

STRUCTURAL CALCULATION PACKAGE
Flat 4, 129 Camberwell Road, SE5 0HB
Project Number: 7393

Revision A

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Checked By TPE

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INTRODUCTION AND SUMMARY:

This is the structural calculation package for the proposed works to Flat 4, 129 Camberwell Road, SE5 0HB. The property is a mid-terrace dwelling. The external walls are solid masonry construction with the floors and roof formed from timber joist construction.

Exploratory works were carried out in order to ascertain the presence and arrangement of existing foundations and were considered during the design of the proposed re-modelling works.

As part of the re-modelling works, the following have been proposed:

- Ground floor extension

New steel structures have been provided where existing load bearing structures are to be demolished during the re-modelling of the property.

Lateral stability throughout the property has been maintained by the introduction of a wind posts.

A desk study has been undertaken using BGS Geology Viewer, and trial pits have been dug on site which identify that London Clay is present. Therefore, an allowable bearing pressure of 100 kN/m² has been allowed for at ground level. All foundations are to extend a minimum depth of 1750 mm BGL. Tree at rear of property to be confirmed.

For referencing of elements refer to the structural drawings. This document is to be read in conjunction with the Architectural and Structural drawings and specifications. Temporary works are to be the responsibility of the contractor.

These calculations are prepared to comply with Eurocodes where applicable, including Load cases and Load combinations. Analysis of steelwork has been carried out using TEKLA Structural Designer 2020.

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APPENDIX

1. BEAM LOAD TAKEDOWN.

1.0 LOADING SUMMARY

LOADCASES:

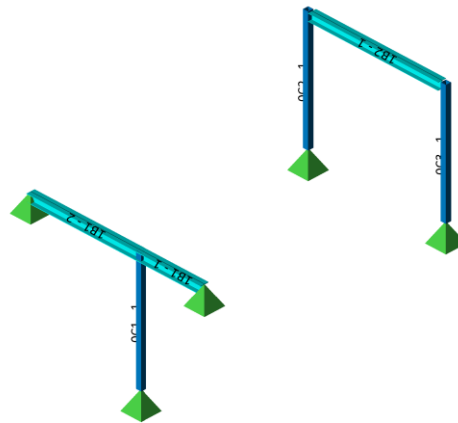
| <u>Loadcase Title</u> | <u>Uniform Load (kN/m)</u> |
|-----------------------|---------------------------------------|
| Gk - Dead | |
| Timber Floor | 0.75 kN/m ² x span |
| Pitched Roof | 1 kN/m ² x span |
| Flat Roof | 1.0 kN/m ² x span |
| Stud Wall | 5 kN/m ³ x width x height |
| Masonry Wall | 19 kN/m ³ x width x height |
| Cavity Wall | 14 kN/m ³ x width x height |
| Qk - Live | |
| Flat Roof | 0.75 kN/m ² x span |
| Pitched Roof | 0.6 kN/m ² x span |
| Residential | 1.5 kN/m ² x span |

DESIGN LIMITS:

| <u>Steel Frames – Serviceability Limits</u> | |
|---|------------------|
| Total Deflection Limit | Span/250 |
| Steel Supporting Brittle Elements | Span/500 or 15mm |
| Sway Deflection of Frames | Height/300 |
| Steel over glazing (Live Load) | 4mm |

2.0 GEOMETRY

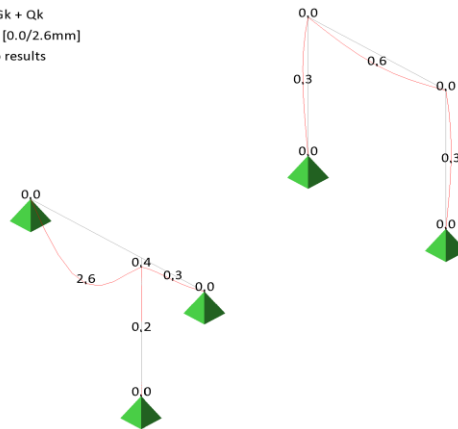
For structural layout and structural element referencing refer to structural drawings.



