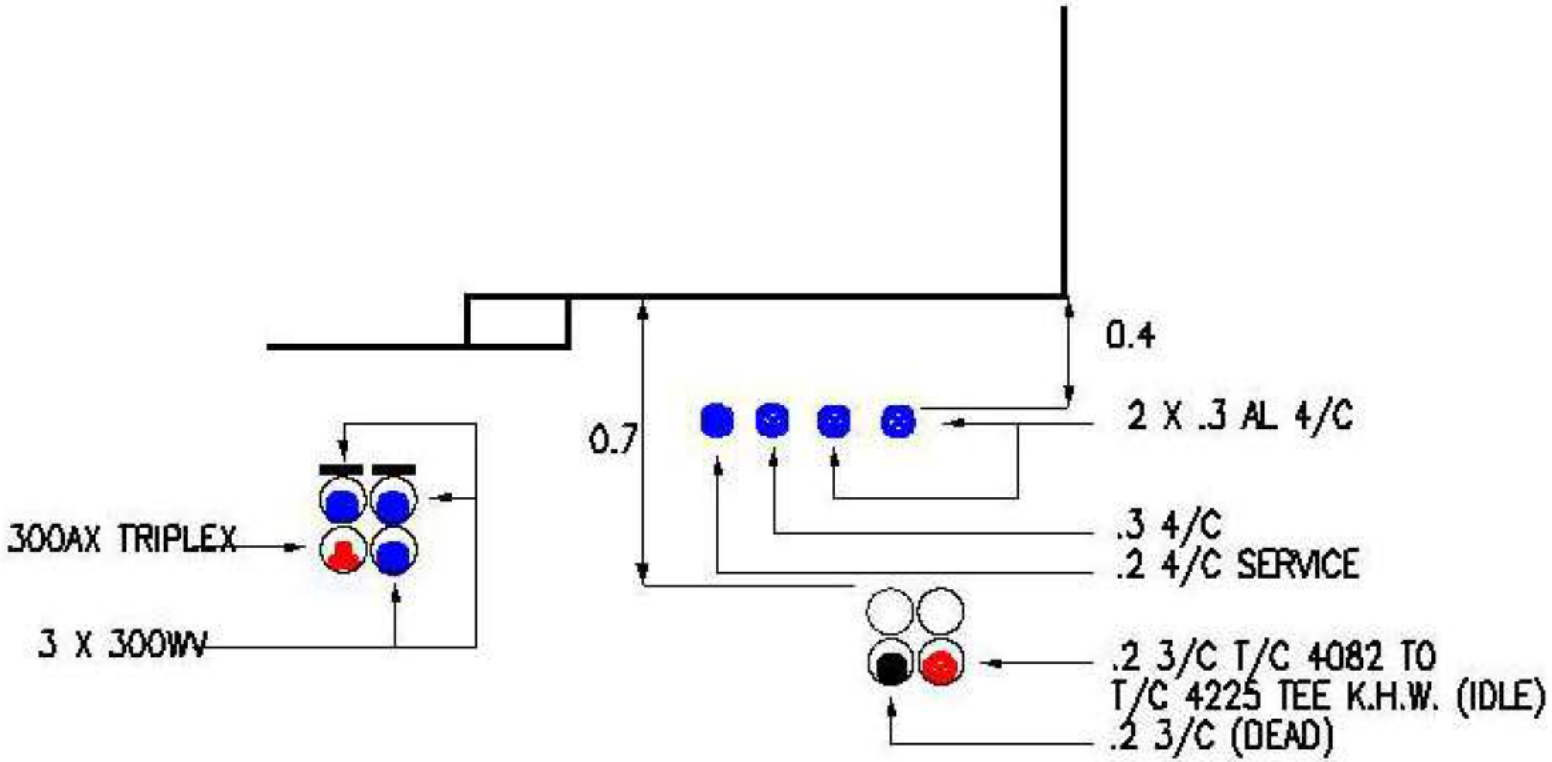
Cross Section : 2018837



ASSUMED SECTION

Cross Section
2018837

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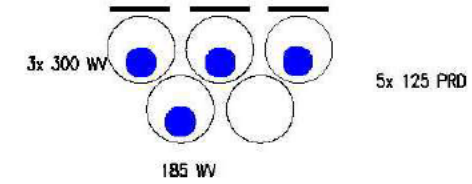
Cross Section : 2769722



Cross Section
2769721

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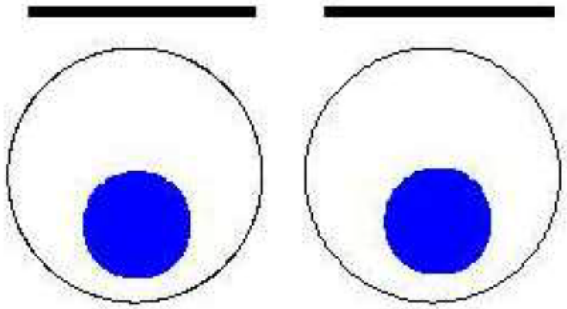
Cross Section : 2769723



2x 125 PRD

2x 300 WV

Cross Section
2769723

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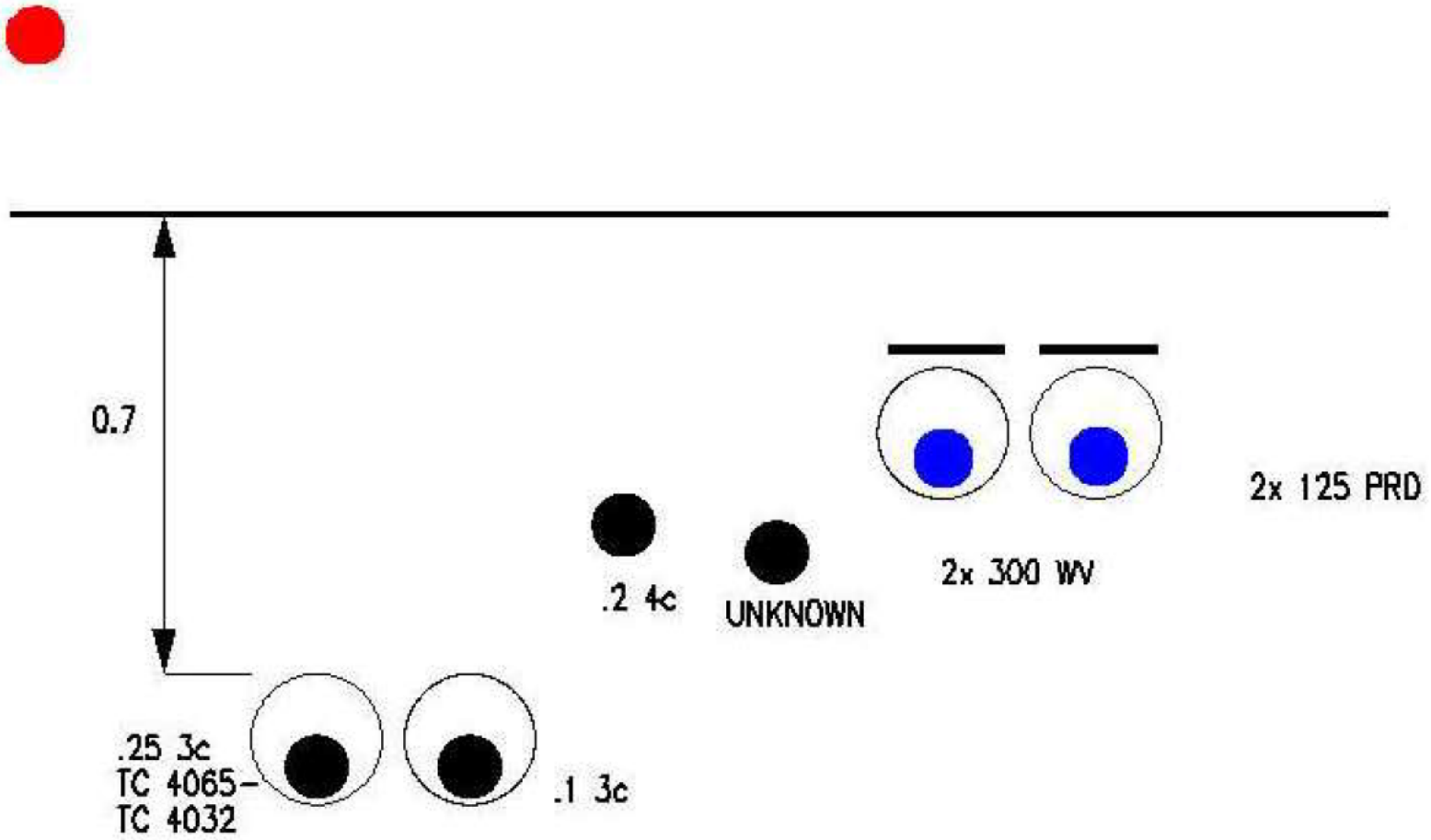
Cross Section : 2769724



