



Planning Statement

FIRE BRIGADE BUILDINGS

50 London Road, Manchester
M1 2PH

On behalf of
Allied London

16/07/2024
Job Ref: 3203

Practice Information

Metropolis PDG Ltd

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TABLE OF CONTENTS

1.0 Introduction

2.0 Site and Surrounding Area

3.0 The Proposed Banners

4.0 Assessment of the Proposals

5.0 Conclusions

Appendix 1 – Previously Approved Commercial Advert Ref: 131639/AOH/2021

Appendix 2 – Scaffolding Technical Data

1.0 Introduction

- 1.1 On behalf of our client, Allied London Group, this application seeks advertisement consent:

“Display of externally illuminated 40m x 12m temporary open weave banner mesh advert on scaffold to part of Fairfield Street and London Road elevations for a temporary period until May 2025.”

- 1.2 The Old Fire station site is currently undergoing redevelopment and conversion and works are continuing. During redevelopment, when façade works have been underway, a scaffold shroud and banner advertisement have been installed on the corner of Fairfield Street and London Road. Temporary Advertisement consent has historically been granted to display one illuminated banner at the Fire Station, Fairfield Street Manchester, M1 2PH. The original consent was sought and approved under planning reference 120744/AOH/2018 and 124446/AOH/2019 and 127794/AO/2020 and was lastly renewed under consent ref 131639/AOH/2021 for a further period of 12 months which expired on 1st September 2022.
- 1.3 This application has followed the lead of the previous consents granted in terms of drawings and supporting documents submitted. It is noted that Listed Building Consent has not been required on previous consents on the basis that the display will be fixed to a scaffold which does not require planning or listed building consent for its erection.
- 1.4 Since April 2022, works have been on hold while Allied London progressed works on Spinningfields and St Johns Quarter, but are now recommencing in earnest.
- 1.5 The proposed illuminated banner will be displayed on a scaffold shroud on the façade of the building. The scaffold installation is essential for the proposed refurbishment work to take place. Details of the siting and design of the scaffold are included with the submission and the application drawings show the location of the commercial content within the replica façade of the building that will be printed on this shroud.
- 1.6 The preservation works include masonry repairs, repointing, cleaning, redecoration, repair and where required replacement of both flat and pitched roof coverings, and the

renewal of lead works and refurbishment of the rain-water goods. A full overhaul and repaint of the fenestration will be completed.

- 1.7 The scaffold was designed and engineered to take into consideration the construction and fabric of the building and tied to the property in accordance with all relevant H&S standards. However, particular care will be undertaken not to damage the stonework of the front elevation, and all tie points will be repaired, filled and painted on completion of the works and removal of the scaffold.
- 1.8 The previously approved commercial advert space is 40m long by 12m high and located on the scaffold on the main South and South East facing elevations of the building, and as shown. (Please see attached drawings and photo overlay).
- 1.9 Given that, in accordance with the specific requirements of the Advertisement Regulations 2007, the impact of the proposals on both amenity and public safety have been tested and considered acceptable on three previous occasions, the proposal is considered acceptable in principle for a temporary period commensurate with works being undertaken.



Site Location Plan

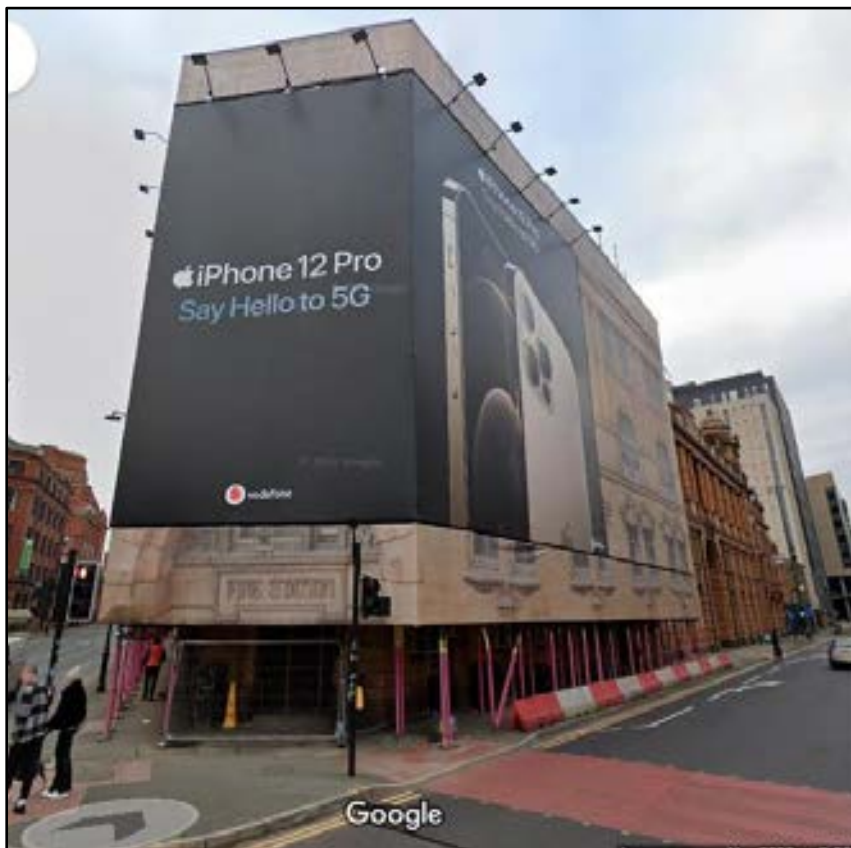


Google View 2023

2.0 Site and Surrounding Area

- 2.1 The Former Fire Station is a Grade II* listed building located on the north side of Fairfield Street and fills the block which overlooks London Road, Whitworth Street and Minshull Street South close to the centre of Manchester.
- 2.2 The site is within the Whitworth Street Conservation Area. The building has a high importance within the Whitworth Street Conservation Area, which was extended in June 1985 to include it.
- 2.3 The building occupies a large plot in a highly prominent and highly visible location. It is situated within the Piccadilly regeneration area, and near to The Corridor, North Campus and Mayfield regeneration areas. Each of these initiatives has identified the adverse impact that the application site has on the regeneration of the area and the importance of bringing forward acceptable proposals that would secure its re-use and refurbishment as soon as possible.
- 2.4 In 2017, planning permission and listed building consent were approved for the refurbishment, restoration, reconfiguration and extension of the former London Road Fire Station to create a mixed-use development comprising of hotel (Use Class C1), workspace/office (Use Class B1), commercial floorspace for shop and food and drink uses (Use Classes A1, A3 and A4), apartments (Use Class C3), cinema and spa (Use Class D2), together with the creation of a new basement area, access and highways works, servicing, rooftop plant, landscaping and associated works (apps. 116099 and 116100). These approvals have been lawfully implemented; however, works to complete this development have been on hold for a short period which Allied London focused on developments at St Johns and Spinningfields. With these developments now largely complete, works are to begin on the conversion of the Old Fire Station.
- 2.5 The building will be sensitively externally cleaned, the stonework repaired and repointed before the long-neglected roofs and rain-water goods are refurbished to prevent further water ingress. Failure to complete these repairs in a timely fashion will allow continued water and frost damage to the external and internal fabric of the building.
- 2.6 The scaffold is designed and engineered to take into consideration the construction and fabric of the building and tied to the property in accordance with all relevant H&S

standards. However, particular care will be undertaken not to damage the stonework of the elevations, and all tie points will be repaired, filled and painted on completion of the works and removal of the scaffold.



Previous Approved Adverts

3.0 The Proposed Banners

- 3.1 As described the proposed commercial banner size is 40m x 12m and located upon a scaffold on the South facing elevations of the building. The banners are of a temporary nature whilst the remedial works are undertaken.
- 3.2 Temporary advertisement consent is sought for the retention of an externally illuminated mesh banner on scaffold whilst development works are ongoing in relation to the above consents. The banner is already in place, having already been given a temporary permission under applications 120744/AOH/2018, 124446/AOH/2019, 127794/AO/2020 and 131639/AOH/2021. The banner is now wanted for a further period of time whilst works are still ongoing. The banner is helping to screen the unsightly scaffold and wraps around the south-east corner of the building only. A series of downlighters externally illuminate the proposed banner. The banner measures 40m wide by 12m high.
- 3.3 All displays will meet the standards set by the Advertising Standards Authority (<http://www.asa.org.uk/asa/>) and will not contain any salacious, or offensive material.

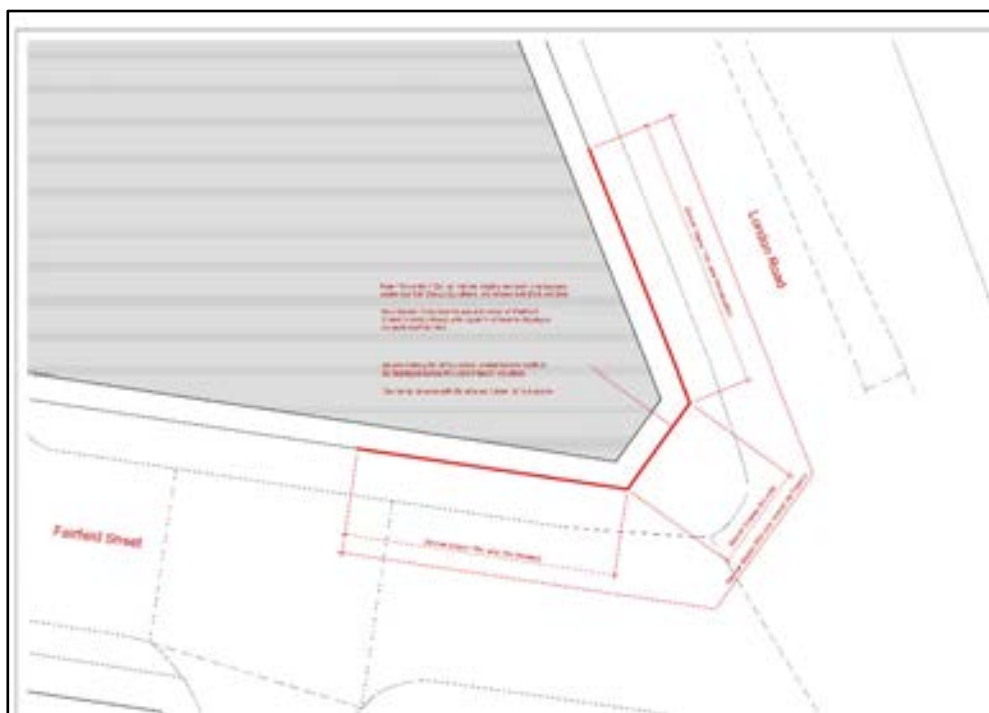
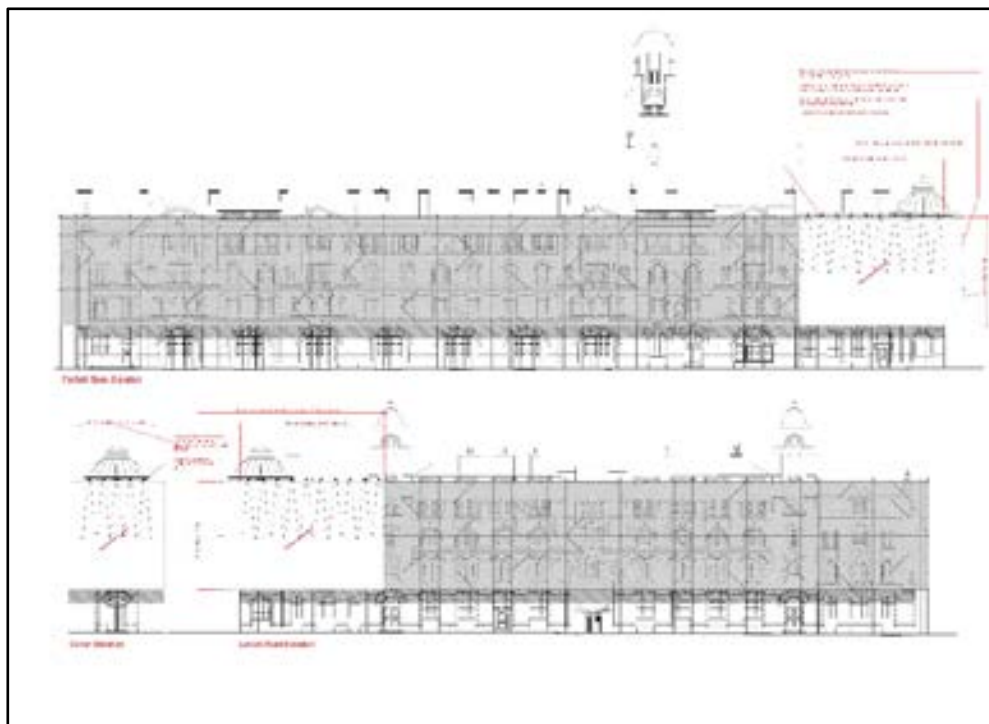
Method of Illumination

- 3.4 The maximum luminance for this banner will not exceed 300cd/m sq. The area around the site is well illuminated and it is considered that the level of illumination proposed will add little to the ambient levels of light in the immediate and wider surroundings.
- 3.5 Only the proposed commercial advertising area of the scaffold will be illuminated, and our lamps are the most economical and environmentally friendly available.
- 3.6 In addition, the illumination will be programmed to come on at dusk and extinguish themselves at 22.00 hours and be shielded to prevent light spill / light pollution.

Methods of Installation and Material

- 3.7 The proposed screen will be manufactured from digitally imprinted hi-tech micromesh PVC material. The material is rip and tear proof and has been tested and approved for large-scale display applications. The material has also been specially designed and manufactured for use as building screens and scaffold safety screens.

- 3.8 Installation is by means of an engineered designed and approved method, which is firmly fixed to the building with primary and secondary safety measures incorporated.
- 3.9 As stated earlier, the method of installation, together with the safety features, meets or exceeds all the relevant health and safety standards.



Proposed Banner

4.0 Assessment of the Proposals

Statutory Context

- 4.1 The Town and Country Planning (Control of Advertisements) (England) Regulations 2007, requires that Local Planning Authorities shall exercise their powers to control advertisements “only in the interest of amenity and public safety, taking account of any material factors...”
- 4.2 The scope of the decision is limited to these issues and Development Plan policies are relevant only in so much as they relate to matters of amenity and public safety.

Public Safety

- 4.3 Banners at the Fire Station will and do not appear as a sudden feature to road-users. The banners are static canvas; they do not incorporate flashing lights or moving parts. It will not require close study, nor will it confuse or obstruct views of road signs or traffic control signals for road-users.
- 4.4 No adverse opinion has been held about Public Safety in previous decisions made by the Local Planning Authority with regard to installing commercial banner adverts upon this building. The Officers Report for the previous consent recorded the following:

“Highways department had no objection subject to control of illumination levels. Environmental Health have no comments or objections to the proposal. It is therefore considered that the development would pose no public safety issues subject to appropriate conditions recommended within this report.”

- 4.5 The method of illumination is directed to the banners and will not cause any glare or distraction to passing motorists.
- 4.6 The materials and method of installation of the banners mean there is no risk of the screens becoming detached from the building, thereby endangering pedestrians or motorists.

Amenity

- 4.7 Large poster hoardings are recognised to often form part of the fabric of commercial areas. It is also held that “all outdoor advertisements are intended to catch the eye of passers-by, if only fleetingly”.

4.8 When considering the amenities issue of a banner advert, "account should be taken not only of factors which may be detrimental to amenity but also of factors which may be to the advantage of the amenity of a locality, such as adding appropriate colour and interest to a drab area or screening an eyesore." The design and scale of the advertisements are considered to be in keeping with the nature of the neighbouring buildings, as well as, character of the busy commercial area.

4.9 The Officers Report for the previous consent recorded the following:

As the banner is only proposed for a temporary period whilst scaffolding surrounds the site in order to implement the works approved under applications 116099 and 116100, it is considered that it is acceptable on this basis as it would not adversely affect visual amenity within the area or the character and appearance of the listed building as it would not be a permanent feature within the street scene.

The hours of operation and the lighting levels for the proposed advert lights have been conditioned so as to not cause an adverse impact on the amenity of nearby residential occupiers.

4.10 It is also noted that Historic England had no comments on the previous application.

4.11 The proposed banners are only of a temporary nature and will be removed on the completion of the refurbishment to the building.

Suggested Conditions

4.12 The previous consents have been subject to conditions to ensure amenity and public safety. These conditions are reproduced below, with the required amendments, and are considered acceptable in respect of the current application.

1) No advertisement is to be displayed without the permission of the owner of the site or any other person with an interest in the site entitled to grant permission.

No advertisement shall be sited or displayed so as to:

(a) endanger persons using any highway, railway, waterway, dock, harbour or aerodrome (civil or military);

(b) obscure, or hinder the ready interpretation of, any traffic sign, railway signal or aid to navigation by water or air; or

(c) hinder the operation of any device used for the purpose of security or surveillance or for measuring the speed of any vehicle.

Any advertisement displayed, and any site used for the display of advertisements, shall be maintained in a condition that does not impair the visual amenity of the site. Any structure or hoarding erected or used principally for the purpose of displaying advertisements shall be maintained in a condition that does not endanger the public. Where an advertisement is required under these Regulations to be removed, the site shall be left in a condition that does not endanger the public or impair visual amenity.

2) The development hereby approved shall be carried out in accordance with the following drawings and documents:

Site Location Plan 3203-D1000-Rev00;

Application Drawings:-

3203-D1300-rev00 – Existing Primary Elevations

3203-D2100-rev00 – Proposed Layout Plan

3203-D2200-rev01 – Proposed Elevations and Section

3203-D2300-rev01 – Proposed Primary Elevations

Reason - To ensure that the development is carried out in accordance with the approved plans, pursuant to policies DC15, DC18 and DC19 of the Unitary Development Plan for the City of Manchester and policies SP1 and DM1 of the Core Strategy.

*3) (a) The express advertisement consent hereby granted is limited to the period until **31 May 2025.***

(b) On the date of the expiry of the express consent period stated above in part (a), the advertisement hoarding(s) and all associated development shall be removed, any use of the land authorised by this consent shall be discontinued, and the land/building shall be reinstated.