Structure 3D - Structural

First-order linear - 1 SLS - Gk + Qk
 Member Deflection Total : [0.0/2.6mm]
 Panel Deflection Total : No results

3.0mm
 2.3mm
 1.5mm
 0.8mm
 0.0mm



Structure 3D - Results - 1 SLS - Gk + Qk

3.0 STEELWORK

BEAM ELEMENT SUMMARY

| Member Reference | Group Ref. | Span | Section | Grade | Length [mm] | No. Connectors | Utilization | Status |
|------------------|------------|------|---------------|-------|-------------|----------------|-------------|--------|
| 1B2 | SBR39 | 1 | UC 152x152x30 | S355 | 2640.0 | | 0.101 | ✓ Pass |
| 1B1 | SBR38 | 1 | UC 152x152x37 | S355 | 1217.1 | | 0.274 | ✓ Pass |
| 1B1 | SBR38 | 2 | UC 152x152x37 | S355 | 2120.0 | | 0.345 | ✓ Pass |

COLUMN ELEMENT SUMMARY

| Member Reference | Group Ref. | Stack | Section | Grade | Length [mm] | Utilization | Status |
|------------------|------------|-------|------------------|-------|-------------|-------------|--------|
| WP | SCR1 | 1 | SHS 100x100x10.0 | S355 | 2500.0 | 0.130 | ✓ Pass |
| WP | SCR1 | 1 | SHS 100x100x10.0 | S355 | 2500.0 | 0.130 | ✓ Pass |
| OC1 | SCR1 | 1 | SHS 100x100x10.0 | S355 | 2500.0 | 0.193 | ✓ Pass |

3.1 Beam Design

Notes on flags/warnings in TEKLA output:

- “Not Required” refers to a check not performed, since the applied force is below a minimum threshold.

These are warnings that do not represent failure of the elements in question. Where required additional calculations are included to confirm behaviour is within parameters.

1B1

Loading

| Loadcase | Source | Direction | In Proj. | Span/Stack | Type | Q ₁ [kN/m] | Length [mm] |
|-------------|--------|-----------|----------|------------|----------|-----------------------|-------------|
| 3 Dead Load | User | Global Z | | 1 | Full UDL | 47.7 | 1217.1 |
| 3 Dead Load | User | Global Z | | 2 | Full UDL | 47.7 | 2120.0 |
| 4 Live Load | User | Global Z | | 1 | Full UDL | 11.7 | 1217.1 |
| 4 Live Load | User | Global Z | | 2 | Full UDL | 11.7 | 2120.0 |

Static

Summary UC 152x152x37(S355)

| Design Condition | # | Design Value | Design Capacity | Units | U.R. | Status |
|----------------------------|---|--------------|-----------------|--------|-------|--------------|
| Classification | 2 | Class 1 | - | - | - | ✓ Pass |
| Shear Major | 2 | 101.0 | 292.4 | kN | 0.345 | ✓ Pass |
| Shear Minor | - | No | Forces | kN | - | Not required |
| Buckling Shear Web | - | 17.350 | 58.580 | - | - | ✓ Pass |
| Moment Major | 2 | 32.3 | 109.6 | kNm | 0.294 | ✓ Pass |
| Moment Minor | - | No | Forces | kNm | - | Not required |
| Axial | - | No | Forces | kN | - | Not required |
| Axial Bending Combined | - | No | Forces | - | - | Not required |
| Buckling Lateral Torsional | 2 | 32.3 | 108.7 | kNm | 0.297 | ✓ Pass |
| Buckling Compression | - | No | Forces | - | - | Not required |
| Buckling Combined | - | No | Forces | - | - | Not required |
| Torsion | - | No | Significant | Forces | - | Not required |
| Deflection Imposed | 1 | 0.5 | 5.9 | mm | 0.080 | ✓ Pass |
| Deflection Wind | - | No | Loads | mm | - | Not required |
| Deflection Total | 1 | 2.4 | 8.5 | mm | 0.281 | ✓ Pass |

1B2

Loading

| Loadcase | Source | Direction | In Proj. | Span/Stack | Type | Q ₁ [kN/m] | Length [mm] |
|-------------|--------|-----------|----------|------------|----------|-----------------------|-------------|
| 3 Dead Load | User | Global Z | | 1 | Full UDL | 3.0 | 2640.0 |