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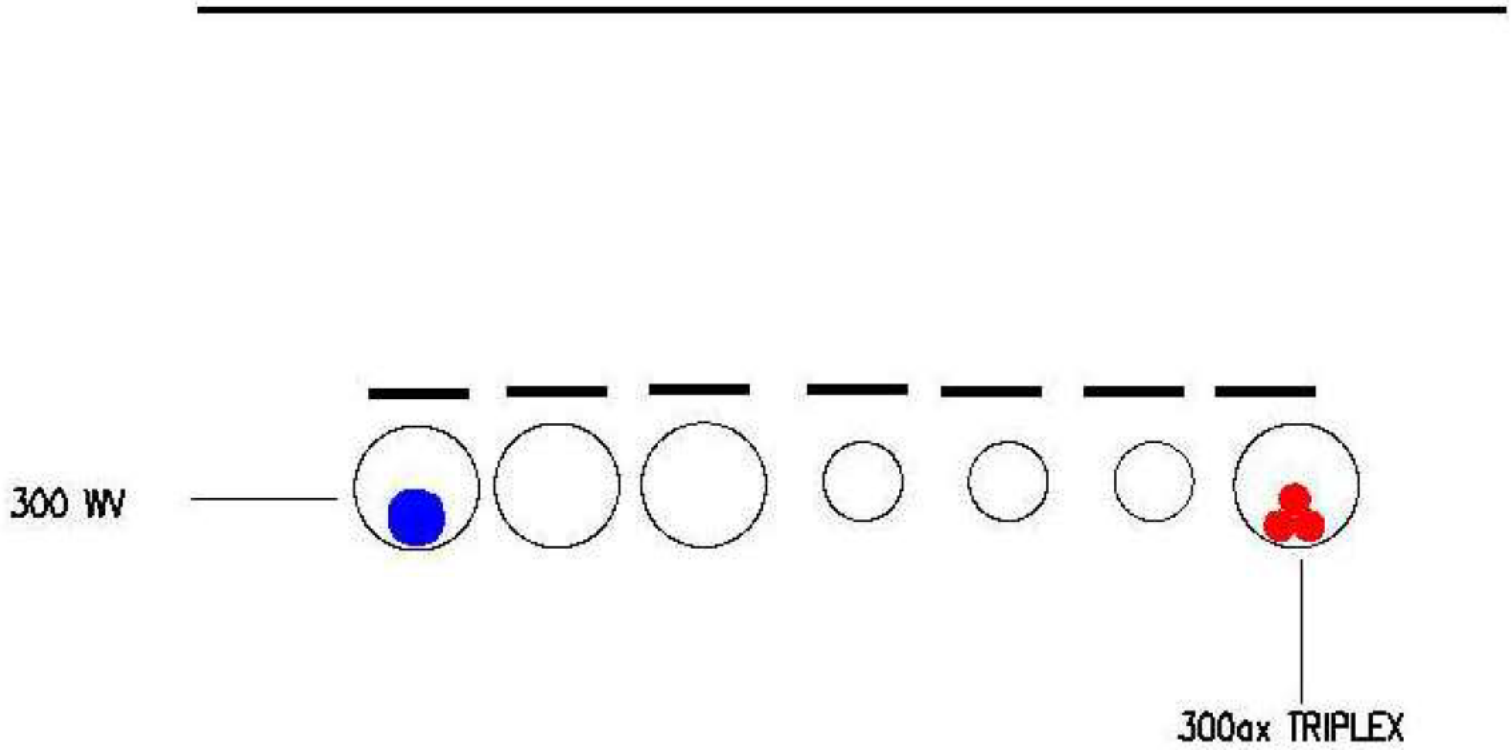
Cross Section : 2015771



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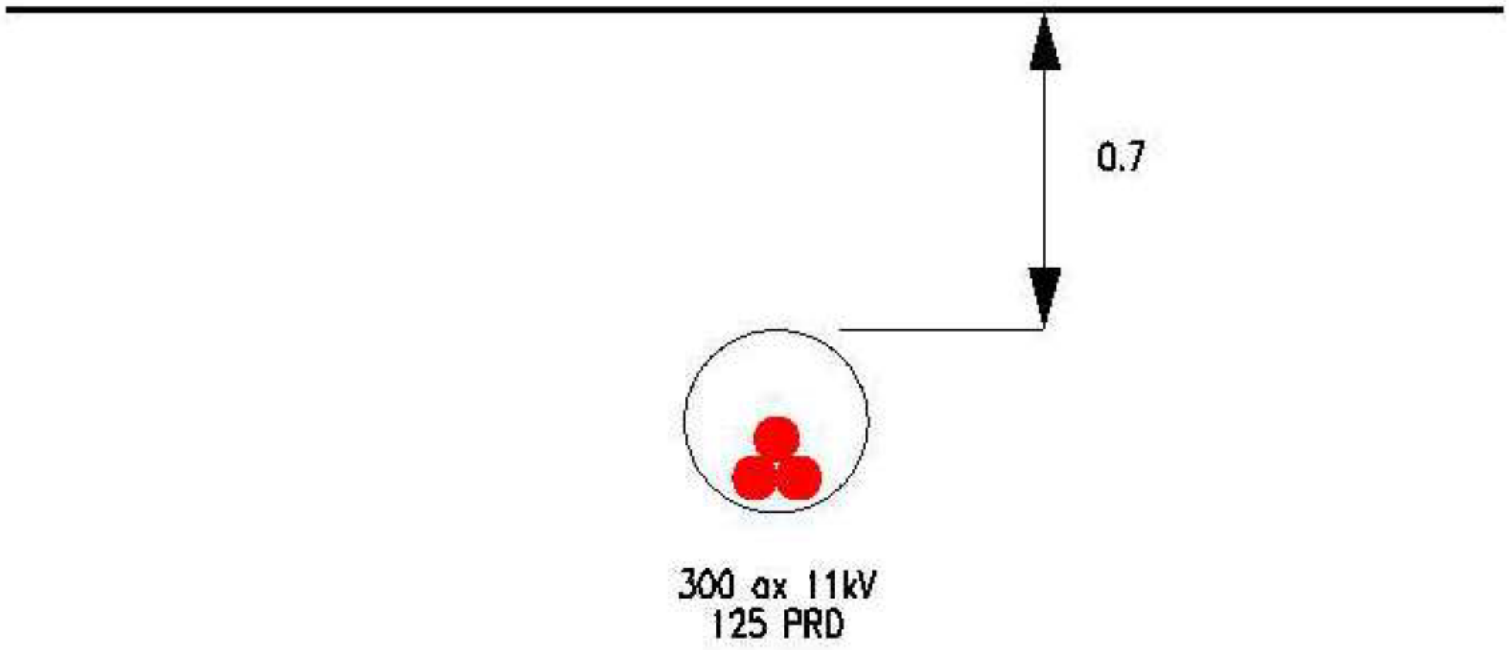
Cross Section : 3465295



Cross Section

3465294

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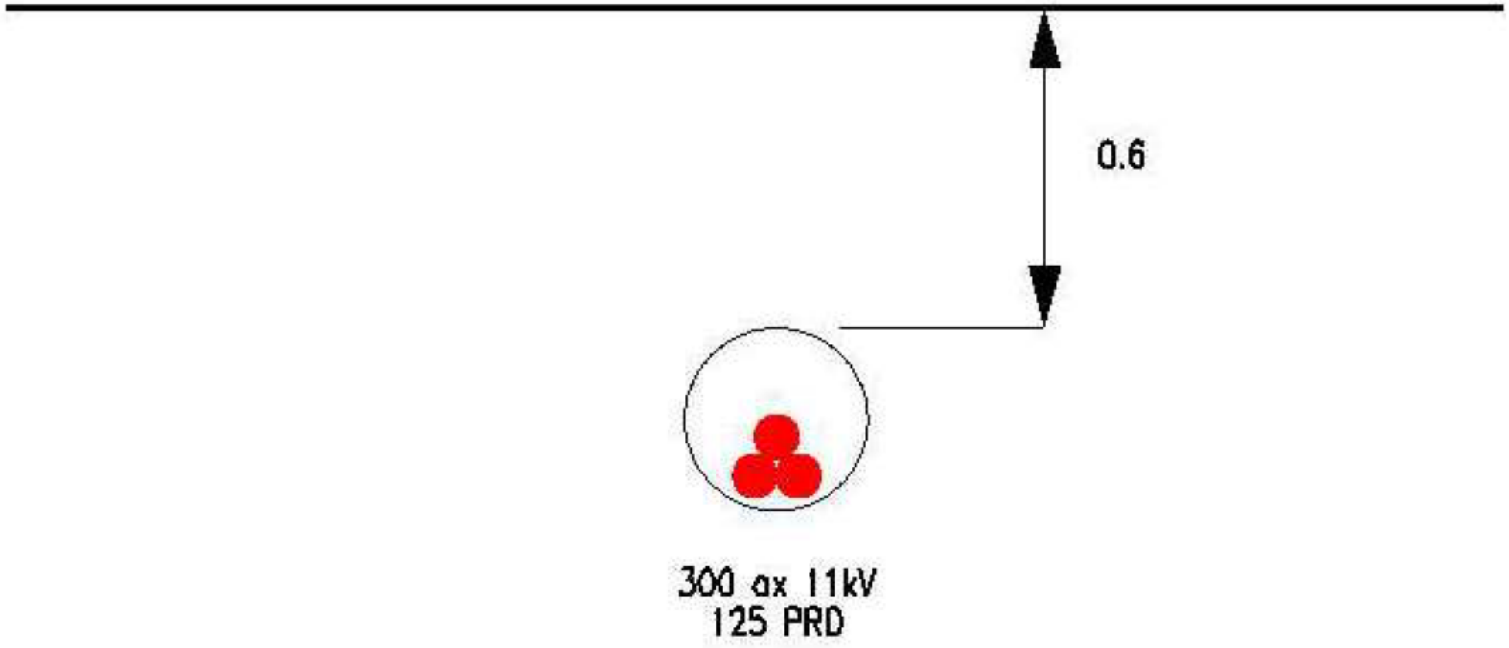