Reason - To enable the City Council to consider the acceptability of the continuance of the display of the advertisement hoarding(s) at the site on the expiry of the period of express consent, having regard to visual amenity and changing circumstances in the locality in order to comply with saved policies DC15, DC18 and DC19 of the Unitary Development Plan for the City of Manchester and policies SP1 and DM1 of the Core Strategy.

4) External lighting shall be designed and installed so as to control glare and overspill onto nearby properties and only utilised when there is an advert in place in this location.

Reason - To safeguard the amenities of the occupiers of nearby properties in order to comply with policies DM1 and SP1 of the Core Strategy and saved policies DC15.1 and DC15.2 of the Unitary Development Plan for the City of Manchester.

5) The lighting units that are proposed to illuminate the temporary banner shall not be in operation during the following hours:

23.00 to 07.00 Monday to Sunday

Reason - In the interests of visual amenity, to avoid the potential for light pollution and to safeguard the amenities of the occupiers of nearby properties in order to comply with policies DM1 and SP1 of the Core Strategy and saved policies DC15.1 and DC15.2 of the Unitary Development Plan for the City of Manchester.

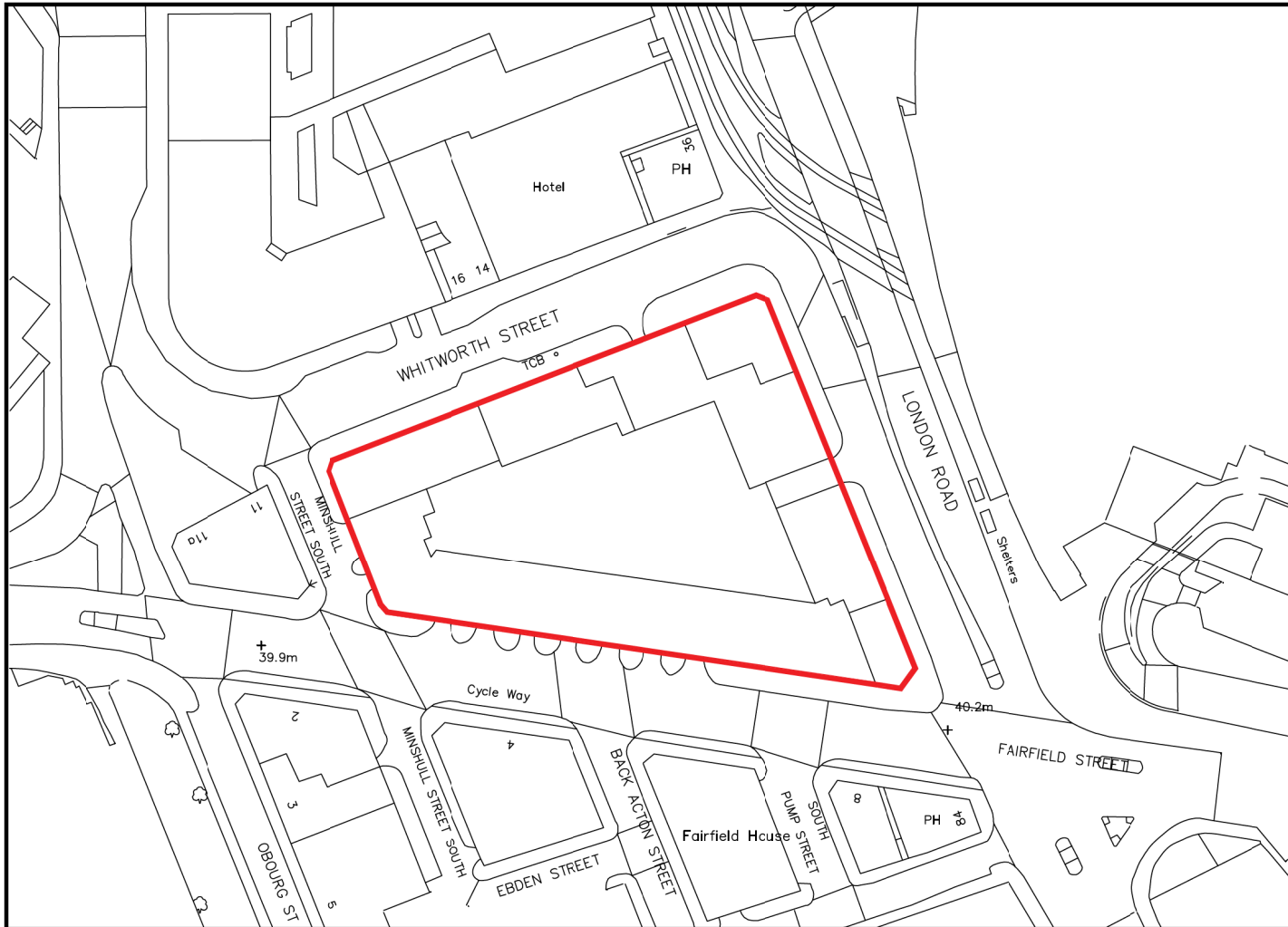
6) The maximum luminance level of the advertisements displayed on the panel shall not exceed 300 cd/m² during non-daylight hours/times of inclement weather.

Reason - To avoid the potential for light pollution and to safeguard the amenities of the occupiers of nearby properties in order to comply with policies DM1 and SP1 of the Core Strategy and saved policies DC15.1 and DC15.2 of the Unitary Development Plan for the City of Manchester.

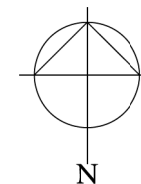
5.0 Conclusions

- 5.1 Until the refurbishment of this building is completed, the temporary banner and the screening of the site will certainly constitute an advantage to the visual amenities. It will add colour and interest to the street scene and provide information to visitors and passers-by.
- 5.2 As previously described the remedial works are being undertaken to allow the long-awaited redevelopment of this building, and as a scaffold is required to complete the job, the owners of Fire Station would hope that a consent to display temporary adverts upon the scaffold would be supported by the Council, as any funds raised by the commercial displays will be utilised for the upkeep of the host property and to offset the cost of the stated works.
- 5.3 When considering its individual merits and the circumstances of this site, the proposal is not harmful to amenity or public safety in this commercial location. Furthermore, the proposal is in keeping with the Councils policies set out in their UDP and The Town and Country Planning (Control of Advertisements) Regulations.

APPENDIX 1



Site Location Plan



London Road Fire Station
50 London Road
Manchester
M1 2PH



First Floor, 44 Charlotte Street,
London, W1T 2NR
 T. 0207 6372057 www.infinity-outdoor.co.uk

Scale	Size	Date
1:1250	A4	June 2018

Drawing Title
Site Location Plan

Drawing Ref	Revision No.
IOL.LRFS.01	-

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London Road Fire Station

50 London Road, Manchester

M1 2PH



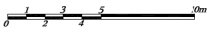
Fairfield Street Elevation



Corner Elevation

London Road Elevation

Primary Elevations as Existing



First Floor, 44 Charlotte Street,
London, W1T 2NR
T: 0207 6072952 www.infinity-outdoor.co.uk

Scale 1:100 Size A0 Date June 2018
Elevations as Existing

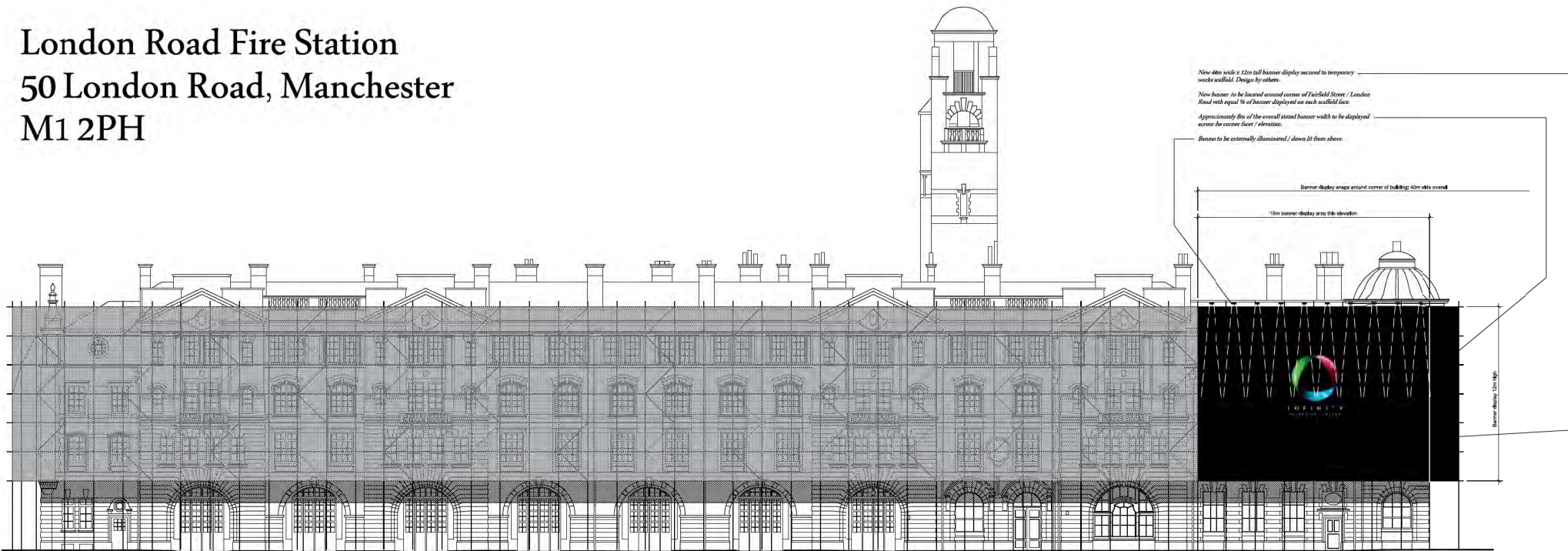
Drawing Ref: IOLLRFS 02 Revision No: -

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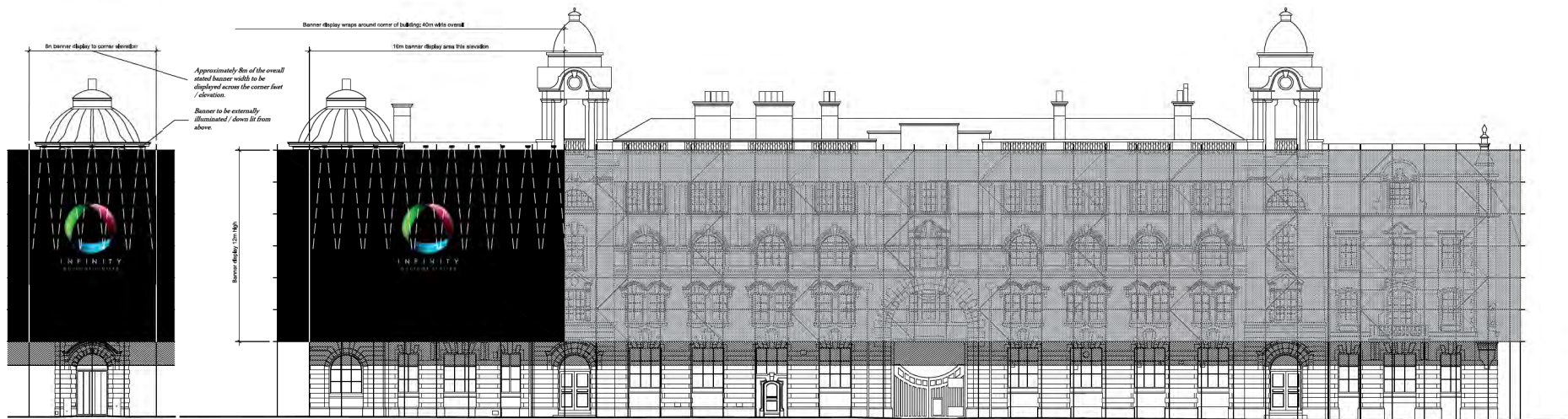
London Road Fire Station

50 London Road, Manchester

M1 2PH



Fairfield Street Elevation



Corner Elevation

London Road Elevation

Primary Elevations as Proposed



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London, W1T 2NR
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Scale 1:100 Size A0 Date June 2018

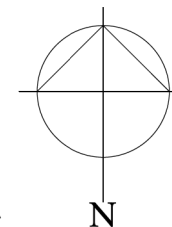
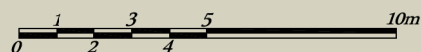
Elevations as Proposed

Drawing Ref IOLLRFS 03 Revision No. -

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Site Layout Plan as Proposed

London Road Fire Station
50 London Road
Manchester
M1 2PH



New 40m wide x 12m tall banner display secured to temporary works scaffold (as denoted by 'zig zag' line style).

Scaffold design by others.

New banner to be located around corner of Fairfield Street / London Road with equal % of banner displayed on each scaffold face.

Approximately 8m of the overall stated banner width to be displayed across the corner facet / elevation.

Banner to be externally illuminated / down lit from above.

Banner display 16m wide this elevation

London Road

Banner display 16m wide this elevation

Banner display 8m wide
Banner display 40m wide overall (all facets)

Fairfield Street



First Floor, 44 Charlotte Street,
London, W1T 2NR

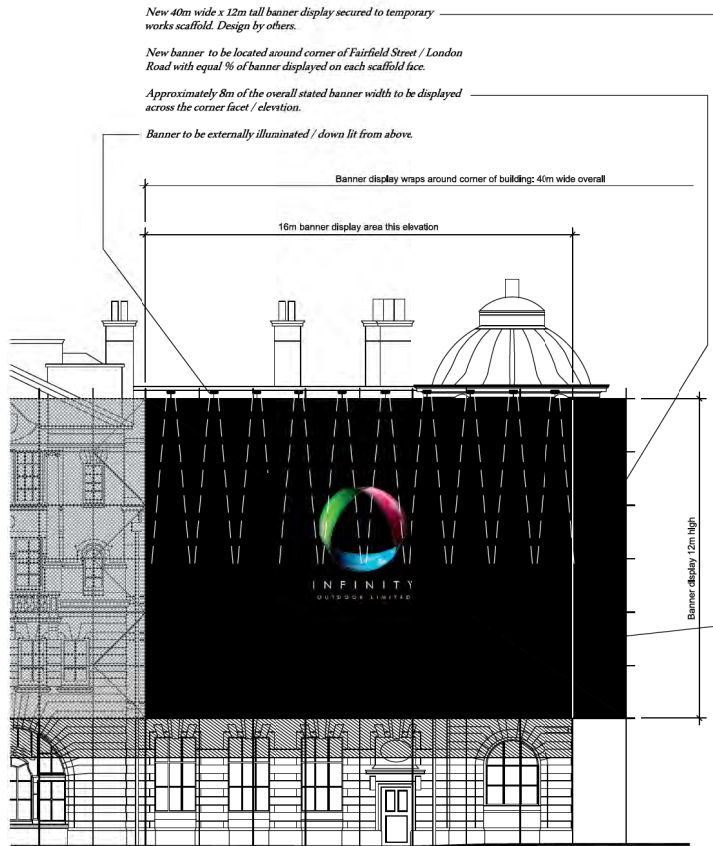
T. 0207 6372057 www.infinity-outdoor.co.uk

Scale	Size	Date
1:100	A2	June 2018

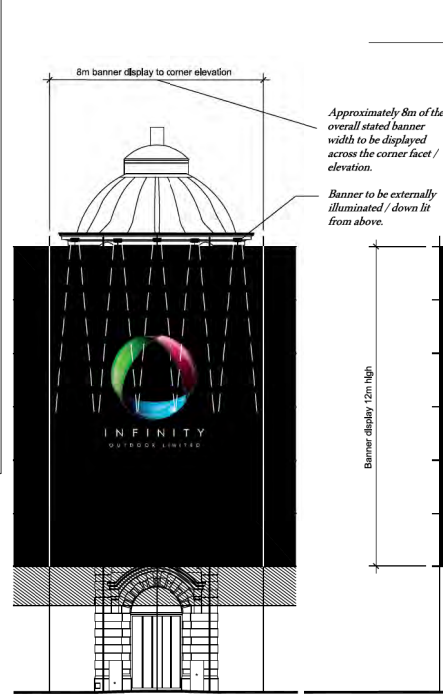
Site Layout as Proposed

Drawing Ref	Revision No.
IOL.LRFS.04	-

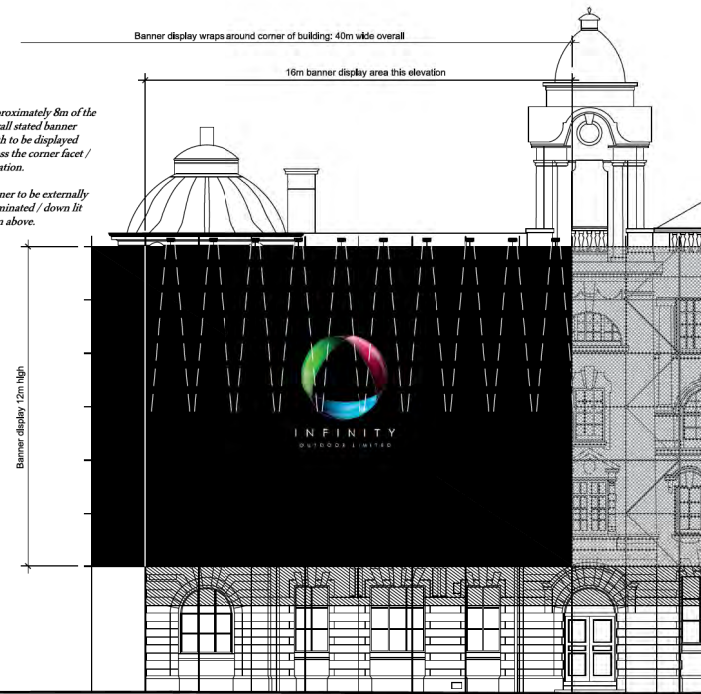
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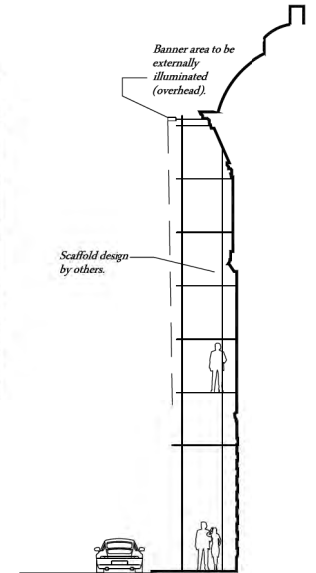
Fairfield Street Elevation