Static

Summary UC 152x152x30(S355)

| Design Condition | # | Design Value | Design Capacity | Units | U.R. | Status |
|----------------------------|----|--------------|-----------------|--------|-------|--------------|
| Classification | 2 | Class 3 | - | - | - | ✓ Pass |
| Shear Major | 5 | -8.8 | 204.4 | kN | 0.043 | ✓ Pass |
| Shear Minor | - | No | Forces | kN | - | Not required |
| Buckling Shear Web | - | 23.931 | 58.580 | - | - | ✓ Pass |
| Moment Major | 5 | -5.4 | 58.2 | kNm | 0.092 | ✓ Pass |
| Moment Minor | - | No | Forces | kNm | - | Not required |
| Axial | 5 | 2.1 | 1038.2 | kN | 0.002 | ✓ Pass |
| Axial Bending Combined | 6 | - | - | - | 0.094 | ✓ Pass |
| Buckling Lateral Torsional | 6 | -5.4 | 58.2 | kNm | 0.092 | ✓ Pass |
| Buckling Compression | 5 | 2.1 | 601.0 | kN | 0.004 | ✓ Pass |
| Buckling Combined | 6 | - | - | - | 0.101 | ✓ Pass |
| Torsion | - | No | Significant | Forces | - | Not required |
| Deflection Imposed | - | No | Loads | mm | - | Not required |
| Deflection Total | 10 | 0.6 | 10.6 | mm | 0.055 | ✓ Pass |

3.2 Column Design

Notes on flags/warnings in TEKLA output:

- Warnings in the columns design section highlight an assumption that the top of the column is effectively restrained.
- “Not Applicable” refers to check not applicable to elements modelled from a closed section.
- “Not Required” refers to a check not performed, since the applied force is below a minimum threshold.

These are warnings that do not represent failure of the elements in question. Where required additional calculations are included to confirm behaviour is within parameters.

OC1

Loading

No entity matches the filter for the current report item.

Static

Summary SHS 100x100x10.0(S355)

| Design Condition | Combination Name | Design Value | Design Capacity | Units | U.R. | Status |
|----------------------------|---|--------------|-----------------|--------|-------|------------------|
| Classification | 2 | Class 1 | - | - | - | ✓ Pass |
| Shear Major | No | Significant | Forces | kN | - | Not required |
| Shear Minor | No | Significant | Forces | kN | - | Not required |
| Buckling Shear Web | No | Significant | Forces | kN | - | ⚠ Not applicable |
| Moment Major | No | Significant | Forces | kNm | - | Not required |
| Moment Minor | No | Significant | Forces | kNm | - | Not required |
| Axial | 2 | 175.5 | 1239.9 | kN | 0.142 | ✓ Pass |
| Axial Bending Combined | - | No | Significant | Forces | - | Not required |
| Buckling Lateral Torsional | - | - | - | - | - | ⚠ Not applicable |
| Buckling Compression | 2 | 175.5 | 910.4 | kN | 0.193 | ✓ Pass |
| Buckling Combined | - | No | Significant | Forces | - | Not required |
| Design Note | Top & Bottom Flanges Laterally Restrained | | | | | ⚠ Warning |
| Design Note | Major and/or Minor Axes Strut Restrained | | | | | ⚠ Warning |

WP

Loading

No entity matches the filter for the current report item.

Static

Summary SHS 100x100x10.0(S355)

| Design Condition | Combination Name | Design Value | Design Capacity | Units | U.R. | Status |
|----------------------------|---|--------------|-----------------|-------|-------|------------------|
| Classification | 2 | Class 1 | - | - | - | ✓ Pass |
| Shear Major | 5 | 2.1 | 357.9 | kN | 0.006 | ✓ Pass |
| Shear Minor | No | Significant | Forces | kN | - | Not required |
| Buckling Shear Web | No | Significant | Forces | kN | - | ⚠ Not applicable |
| Moment Major | 5 | 5.4 | 41.3 | kNm | 0.130 | ✓ Pass |
| Moment Minor | No | Significant | Forces | kNm | - | Not required |
| Axial | 5 | 8.8 | 1239.9 | kN | 0.007 | ✓ Pass |
| Axial Bending Combined | 5 | - | - | - | 0.130 | ✓ Pass |
| Buckling Lateral Torsional | - | - | - | - | - | ⚠ Not applicable |
| Buckling Compression | 5 | 8.8 | 910.4 | kN | 0.010 | ✓ Pass |
| Buckling Combined | 5 | - | - | - | 0.088 | ✓ Pass |
| Design Note | Top & Bottom Flanges Laterally Restrained | | | | | ⚠ Warning |
| Design Note | Major and/or Minor Axes Strut Restrained | | | | | ⚠ Warning |

WP

Loading

No entity matches the filter for the current report item.