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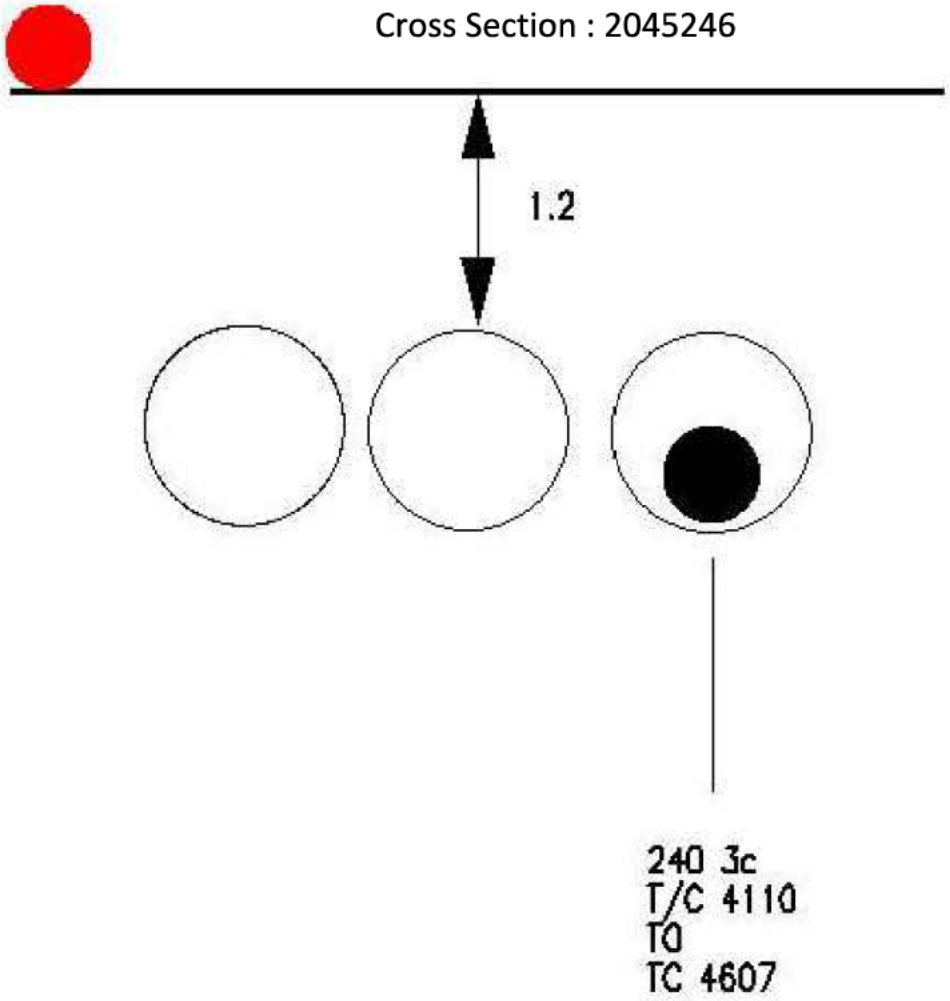
Cross Section : 2045246



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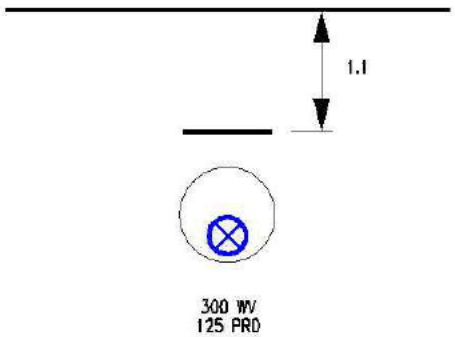
Cross Section : 2786958



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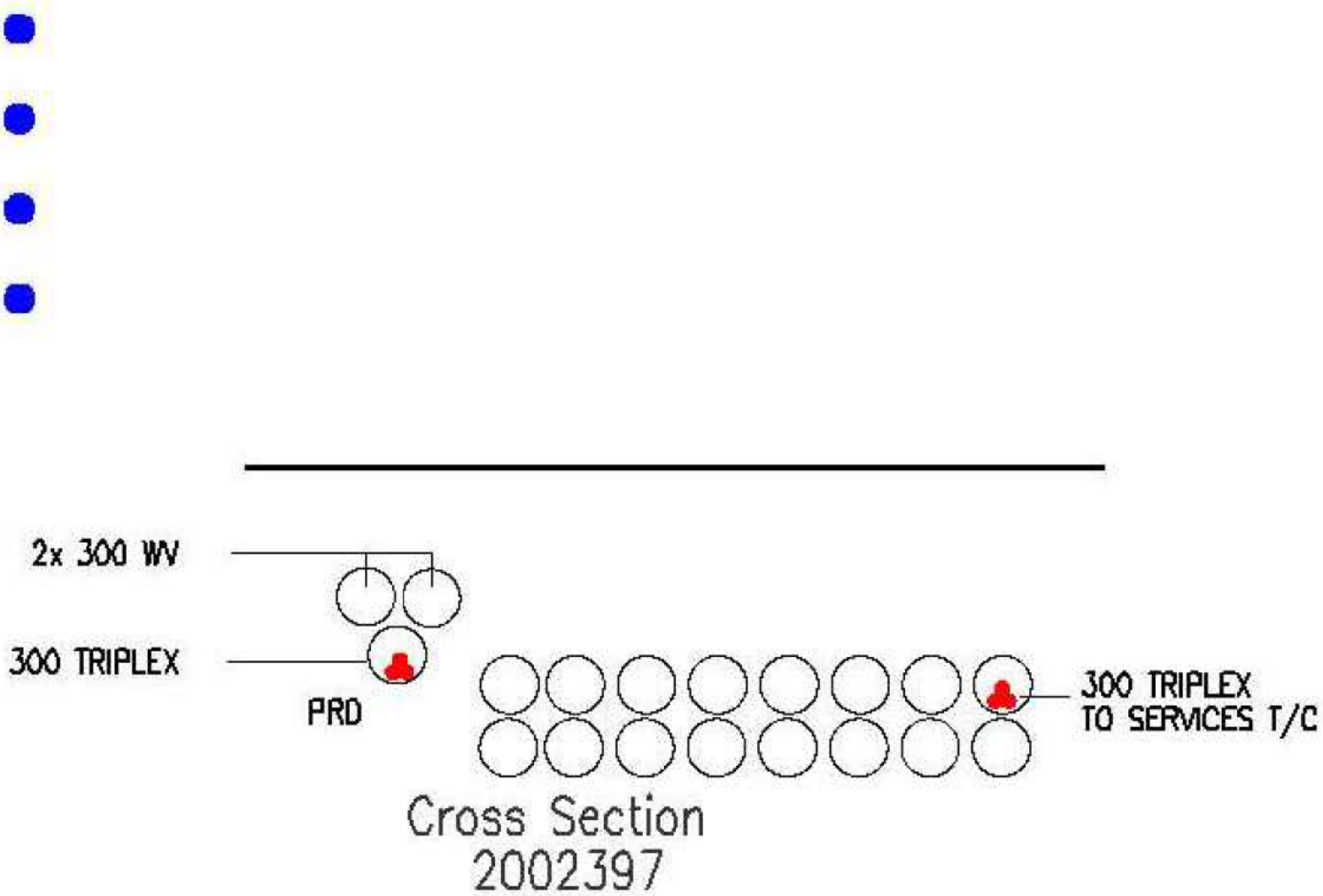
Cross Section : 2002397