Corner Elevation

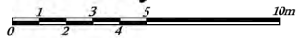


London Road Elevation



Typical Section

Primary Elevations (& Section) as Proposed



London Road Fire Station
50 London Road, Manchester
M1 2PH



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London, W1T 2NR
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Scale 1:100 Size A1 Date June 2018

Elevations as Proposed

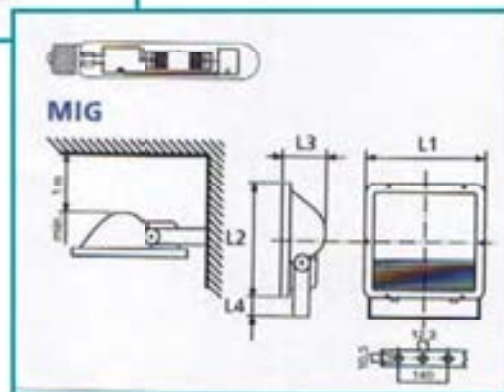
Drawing Ref IOL.LRFS.05 Revision No. -

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Lighting Information



MIG



MIG

FEATURES

- Protective system **IP 65**
- Solid and functional design
- Diecast aluminium housing and lid with cooling ribs
- Pure aluminium reflector
- With integrated ballast, ignitor and capacitor
- Wind exposed surface
ACT: 0,110 m²; MIG: 0,180 m²

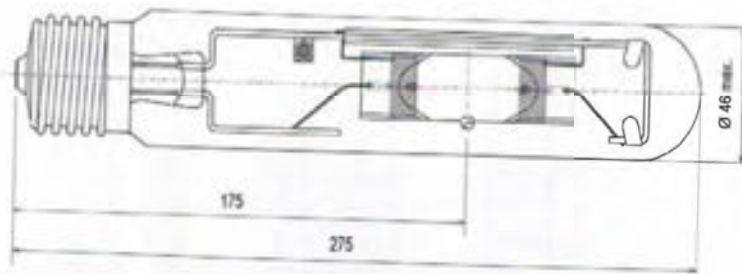
APPLICATION

- Monuments/bridges
- Industrial areas
- Big building sites
- Small sports fields

LIGHT SOURCES

- For ACT: Metal-halide lamps double-ended RX7s and Fc2 (> see BLV catalogue)
- For MIG: Metal-halide lamps single-ended E40 (> see BLV catalogue)

MIG Metal-Halide Lamps



Spezifikation / Specification:

Lampenleistung / Lamp wattage:

Lampenstrom / Lamp current:

Zündspannung / Ignition voltage:

Farbtemperatur / Colour temperature:

Farbkoordinaten / Colour coordinates:

Lichtstrom / Luminous flux:

Mittlere Lebensdauer / Average lifetime:

Socket / Base:

Zulässige Brennlage / Reliable burning position:

Kolbenform / Bulb contour:

Kobentyp / Bulb type:

Verpackungseinheit (Stück.) / Box quantity (pcs.):

400 W

4,0 A

4 kV

4200 K

x: 0,372 y: 0,370

42000 lm

8.000 h

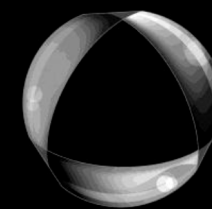
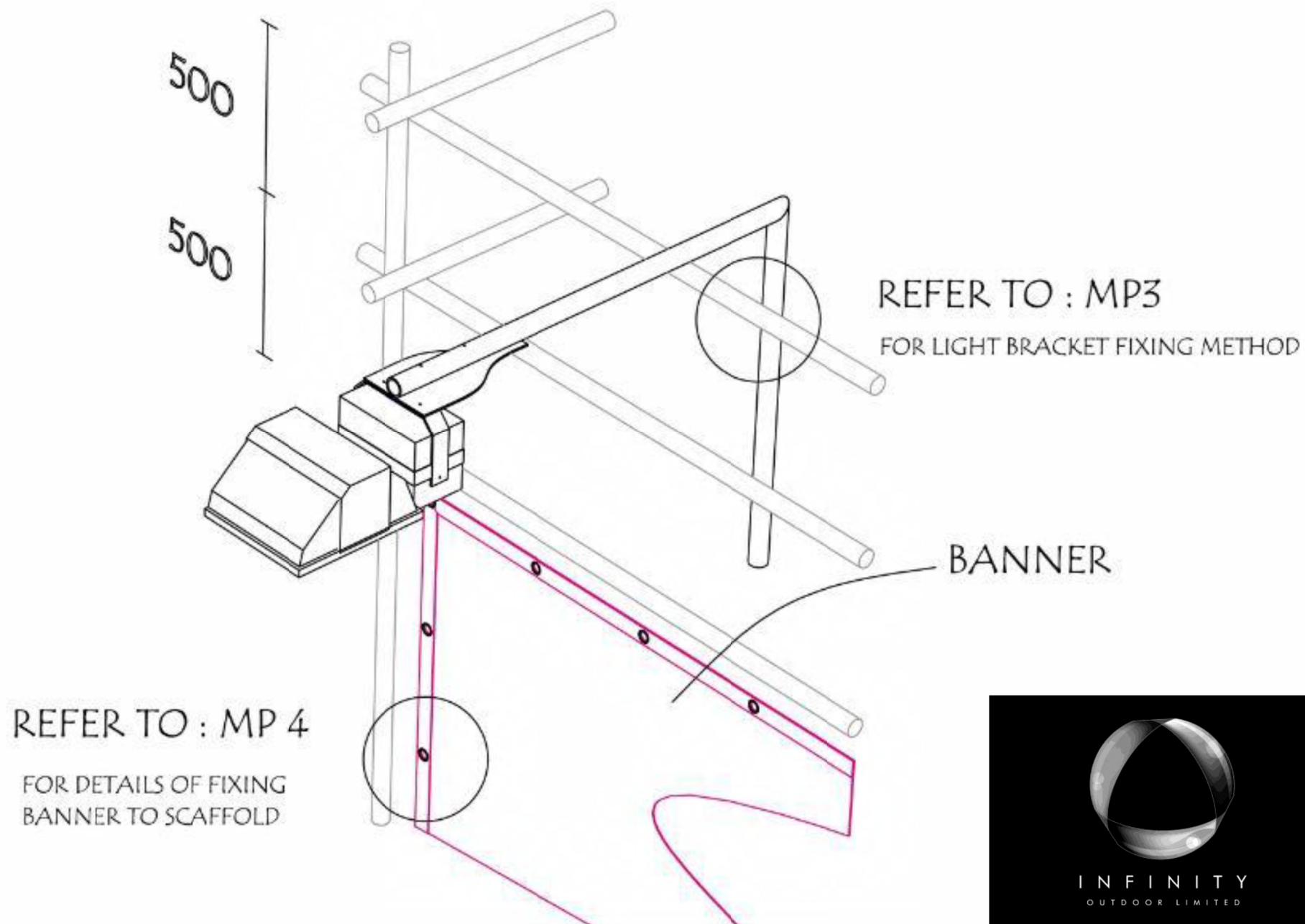
E40

u360

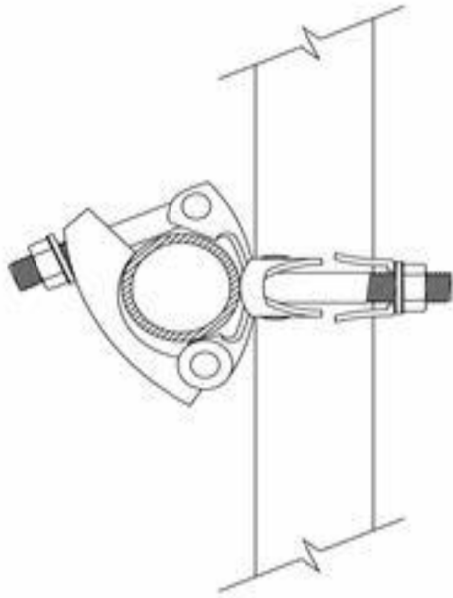
röhrenförmig / tubular

klar / clear

12

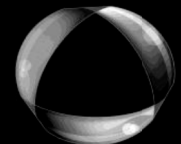
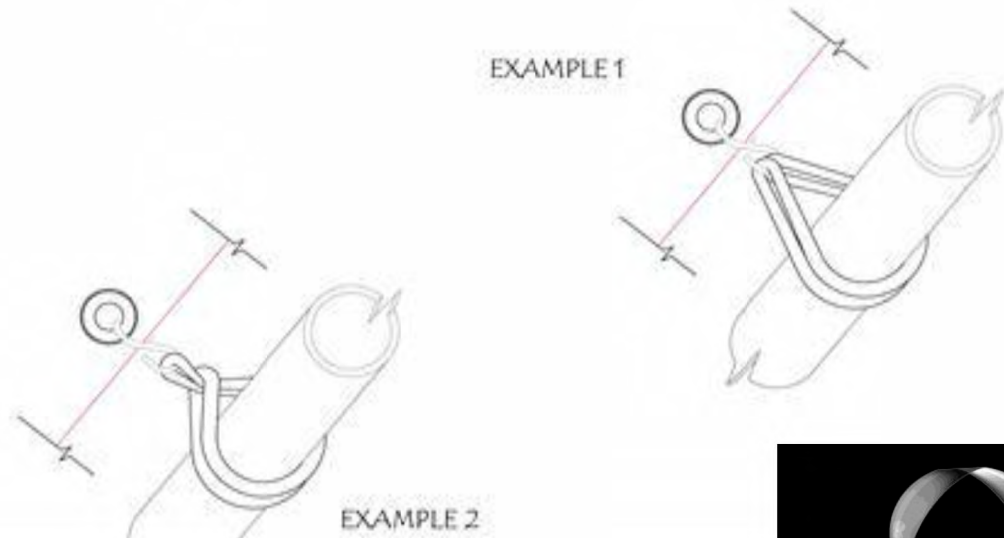


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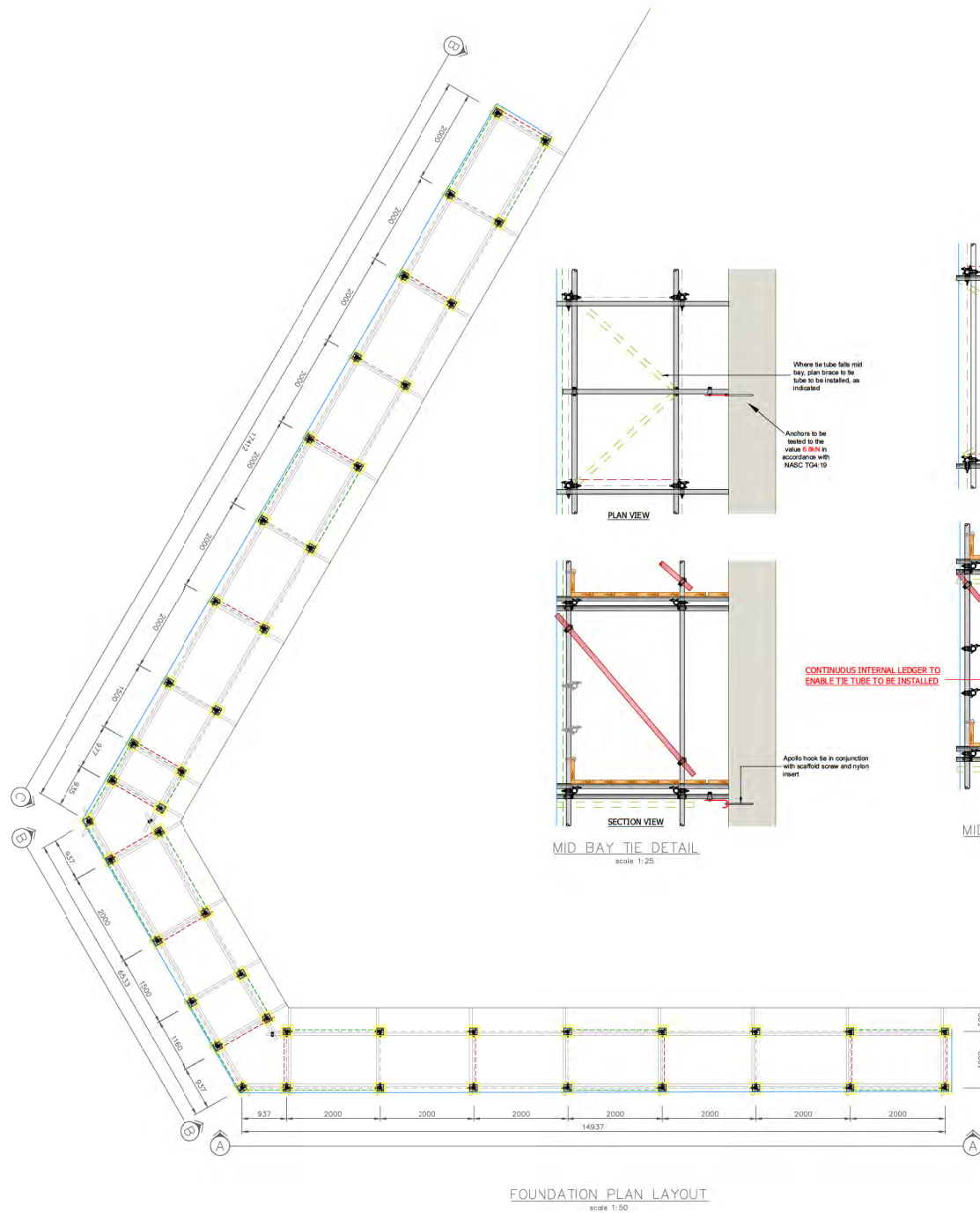
DRAWING SHOWING :
LIGHT BRACKET
FIXING METHOD.

DETAILS OF FIXING BANNER TO SCAFFOLD



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APPENDIX 2



RISK — ACCURACIES IN BUILDING LINE CAUSING SCAFFOLD TO BE DIMENSIONALLY INACCURATE
Control Measure: Prior to erection the scaffold contractor and/or principal contractor should check the existing structure to ensure the scaffold can be based out and erected as detailed and inform Creator Ltd of any discrepancies.

RISK — OVERLOADING OF EXISTING STRUCTURE
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing structure. Creator Ltd to be contacted where structure is deemed unsafe to support scaffold structure.

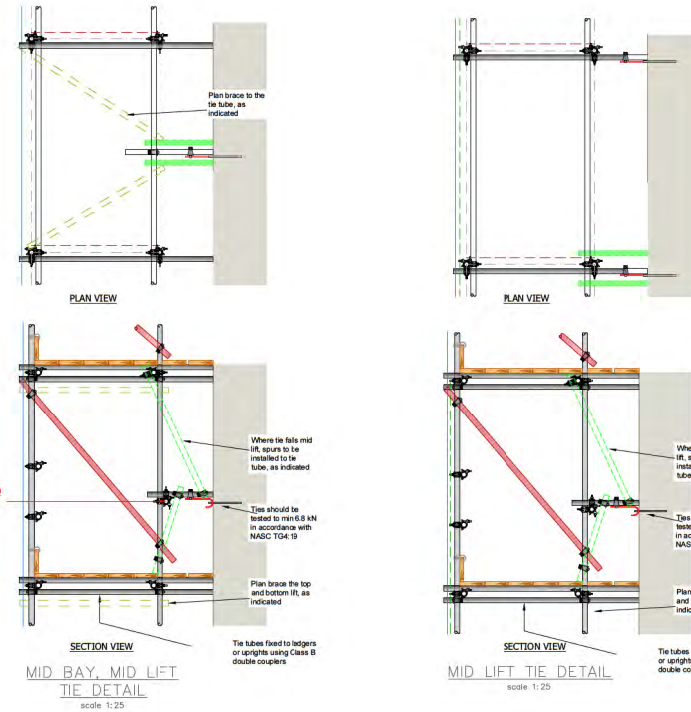
RISK — EXCESSIVE BAY SIZES INSTALLED DURING ERECTION
Control Measure: The scaffold contractor must ensure that the maximum bay size installed are as indicated and should not be exceeded. It is the responsibility of the scaffold contractor to remedy any defects.

RISK — EXCESSIVE LIFT HEIGHTS CAUSING BUCKLING
Control Measure: Maximum lift heights to be installed as detailed by the scaffold contractor and have a maximum tolerance of a 100mm

RISK — OVERLOADING OF SCAFFOLD STRUCTURE
Control Measure: The design service loads indicated should be closely site managed to ensure that only 2 number of working levels are present at one time. The load conditions of the scaffold should be clearly identified on the scaff.

RISK — VEHICULAR COLLISION
Control Measure: Principle contractor to closely site manage, ensure clear signage is installed and where required temporary crash barriers (TCB) to be installed to prevent collision with the scaffold structure

RISK — OVERLOADING OF EXISTING STRATA
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing strata. Creator Ltd to be contacted where strata is deemed unsafe to support scaffold structure.



SCAFFOLD TO BE TIED TO MASONRY ONLY. SEE ELEVATION DRAWINGS FOR POSITIONS

SCAFFOLD MUST ABUT EXISTING STRUCTURE AT EVERY NODE



SHEETING LOCATION TO BE DECIDED BY SITE & FIXED AS PER MANUFACTURER'S GUIDELINES, OTHERS TO APPRAISE

ALL COUPLERS TO BE CLASS B (UNLESS OTHERWISE STATED)

ANCILLARY NOTES :
MAXIMUM LEVELLOAD =
1 LEVEL AT 0.75kN/m²
1 LEVEL AT 0.75kN/m²
MAXIMUM LEG LOAD (UNFACTORED) = 10.5kN
TRANSOM SPACINGS = 1200mm c/c
CLADDING: FULLY CLAD

DOCUMENT REFERENCES
This design is to be read in conjunction with the following design drawings and/or documents:
CRE-IBN-150-009A_REPORT
APPENDIX A - CRE-IBN-150-009A_1,2,3,4,5.dwg

REVISIONS / REVISIONS									
NO.	DATE	DESCRIPTION	BY	CHKD	DATE	APPROV	DATE	DATE	DATE
1	20/06/24	20/06/24	HA	30.04.24	RB	30.04.24			
2	30.04.24	RB	30.04.24						
3	30.04.24	RB	30.04.24						
4	30.04.24	RB	30.04.24						
5	30.04.24	RB	30.04.24						
6	30.04.24	RB	30.04.24						
7	30.04.24	RB	30.04.24						
8	30.04.24	RB	30.04.24						
9	30.04.24	RB	30.04.24						
10	30.04.24	RB	30.04.24						

FOR APPROVAL

CRE-IBN-150-009A

1: 30.25

AI

CREATOR
SCAFFOLD DESIGNS

ADVERTISMENT SCAFFOLD
LONDON ROAD FIRE STATION
LONDON ROAD, MANCHESTER
M1 2PH

SEE QUOTE

Technical Data Sheet

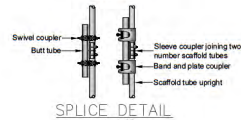
Product Designation : CSS
Type : Dual Thread Concrete Screw - OPTION 1 CE Approved
Material : Hardened Steel
Finish : Bright Zinc Plated (thickness 3~5 Microns)
Load Class (TG20) : Medium to Heavy Duty in C20/25 Concrete



PROPOSED TIE INTO MORTAR JOINTS. MUST NOT BE TIED INTO TERRACOTTA

PULL TEST ANCHORS TO 5.8kN IN LINE WITH TG4:19.