Static

Summary SHS 100x100x10.0(S355)

| Design Condition | Combination Name | Design Value | Design Capacity | Units | U.R. | Status |
|----------------------------|---|--------------|-----------------|-------|-------|------------------|
| Classification | 2 | Class 1 | - | - | - | ✓ Pass |
| Shear Major | 6 | -2.1 | 357.9 | kN | 0.006 | ✓ Pass |
| Shear Minor | No | Significant | Forces | kN | - | Not required |
| Buckling Shear Web | No | Significant | Forces | kN | - | ⚠ Not applicable |
| Moment Major | 6 | -5.4 | 41.3 | kNm | 0.130 | ✓ Pass |
| Moment Minor | No | Significant | Forces | kNm | - | Not required |
| Axial | 6 | 8.8 | 1239.9 | kN | 0.007 | ✓ Pass |
| Axial Bending Combined | 6 | - | - | - | 0.130 | ✓ Pass |
| Buckling Lateral Torsional | - | - | - | - | - | ⚠ Not applicable |
| Buckling Compression | 6 | 8.8 | 910.4 | kN | 0.010 | ✓ Pass |
| Buckling Combined | 6 | - | - | - | 0.088 | ✓ Pass |
| Design Note | Top & Bottom Flanges Laterally Restrained | | | | | ⚠ Warning |
| Design Note | Major and/or Minor Axes Strut Restrained | | | | | ⚠ Warning |

4.0 END REACTION FORCES

St. 1 (1)

| Reference | Span | Section | Grade | Loadcase | End | F _x | F _y | F _z | M _x | M _y | M _z |
|-----------|------|---------------|-------|-------------|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | | | | | | [kN] | [kN] | [kN] | [kNm] | [kNm] | [kNm] |
| 1B1 | 1 | UC 152x152x37 | S355 | 3 Dead Load | 1 | 0.0 | 0.0 | 14.7 | 0.0 | 0.0 | 0.0 |
| | | | | | 2 | 0.0 | 0.0 | 43.4 | 0.0 | 17.5 | 0.0 |
| | | | | 4 Live Load | 1 | 0.0 | 0.0 | 3.6 | 0.0 | 0.0 | 0.0 |
| | | | | | 2 | 0.0 | 0.0 | 10.6 | 0.0 | 4.3 | 0.0 |
| | 2 | UC 152x152x37 | S355 | 3 Dead Load | 1 | 0.0 | 0.0 | 58.8 | 0.0 | -17.5 | 0.0 |
| | | | | | 2 | 0.0 | 0.0 | 42.3 | 0.0 | 0.0 | 0.0 |

| Reference | Span | Section | Grade | Loadcase | End | F _x | F _y | F _z | M _x | M _y | M _z |
|-----------|------|---------------|-------|-------------|-----|----------------|----------------|----------------|----------------|----------------|----------------|
| | | | | | | [kN] | [kN] | [kN] | [kNm] | [kNm] | [kNm] |
| 1B2 | 1 | UC 152x152x23 | S355 | 4 Live Load | 1 | 0.0 | 0.0 | 14.4 | 0.0 | -4.3 | 0.0 |
| | | | | | 2 | 0.0 | 0.0 | 10.4 | 0.0 | 0.0 | 0.0 |
| | | | | 3 Dead Load | 1 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | 0.0 |
| | | | | | 2 | 0.0 | 0.0 | 4.0 | 0.0 | 0.0 | 0.0 |
| | | | | 4 Live Load | 1 | - | - | - | - | - | - |
| | | | | | 2 | - | - | - | - | - | - |

5.0 CONNECTION DESIGN

END-PLATE CONNECTIONS

All end plate connections to be 4no. M16 bolts with 10mm thick endplate.

Connection Capacity = 240kN

6.0 PADSTONES AND FOUNDATIONS

SLS REACTIONS

| Beam | Reaction | Selection | Capacity |
|------|----------|--------------------------------|----------|
| 1B1 | 52.7kN | 450x215x15mm thick steel plate | 58.1kN |
| 1B1 | 18.3kN | 200x215x15mm thick steel plate | 25.8kN |

FOUNDATION UNDER 0C1

Foundation design: Reaction = 127 kN (SLS)

ABP = 100 kN/m²

Required Area = 127/ 100 = 1.27m²

Therefore, use 1200X1200mm wide pad 1750mm deep.

By inspection, 450mm wide, 1750mm deep foundation is suitable for WP's.

7.0 WIND POSTS

2no. wind posts will be installed at ground floor level to provide lateral stability.

