S R BRUNSWICK CEng FICE

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Prepared by:	Sheet:
SRB	1515 - 1
Checked by:	Date:
	May '15

55 Greencroft Gardens

The following calculations are for the design of an enlarged basement and internal alterations to this ground floor flat in a terraced property.

These calculations should be read in conjunction with all relevant Architects Drawings. The caculations have been prepared to comply with all relevant British Standards and Building Regulations.

Loadings

Roof - Terrace

Paving	1.20	KN/m2
Membrane	0.20	KN/m2
Rafters	0.10	KN/m2
P/bd and skim	0.30	KN/m2
	1.80	KN/m2

Super say 2.0 KN/m2 to allow for planters

UDL 3.8 KN/m2

Flat roof , no access say 1.9 KN/m2

Floor

Boards	0.15	KN/m2
Joists	0.15	KN/m2
Plasterboard & Skim	0.30	KN/m2
Super	1.50	KN/m2
	2.10	KN/m2

Partitions - stud say 0.60 KN/m2

Cavity Wall 3.60 KN/m2

Solid wall 215 say 4.50 KN/m2

Solid wall 340 say 7.2 KN/m2

Dormer cheek say 1.5 KN/m2

Timber to be Grade C16 to BS 5268

Steel to be Grade 43 to BS 449

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Ground floor plan - Proposed - showing structure over

Rafters 200 x 50 @ 400 ctrs

R1 & R2 203 x 133 x 25 UB

Frame 1
Top member 203 UC 60
Mid member 203 x 133 x 25 UB
Bottom 203 UC 71 Concrete encased
Stanchions 203 UC 52

Frame 2
Top member 203 UC 46
Mid member 203 UC 46
Bottom 203 UC 46 concrete encased
Stanchions 203 UC 46

Min steel connection
4M16 Grade 8.8 bolts with
8mm end plate and 6mm full profile
fillet weld. Top flanges flush.

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Joists to flat roof

Span 3900

UDL 1.9 KN/m2

Max BM 1.9 x 3.9Sq / 8 = 3.6 KNm

Z reqd = 3.6 e6 / 5.3 x 1.1 x 1.25 = 496 e3 mm3/m

Try 175 x 50 @ 400 ctrs (Z = 560 e3 mm3 / m)

Deflection

5 x 1.9 x 0.4 x (3.9)4 x e3 / 384 x 8.8 x 18.9 = 13.8mm

Too high

Provide
200 x 50 @ 400 ctrs
Defl = 9.1mm
0.0023 x span

Beam R1 carrying roof / skylight - (R2 Similar)

Span 5500

UDL 1.9 x 4.5/ 2 + say 0.3KN/m for glass = 4.6 KN/m

Max BM 4.6 x 5.5Sq / 8 = 17.4 Knm

Try 203 x 133 x 25 UB

L / Ry = 5500 / 31 = 178 D/T = 26

Pbc = 79 N/mm2

Fbc = 17.4 e6 / 231.9 e3 = 75 N/mm2

OK

Deflection

5 x 4.6 x (5.5)4 x e5 / 384 210 x 2356 = 11 mm

Span / 500

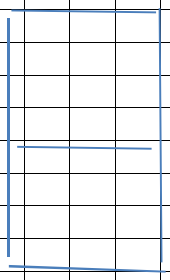
OK

Provide
203 x 133 x 25 UB

Frame 1 on line of external wall above

The frame is to be a box frame bearing on the extg foundation with intermediate beam to carry Grd floor

Loading
Top beam
Masonry 4.5 KN/m2 x 4.8m = 21.6 KN/m
Roof terrace 3.8 Kn/m2 x 2/2 = 3.8 KN/m
1st floor 2.1KN/m2 x say 2m = 4.2 KN/m
29.6 KN/m