FOR ALL STANDARDS WHERE SHEETED OR BANNER FRAME OCCURS



SPLICE DETAIL scale 1:25

RISK - ACCURACIES IN BUILDING LINE CAUSING SCAFFOLD TO BE DIMENSIONALLY INACCURATE.
Control Measure: Prior to erection the scaffold contractor and/or principal contractor should check the existing structure to ensure the scaffold can be based out and erected as detailed and inform Creator Ltd of any discrepancies.

RISK - OVERLOADING OF EXISTING STRUCTURE.
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing structure. Creator Ltd to be contacted where structure is deemed unsafe to support scaffold structure.

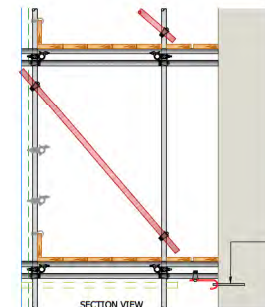
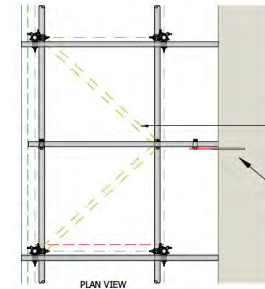
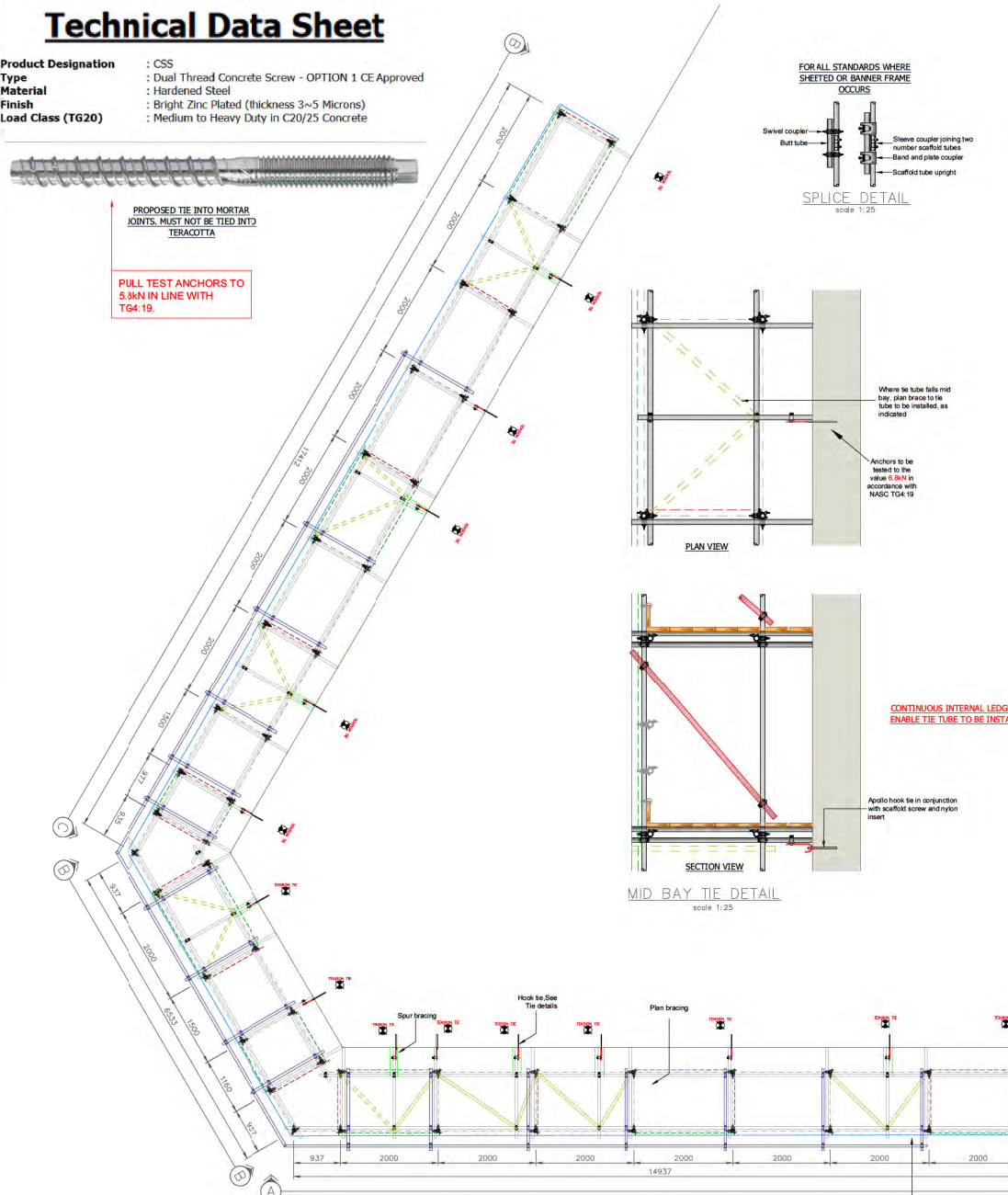
RISK - EXCESSIVE BAY SIZES INSTALLED DURING ERECTION.
Control Measure: The scaffold contractor must ensure that the maximum bay size installed as indicated and should not be exceeded. It is the responsibility of the scaffold contractor to remedy any defects.

RISK - EXCESSIVE LIFT HEIGHTS CAUSING BUCKLING.
Control Measure: Maximum lift heights to be installed as detailed by the scaffold contractor and have a maximum tolerance of ±100mm.

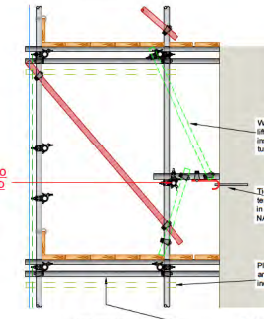
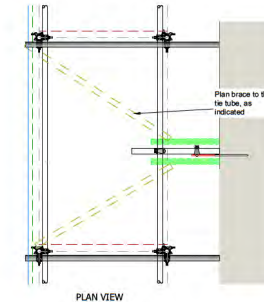
RISK - OVERLOADING OF SCAFFOLD STRUCTURE.
Control Measure: The design service loads indicated should be closely adhered to ensure that only 2 number of working levels are present at one time. The load conditions of the scaffold should be clearly identified on the scaffolding.

RISK - NEWCOMER COLLISION.
Control Measure: Principle contractor to closely site manage, ensure clear signage is installed and where required temporary crash barriers (TCB) to be installed to prevent collision with the scaffold structure.

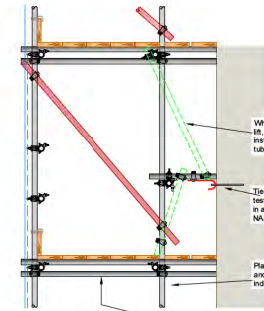
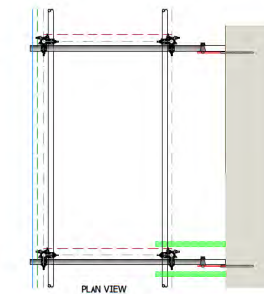
RISK - OVERLOADING OF EXISTING STRATA.
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing strata. Creator Ltd to be contacted where strata is deemed unsafe to support scaffold structure.



MID BAY TIE DETAIL scale 1:25



MID BAY, MID LIFT TIE DETAIL scale 1:25



MID LIFT TIE DETAIL scale 1:25

CONTINUOUS INTERNAL LEDGER TO ENABLE TIE TUBE TO BE INSTALLED

Apollon hook tie in conjunction with scaffold screw and nylon insert

Advertising banner/Sheeting to be installed as per manufacturer's guidelines and location to be decided by site

TIE LEVEL PLAN LAYOUT scale 1:50

BANNER FRAME TO BE DIRECTED OUT OF KEE KLAMP FITTINGS. ALL CONNECTIONS TO BE MADE WITH 300MM OF THE UNDERLING LEDGER CONNECTIONS. MAXIMUM DISTANCE FROM 300MM FROM THE FACE OF THE SCAFFOLD.



DETAIL 1 KEY CLAMP COUPLERS

SCAFFOLD TO BE TIED TO MASONRY ONLY. SEE ELEVATION DRAWINGS FOR POSITIONS

SCAFFOLD MUST ABUT EXISTING STRUCTURE AT EVERY NODE

LEGEND

- Structural Wall
- Scaffold Frame
- Tie Rods / Scaffold Boards
- Working Line
- Frame Line (Plan, Section)
- Transverse Line (Plan, Elevation)
- Longitudinal Line (Section)
- Ledger Line (Plan, Elevation)
- Plan Line (Plan, Section, Elevation)
- Scaffold Curve Line (Plan)
- 40mm Diameter Scaffold Tube
- Cladding Material (Sheeting / Walling)
- Spigot Detail
- Supplementary Coupler / Check Fitting
- The Loaders (Plan, Section, Elevation)
- Function
- Upright Cut Off
- Vertical Rod
- Ledger Line (Elevation, Section)
- Frame Line (Elevation, Section)
- Double Coupler (Plan, Elevation, Section)
- Horizontal Rods, Wall/Clad (Plan, Elevation, Section)

SHEETING LOCATION TO BE DECIDED BY SITE & FIXED AS PER MANUFACTURER'S GUIDELINES, OTHERS TO APPRAISE

ALL COUPLERS TO BE CLASS B (UNLESS OTHERWISE STATED)

ANCILLARY NOTES :
MAXIMUM LEVELLOAD = 1 LEVEL AT 0.75kN/m²
1 LEVEL AT 0.75kN/m²
MAXIMUM LEG LOAD (UNFACTORED) = 10.5kN
TRANSOM SPACINGS = 1200mm c/c
CLADDING: FULLY CLAD

DOCUMENT REFERENCES
This design is to be read in conjunction with the following design drawings and/or documents:
CRE-BN-140-009A REPORT
APPENDIX A - CRE-BN-140-009A_1,2,3,4,5.dwg

REVISIONS / REVISIONS

REV	DATE	BY	CHKD	DATE	APPR	DATE
A	20/06/24	20/06/24				
HA	30/04/24	RWB	30/04/24	RWB	30/04/24	

FOR APPROVAL

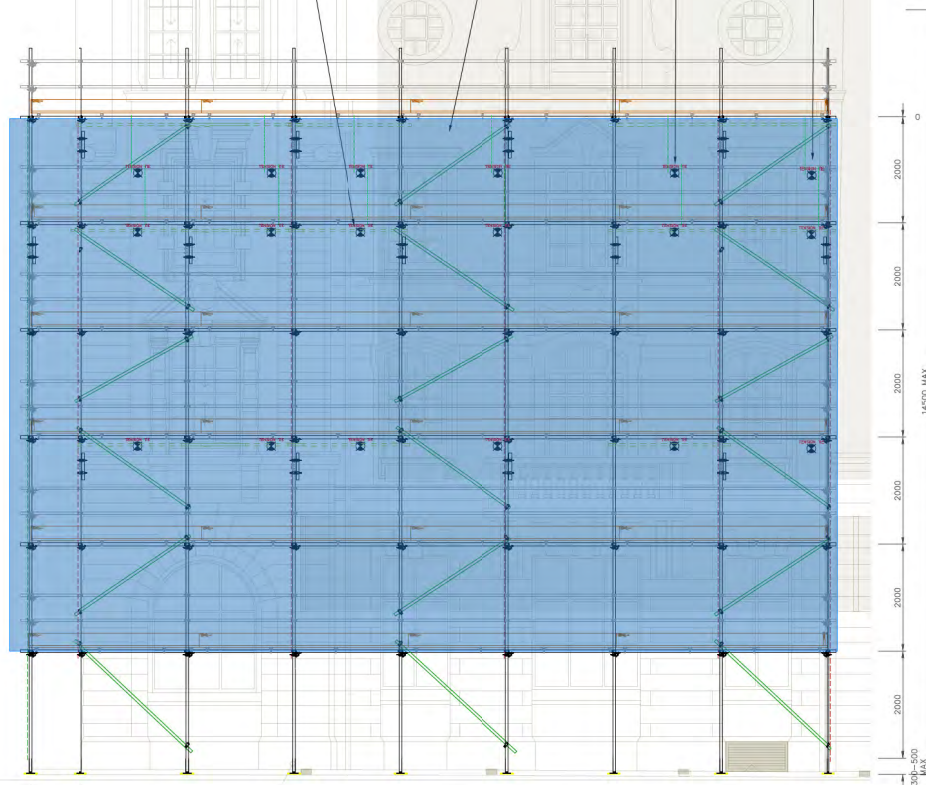
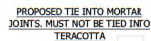
CRE-BN-140-009A 2 1:30.25 AI

ADVERTISHER SCAFFOLD
LONDON ROAD FIRE STATION
LONDON ROAD, MANCHESTER
M1 2PH

SEE QUOTE

CREATOR
SCAFFOLD DESIGNS

Product Designation : CSS
Type : Dual Thread Concrete Screw - OPTION 1 CE Approved
Material : Hardened Steel
Finish : Bright Zinc Plated (thickness 3~5 Microns)
Load Class (TG20) : Medium to Heavy Duty in C20/25 Concrete



Entrance

Sh

locumtenens

ELEVATION A — A

scale 1:50

TYPICAL SECTION

scale 1:50

BANNER FRAME TO BE ERECTED OUT OF KEE KLAMP
FITTINGS. ALL CONNECTIONS TO BE MADE WITH
300MM OF THE UNDERSLUNG LEDGER CONNECTIONS.
MAXIMUM DISTANCE FROM 300MM FROM THE FACE
OF THE SCAFFOLD.



DETAIL 1
KEY CLAMP COUPLERS

Splice # 1, see details

Advertising banner to be installed as per manufacturer's guidelines and location to be decided by site

Brace to inside leg for full height at positions indicated on plan/elevation (bracing pattern same as on outside legs)

RISK – EXCESSIVE BAY SIZES INSTALLED DURING ERECTION.

Control Measure: The scaffold contractor must ensure that the maximum bay size installed are as indicated and should not be exceeded. It is the responsibility of the scaffold contractor to remedy any defects.

RISK – EXCESSIVE LIFT HEIGHTS CAUSING BUCKLING
Control Measure: Maximum lift heights to be installed as detailed by the scaffold contractor and have a maximum tolerance of +100mm

RISK – OVERLOADING OF SCAFFOLD STRUCTURE
Control Measure: The design service loads indicated

RISK — VEHICULAR COLLISION
Control Measure: Principle contractor to closely site manage, ensure clear signage is installed and where required temporary crash barriers (TCB) to be installed to prevent collision with the scaffold structure

RISK – OVERLOADING OF EXISTING STRATA
Control Measure: Principal contractor to employ a structural

engineer to ensure the applied loads from the scaffold do not overload the existing strata. Creator Ltd to be contacted where strata is deemed unsafe to support scaffold structure.

SCAFFOLD TO BE TIED TO
MASONRY ONLY.
SEE ELEVATION DRAWINGS FOR
POSITIONS

**SCAFFOLD MUST ABUT EXISTING
STRUCTURE AT EVERY NODE**

LEGEND

-  Structural Steel
-  Scaffold Braces
-  Timber Products / Scaffold Boards
-  Building Details
-  Facade Brice (Plan, Section)
-  Translational Brice (Plan, Elevation)
-  Translational Ince (Section)
-  Kandelopentrich
-  Ledger Brice (Plan, Elevation)
-  Plan Brice (Plan, Section, Elevation)
-  Scaffold Crane Line (Plan)
-  45/90° Corner Scaffolding
-  Climbing Network (Shooting / Netting)
-  Splice Detail
-  Supplementary Coupler / Check Fitting
-  Tie Location (Plan, Section, Elevation)
-  Purcellnet
-  Vertical Cut Off
-  Residual Risk
-  Ledger Brice (Elevation, Section)
-  Facade Brice (Elevation, Section)
-  Double Coupler (Plan, Elevation, Section)
-  Prefabricated Braces, roadway (Plan, Elevation, Section)

**SHEETING LOCATION TO BE DECIDED
BY SITE & FIXED AS PER
MANUFACTURER'S GUIDELINES,
OTHERS TO APPRAISE**

ALL COUPLERS TO BE CLASS B
(UNLESS OTHERWISE STATED)

ANCILLARY NOTES :
 MAXIMUM LIVELOAD :
 1 LEVEL AT 0.75kN/m²
 1 LEVEL AT 0.75kN/m²
 MAXIMUM LEG LOAD (UNFACTORED)
 = 10.5kN
 TRANSOM SPACINGS = 1200mm
 CLADDING: FULLY CLAD

DOCUMENT REFERENCES

This design is to be read in conjunction with the following design drawings and/or documents:
CRE-IBN-160-008A_REPORT
APPENDIX A - CRE-IBN-160-008A_1.2.3.4.5.d

AMENDMENTS / REVISIONS

A	SLB	20/06/24		20/06/24		
-	HA	30.04.24	BWB	30.04.24	KRB	30.04.24
RKV	SU	DATZ	GUEV	DATZ	AGRD	DATZ



FOR APPROVAL

Case Number:	Case Number:	Date:	Doc.:
CRF-ZEN-160-008A	3	1 : 50,25	AI
ADVERTISMENT SCAFFOLD LONDON ROAD FIRE STATION LONDON ROAD, MANCHESTER M1 2PH			

SEE QUOTE

CREATOR
SCAFFOLD DESIGNS
A Division of Scaffolding Concepts, Inc.