Wind Load:

Wk: Total wind load @ 0.6kN/m² @ 4m² area
Factored (2.4x1.5)

= 2.4kN

= 3.6kN

Load on each post = 3.6/2= 1.8kN (Factored)
= 2.4/2= 1.2kN (Unfactored)

Max applied moment of the beam, Med = 2.4*2.5= 6.0kNm

Use: 100x100x10.0 SHS (M_{RD} = 41.2kNm)

Max deflection, cantilevering post $d = 1.2 \cdot 2500^3 / (3 \cdot 210 \cdot 462E4) = 6.44\text{mm} < 8.3\text{mm}$

Lever arm at connection between wind post and foundation = 250mm

Tension in the bolt at connection with the foundation: (6/0.25)/2= 12kN

Use: 250x250x10mm thick steel baseplate with 4no. M16 resin anchors, 300mm embedment (N_{RD}= 31.2kN)

BEAM LOAD TAKE DOWN

Project: Flat 4 129 Camberwell Road
 Job No.: 7393

By: RE

Checked: TPE

Date: August 2021



Beam 1B1

| Loadcase | | Used y/n? | Load Ratio | Load Span (m) | Height (m) | Thickness (m) | Area (m ²) | Applied Load | Position from LHS (m) | |
|------------------|------|-------------------|------------|---------------|------------|---------------|------------------------|--------------|-----------------------|----------|
| UDL Loads | | | | | | | | | | |
| Gk | | | | | | | | | | |
| Masonry Wall | 19 | kN/m ³ | Y | | 9.50 | 0.22 | | 38.8 | kN/m | Full UDL |
| Timber Floor | 0.75 | kN/m ² | Y | 1/2 | 3.4 | | | 1.3 | kN/m | Full UDL |
| Timber Floor | 0.75 | kN/m ² | Y | 1/2 | 3.4 | | | 1.3 | kN/m | Full UDL |
| Timber Floor | 0.75 | kN/m ² | Y | 1/2 | 3.4 | | | 1.3 | kN/m | Full UDL |
| Timber Floor | 0.75 | kN/m ² | Y | 1/2 | 3.4 | | | 1.3 | kN/m | Full UDL |
| Timber Flat Roof | 0.75 | kN/m ² | Y | 1/2 | 4.0 | | | 1.5 | kN/m | Full UDL |
| Timber Stud Wall | 5 | kN/m ³ | Y | | 3.00 | 0.15 | | 2.3 | kN/m | Full UDL |
| Total | | | | | | | | 47.7 | | |

| | | | | | | | | | | |
|-------------------|------|-------------------|---|-----|-----|--|--|-------------|------|----------|
| Qk | | | | | | | | | | |
| Residential Floor | 1.5 | kN/m ² | Y | 1/2 | 3.4 | | | 2.6 | kN/m | Full UDL |
| Residential Floor | 1.5 | kN/m ² | Y | 1/2 | 3.4 | | | 2.6 | kN/m | Full UDL |
| Residential Floor | 1.5 | kN/m ² | Y | 1/2 | 3.4 | | | 2.6 | kN/m | Full UDL |
| Residential Floor | 1.5 | kN/m ² | Y | 1/2 | 3.4 | | | 2.6 | kN/m | Full UDL |
| Imposed Flat Roof | 0.75 | kN/m ² | Y | 1/2 | 4.0 | | | 1.5 | kN/m | Full UDL |
| Total | | | | | | | | 11.7 | | |

Beam 1B2

| Loadcase | | | Load Ratio | (m) | (m) | Thickness (m) | Area (m ²) | Applied Load | Position from LHS (m) | |
|------------------|----|-------------------|------------|-----|------|---------------|------------------------|--------------|-----------------------|----------|
| UDL Loads | | | | | | | | | | |
| Gk | | | | | | | | | | |
| Cavity Wall | 19 | kN/m ³ | Y | | 0.80 | 0.20 | | 3.0 | kN/m | Full UDL |
| Total | | | | | | | | 3.0 | | |

Point Loads

| | | | | | | | | | | |
|-------------|-----|-------------------|---|--|--|--|------|-----|----|------------------------------|
| Qk | | | | | | | | | | |
| Wind Load 1 | 0.6 | kN/m ² | Y | | | | 4.00 | 2.4 | kN | Applied to Stability Frame 1 |
| Wind Load 2 | 0.6 | kN/m ² | Y | | | | 4.00 | 2.4 | kN | Applied to Stability Frame 1 |