

Client: R & N Investments

Fire Escape structural design calculations:

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B1	Existing Structure Reuse
C1	Floor Plate Design
D1 – D2	Beam Design
E1	Foundation Design

Prepared by:	Date:	Checked by:	Date:	Approved by:	Date:
TM	Mar 2021	AB	Mar 2021	KGP	Mar 2021

Revisions:

[illegible]

Project Title:

New North Road Huddersfield

Project No:

186-25

Prepared by:

TM

Date:

Mar 2021

Checked by:

KGP

Date:

Mar 2021

Introduction:A) Proposed Structure Description

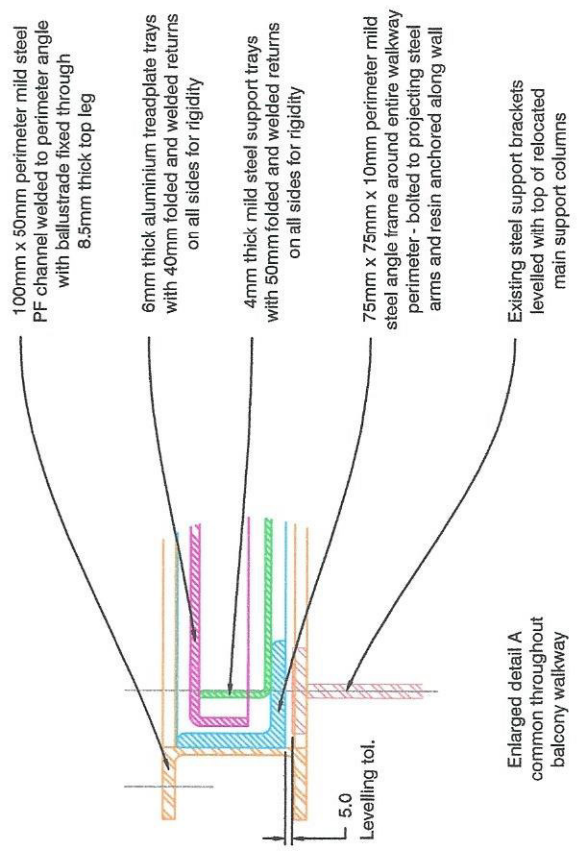
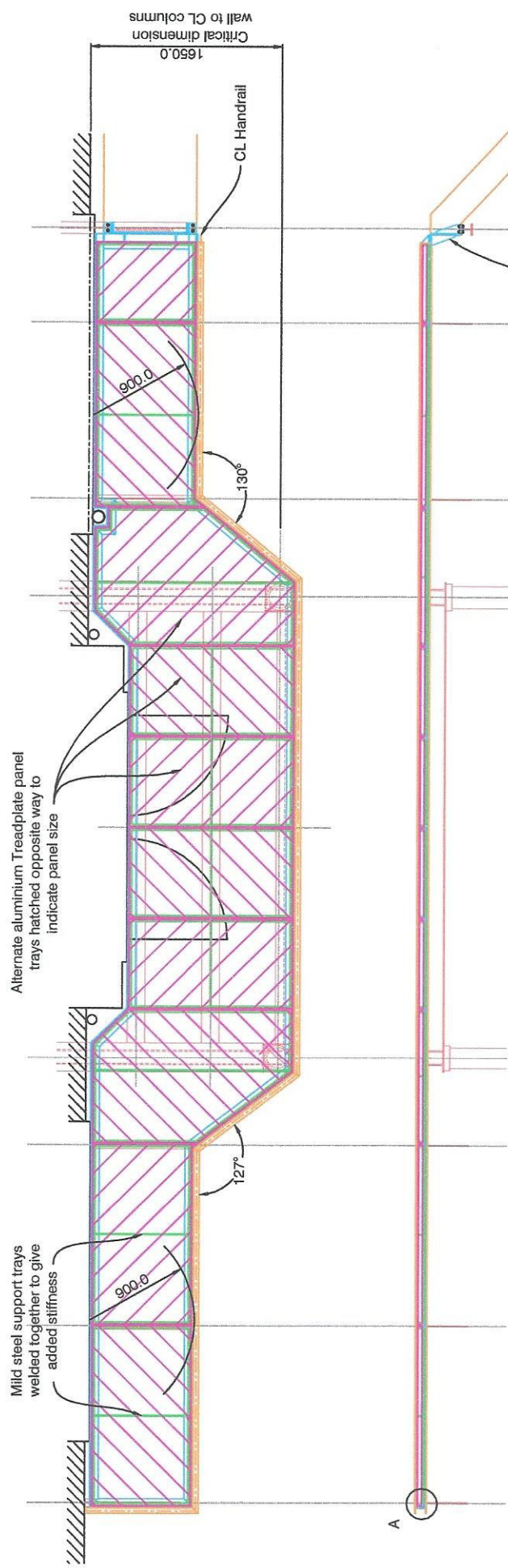
- An existing balcony and fire escape are to be replaced. The existing cantilevers, columns and beams are to be reused wherever possible. New floor plate and supporting beams are to be designed.

B) Design Codes

- BS 6399-1:1996 - Loading for buildings - Part 1: Code of practice for dead and imposed loads.
- BS 6399-2:1997 - Loading for buildings - Part 2: Code of practice for wind loads.
- BS 5950-1:2000 - Structural use of steelwork in building - Part 1: Code of practice for design - Rolled and welded sections.