Technical Data Sheet

Product Designation : CSS
Type : Dual Thread Concrete Screw - OPTION 1 CE Approved
Material : Hardened Steel
Finish : Bright Zinc Plated (thickness 3~5 Microns)
Load Class (TG20) : Medium to Heavy Duty in C20/25 Concrete



PROPOSED TIE INTO MORTAR JOINTS, MUST NOT BE TIED INTO TERACOTTA

PULL TEST ANCHORS TO 5.8kN IN LINE WITH TG4-19.

RISK — ACCURACIES IN BUILDING LINE CAUSING SCAFFOLD TO BE DIMENSIONALLY INACCURATE
Control Measure: Prior to erection the scaffold contractor and/or principal contractor should check the existing structure to ensure the scaffold can be based out and erected as detailed and inform Creator Ltd of any discrepancies.

RISK — OVERLOADING OF EXISTING STRUCTURE
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing structure. Creator Ltd to be contacted where structure is deemed unsafe to support scaffold structure.

RISK — EXCESSIVE BAY SIZES INSTALLED DURING ERECTION
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RISK — EXCESSIVE LIFT HEIGHTS CAUSING BUCKLING
Control Measure: Maximum lift heights to be installed as detailed by the scaffold contractor and have a maximum tolerance of ±10mm.

RISK — OVERLOADING OF SCAFFOLD STRUCTURE
Control Measure: The design service loads indicated should be closely site managed to ensure that only 7 number of working levels are present at one time. The load conditions of the scaffold should be clearly identified on the scaffolding.

RISK — VEHICULAR COLLISION
Control Measure: Principal contractor to closely site manage, ensure clear signage is installed and where required temporary crash barriers (TCB) to be installed to prevent collision with the scaffold structure.

RISK — OVERLOADING OF EXISTING STRATA
Control Measure: Principal contractor to employ a structural engineer to ensure the applied loads from the scaffold do not overload the existing strata. Creator Ltd to be contacted where strata is deemed unsafe to support scaffold structure.

SCAFFOLD TO BE TIED TO MASONRY ONLY. SEE ELEVATION DRAWINGS FOR POSITIONS.

SCAFFOLD MUST ABUT EXISTING STRUCTURE AT EVERY NODE

LEGEND



BANNER FRAME TO BE ERECTED OUT OF KEE CLAMP FITTINGS. ALL CONNECTIONS TO BE MADE WITH 300MM OF THE UNDERSLING LEDGER CONNECTIONS. MAXIMUM DISTANCE FROM 300MM FROM THE FACE OF THE SCAFFOLD.

SHEETING LOCATION TO BE DECIDED BY SITE & FIXED AS PER MANUFACTURER'S GUIDELINES. OTHERS TO APPRAISE.

ALL COUPLERS TO BE CLASS B (UNLESS OTHERWISE STATED)

ANCILLARY NOTES :
MAXIMUM LEVEL LOAD = 1 LEVEL AT 0.75kN/m²
1 LEVEL AT 0.75kN/m²
MAXIMUM LEG LOAD (UNFACTORED) = 10.5kN
TRANSOM SPACINGS = 1200mm c/c
CLADDING: FULLY CLAD

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APPENDIX A - CRE-IBN-140-009A_1,2,3,4,5.dwg

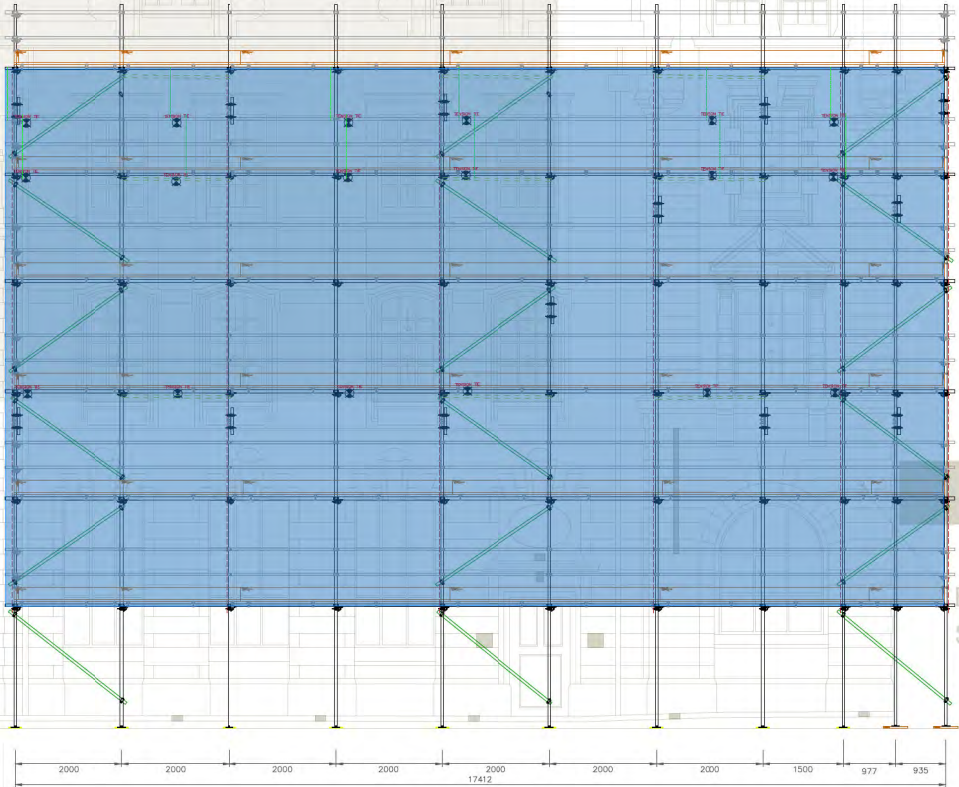
REVISIONS / REVISIONS					
REV	DATE	DESCRIPTION	DATE	APPROVED	DATE
A	20/06/24	20/06/24			
HA	30/04/24	RWB	30/04/24	RWB	30/04/24



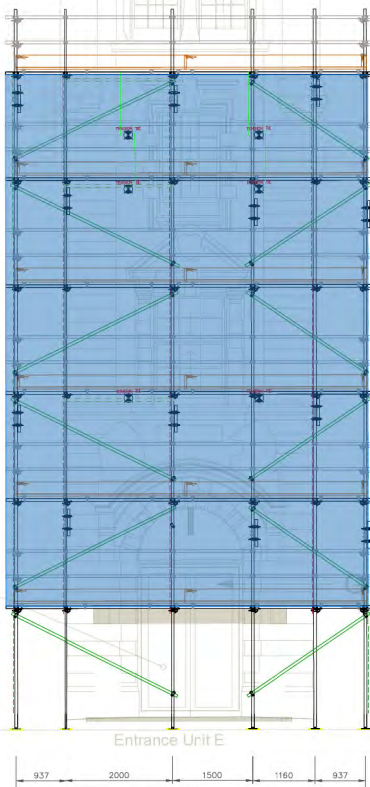
FOR APPROVAL

ADVERTISMENT SCAFFOLD
LONDON ROAD FIRE STATION
LONDON ROAD, MANCHESTER
M1 2PH

SEE QUOTE



ELEVATION C - C
scale 1:50



ELEVATION B - B
scale 1:50



DETAIL 1
KEY CLAMP COUPLERS

- 225 x 38mm BS EN 2482 visually graded scaffold board placed over board secured against movement using board clips or single couplers to uprights. Where a joint in boards occurs additional (tube) (s) from handrails to ledger to enable boards to be secured against movement.
- 225mm x 38mm BS EN 2482 visually graded scaffold boards as decking members with no greater gap than 25mm between boards. (Except between main boards and inside boards where gap should not exceed 50mm). Where there is a risk of falling materials causing injury all gaps should be covered with plywood or similar. Boards to have no greater gap than 150mm.
- Where there are three (3) inside boards the maximum design service load should not exceed **0.75kN/m²** on levels indicated.
- Ply board cover to be installed by principal contractor. Fixed secured to boarded deck using screws.
- Where handrails are to be double boarded with a polythene/vitreous membrane sandwiched between scaffold board layers as means of protection to persons walking below.
- Board transoms at **indicated** c/c secured using EN 74 single couplers.
- Use board transoms to add to the existing structure.
- Scaffold tube ledgers secured to standards using double couplers or using prefabricated transoms as necessary. Joints in ledgers to be made using EN 74 sleeve couplers.
- Scaffold tube guardrails secured at every lift for full perimeter using joints. Joints in handrail to be made using EN 74 sleeve couplers.
- All internal braced lifts should have a single principal guardrail and board transoms to facilitate erection and dismantling in accordance with SG4-Cant.
- Scaffold tube internal guardrails must be installed at each lift where falls internally are possible.
- Uprights to be within all positions indicated not exceeding the maximum bay sizes shown (±50mm tolerance). All uprights to be within 1% of plumb (10mm out of plumb every 1000mm vertical tolerance).
- Joints in uprights to be made using EN 74 sleeve couplers.
- Pedestrian lift heights to be as indicated. Foam bumpers and coupler bolt nipples to be used as pedestrian protection or slip protection measure as necessary.
- Ladder access to be installed at a gradient of 1 horizontal to 4 vertical, fixed securely to scaffold transoms. Ladder gates/trafopans to be installed as per manufacturers guidance to prevent falls through decking.
- Facade bracing secured at positions indicated on design between standards using swivels or to ledgers/transoms using tie rods to full height. All bracing connections must be within 300mm of the node.
- Ledger brace secured at centres indicated on drawings. All bracing must be within 150mm of the node. Secure to uprights using swivels or to ledgers/transoms using doubles.
- All load bearing transoms to abut the wall. Plastic end caps must be used if required under the specification for works in order to protect the existing structure.
- Scaffold tie tube secured to both inside and outside standards or ledgers. The tie tube should be within 300mm of the node.
- Scaffold to be tied into the existing structure at positions indicated on the design using tie detail(s) shown as the method of fixing.
- All supplementary couplers fixed tight to existing connection ensuring main body of the coupler abuts the main body of the coupler above. As indicated on design.
- Monarflex/Sheeting or other sold fire retardant sheeting secured inside or outside face of the outside upright/ledger using manufacturer approved hunge chords or zips ties at 500mm c/c to 'sheeting rails' at 1000mm c/c vertically up the height of the scaffold.

34. This document remains the exclusive property of Creator Ltd and should be returned immediately upon request. No modification or alteration should be made to the design without written permission from Creator Ltd.

26. The anchors / ties used in design are based on correct installation in accordance with manufacturer's details and the implementation of proof tests in accordance with NASC T64:(Current) to ensure suitability of building strata. A minimum of 5% of the total number of anchors/ties should be tested to the values indicated in 'LOADINGS' notes. It is the responsibility of the Principal Contractor or Project Management Team to ensure approval of loads is sought from a structural engineer - CREATOR Ltd cannot take responsibility for the existing structure and its load



Hazard:	Initial Risk			Risk Control Measures:	Residual Risk		
	P	R	L		P	R	L
Inaccuracies in the visual representation and detailing of existing 'structure' and ground based obstacles etc.	C	1	M	Accuracies to be checked on site and any discrepancies made aware of to Creator Ltd as erection progresses.	C	1	M
Excessive bay sizes installed during erection process causing structural failure of various members.	C	4	S	Bay sizes indicated to be maintained with the tolerances level indicated on the design. This tolerance should not be the norm for all bays. The maximum design service load indicated to be managed by the principal contractor and all loads indicated on the Scafftag	C	1	M
Failure of the scaffold during the in-use phase caused by overloading.	A	4	M	Maximum design service load indicated to be managed by the principal contractor and all loads indicated on the Scafftag	A	3	L
Excessive lift heights installed during erection causing buckling of the uprights.	C	4	S	Maximum lift heights to be installed by the scaffold contractor as detailed in the design ±100mm.	A	3	L
Unauthorised access onto/into the scaffold structure	D	3	S	Where appropriate, ladder access will be installed and dismantled when required. Where indicated on the design, hoarding will be installed by the principal contractor.	A	3	L
Damage to the scaffold structure caused by on-site works or otherwise.	B	4	H	The principal contractor is to ensure all relevant procedures are in place when site vehicles are operating in close proximity of the scaffold structure.	A	3	L
Overloading of existing structure due to the need to support the scaffold structure.	B	4	H	All loads to the existing structure(s) will be checked by a structural engineer before erecting the scaffold.	A	3	L
Failure of the existing bearing stratum by means of: exceeding the bearing stratum, immediate settlement, consolidation settlement, saturated soils etc.	C	4	S	The maximum legloads and reactions should be appraised by the principal contractor. All founded on hardstanding.	A	3	L
Instability of scaffold boards to main boarded deck(s) during all stages i.e. in-use and out-of-use.	A	4	M	All boards to be secured down against uplift using board clips or similar.	A	4	M
Instability of ladder access and the ability for persons to fall as a result. Also, falls as a result of no handrails adjacent to ladder access.	B	4	H	Ladder to be effectively secured against movement and access gate provided adjacent to the ladder access	A	1	L
Insufficient board bearers (transoms) causing boards to fail under maximum design service load	A	4	M	Transoms to be installed at positions / centres indicated on the design	A	3	L
Boards of insufficient 'quality' to sustain maximum design service load (defects in boards such as rotting, 'cuf' etc)	C	4	S	Boards should be visually inspected regularly to ensure they are of sufficient 'quality' to sustain the loads. Boards of insufficient quality should be replaced.	A	3	L
Materials / objects falling from boarded deck level / persons passing through void between intermediate guardrail and deck	A	5	M	Toeboards to be secured to leading edges and double guardrails installed where falls from height are possible	A	1	L
Materials / objects falls through scaffold into a pedestrianised area or other area causing damage / injury to persons / objects.	B	5	H	Toeboards to be secured to leading edges and double guardrails installed where falls from height are possible. A protective polythene layer is to be installed between boards.	B	1	L
Falls from height / gaps in decking members	B	5	H	Double guardrails installed where falls from height are possible. Gaps to be a maximum of 25mm except between any inside board and main boards which should be 50mm	B	1	L
Coupler of insufficient tightness, grade and quality	C	5	S	Couplers to be manufactured to EN74 and should be tightened to a 50Nm torque. Couplers should be undamaged	C	1	M
Collision of vehicles with scaffold	C	5	S	Demarcation to be implemented. To prevent collision temporary vehicle crash barriers to be installed by the principal contractor.	C	1	M

CREATOR
SCAFFOLD DESIGNS
& TEMPORARY WORKS CONSULTANTS LTD

Company Address:
Pulverton House, Pulverton Road,
Barnstaple, SA6 1DH
Contact Details:
Email:
enquiries@creator-scaffoldsdesigns.co.uk
Tel: 0114 3610050
www.creator-scaffoldsdesigns.co.uk

Notes

CProb of 0.83 taken as a temporary works reduction factor
for a design life of less than 2 years as per Cl. 4.2.3 of NASC TG20:21, L.3.5
of BS 5975:2019 and Cl. 8.2.4.1 of BS EN 12811-1:2013.

Peak velocity pressure calculation to BS EN 1991-1-4:2005+A1:2010 and UK national annex

VelVenti v2.9 (build 266) Copyright © 2023 Computer and Design Services Ltd.

Description	Value
Site location	53.476937°N -2.231962°E
Fundamental basic wind velocity, $V_{b,map}$ (m/s)	22.7
Site altitude, A (m)	51
Seasonal factor is based on all year.	
Probability factor, C_{prob}	0.84 ★
Altitude factor, C_{alt}	1.049
Orography	Not significant
The site is in town terrain	
Distance inside town terrain (km)	1.66
Effective height, z_e (m)	20.0
Exposure correction factor, $C_{e,T}$	0.96
Peak velocity, V_p (m/s)	32.6

(Figure NA.1)

(NA.2.8)

(NA.2.5)

(A.5)

(Figure NA.8)

Description	Value
OS grid reference	SJ 84702 97826
Structure height, h (m)	20.00
Structure orientation from North (°N)	0
Seasonal factor, C_{season}	1.00
Directional factor, C_{dir}	0.99
Local effects factor, K_f	1.00
Orography factor, C_o	1.000
Distance to shoreline (km)	48.51
Displacement height, h_{dis} (m)	0.0
Exposure factor, C_e	2.83
Zone for size factor, C_s	C
Peak velocity pressure, q_p (kN/m ²)	0.652

(Table NA.2)

(Table NA.1)

(A.3(4))

(A.3)

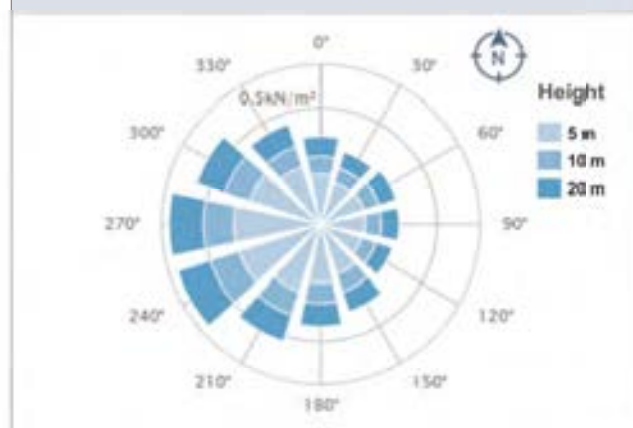
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(Figure NA.7)

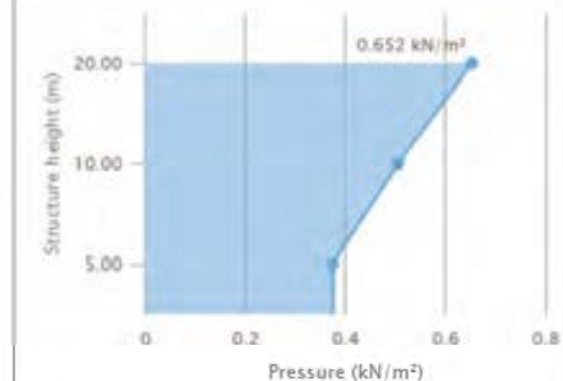
(NA.8)

(NA.2.17)

Pressure variation across compass directions



Pressure variation with height in dominant wind direction (270°)