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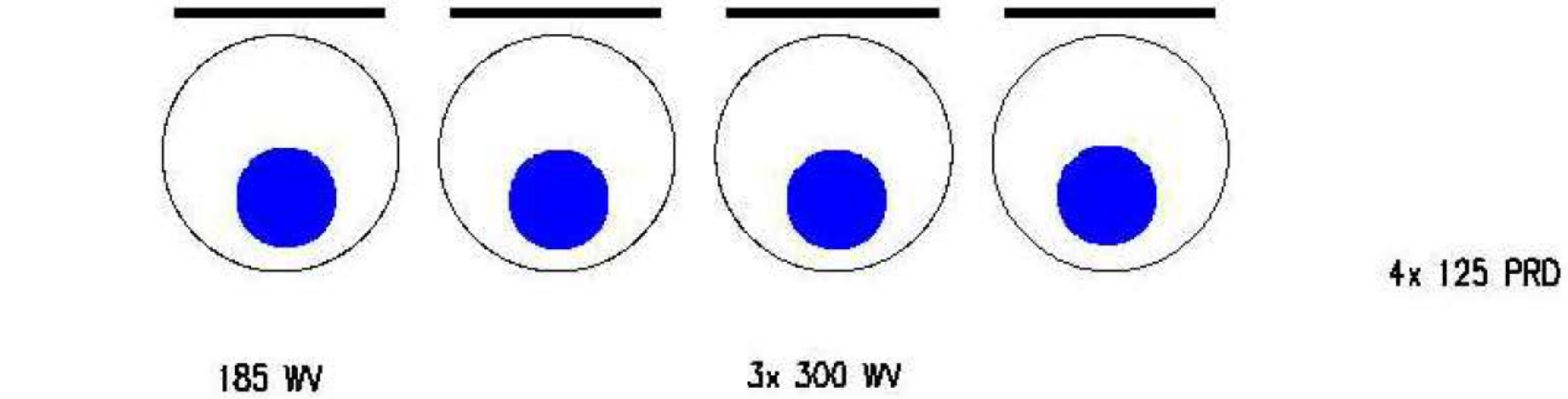
Cross Section : 2769721



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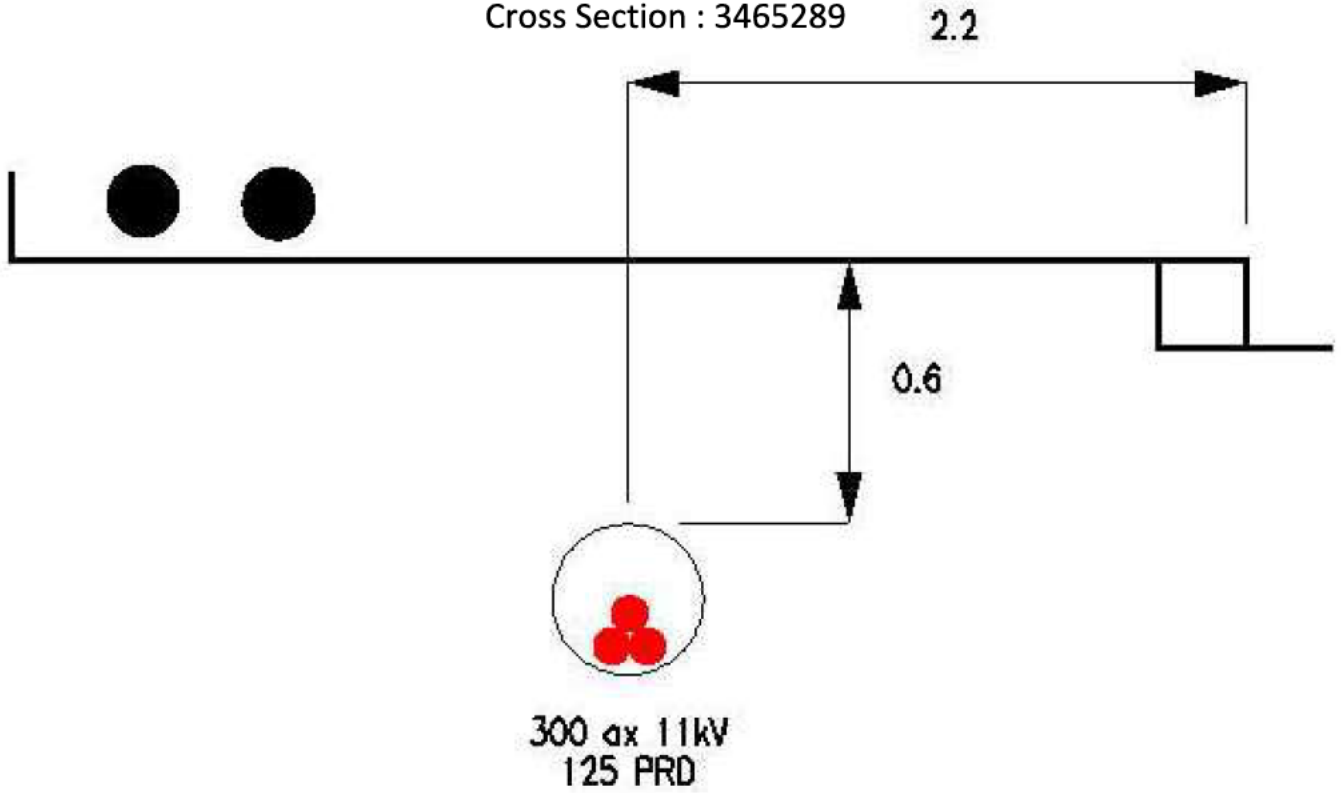
Cross Section : 3465289



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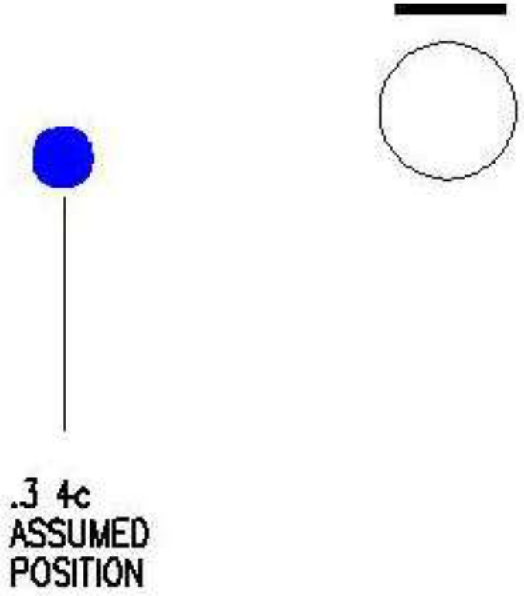
Cross Section : 2053558



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0800 056 5866
EMERGENCY - If you damage a cable or line
Phone 0800 783 8838 (24hrs)
URGENTLY

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LOOK OUT LOOK UP

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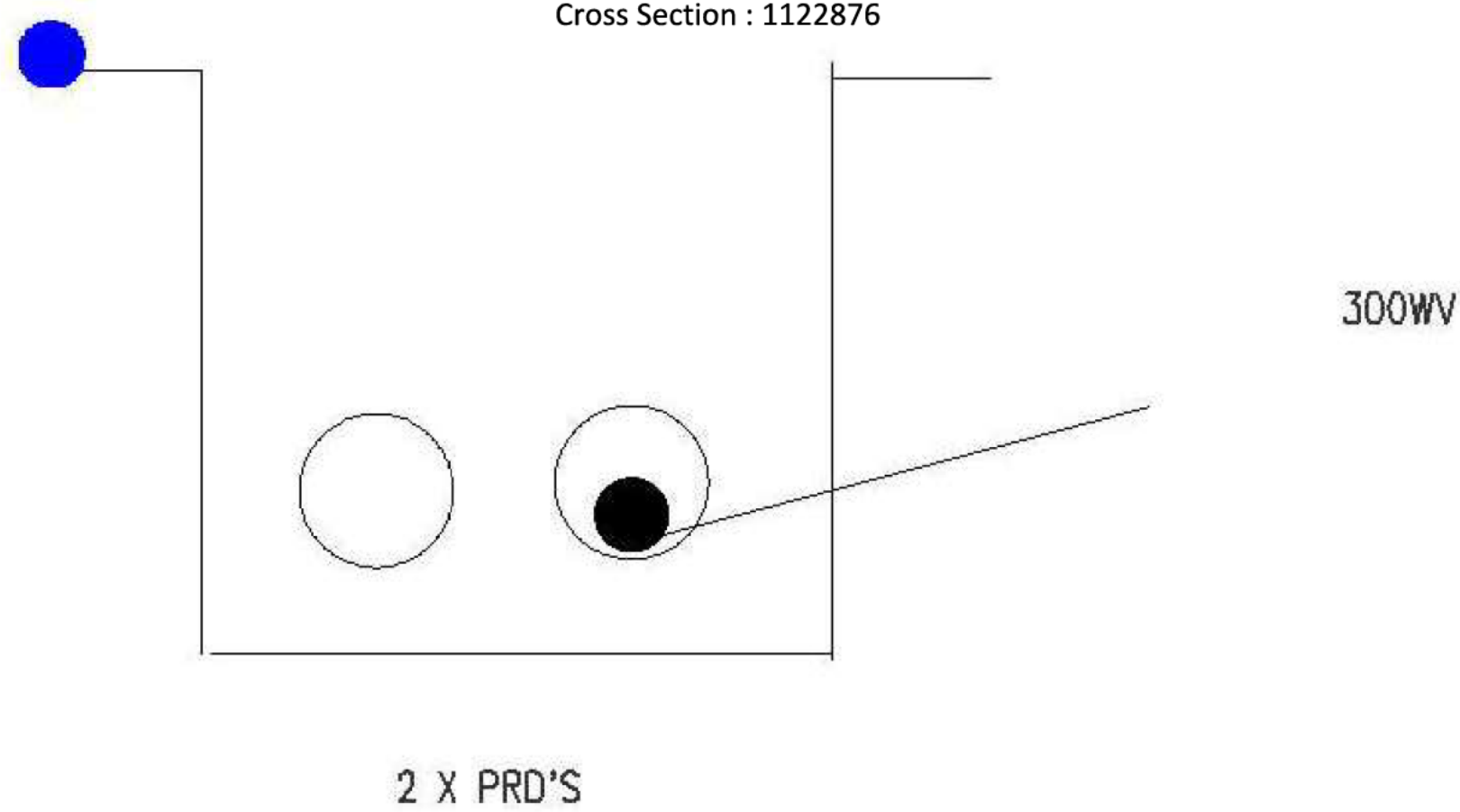
Cross Section : 1122876