For typical details see sheet / 11

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Loading Grd floor

floor 1.9 KN/m2 x 8 / 2 = 7.6 KN/m

Top Member

UDL 29.6 KN/m

Max BM 29.6 x 4.3Sq / 8 = 68.4 KNm

Try 203 UC 60

L / Ry = 1.2 x 4300 / 51.9 = 100 D/T = 14.8

Pbc = 139 N/mm3

Fbc = 68.4 e6 / 581.1 e3 = 114 N/mm2

Deflection

5 x 29.6 x (4.3)4 x e5 / 384 x 210 x 6088 = 10.3mm

Span / 417 Provide

OK 203 UC 60 for top member

Middle member

UDL 7.6 KN/m

Max BM 7.6 x 4.3Sq / 8 = 17.6 KNm

By Inspection Provide

From sht / 3 203 x 133 x 25 UB

Bottom member

UDL 29.6 + 7.6 = 37.2 KN/m

Max BM 37.2 x 4.3Sq / 8 = 86 KNm

Try 203 UC 60 concrete encased

Fbc = 86 e6 / 581.1 e3 = 149 N/mm2

OK

Deflection

5 x 37.2 x (4.3)4 x e5 / 384 x 210 x 6088 = 13.0mm

Span / 330

high Provide 203 UC 71

deflection 10.3mm

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Stanchion

Ht say 6600

Cap connection with total load = 37.2 x 4.3/2 = 80 KN

BM

cap connection 80 x 0.05 = 4.0 KNm

Stability 80 x 6.6 x 2.5% = 13.2 KNm

17.2 KNm

Try 203 UC 46

L/Ry 1.5 x 6600 / 51.1 = 194 D/T = 18.5

Pbc = 86 N/mm2 Pc = 25 N/mm2

Fbc = 17.2 e6 / 449.2 e3 = 38 N/mm2

Fc = 80 e3 / 58.8 e2 = 14 N/mm2

UF = 38 / 86 + 14 / 25 = 1.1

Too high

Provide 203 UC 52

Frame 2 on rear elevation

Loading

top member

Roof 1.9 Kn/m2 x say 3m = 5.7 KN/m

masonry cladding 3.6Kn/m2 x 0.7 = 2.5 KN/m

8.2 KN/m

Middle member say as top as floor spans parallel

Use same section for all spans so assume UDL = 16 KN/m

Max BM 16 x 4.3Sq / 8 = 37 KNm

Try 203 UC 46

Fbc = 37 e6 / 449.2 e3 = 82 N/mm2

Deflection

5 x 16 x (4.3)4 x e5 / 384 x 210 x 4564 = 7.4mm

OK

Stanchion by inspection to be 203 UC 46

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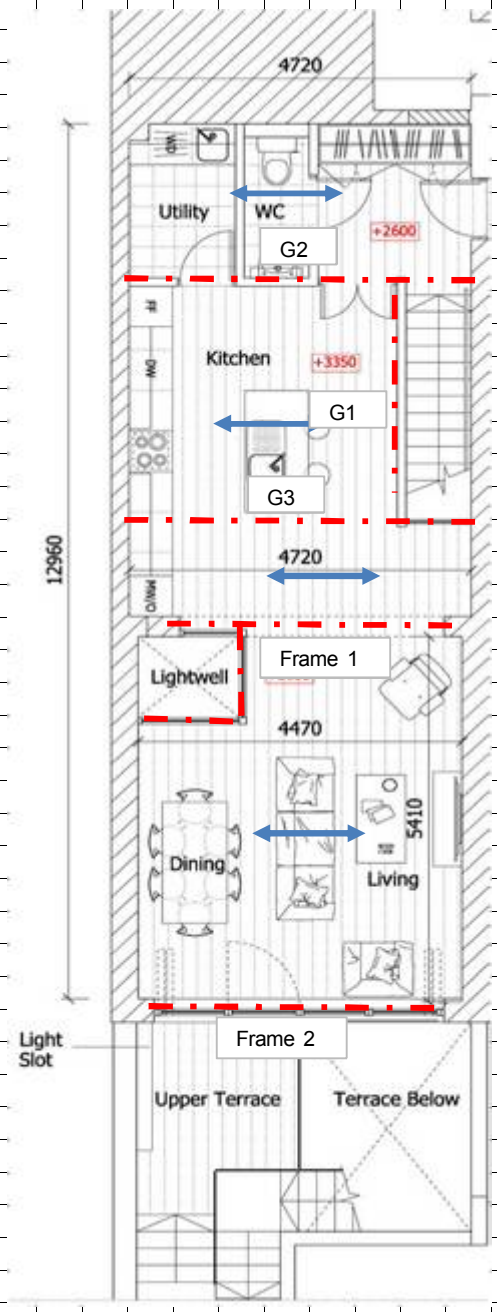
Ground Floor Plan showing structure