Peak velocity pressure variation with height across all wind directions



GLOBAL CONSTRUCTION
SOFTWARE AND SERVICES

Project no: CRE-IBN-160-008

Prepared by: HANAN AMEEN

Checked by: KARL BIRD

Site reference: London Road, Greater Manchester, M1 2PH, UK

Calculation no:

Date: 30-04-2024

Page no: 2

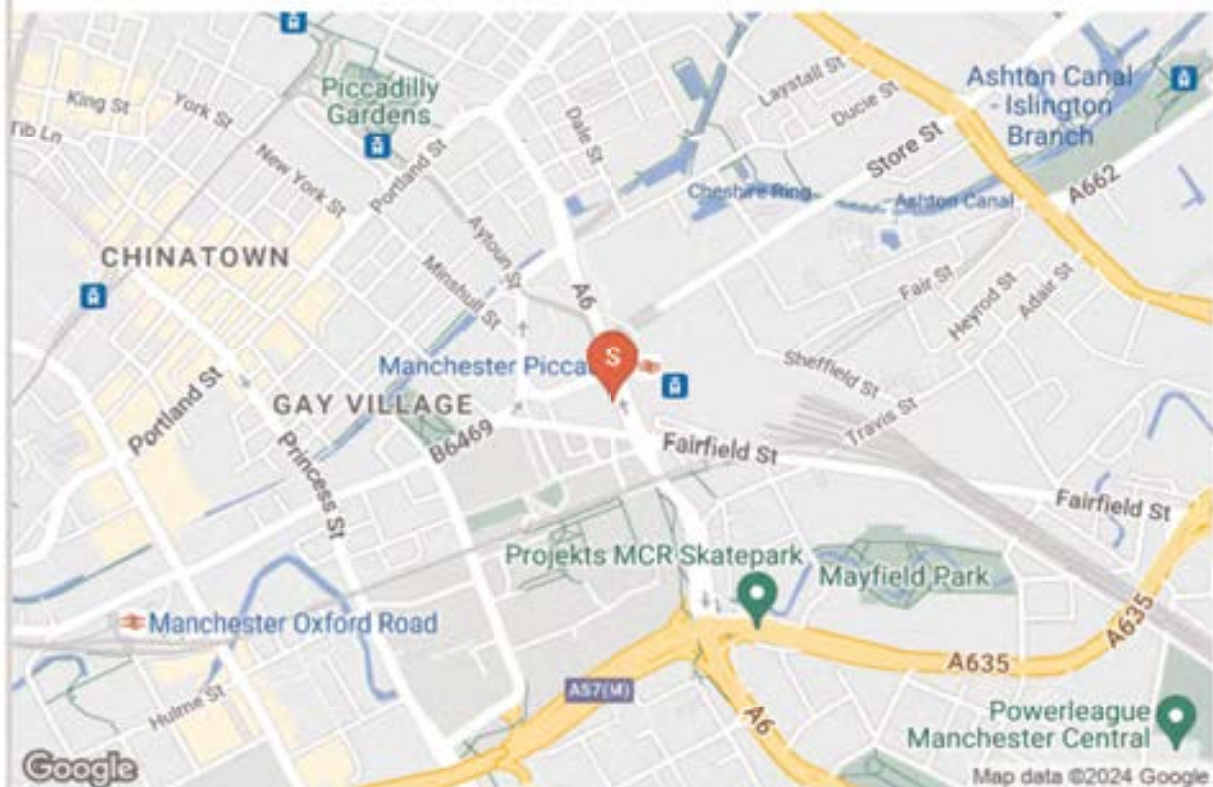
Structure height/Direction	Peak velocity pressure (kN/m ²)											
	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12
	0°	30°	60°	90°	120°	150°	180°	210°	240°	270°	300°	330°
5.0 m	0.216	0.187	0.195	0.193	0.136	0.224	0.250	0.301	0.371	0.374	0.322	0.259
10.0 m	0.291	0.252	0.264	0.261	0.250	0.302	0.337	0.405	0.501	0.505	0.434	0.349
20.0 m	0.376	0.326	0.341	0.337	0.323	0.390	0.435	0.524	0.647	0.652	0.561	0.451

Snow load according to BS EN 1991-1-3 A1:2015 and UK national annex

Description	Value
Characteristic snow load at 100 m altitude (kN/m ²)	0.50
Characteristic ground snow load, S_k (kN/m ²)	0.50

★ Denotes a user input in place of a value provided by the software.

Site Location - Latitude: 53.476937, Longitude: -2.231962





CREATIVE ENGINEERING WITH COMPLETE CUSTOMER FOCUS
IN MIND

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CALCULATIONS

Report Prepared For: IBN SCAFFOLD ACCESS LTD

Design Reference / Site Reference: LONDON ROAD FIRE STATION

Site Address: **ADVERTISEMENT SCAFFOLD**
LONDON ROAD
MANCHESTER
M1 2PH

Document Reference Number: CRE-IBN-160-008A

DOCUMENT ISSUE STATUS: FOR CONSTRUCTION

REVISIONS

Revision	Prepared	Date	Checked	Date	Approved	Date	Issue Status
-	HA	30/04/2024	RWB	30/04/2024	KRB	30/04/2024	FOR CONSTRUCTION
Revision Description: First issue.							
A	SLB	20/06/2024	KRB	20/06/2024			FOR CONSTRUCTION
CONSIDER THE TIES							

DOCUMENT SIGNATORIES / CATI CHECK CERTIFICATE

We certify that reasonable professional skill and care has been used in the preparation of this document and in the checking and approval process with a view to securing that:

1. It has been prepared and checked in accordance with the following standards, policies and procedures:

Creator Ltd. Document QM.CRE.2014.02
BS 5975:2019
NASC TG20:21
Full relevant Eurocode suite and other supporting standards

2. All requirements have been accurately translated and incorporated within this document and other associated documents, listed herein, all of which have been checked in accordance with Creator Ltd Quality Management System. The unique reference numbers of the documents which have been checked are:

CRE-IBN-160-008A_CALC
APPENDIX A - CRE-IBN-160-008A-1,2,3,4,5_DRG
APPENDIX B - CRE-IBN-160-008A_WIND

Prepared By:

Name	Scott Blackmore
Position	Trainee Design Engineer
Signed	<i>Scott Blackmore</i>
Date	20/06/2024
Engineering Qualifications	X

Checked By:

Name	Karl Bird
Position	Director
Signed	<i>Karl Bird</i>
Date	20/06/2024
Engineering Qualifications	MEng (Hons)

PROJECT STATUS: FOR CONSTRUCTION

GENERAL NOTES - BASIS OF DESIGN

The approach adopted for the analytical analysis of the temporary structure will be the Limit State approach applying partial safety factors for actions and materials in accordance with the Eurocode Suite and BS EN 12811-1. The following partial safety factors will be used in the design;

Partial Safety Factors for Actions, γ_F :

Verification	γ_G (Unfavourable)	γ_G (Favourable)	γ_Q (Unfavourable)	γ_Q (Favourable)
BS EN 12811-1 (10.3.2)	1.50	1.00	1.50	1.00
Ultimate (EN 1990 Eq. 6.10)	1.35	1.00	1.50	1.00
Servicability (EN 1990 Eq. 6.14a/b)	1.00	1.00	1.00	1.00
Accidental (EN 1990 Eq. 6.11a/b)	1.00	1.00	1.00	1.00

Where partial safety factors differ either by requirement of codes or by engineering judgement these will be described and explained within the relevant section.

48.3mm CHS (SCAFFOLD TUBE) CHARACTERISTIC PROPERTIES (STEEL)

The following cross-sectional properties have been calculated for standard 48.3mm CHS steel scaffold tube. These properties will then be applied to enable the ultimate capacities to be calculated for use in design.

Steel Circular Hollow Section Dimensions and Properties

		British Standard Reference	
		BS EN 39 (As New) (Type 3)	BS EN 39 (As New) (Type 4)
Section Designation	d (mm)	48.3	48.3
	t (mm)	3.20	4.00
Mass per Metre (kg/m)		3.56	4.37
Cross-Sectional Area, A (cm ²)		4.53	5.57
Ratio for Local Buckling d/t		15.1	12.1
2 nd Moment of Area, I (cm ⁴)		11.6	13.8
Radius of Gyration, i (cm)		1.60	1.57
Elastic Modulus, W _{el} (cm ³)		4.80	5.70
Plastic Modulus, W _{pl} (cm ³)		6.52	7.87
Modulus of Elasticity, E (N/mm ²)		210000	

BS EN 39 tube of grade S235 steel. Characteristic tensile strength 340N/mm² < R_m < 502N/mm²

All tube is structural HFCHS (hot finished)

For CHS tolerances see BS EN 39

Circular hollow section classification check (EN 1993-1-1);

Class 1 section = $d / t \leq 50\epsilon^2$ where;

$$\epsilon = \sqrt{(235 / f_y)} = 1.000$$

$$50\epsilon^2 = 50$$

Therefore in both cases the scaffold tube satisfies Class 1 section classification

Ultimate bending moment resistance, $M_{pl,Rd} = (W_{pl} \times f_y) / \gamma_{M0}$

		British Standard Reference	
		BS EN 39 (As New) (Type 3)	BS EN 39 (As New) (Type 4)
Yield Strength, f_y (N/mm ²)		355	235
Partial Safety Factor for Material (EN 1993-1-1)		1.00	
Ultimate Bending Resistance, $M_{pl,Rd}$ (kNm)		2.315	1.850

Ultimate shear force resistance, $V_{pl,Rd} = A_v \times (f_y / \sqrt{3}) / \gamma_{M0}$ where;

Shear area, $A_v = 2A / \pi$

	British Standard Reference	
	BS EN 39 (As New) (Type 3)	BS EN 39 (As New) (Type 4)
Shear Area, A_v (cm ²)	2.89	3.54
Yield Strength, f_y (N/mm ²)	355	235
Partial Safety Factor for Material (EN 1993-1-1)	1.00	
Ultimate Shear Force Resistance, $V_{pl,Rd}$ (kN)	59.16	48.08

Any tube that is showing signs of defects and/or is pitted and rusty should not be used. The design herein is based on "as new" with no loss of wall thickness.

As Type 4 tube is most common the following ultimate values of resistance will be used in the design;

$M_{pl,Rd} =$	1.850 kNm	$V_{pl,Rd} =$	48.08 kN
---------------------------------	------------------	---------------------------------	-----------------

SCAFFOLD BOARDS AND TIMBER BATTENS

The table below describes the different timber scaffold boards to be used as per BS 2482.

British Standard Reference	Section Designation		Support Centres (mm)	Ultimate Moment Capacity (kNm)
	b (mm)	h (mm)		
BS 2482	225	38	1200	0.77
BS 2482	225	38	1500	1.19
BS 2482	225	63	2500	2.10

Because of the nature of timber and the factors affecting its performance the values of bending strength obtained by testing in accordance with BS 2482 C.2 ought not be used as design values.

As the above values ought not be used as design values we will check the ultimate resistance values using methods described in EN 1995-1-1 for the most commonly used timber scaffold board currently used in industry.

Timber Section Dimensions and Properties;

Section Designation	b (mm)	225.0
	h (mm)	38.00
Cross-Sectional Area, A (cm ²)		85.50
2 nd Moment of Area	I_{xx} (cm ⁴)	102.9
Elastic Section Modulus	W_{xx} (cm ³)	54.15
Radius of Gyration	i_y (cm)	1.097

Material Properties of Timber (Table 1 EN 338)

Timber Grade	C24
Bending, f_{mk} (N/mm ²)	24.0
Shear, f_{vk} (N/mm ²)	2.50
Mean Modulus of Elasticity Parallel to Grain, $E_{0,mean}$ (kN/mm ²)	11.00

The tabulated properties are compatible with timber at a moisture content consistent with a temperature of 20°C and a relative humidity of 65%.

Duration of Load and Service Class [BS EN 1995-1-1]

Load Duration Class [Table 2.1 & 2.2 BS EN 1995-1-1]	Medium Term
Service Class [2.3.1.3 BS EN 1995-1-1]	Service Class 3
Modification Factor, k_{mod} [Table 3.1 BS EN 1995-1-1]	0.65

Lateral Torsional Buckling Check (Table 4.3 of IStructE Manual for the Design of Timber Buildings to Eurocode 5)

Depth, $h =$	38.00 mm
Breadth, $b =$	225.0 mm
Depth to Breadth ratio =	0.169
Lateral Support Scenario =	None

Maximum Ratio = 2
Beam not prone to lateral torsional buckling.

Ultimate Bending Moment Resistance

Design Bending Strength, $f_{m,d} = k_{mod} \times k_h \times f_{m,k} / \gamma_M$ (2.4.1 BS EN 1995-1-1)

Where;

$k_h = \text{lesser of either } (150 / h)^{0.2} \text{ or } 1.3 = 1.3$

$\gamma_M = 1.3 \text{ for solid timber}$

Design Bending Strength = 15.60 N/mm²

Ultimate Bending Moment, $M_{ult} = f_{m,d} \times W_{yy}$

Ultimate Bending Moment, $M_{ult} = 0.845 \text{ kNm}$

Ultimate Shear Force Resistance

Design Shear Strength, $f_{v,d} = k_{mod} \times f_{v,k} / \gamma_M$ (2.4.1 BS EN 1995-1-1)

Design Shear Strength = 1.250 N/mm²

Ultimate Shear Force, $V_{ult} = f_{v,d} \times b \times h_{ef} / 1.5$ re-arranged from;

Shear Stress, $\tau_d = 1.5 \times V / b \times h_{ef}$

Where;

$\tau_d = f_{v,d} = 1.250 \text{ N/mm}^2$

Ultimate Shear Force, $V_{ult} = 7.125 \text{ kN}$

COUPLERS (ULTIMATE VALUES OF RESISTANCE)

The below table includes resistance values obtained from Table 8 of EN 74-1.

Coupler Type	Parameter	Coupler Class	
		A	B
Right Angled Coupler, RA (Double Coupler)	Slipping Force	10.0 kN	15.0 kN
	Rotational Stiffness	-	7.50 kNm/rad
	Cruciform Bending	-	1.60 kNm
Swivel Coupler (SW)	Slipping Force	10.0 kN	15.0 kN
Sleeve Coupler (SF)	Slipping Force	6.00 kN	9.00 kN
	Bending Moment	-	1.40 kNm
Other / Unclassified			
Gravlock/Girder Coupler	Slipping Force	Along the Flange	16.5 kN
		Against the Flange	10.0 kN
		Away from the Flange	49.5 kN

BEAMS (ULTIMATE VALUES OF RESISTANCE)

The below table includes resistance values obtained from the suppliers for different types of beams.

Beam Type	Restraint Arrangement	Ultimate Bending Moment Resistance (kNm)	Ultimate Shear Force Resistance (kN)

SELF WEIGHTS / PERMANENT ACTIONS

Tube & Fitting Components

Component	Units	Self Weights (SLS)	Factored Self Weights (ULS)
48.3mm x 4.0mm CHS Steel Scaffold Tube	kN/m	0.043	0.064
38mm Timber Scaffold Board	kN/m ²	0.245	0.368
9mm Plywood	kN/m ²	0.053	0.080
Right Angled Coupler	kN	0.012	0.018
Swivel Coupler	kN	0.013	0.0195
Single Coupler	kN	0.010	0.015
Sleeve Coupler	kN	0.010	0.015
Band & Plate Coupler	kN	0.020	0.030
Typical Beam Arrangement (obtained below)	kN/m ²	0.228	0.342
N/A	N/A	0.000	0.000

Note 1: Ultimate bending moment resistance value predominantly used in design =

1.850 kNm

Note 2: Ultimate shear force resistance value predominantly used in design =

48.1 kN

Beam Configuration Self Weight Calculations

Consider: 2.000 m width x 2.000 m length = 4.000 m ² area				
Component	Length (m)	No.	Unit Self Weight (SLS)	Lineweight (kN)
Prefab. Beams	2.000	2.000	0.050 kN/m	0.200
Lacing Tubes	2.000	3.000	0.043 kN/m	0.258
Bracing Tubes	4.000	2.000	0.043 kN/m	0.344
RA Coupler		8.000	0.012 kN	0.096
SW Coupler		1.000	0.013 kN	0.013
Total Lineweight =				0.911
Beam Self Weight = Total Lineweight / Area =				0.23 kN/m ² (Unfactored)

CONSIDER THE WIND LOADING

REFER: CRE-IBN-160-008_WIND

Peak Velocity Pressure = 0.652 kN/m² (Unfactored)
Equivalent wind speed = 72 mph

CONSIDER THE SNOW LOADING

Using both BS EN 1991-1-3 and TG9:current we will obtain the design snow load, S_d.

Design snow load, S_d = S_k x μ

Characteristic ground snow load, S_k (kN/m²) = 0.2 + 0.1Z + (A - 100) / 525

S _k (kN/m ²)	Shape Coefficient, μ ^[3]	Design Snow Load, S _d (kN/m ²)
0.500	0.8	0.400

Note 1: S_{sk} is obtained from Figure D.1 of TG9:current or Figure C.9 of BS EN 1991-1-3

Note 2: Z = 10 x S_{sk} - 2

Note 3: μ is obtained from Table D.1 of TG9:current or Table 5.2 of BS EN 1991-1-3

The design snow load, S_d is based on an annual probability of exceedence of 0.02 (1 in 50 years).

Due to the temporary nature of the structure we will take a reduction on this by using expression D.1 from BS EN 1991-1-3 where S_n is the ground snow load with a probability of exceedence of n years.

$$S_n = S_k \left\{ \frac{1 - \sqrt[6]{\frac{\ln(-\ln(1 - P_n)) + 0.57722}{\pi}}}{(1 + 2.5923P_n^2)} \right\}$$

The value of S_n will also be multiplied by the shape coefficient stated above.