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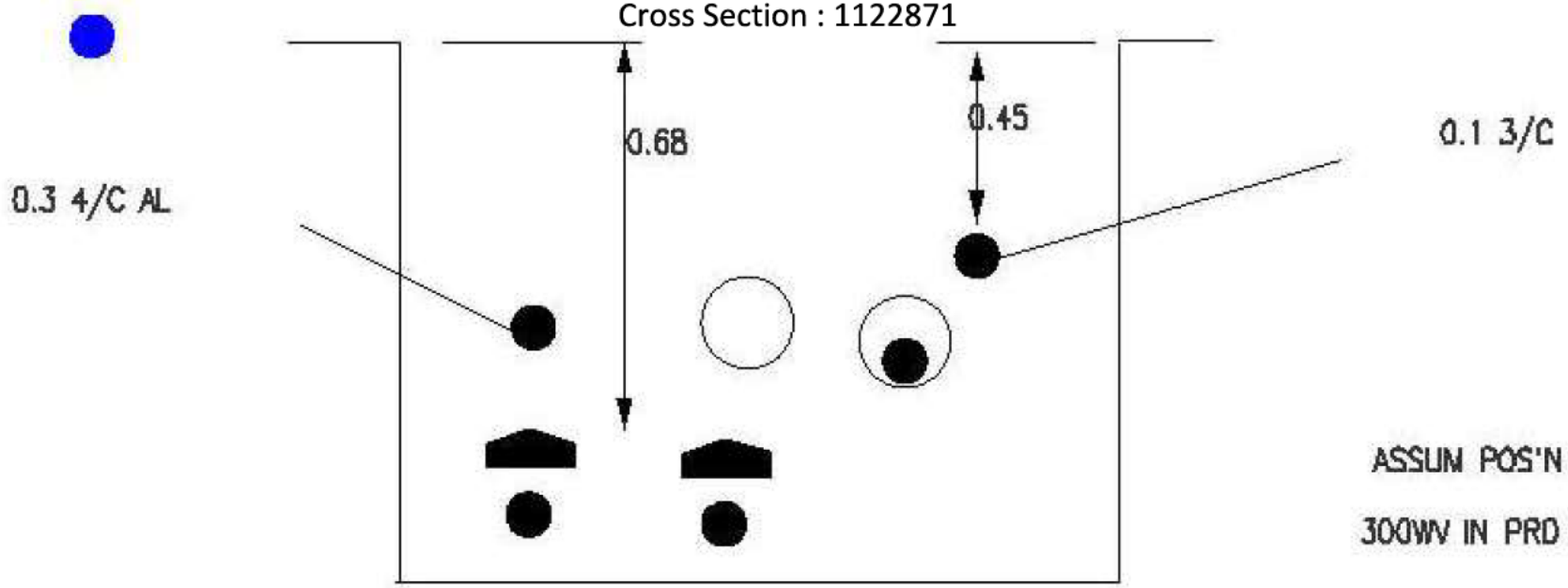
Cross Section : 1122871



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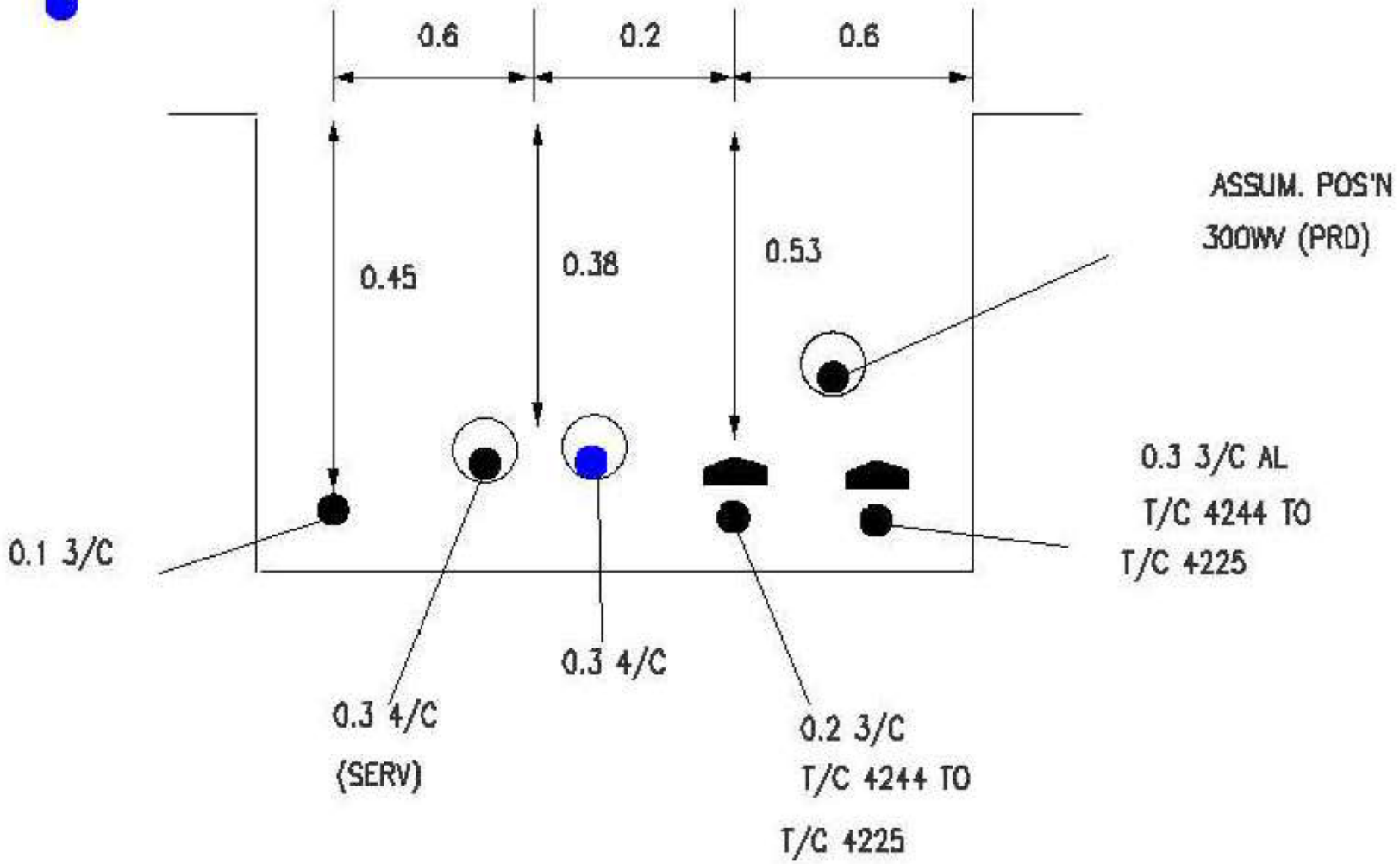

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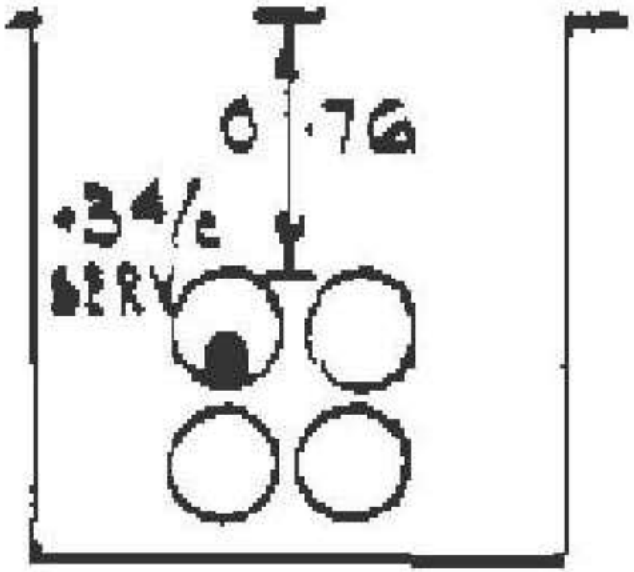
Cross Section : 1121782