C) CDM

- Designer risk assessment provided.
- Construction method statement to be provided by contractor prior to construction.



- KEY :-**
- Structural support elements either existing (projecting wall brackets), relocated (main circular columns with projecting I beam pairs cut back), or set of 3 new I beams across main doors
 - Perimeter mild steel 75mm x 75mm x 10mm angle fully welded at corners as a continuous frame shimmed off structural supports :- frame fabricated in largest handleable pieces and any on site jointing to be by means of bolted lapping plates
 - 100mm x 50mm mild steel PF Channel welded to outside of perimeter angle to provide continuous 8.5mm thick grounds for fixing metal balustrading through
 - 4mm thick mild steel support trays with 50mm folded upstand with welded corners fixed within rebate formed by perimeter angle to give rigidity to walkway floor
 - 6mm thick aluminium trays with 40mm folded downstand with welded corners fitted around mild steel support trays - combined effect of trays to result in firm and stable platform
- 8mm thick mild steel folded "Z" pressing with welded fillets both sides bolted to stair-support beam so as to carry end of walkway :- exact connection to top stair tread to be determined once approval of main structure is agreed



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Existing Structure Reuse.

The existing cast iron balcony cantilevers, plate beams and columns are in visibly good condition, showing no structural imperfections.

The beams are to be reduced in length and the columns moved to support the new end position, reducing the load on these elements. ∴ okay.

The existing cast iron balcony cantilevers will retain their current use with infrequent use, mostly for maintenance and as a fire escape. The proposed loading will be consistent with the historically applied loads. ∴ okay.



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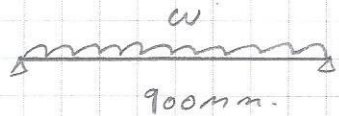
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Floor plate check

office load = 2.5 kN/m^2 ; as per rooms connected to balcony.



$$w = 2.5 \text{ kN/m. SLS.}$$

$$m = \frac{wL^2}{8} = \frac{1.6 \times 2.5 \times 0.9^2}{8} = 0.40 \text{ kNm}$$

Yield strength Aluminium = 240 N/mm²
grade S754

$$t_{min} = \sqrt{\frac{400 \times 4}{1.0 \times 240 \times 10^6}} = 2.6 \text{ mm}$$

$$E = 69 \text{ GPa}$$

$$I_{req} = \frac{5wL^4}{384E^{1/360}} = \frac{1800 \times 2.5 \times 10^3 \times 0.9^3}{384 \times 69 \times 10^9} = 0.13 \text{ cm}^3$$

$$t_{min} = 3 \sqrt{\frac{0.13 \times 12}{100}} = 0.25 \text{ cm} = 2.5 \text{ mm}$$

∴ Use 6mm thick tread plate.



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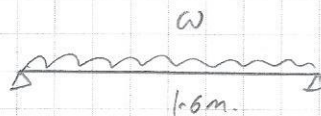
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Proposed edging beam.



0.45m contributing span

$$w = \left(\frac{1.0}{2.5} \right) \times 0.45 = 0.45 \text{ kN/m dead} \\ 1.13 \text{ kN/m imposed.}$$

$$M = \left(1.0 \times 0.45 + 1.6 \times 1.13 \right) \times \frac{1.6^2}{8} = 0.8 \text{ kNm.}$$

$$Z_{req} = \frac{800}{355 \times 10^6} = 2.25 \text{ cm}^3.$$

$$I_{req} = 1.905 \times 1.6 \times 10^6 = 12.5 \text{ cm}^4.$$

Use 100x50x10 PEC S355

$$M_b(2.0m) = 11.0 \text{ kNm}$$

$$I = 208 \text{ cm}^4$$

$$Z = 41.5 \text{ cm}^3$$

(gr 8.8)

All Steel-Steel Connections to be min 2 no M12 bolts and use min 10mm thick S275 plate for pin or end plates.

All steel to be painted for corrosion protection. Any waterproofing by Architect.



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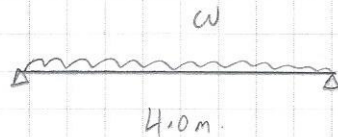
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Proposed beams.



Contributing Span = 0.7m.

$$w = 0.7 \left(\frac{1.0}{2.5} \right) = \begin{matrix} 0.7 \text{ kN/m dead} \\ 1.75 \text{ kN/m imposed} \end{matrix}$$

$$M = \frac{wL^2}{8} = \frac{(1.4 \times 0.7 + 1.0 \times 1.75) \times 4.0^2}{8} = 7.6 \text{ kNm}$$

$$I_{req} = 1.905 \times 2.45 \times 4.0^3 = 299 \text{ cm}^4$$

Use 127 x 76 x 13 UB . S355

$$M_b (4.0m) = 10.1 \text{ kNm}$$

$$I = 473 \text{ cm}^4$$



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Column foundation.

$$\text{Supported area} = \frac{1}{4} \times 4 \times 1.75 + \frac{1}{4} \times \frac{(0.9 + 1.75)}{2} \times 0.75$$

$$= 1.75 + 0.25 = 2 \text{ m}^2$$

Say 1.0 kN/m² dead.
2.5 kN/m² imposed.

$$\Rightarrow \text{Total load} = 7.0 \text{ kN}$$

∴ 0.6 x 0.6 x 0.3m deep pad, bearing on competent strata.

C35 concrete.