G1, G2 & G3 - 203 x 133 x 25 UB

Framing to lightwell
203 x 133 x 25 UB in floors with
152 UC 23 stanchion

Floor joists 250 x 50 @ 400 ctrs Grade C16

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Design of floor joists

Span 4800

UDL 2.1 Kn/m2

Max BM 2.1 x 4.8Sq / 8 = 6.0 KNm

Z reqd 6.0 e6 / 5.3 x 1.1 = 1037 e3 mm3/m

Try 250 x 50 @ 400 ctrs (Z = 1165 e3 mm3 / m)

Deflection

5 x 2.1 x 0.4 x (4.8) x e3 / 384 x 8.8 x 56.9 = 11.6mm

0.0024 x span

Provide
250 x 50 @ 400 ctrs
Grade C16

Beam G1 trimming stair

Span 4000

Loading

floor 2.1 KN/m2 x 3.9 / 2 = 4.1 KN/m

Enclosing wall 0.6 KN/m2 x 3.4 = 2.0 KN/m

6.1 KN/m

Reaction 12.2 KN

Max BM 6.1 x 4Sq / 8 = 12.2 Knm

Try 203 x 133 x 25 UB

L/Ry = 4e3 / 31 = 129 D/T = 26

Pbc = 102 N/mm2

Fbc = 12.2 e6 / 231.9 e3 = 55 N/mm2

Deflection

5 x 6.1 x (4)4 x e5 / 384 x 210 x 2356 = 4.1mm

OK

Provide
203 x 133 x 25 UB

Beam G2 & G3 carrying G1

Span 4800

Loading from G1 1m from support

BM 12.2 x 1 x 3.8 / 4.8 = 9.7 Knm

By Inspection

Provide
203 x 133 x 25 UB

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Framing to lightwell

By inspection provide 203 x 133 x 25 UB floor beams and 152 UC 23 for the column.

Underpinning to Party walls to allow extension of LG floor

Lower Ground Floor Plan

wall previously underpinned to develop adjoining property

Note trial holes wil lbe required to determine the exact level of the exisitng foundations currently LG floor is 1m below Grd floor so area to be lowered a maximum of 2.5m.

Existing party wall is likely to be min of 340mm Reinforced underpin to be equal to wall thickness with heel extended to exisitng foundation width

Underpin to be in max 1.2m widths and link with the slab to resist lateral loading reinforcement to be

Underpin to be min 300 thick but to support full wall width with heel to reflect any spread footing. Reinforcement to be H16 at 200 ctrs vertically in each face with H12 @ 200 ctrs distribution. Base to be reinforced with H16 @ 200 ctrs as wall

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Design of new retaining wall to LG floor