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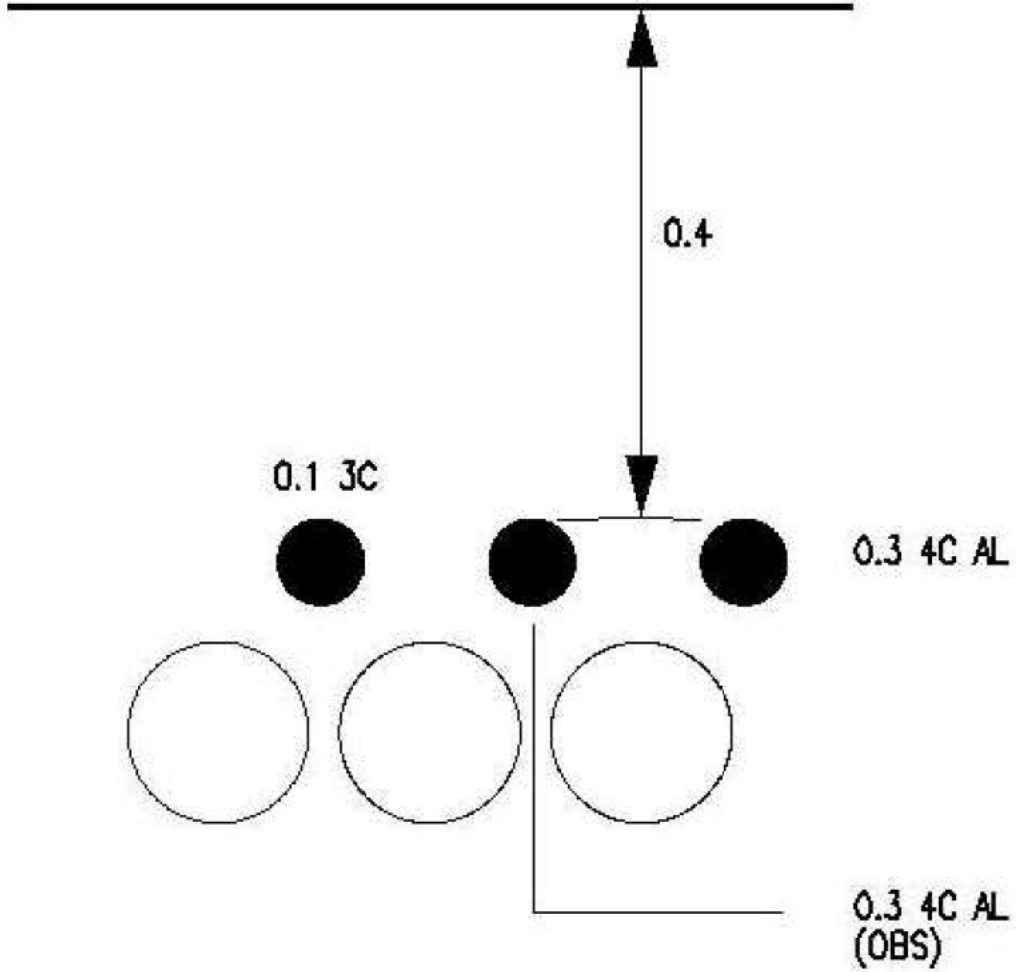
Cross Section : 3830250



Cross Section
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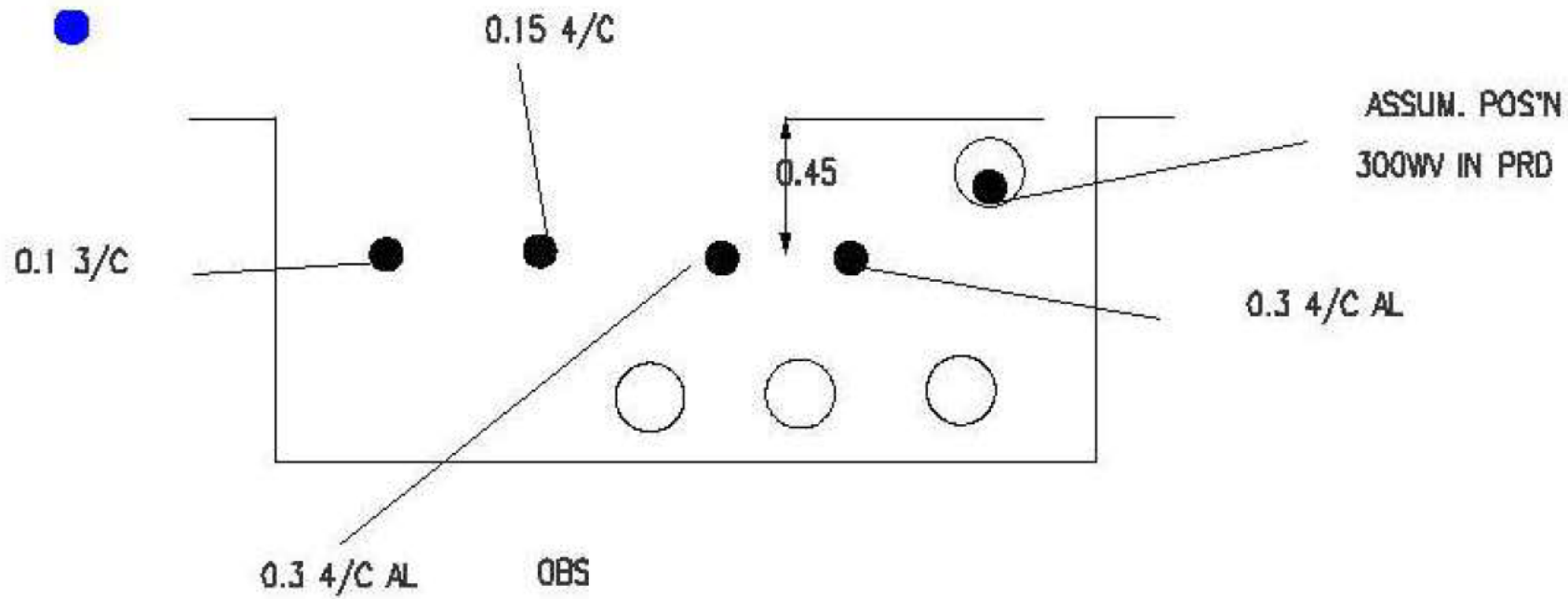
Cross Section : 1122874



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Cross Section : 2778658

300 WV

2 x 300 ax
TRIPLEX
11 kV

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UK Power Networks Feedback Tool

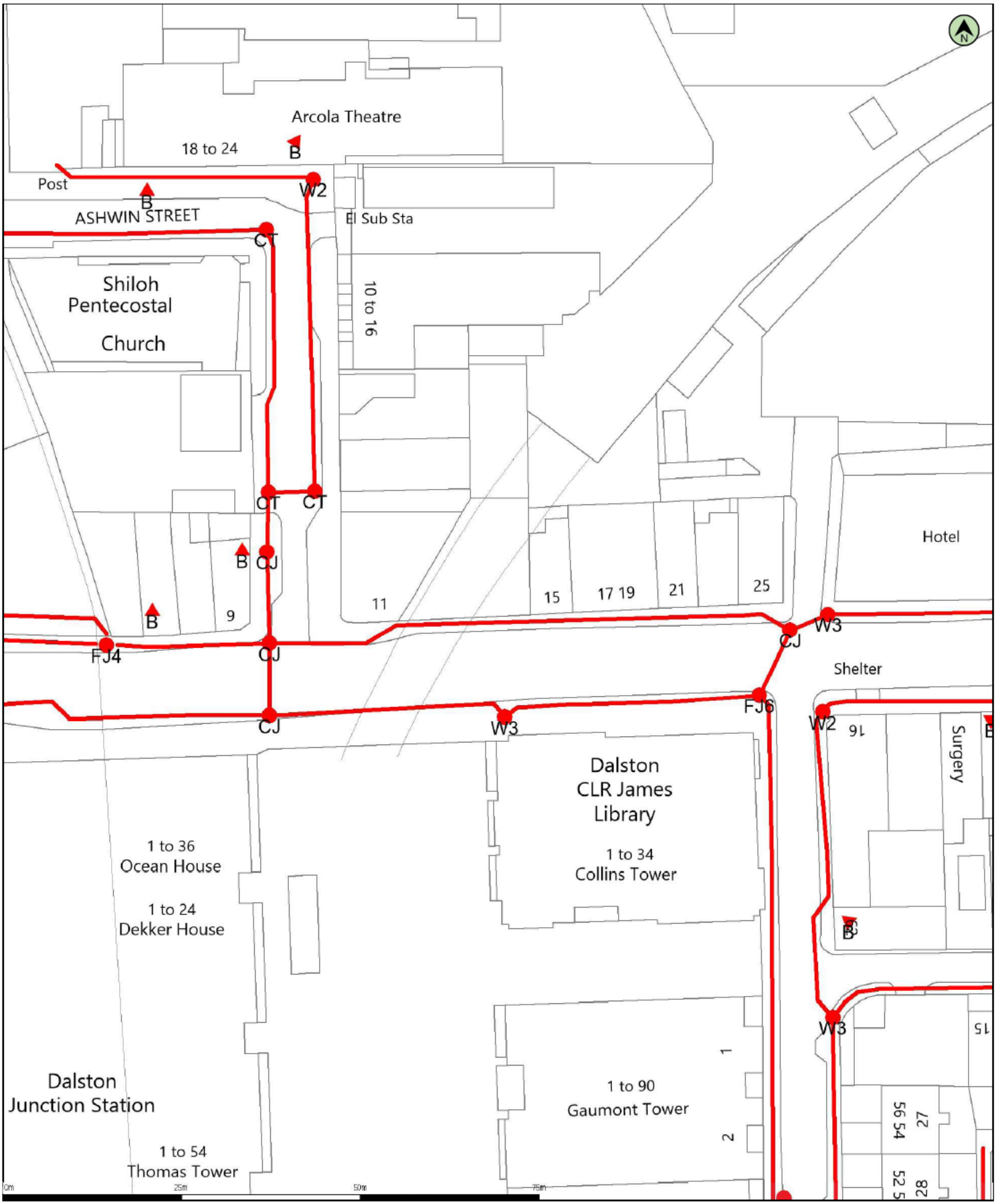
Please help UK Power Networks improve the accuracy of their network records and help make it safer for all those working around them in future.