S _k (kN/m ²)	Coefficient of Variation, V ^[1]	Return Period, n (years)	Annual Probability of Exceedence, P _n	μ	S _n (kN/m ²)
0.500	0.8	10	0.1	0.8	0.266

Note 1: The coefficient of variation stated above is the average for 18 european countries

SUMMARY OF ACTIONS

Design Service Loads	Units	SLS	ULS	No. of Levels Loaded
Design Service Load 1;	kN/m ²	0.750	1.125	1.000
Design Service Load 2;	kN/m ²	0.750	1.125	1.000
Design Service Load 3;	kN/m ²	0.000	0.000	0.000
Design Service Load 4;	kN/m ²	0.000	0.000	0.000
Inside Board Design Service Load;	kN/m ²	0.750	1.125	2.000
Point Load to Deck;	kN	0.000	0.000	
Fan Design Service Load;	kN/m ²	0.000	0.000	0.000
Other				
Wind Loading;	kN/m ²	0.652	0.978	
Working Wind Loading ^[1] ;	kN/m ²	0.200	0.300	
Snow Loading;	kN/m ²	0.266	0.399	
Horizontal Force in Absence of Wind ^[2] ;	kN	0.300	0.450	
Horizontal Handrail Force ^[2] ;	kN	0.300	0.450	
N/A	N/A	0.000	0.000	0.000

Note 1; Value obtained from part 6.2.7.4.2 of BS EN 12811

Note 2; Value obtained from part 6.2.5.2 of BS EN 12811

Accidental Loads	Units	SLS	ULS	No. of Levels Loaded
Vertical Guardrail Load ^[1]	kN	1.250	1.250	
N/A	N/A	0.000	0.000	0.000

Note 1; Value obtained from part 6.2.5.1 of BS EN 12811

CONSIDER THE BOARDS AS DECKING MEMBERS

Consider the Worst Case Loading;

Load Type	Units	SLS	ULS	
Permanent Actions;				
38mm Timber Scaffold Board	kN/m ²	0.245	0.368	SINGLE BOARDS NO COVER
9mm Plywood	kN/m ²	0.000	0.000	
Variable Actions;				
Maximum Design Load	kN/m ²	1.500	1.125	
Point Load to Deck	kN	0.000	0.000	
F ₁ (500mm Along the Length) ^[1]	kN/m	3.000	4.500	1.5kN Total
F ₂ (200mm x 200mm) ^[2]	kN/m	5.000	7.500	1.0kN Total

[1] BS EN 12811-1 Clause 6.2.2 specifies a load to act over a 500mm x 500mm area. Scaffold boards are less than 500mm wide so we have assumed an equivalent UDL acting over 500mm giving the total value specified.

[2] BS EN 12811-1 Clause 6.2.2 specifies a load to act over a 200mm x 200mm area. As scaffold boards are very nearly 200mm wide in total we have assumed an equivalent UDL acting over 200mm giving the total value specified.

BS EN 12811-1 Clause 6.2.2 only gives guidance up to load class 6 (6.0kN/sq.m). For any load greater than load class 6 we will adopt the maximum from the guidance.

Consider the Ultimate Checks;

Design Load;

Maximum moment =
$$\frac{wL^2}{8} + \frac{PL}{4}$$

Single board width = 0.225 m

Total uniformly distributed load, w = 0.336 kN/m (Factored)

Point load to deck, P = 0.000 kN (Factored)

Distance between supports, L = 1.200 m

Maximum moment =
$$\frac{0.336 \times 1.200^2}{8} + \frac{0.000 \times 1.200}{4} = 0.060 \text{ kNm}$$

Maximum moment = 0.060 kNm

PASS - Calculated bending moment is less than the ultimate bending moment capacity.

Maximum shear force =
$$\frac{wL}{2} + P$$

Total uniformly distributed load, w = 0.336 kN/m (Factored)

Point load to deck, P = 0.000 kN (Factored)

Distance between supports, L = 1.200 m

Maximum shear force =
$$\frac{0.336 \times 1.200}{2} + 0.000 = 0.201 \text{ kN}$$

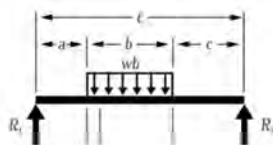
Maximum shear force = 0.201 kN

PASS - Calculated shear force is less than ultimate shear force capacity.

F₁;

Bending moment due to self weight only = 0.066 kNm

We will now assume that, for the worst case bending moment, the UDL will be central to the span.



$$R_1 = V_1 \text{ (max when } a < c) = \frac{wb}{2L}(2c + b)$$

$$M_{\text{max}} \left(\text{at } x = a + \frac{R_1}{w} \right) = R_1 \left(a + \frac{R_1}{2w} \right)$$

Reaction = 1.125 kN

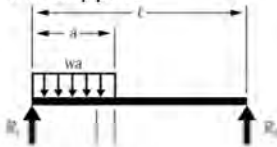
Maximum moment = 0.534 kNm

Maximum moment = 0.601 kNm

PASS - Calculated bending moment is less than the ultimate bending moment capacity.

Shear force due to self weight only = 0.221 kN

We will now assume that, for the worst case shear force, the UDL will act immediately adjacent to the support.



$$R_1 = V_1 = \dots = \frac{wa}{2l}(2l - a)$$

Shear force = 2.969 kN

Maximum shear force = 3.189 kN

PASS - Calculated shear force is less than ultimate shear force capacity.

F₂:

Bending moment due to self weight only = 0.066 kNm

We will now assume that, for the worst case bending moment, the UDL will be central to the span.

Reaction = 0.75 kN

Maximum moment = 0.413 kNm

Maximum moment = 0.479 kNm

PASS - Calculated bending moment is less than the ultimate bending moment capacity.

Shear force due to self weight only = 0.221 kN

We will now assume that, for the worst case shear force, the UDL will act immediately adjacent to the support.

Shear force = 1.375 kN

Maximum shear force = 1.596 kN

PASS - Calculated shear force is less than ultimate shear force capacity.

Consider the Serviceability Checks:

$$\text{Maximum deflection, } \delta \text{ (mm)} = \frac{5wL^4}{384EI} + \frac{PL^3}{48EI}$$

Single board width =

225 mm

Total uniformly distributed load, w =

3.4E-04 kN/mm (Unfactored) (neglecting self weights of timber)

Point load to deck, P =

0.000 kN (Unfactored)

Distance between supports, L =

1200 mm

Modulus of elasticity, E =

11.000 kN/mm²

Second moment of area, I =

1.03E+06 mm⁴

Deflection, δ =

5	x	3.4E-04	x	2.07E+12
384	x	11.000	x	1.03E+06
+				
0.000	x	1.73E+09		
48	x	11.000	x	1.03E+06

Deflection, δ =

0.805 mm

Deflection limit =

Span	=	12.000 mm
100		

PASS - Calculated maximum deflection is less than specified deflection limit.

CONSIDER THE BOARD TRANSOMS

Consider the Worst Case Loading;

Load Type	Units	SLS	ULS	
Permanent Actions;				
38mm Timber Scaffold Board	kN/m ²	0.245	0.368	SINGLE BOARDS
9mm Plywood	kN/m ²	0.000	0.000	NO COVER
Variable Actions;				
Maximum Design Load	kN/m ²	0.750	1.125	
Point Load to Deck	kN	0.000	0.000	

Consider the Ultimate Checks;

Maximum moment =

Maximum moment =	$\frac{wL^2}{8}$	+	$\frac{PL}{4}$				
	8		4				
Transom centres =	1.200	m					
Total uniformly distributed load, w =	1.791	kN/m (Factored)					
Point load to deck, P =	0.000	kN (Factored)					
Width of scaffold, L =	1.200	m					
Number of transoms at node =	1.000	no. (Resistance values are multiplied by the number)					
Maximum moment =	1.791	x	1.44	+	0.000	x	1.200
		8				4	

Maximum moment = 0.322 kNm

PASS - Calculated bending moment is less than the ultimate bending moment capacity.

Maximum shear force =

Maximum shear force =	$\frac{wL}{2}$	+	P	
Total uniformly distributed load, w =	1.791	kN/m (Factored)		
Point load to deck, P =	0.000	kN (Factored)		
Width of scaffold, L =	1.200	m		
Maximum shear force =	$\frac{1.791 \times 1.200}{2}$	+	0.000	

Maximum shear force = 1.075 kN

PASS - Calculated shear force is less than ultimate shear force capacity.

Consider the Serviceability Checks;

Maximum deflection, δ (mm) =	$\frac{5wL^4}{384EI}$	+	$\frac{PL^3}{48EI}$		
Transom centres =			1200	mm	
Total uniformly distributed load, w =			1.19E-03	kN/mm (Unfactored)	
Point load to deck, P =			0.000	kN (Unfactored)	
Width of scaffold, L =			1200	mm	
Modulus of Elasticity, E =			210	kN/mm ²	
Second moment of area, I =			1.38E+05	mm ⁴	
Deflection, δ =	5	x	1.19E-03	x	2.07E+12
	384	x	210	x	1.38E+05
			+		
		0.000	x	1.73E+09	
	48	x	210	x	1.38E+05
Deflection, δ =			1.115	mm (Deflection divided by number of transoms)	
Deflection limit =	Span	=	12.000	mm	
	100				

PASS - Calculated maximum deflection is less than specified deflection limit.

CONSIDER THE LEDGERS

Consider the Worst Case Loading;

Load Type	Units	SLS	ULS	
Permanent Actions;				
38mm Timber Scaffold Board	kN/m ²	0.245	0.368	SINGLE BOARDS
9mm Plywood	kN/m ²	0.000	0.000	NO COVER
Variable Actions;				
Maximum Main Board Design Load	kN/m ²	0.750	1.125	
Maximum Inside Board Design Load	kN/m ²	0.750	1.125	
Point Load to Deck	kN	0.000	0.000	

Consider the Ultimate Checks;

Shear forces will be neglected from this section as the bending moment will always be the critical strength property with regards to the ledgers.

Maximum moment due to point load =

PL

5

Scaffold arrangement =

DOUBLE WIDTH

Number of Inside Boards =

2.000 No.

Main Boards

Main Boards

Inside Boards

A	1.200	B	1.200	C	0.45
Reaction at node (kN) = Transom Centres (m) x Width over Node (m) x Actions over Node (kN/m ²)					
Reaction at A =	1.200	x	0.600	x	1.493
Reaction at A =	1.075 kN (Factored)				
Reaction at B =	1.200	x	1.200	x	1.493
Reaction at B =	2.149 kN (Factored)				
Reaction at C =	1.200	x	0.600	x	1.493
			+		
	1.200	x	0.45	x	1.493

Reaction at C = 1.881 kN (Factored)

Maximum reaction (kN) = Maximum Reaction at Node (kN) + Point Load to Deck (kN)

Maximum reaction = 2.149 + 0.000 = 2.149 kN (Factored)

We will now re-arrange the bending moment equation in terms of L to find the maximum span.

$$1.850 = \frac{2.149 L}{5} \quad \text{Therefore; } L_{\max} = 2.600 \text{ m}$$

$$L_{\text{design}} = 2.000 \text{ m}$$

PASS - Intended ledger span is less than maximum possible calculated ledger span

Consider the Connection Properties;

The maximum load concentrated at the connection is the maximum value at point B or C dependent upon the scaffold arrangement.

Maximum width of main boards over connection =

1.200 m

Maximum width of inside boards over connection =

0 m

Total load at the connection = 3.582 + 0.000 + 0.000

Total load at the connection = 3.582 kN (Factored)

PASS - Total load is less than the slipping capacity of an EN74 Class A double coupler.

CONSIDER THE GUARDRAILS

SOLIDLY CLAD

Case 1 - Fall Prevention and Working Wind;

Load Type	Units	SLS	ULS
Permanent Actions;			
48.3mm x 4.0mm CHS Steel Scaffold Tube	kN/m	0.043	0.064
Variable Actions;			
Working Wind Loading	kN/m ²	0.200	0.300
Horizontal Handrail Force	kN	0.300	0.450

Shear forces will be neglected from this section as the bending moment will always be the critical strength property with regards to the guardrails.

Maximum moment =

$$wL^2$$

+

$$PL$$

8

4

Uniformly distributed load, w = Working wind load (kN/m²) x Pressure coefficient x Containment x Width over guardrail (m)

Pressure coefficient =

1.200

Containment =

1.000

Width over guardrail =

1.0000 m

$$1.850 = 0.053 L^2 + 0.1125 L$$

Using the quadratic equation we will solve to find the maximum possible guardrail span;

$$\text{if; } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

-0.113	+	0.636	=	4.940 m
-0.1125	+	0.636	=	7.061 m
		0.106		

Maximum guardrail span for fall prevention and working wind = 4.940 m

Case 2 - Full Wind;

Load Type	Units	SLS	ULS
Permanent Actions;			
48.3mm x 4.0mm CHS Steel Scaffold Tube	kN/m	0.043	0.064
Variable Actions;			
Full Wind Loading	kN/m ²	0.652	0.978

Maximum moment =

$$wL^2$$

8

Uniformly distributed load, w = Full wind load (kN/m²) x Pressure coefficient x Containment x Width over guardrail (m) where values have been defined above.

$$1.850 = 0.155 L^2$$

Maximum guardrail span for full wind loading = 3.457 m

Case 3 - Accidental Vertical Action;

Load Type	Units	SLS	ULS
Accidental Actions;			
Vertical Guardrail Load	kN	1.250	1.250

Only accidental loads will be adopted in this design consideration as the structure is not deemed as serviceable after an accidental event. A full inspection of the area is to be carried out and any amendments required are to be made prior to returning to a serviceable state.

Maximum moment =

$$PL$$

4

$$1.850 = 0.313 L$$

Maximum guardrail span for accidental vertical actions = 5.919 m

Case 4 - Maximum Allowable Deflection:

The deflection limits for an edge protection system will only be relevant during the 'In Service' phase therefore the following serviceable (SLS) loads apply:

Load Type	Units	SLS	ULS
Variable Actions:			
Working Wind Loading	kN/m ²	0.200	0.300
Horizontal Handrail Force	kN	0.300	0.450

Permanent actions have been neglected from this consideration.

$$\text{Maximum deflection, } \delta \text{ (mm)} = \frac{PL^3}{48EI}$$

Point load, P = ((Working wind load (kN/m²) x Pressure coefficient x Containment x Width over guardrail (m)) x Maximum handrail span (m)) + Horizontal handrail force (kN) where values have been defined above.

Pressure coefficient =

1.200

Containment =

1.000

Width over guardrail =

1.0000 m

Minimum guardrail length =

3.457 m

Point load, P =

1.130 kN (Unfactored)

Modulus of Elasticity, E =

210 kN/mm²

Second moment of area, I =

1.16E+05 mm⁴

Maximum allowable deflection =

35 mm

$$35 = \frac{9.67E-10 L^3}{48EI}$$

Maximum guardrail span when 'In Service' = 3.307 m

Maximum allowable guardrail span for use in the design = 3.307 m

Actual guardrail span used in the design = 2.000 m

PASS - Actual guardrail span is less than maximum allowable guardrail span

CONSIDER THE UPRIGHTS

When considering the uprights the following combinations apply:

- In service ultimate axial compression = Permanent action @ ULS + Variable action @ ULS
- Out of service ultimate axial compression = Permanent action @ ULS + Variable action @ SLS
- In service actual axial compression = Permanent action @ SLS + Variable action @ SLS
- Out of service actual axial compression = Permanent action @ SLS + Variable action @ SLS

INSIDE UPRIGHT

Inside Boards? 2.000 no.

Tube Self Weight per Node:

Number	Tube	Length (m)	Total Length (m)	Self Weight (kN/m)	Total Self Weight (kN)
1.000	Upright	2.000	2.000	0.0429	0.086
1.000	Ledger	2.000	2.000	0.0429	0.086
1.000	Transom	1.050	1.050	0.0429	0.045
3.000	Board Transom	1.050	3.150	0.0429	0.135
1.000	Ledger Brace	1.414	1.414	0.0429	0.061
1.000	Facade Brace	1.414	1.414	0.0429	0.061
0.000	Handrails	2.000	0.000	0.0429	0.000

Coupler Self Weight per Node:

Number	Coupler	Self Weight (kN)	Total Self Weight (kN)
2.000	Right Angled Coupler	0.012	0.024
2.000	Swivel Coupler	0.013	0.026
3.000	Single Coupler	0.010	0.030
1.000	Sleeve Coupler	0.010	0.010

Unfactored tube and coupler self weight per node = 0.563 kN (Unfactored)

Board Self Weight per Node:

Board self weight =	0.245 kN/m ² (Unfactored)
Length of boards =	2.000 m
Number of boards =	3.500 no.
Single board width =	0.225 m
Area over node =	1.575 m ²
Board self weight per node =	0.386 kN (Unfactored)

Variable Action per Node - Main Boards:

Length over node = 2.000 m
Width over node = 0.600 m
Area over node = 1.200 m²

	Unfactored Area Load (kN/m ²)	Total Load per Node (kN)
Design Service Load [1]	0.750	0.900
Design Service Load [2]	0.750	0.900

Variable Action per Node - Inside Boards:

Length over node =	2.000 m
Number of inside boards over node =	2.000 no.
Single board width =	0.225 m
Area over node =	0.900 m ²

	Unfactored Area Load (kN/m ²)	Total Load per Node (kN)
Inside Board Design Service Load	0.750	0.675

Load due to Other;

7 kN (Unfactored)

Unfactored In Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.563	4.221
8.000	Board Self Weight	0.386	3.087
1.000	Design Service Load [1]	0.900	0.900
1.000	Design Service Load [2]	0.900	0.900
2.000	Inside Board Design Service Load	0.675	1.350
0.000	Load due to Other;	0.000	0.000

Unfactored In Service Legload = 10.458 kN

Unfactored Out of Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.563	4.221
8.000	Board Self Weight	0.386	3.087
0.000	Load due to Other;	0.000	0.000

Unfactored Out of Service Legload = 7.308 kN

Factored In Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.844	6.331
8.000	Board Self Weight	0.579	4.631
1.000	Design Service Load [1]	1.350	1.350
1.000	Design Service Load [2]	1.350	1.350

2.000	Inside Board Design Service Load	1.013	2.025
0.000	Load due to Other;	0.000	0.000

Factored In Service Legload = 15.687 kN

Factored Out of Service Legload;

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.844	6.331
8.000	Board Self Weight	0.579	4.631
0.000	Load due to Other;	0.000	0.000

Factored Out of Service Legload = 10.962 kN

Summary:

Unfactored In Service Legload =	10.458 kN
Factored In Service Legload =	15.687 kN
Unfactored Out of Service Legload =	7.308 kN
Factored Out of Service Legload =	10.962 kN

Effective Lengths:

Effective length, L_e = Open length of upright (m) x Effective length coefficient where;

Open length of upright = 2.000 m

Effective length coefficient = 1.10

Effective length, L_e = 2.200 m

Compressive Resistance:

We will obtain this value using values described herein and BS EN 1993-1-1 Clause 6.3.1.2.