Ht retained say 2500

Assumed soil parameters for back fill material

density 18 KN/m2

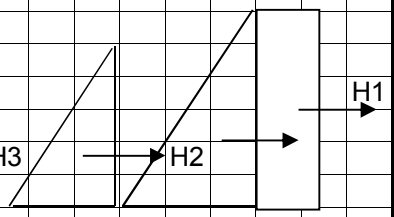
Ka = 0.38

Surcharge say 10 KN/m2

H1 10KN/m2 x 0.38 x 2.5 = 9.5 KN/m

H2 soil = 18 x 0.38 x 2.5Sq/2

21.4 KN/m



H3 Water = 10KN/m2 x 2.0Sq/2

20 KN/m

Total load = 62.2 KN/m

Max BM for cantilever

9.5 x 2.5/2 + 21.4 x 2.5/3 + 20 x 2/3 = 43 KNm

Ult load say 43 KN/m x 1.55 = 66.7 KNm

Try 300 thick RC wall

Cover say 50mm d = 240

M/b*dsq*fcu = 66.7 e6 / (e3 x 240Sq x 35) = 0.033

a1 = 0.94

Ast = 66.7 e6 / (0.87 x 500 x 0.94 x 240) = 680 mm2 / m

Provide H16 @ 200 ctrs (1010 mm2) in each face vertically

Distribution steel T12 @ 200 ctrs (566 mm2 / m in each face)

min steel 0.13% area = 390 mm2/m

Check slenderness

Span / depth = 7 M/bdSq = 1.2

Mf = 1.8 Mf Comp = 1.1

Allowable span = 7 x 1.8 x 1.1 x 240 = 3300

OK

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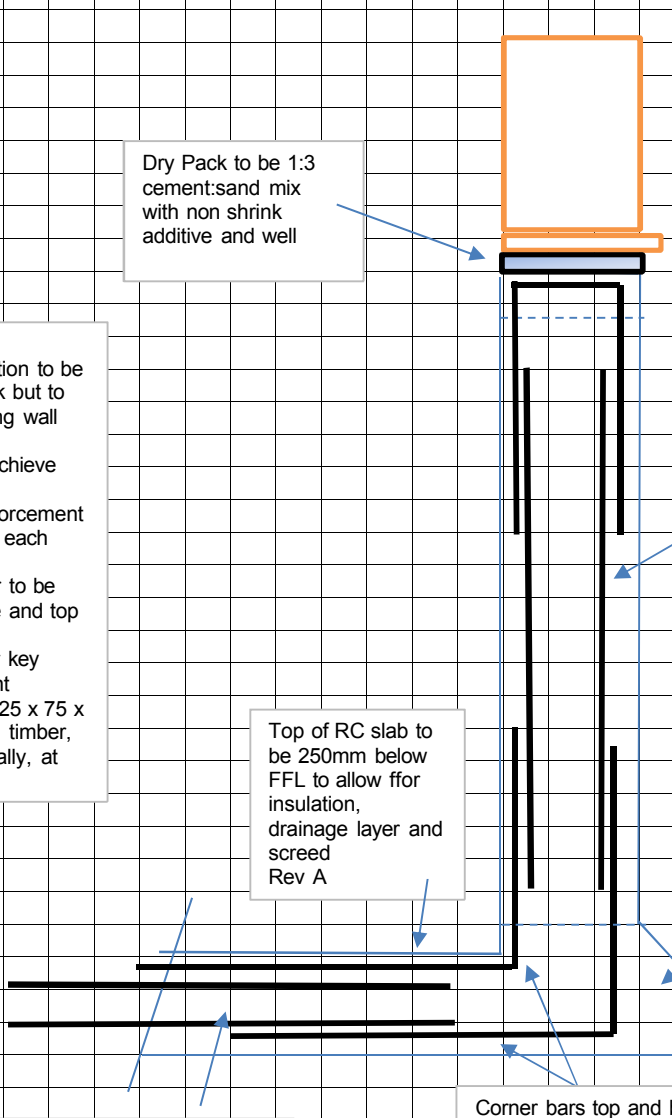