All you need to do is:

1. Use your phone camera to scan the QR code:
2. Provide feedback on what you have found on site (good or bad)
3. Upload a photo if needed

Thank you for making the area a safer place to dig.

UK Power Networks, working with LSBUD



Data updated: 01/10/21

Scale: 1:500

Map Centre: 533635,184806

Date: 13/10/21

Our Ref: 673461 - 1

Telecoms Plan A3

Powered by digdat

Duct, Trench

Chamber / Pole

Cabinet

brian_mcmaster@national-one-call.co.uk

NOC/CTWSV456

[redacted]

PlanToDig
1 Mill Place Mill Road Ind Est Linlithgow Bridge
Linlithgow West Lothian
EH49 7TL

Date: 13/10/2021

Zayo Plant Protection Centre
c/o JSM Group Ltd
Plant Protection Department
Sterling House
Mutton Lane
Potters Bar
Herts, EN6 3AR

Our Reference: 23548644
Your Reference: NOC/CTWSV456

Dear Mr [redacted]

ZAYO GROUP UK LTD NOT AFFECTED C2 PRELIMINARY PLANT ENQUIRY

We acknowledge with thanks your request dated 13/10/2021 08:58:13 AM for information on the location of our services.

Having examined our records, we can confirm that **ZAYO GROUP UK LTD** has no owned apparatus within the search area of your enquiry detailed in the reference/location provided.

Please do not hesitate to contact us for further assistance.

Regards,

Zayo Group UK Ltd c/o JSM Group Ltd
JSM Plant Protection Department
T: 01992 655 919
zayoplantenquiries@jsmgroup.com

Date Requested: 13/10/2021

Requested by: Brian McMaster

Company: PlanToDig

Job Reference: 23548644

Your Scheme/Reference: NOC/CTWSV456

ZAYO DUCT

or ZAYO CHAMBER

Dig Sites: Line Area

Scale on A4 paper: 1:1000

zayo GROUP

4th Floor Harmsworth House
13-15 Bouverie Street
London EC4Y 8DP

Linesearch before U dig

Protecting Lives, Cables & Pipes

Warning: PDF designed for colour print only with no page scaling. . This Information is given as a guide only and its accuracy cannot be guaranteed

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In Emergency Only and if Zayo Plant or Cables damaged call: 0800 169 1646 .

JSM

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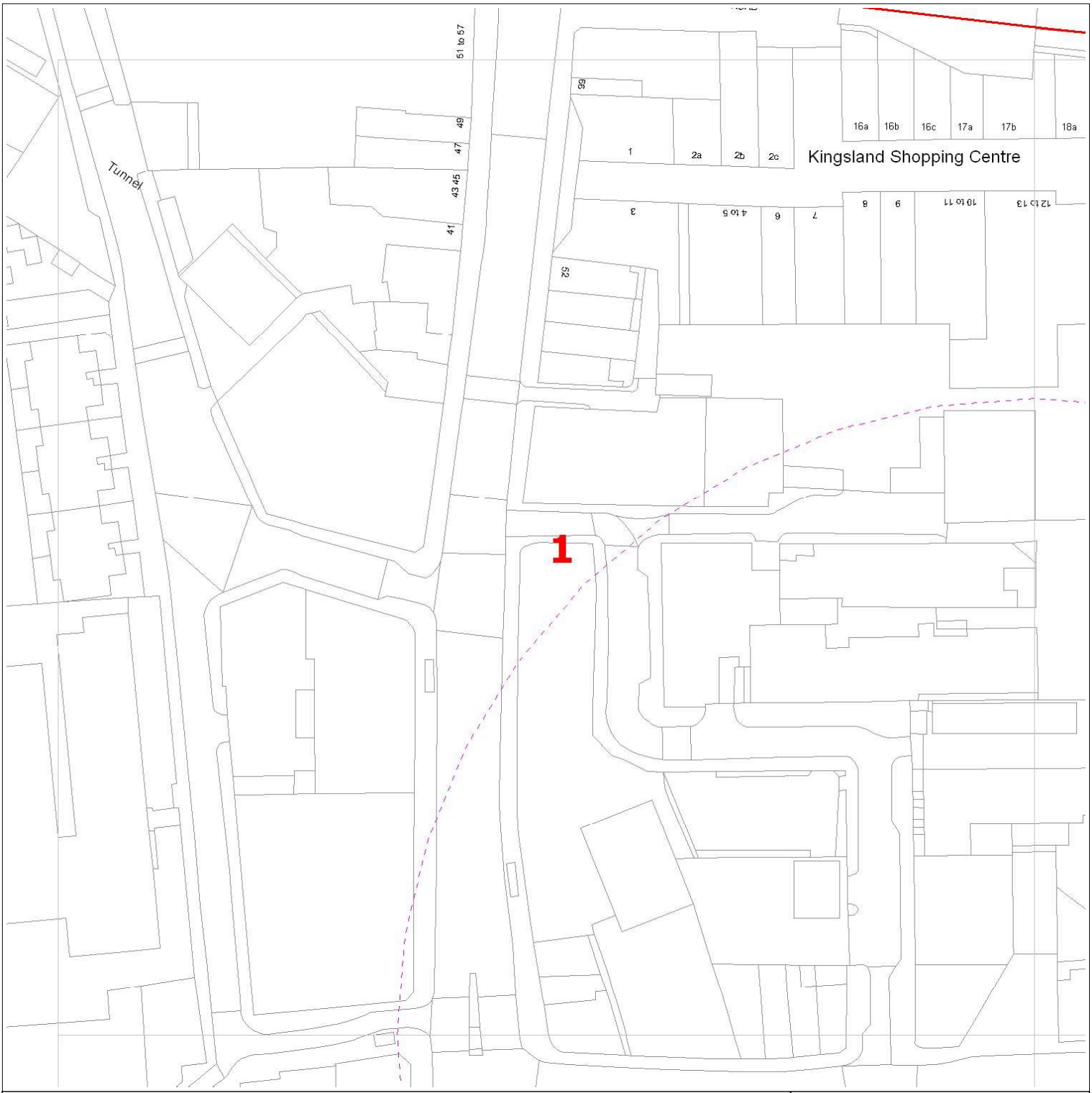

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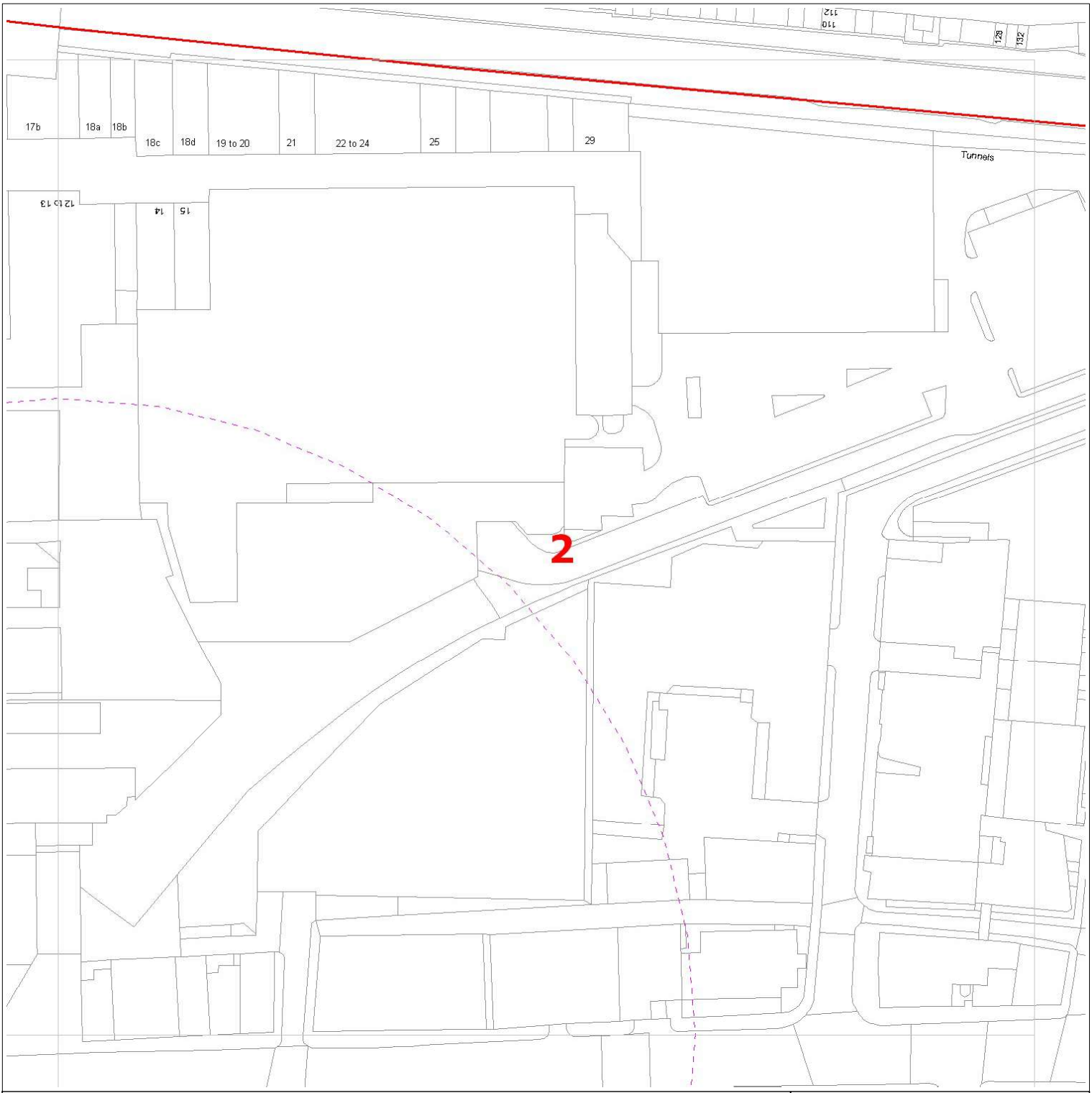