$\lambda = L_e / i = 139.89$

$1/\lambda = \lambda / ((\pi^2 \times E) / f_y)^{0.5} = 1.49$

Factor for the buckling curve, $\alpha = 0.49$

$\phi = 0.5 (1 + \alpha(\lambda - 0.2) + 1/\lambda^2) = 1.925$

$X = 1 / (\phi + (\phi^2 - 1/\lambda^2)^{0.5}) = 0.318$

Design Buckling Resistance, $N_{Rd} = X \times f_y \times A$ where;

Yield strength, $f_y = 235 \text{ N/mm}^2$

Cross-sectional area, $A = 557 \text{ mm}^2$

Design Buckling Resistance = 41.591 kN

COLD FORMED

Bending Moments in Standard When In Service at Ultimate Limit State:

Case 1; Maximum compression in standard x % out of plumb = Moment due to compression

Moment = 15.687 x 1.0% = 0.157 kNm

Case 2; ((Working wind pressure x Width over upright) x Open length of upright²) / 10 = Moment due to wind (10 is used to account for continuity in the upright)

Working wind pressure = 0.300 kN/m² (Factored)

Pressure coefficient = 1.2 CPe

Solidity ratio = 1.0

Tube diameter = 0.0483 m

UDL up the face = 0.017 kN/m (Factored)

Open length of upright = 2.000 m

Moment = $\frac{0.017 \times 4.000}{10} = 0.007 \text{ kNm}$

Case 3; (Horizontal handrail load x Open length of upright) / 6 = Moment due to fall arrest (6 is used to account for continuity in the upright)

Horizontal handrail load = 0.450 kN (Factored)

Open length of upright = 2.000 m

Moment = $\frac{0.450 \times 2.000}{6} = 0.15 \text{ kNm}$

Total moment in upright = 0.314 kNm

Critical Interaction Check When In Service at Ultimate Limit State:

$1.0 > (\text{Calculated moment} / \text{Moment capacity}) + (\text{Calculated compression} / \text{Buckling resistance})$

$$\text{Critical interaction} = \frac{0.314}{1.850} + \frac{15.687}{41.591} = 0.547$$

PASS - Upright passes buckling checks made at Ultimate Limit State

Bending Moments in Standard When Out of Service at Ultimate Limit State:

Case 1; Maximum compression in standard x % out of plumb = Moment due to compression

$$\text{Moment} = 10.962 \times 1.0\% = 0.110 \text{ kNm}$$

Case 2; $((\text{Full wind pressure} \times \text{Width over upright}) \times \text{Open length of upright}^2) / 10 = \text{Moment due to wind}$ (10 is used to account for continuity in the upright)

Full wind pressure = 0.978 kN/m² (Factored)

Pressure coefficient = 1.2 C_{Pe}

Solidity ratio = 1.0

Tube diameter = 0.0483 m

UDL up the face = 0.057 kN/m (Factored)

Open length of upright = 2.000 m

$$\text{Moment} = \frac{0.057 \times 4.000}{10} = 0.023 \text{ kNm}$$

Total moment in upright = 0.132 kNm

Critical Interaction Check When In Service at Ultimate Limit State:

$1.0 > (\text{Calculated moment} / \text{Moment capacity}) + (\text{Calculated compression} / \text{Buckling resistance})$

$$\text{Critical interaction} = \frac{0.132}{1.850} + \frac{10.962}{41.591} = 0.335$$

PASS - Upright passes buckling checks made at Ultimate Limit State

OUTSIDE UPRIGHT

Tube Self Weight per Node;

Number	Tube	Length (m)	Total Length (m)	Self Weight (kN/m)	Total Self Weight (kN)
1.000	Upright	2.000	2.000	0.0429	0.086
1.000	Ledger	2.000	2.000	0.0429	0.086
1.000	Transom	0.600	0.600	0.0429	0.026
3.000	Board Transom	0.600	1.800	0.0429	0.077
1.000	Ledger Brace	1.414	1.414	0.0429	0.061
1.000	Facade Brace	1.414	1.414	0.0429	0.061
2.000	Handrails	2.000	4.000	0.0429	0.171

Coupler Self Weight per Node;

Number	Coupler	Self Weight (kN)	Total Self Weight (kN)
4.000	Right Angled Coupler	0.012	0.048
2.000	Swivel Coupler	0.013	0.026
3.000	Single Coupler	0.010	0.030
1.000	Sleeve Coupler	0.010	0.010

Unfactored tube and coupler self weight per node = 0.681 kN (Unfactored)

Board Self Weight per Node:

Board self weight = 0.245 kN/m² (Unfactored)

Length of boards = 2.000 m

Number of boards = 3.500 no. (including toeboard)

Single board width = 0.225 m

Area over node = 1.575 m²

Board self weight per node = 0.386 kN (Unfactored)

Variable Action per Node - Main Boards:

Length over node = 2.000 m
Width over node = 0.600 m
Area over node = 1.200 m²

	Unfactored Area Load (kN/m ²)	Total Load per Node (kN)
Design Service Load [1]	0.750	0.900
Design Service Load [2]	0.750	0.900

Load due to Other;

	kN (Unfactored)
--	-----------------

Unfactored In Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.681	5.108
8.000	Board Self Weight	0.386	3.087
1.000	Design Service Load [1]	0.900	0.900
1.000	Design Service Load [2]	0.900	0.900
0.000	Load due to Other;	0.000	0.000

Unfactored In Service Legload = 9.995 kN

Unfactored Out of Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	0.681	5.108
8.000	Board Self Weight	0.386	3.087
0.000	Load due to Other;	0.000	0.000

Unfactored Out of Service Legload = 8.195 kN

Factored In Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	1.022	7.662
8.000	Board Self Weight	0.579	4.631
1.000	Design Service Load [1]	1.350	1.350
1.000	Design Service Load [2]	1.350	1.350
0.000	Load due to Other;	0.000	0.000

Factored In Service Legload = 14.993 kN

Factored Out of Service Legload:

No. of Levels Loaded	Load Type	Load per Node (kN)	Total Load (kN)
7.500	Tube and Coupler Self Weight	1.022	7.662
8.000	Board Self Weight	0.579	4.631
0.000	Load due to Other;	0.000	0.000

Factored Out of Service Legload = 12.293 kN

Summary:

Unfactored In Service Legload =	9.995 kN
Factored In Service Legload =	14.993 kN
Unfactored Out of Service Legload =	8.195 kN
Factored Out of Service Legload =	12.293 kN

Effective Lengths:

Effective length, L_e = Open length of upright (m) x Effective length coefficient where;

Open length of upright = 2.000 m
Effective length coefficient = 1.10
Effective length, L_e = 2.200 m

Compressive Resistance:

We will obtain this value using values described herein and BS EN 1993-1-1 Clause 6.3.1.2.

$\lambda = L_e / i = 139.89$

$1/\lambda = \lambda / ((\pi^2 \times E) / f_y)^{0.5} = 1.49$

Factor for the buckling curve, $\alpha = 0.49$

COLD FORMED

$\phi = 0.5 (1 + \alpha(1/\lambda - 0.2) + 1/\lambda^2) = 1.925$

$\chi = 1 / (\phi + (\phi^2 - 1/\lambda^2)^{0.5}) = 0.318$

Design Buckling Resistance, $N_{Rd} = \chi \times f_y \times A$ where;

Yield strength, $f_y = 235 \text{ N/mm}^2$

Cross-sectional area, $A = 557 \text{ mm}^2$

Design Buckling Resistance = 41.591 kN

Bending Moments in Standard When In Service at Ultimate Limit State:

Case 1; Maximum compression in standard x % out of plumb = Moment due to compression

Moment = 14.993 x 1.0% = 0.150 kNm

Case 2; ((Working wind pressure x Width over upright) x Open length of upright²) / 10 = Moment due to wind (10 is used to account for continuity in the upright)

Full wind pressure = 0.300 kN/m² (Factored)

Pressure coefficient = 1.2 CPe

Solidity ratio = 1.0

Width over upright = 2.0000 m

UDL up the face = 0.720 kN/m (Factored)

Open length of upright = 2.000 m

Moment = $\frac{0.720 \times 4.000}{10} = 0.288 \text{ kNm}$

Case 3; (Horizontal handrail load x Open length of upright) / 6 = Moment due to fall arrest (6 is used to account for continuity in the upright)

Horizontal handrail load = 0.450 kN (Factored)

Open length of upright = 2.000 m

Moment = $\frac{0.450 \times 2.000}{6} = 0.15 \text{ kNm}$

Total moment in upright = 0.588 kNm

Critical Interaction Check When In Service at Ultimate Limit State:

$1.0 > (\text{Calculated moment} / \text{Moment capacity}) + (\text{Calculated compression} / \text{Buckling resistance})$

Critical interaction = $\frac{0.588}{1.850} + \frac{14.993}{41.591} = 0.678$

PASS - Upright passes buckling checks made at Ultimate Limit State

Bending Moments in Standard When Out of Service at Ultimate Limit State:

Case 1; Maximum compression in standard x % out of plumb = Moment due to compression

$$\text{Moment} = 12.293 \quad \times \quad 1.0\% \quad = \quad 0.123 \text{ kNm}$$

Case 2; ((Full wind pressure x Width over upright) x Open length of upright²) / 10 = Moment due to wind (10 is used to account for continuity in the upright);

Working wind pressure = 0.978 kN/m² (Factored)

Pressure coefficient = 1.2 CPe

Solidity ratio = 1.0

Width over upright = 2.0000 m

UDL up the face = 2.347 kN/m (Factored)

Open length of upright = 2.000 m

$$\text{Moment} = \frac{2.347 \times 4.000}{10} = 0.939 \text{ kNm}$$

Total moment in upright = 1.062 kNm

Critical Interaction Check When In Service at Ultimate Limit State:

1.0 > (Calculated moment / Moment capacity) + (Calculated compression / Buckling resistance)

$$\text{Critical interaction} = \frac{1.062}{1.850} + \frac{12.293}{41.591} = 0.870$$

PASS - Upright passes buckling checks made at Ultimate Limit State

CONSIDER THE TIES

Full wind pressure = 0.652 kN/m² (Unfactored)
Working wind pressure = 0.200 kN/m² (Unfactored)

CONSIDER THE TIE FORCES

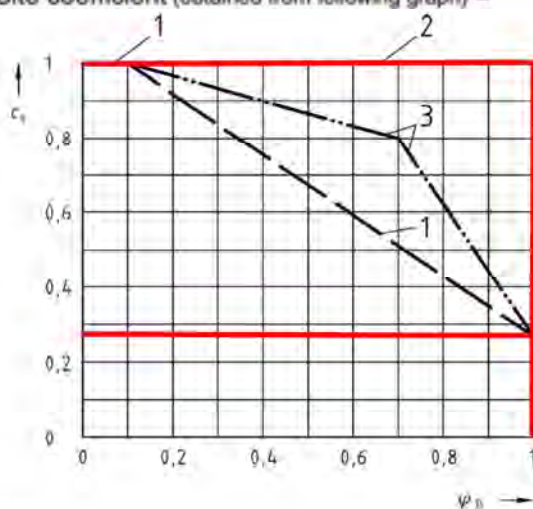
Horizontal distance over tie = 4.000 m (Max width)

For Solidly Clad Scaffold Structures;

Tie value perpendicular to façade = Site coefficient x Σ (Aerodynamic force coefficient x width x Full wind pressure) where;

Aerodynamic force coefficient = 1.3
Width = 4.000 m
Building solidity ratio, ϕ_B = 1.0

Site coefficient (obtained from following graph) = 0.25 (tie)

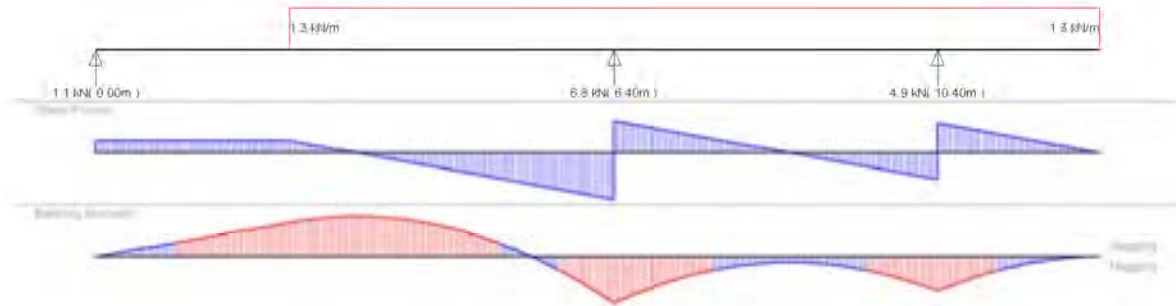


Key

- 1 netting in both normal and parallel directions;
- 2 sheeting in both normal and parallel directions;
- 3 for sheeting, but only for calculation of the tensile anchoring forces normal to the façade;
- c_s site coefficient;
- ϕ_B the solidity ratio.

	SLS (kN)	ULS (kN)	
Tie Value When In Service	0.260	0.390	(not critical to the design)
Tie Value When Out of Service	0.848	1.271	(critical to the design)

UDL = WIND X 4.0m Horizontally X 1.3CPE X 0.25kNm² Board self-weight X 1.5FOS
UDL = 1.2714



Beam Length 12.40 m

APPLIED LOADING

Distributed Loads

1.27 kN/m at 2.400 m --> 1.27 kN/m at 12.400 m

REACTIONS (+ve Upward)

1.05 kN at 0.00 m

6.80 kN at 6.40 m

4.86 kN at 10.40 m

RESULTS SUMMARY

Max. Reaction	6.80 kN at 6.400 m
Max. Sag Bending Moment	2.95 kN.m at 3.250 m
Max. Hog Bending Moment	3.45 kN.m at 6.400 m
Max. Shear Force	4.03 kN at 6.400 m

max moment = 2.95 kNm
width between the lattice = 1.2 m

Tension in the upright = 2.458 kN < 6kN
Hence, no splice are needed (capacity 16kN)

Force in brace = shear force
= 4.03 kN

Axial force in brace = shear force / sin (30)
= 8.06 kN < 15 kN

Hence , bracing is adequate and no subs necessary

Eventually, maximum tie value =

6.800 kN at ULS
4.533 kN at SLS

this is over 2 No ties in the top lift, hence, the values could be halved

Eventually, maximum tie value =

4.900 kN at ULS
3.267 kN at SLS

And, Force on the ground = 1.100 kN at ULS
Self weight of the structure = 7.308 kN at SLS
Coefficient of friction = 0.4

Frictional force = 2.923 kN

hence, extra force that cant be resisted in friction is to be transferred back to the tie through the pull back bracing

Extra force = force on the ground from the wind - frictional force
= -1.82 kN

By inspection, the facade bracing is adequate in transferring the force to the ties and spur bracing is not necessary

CONSIDER THE ABUTTING FORCES

Full wind pressure = 0.652 kN/m² (Unfactored)
Working wind pressure = 0.2 kN/m² (Unfactored)
Vertical distance over tie = 2.000 m (Max width)
Horizontal distance = 2.000 m
Area over tie = 4.000 m²

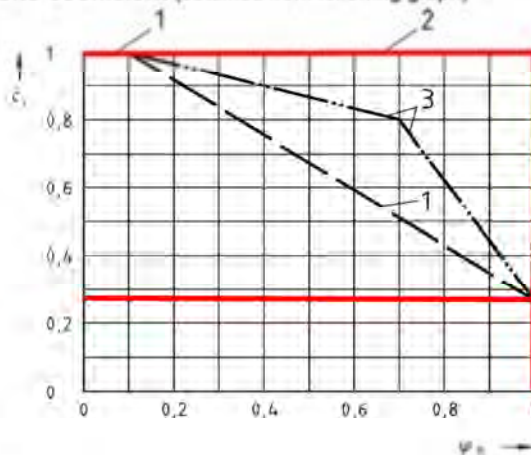
For Solidly Clad Scaffold Structures;

Abutting value perpendicular to façade = Site coefficient x Σ (Aerodynamic force coefficient x width x Full wind pressure) where;

Aerodynamic force coefficient = 1.3
Area = 4.000 m²

Building solidity ratio, ϕ_B = 1.0

Site coefficient (obtained from following graph) = 1.0 ABUTTING



Key

- 1 netting in both normal and parallel directions;
- 2 sheeting in both normal and parallel directions;
- 3 for sheeting, but only for calculation of the tensile anchoring forces normal to the façade;
- cs site coefficient;
- phi_B the solidity ratio.

	SLS (kN)	ULS (kN)	
Abutting Value When In Service	1.040	1.560	(not critical to the design)
Abutting Value When Out of Service	3.390	5.086	(critical to the design)

As the maximum tie value < 30kN, they are adequate

LOADING SUMMARY

Tie Values

Solidly Clad Scaffold Structure:

Maximum Calculated Tie Value =	2.267 kN (Unfactored)
Maximum Calculated Tie Value =	3.400 kN (Factored)
Maximum Calculated Abutting Value =	3.390 kN (Unfactored)
Maximum Calculated Abutting Value =	5.086 kN (Factored)

Pull-Test/Proof Test Loads:

Maximum Calculated Tie Value =	6.600 kN (Factored)
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Legload(s), Bearing Pressure(s), Reaction Forces

Loads to Ground:

Maximum Calculated Legload =	10.5 kN (Unfactored)
Maximum Calculated Legload =	15.7 kN (Factored)

Reaction Forces:

Maximum Calculated Reaction Force(s) = As indicated on the design.

Design Actions/Variable Actions

All design actions/variable actions stated below are unfactored (SLS) values;

Allowable Design Actions:

Design Service Load 1 =	0.750 kN/m ² on	1.000 no. levels
Design Service Load 2 =	0.750 kN/m ² on	1.000 no. levels
Inside Board Design Service Load =	0.750 kN/m ² on	2.000 no. levels

Allowable Variable Actions:

Maximum Calculated Wind Pressure =	0.652 kN/m ² =	72 mph
Working Wind Pressure =	0.200 kN/m ² =	40 mph
Maximum Calculated Snow Loading =	0.266 kN/m ²	

Number of Boarded Levels

Maximum Number of Boarded Levels =	8.000 no. levels
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Where the maximum number of boarded levels is different this is indicated on the design.

APPENDIX A - DESIGN(S), DRAWING(S), SKETCH(ES)