General Notes

1) concrete section to be min 300mm thick but to match the existing wall thickness.
2) Concrete to achieve 35N at 28 days
3) Cover to reinforcement to be min 40mm each face
4) 100mm kicker to be provided at base and top of wall
5) Provide shear key between adjacent sections using 225 x 75 x 300 long shaped timber, orientated vertically, at

Wall and base to be built in max 1.2m widths to suit final profile

Underpinning / LG floor detail

Same detail is to be provided at rear lightwell

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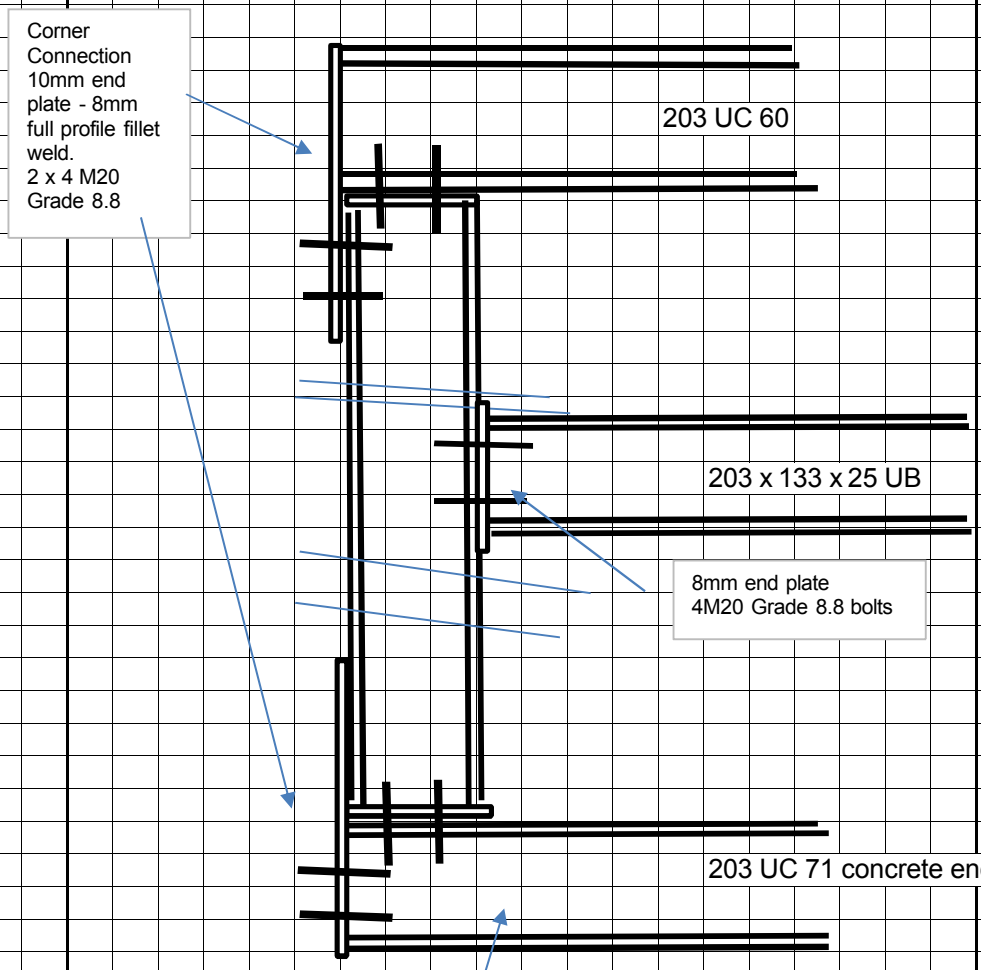
Typical steelwork detail



NOTE: The frames are to be on existing foundations and the new LG floor is to encase the bottom section of the frame

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Underpinning sequence

Rev A u/pin sequence added

Indicative underpinning sequence shown, pins to be constructed and completed in sequence including drypacking

Lower Ground Floor Plan