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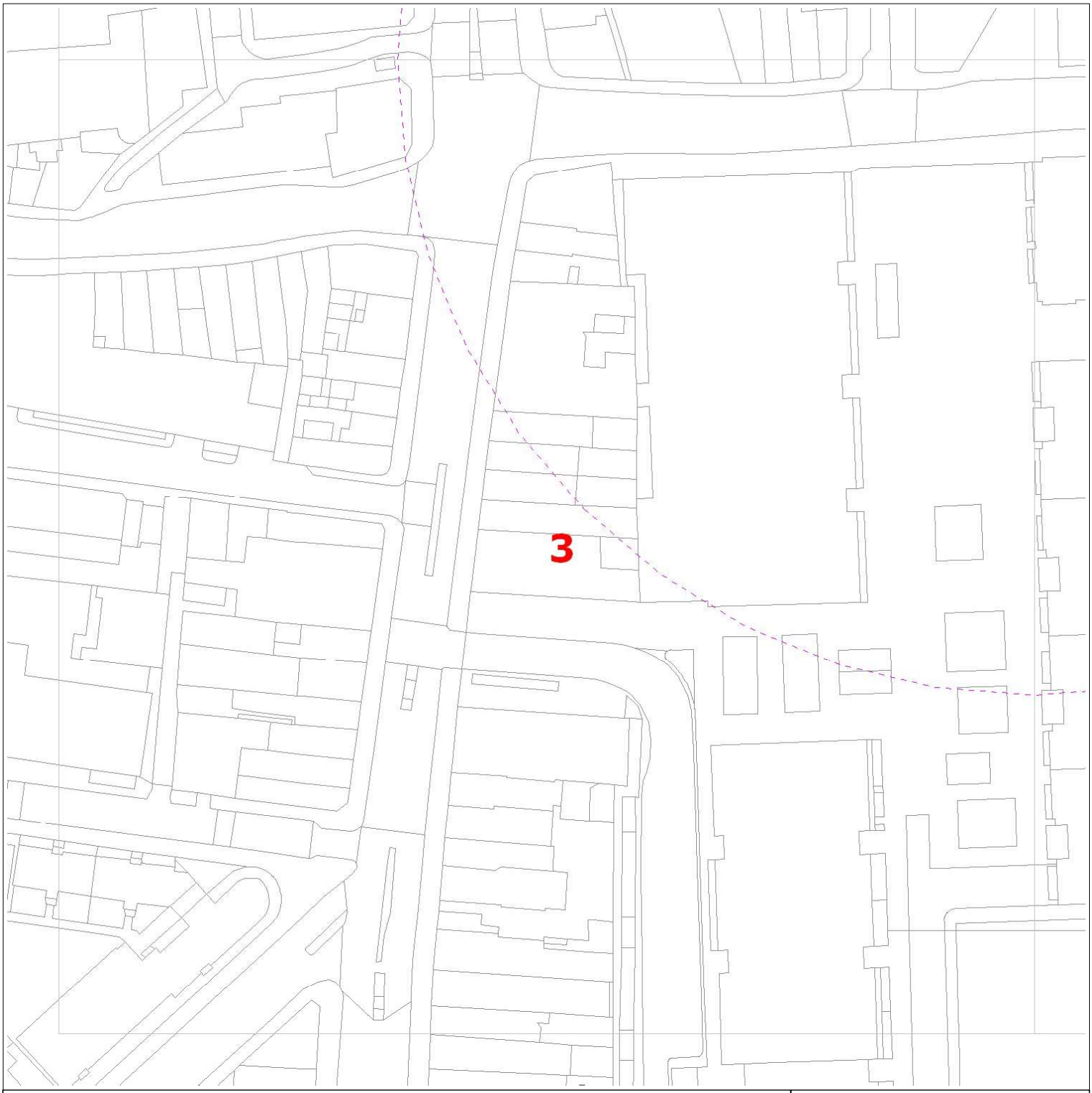

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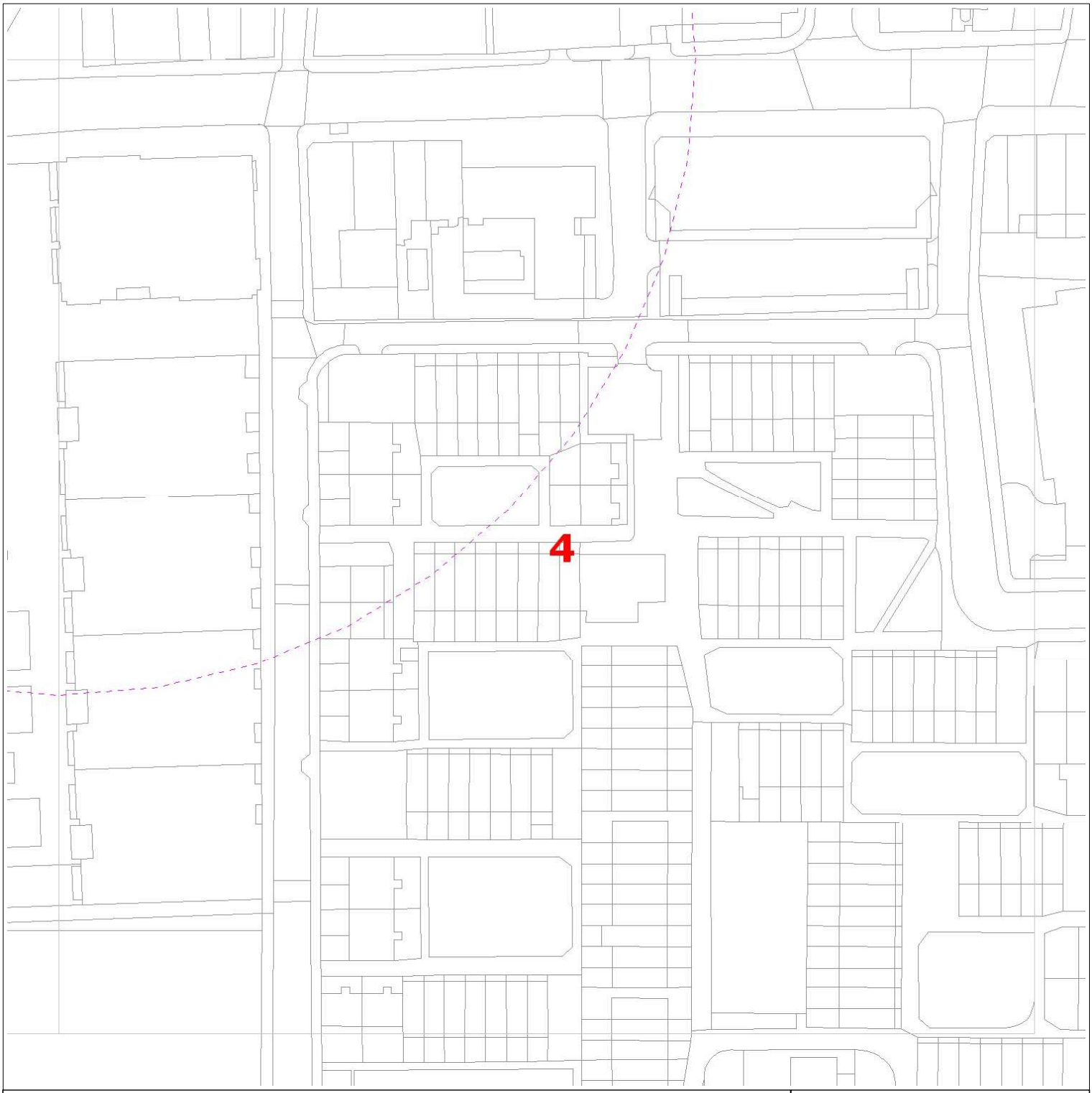

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