Right Side Mosul
Low Cost House Units

2019-06-16

Architectural Documents for Type B
**ARCHITECTURAL LIST OF DRAWING**

<table>
<thead>
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<td>Site Plan</td>
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<td>A3</td>
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<td>AR-PL-02</td>
<td>Typical Apartment Plans</td>
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<tr>
<td>AR-PL-03</td>
<td>Typical Handicap Apartment Plans</td>
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<tr>
<td>AR-PL-04</td>
<td>Ground Floor Plan - Type B</td>
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<td>Elevation A&amp;B - Type B</td>
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<tr>
<td>AR-DR-01</td>
<td>Door Schedule and Drawings</td>
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<td>AR-WN-01</td>
<td>Window Schedule and Drawings</td>
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<td>Floor Ceramic Details Above Reinforced Slab</td>
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Notes:
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This drawing is to be read in conjunction with all other relevant drawings.

**Legend:**

- **Project:** Right Side Mosul Buildings
- **Drawing:** List of Drawings - Architectural Works
- **Location:** Mosul
- **Scale:** N/A
- **Format:** A3
- **Arch:** Shahyan Lutfi
- **Approved by:** R.Almasri
- **Client:** UN-HABITAT

---

*Right Side Mosul Buildings*

*Drawing: List of Drawings - Architectural Works*

*Location: Mosul*

*Scale: N/A*

*Format: A3*

Arch: Shahyan Lutfi
Approved by: R. Almasri
Client: UN-HABITAT
Gross Area : 61.3m²
Total Area B : 78.8m²
Total Area C : 80.4m²
<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
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</thead>
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<tr>
<td>01</td>
<td>Apartment entrance</td>
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<tr>
<td>02</td>
<td>Main hall</td>
</tr>
<tr>
<td>03</td>
<td>Master bedroom</td>
</tr>
<tr>
<td>04</td>
<td>Bedrooms</td>
</tr>
<tr>
<td>05</td>
<td>Kitchen</td>
</tr>
<tr>
<td>06</td>
<td>Bath rooms</td>
</tr>
<tr>
<td>07</td>
<td>Main Corridor</td>
</tr>
<tr>
<td>08</td>
<td>Main Stairs</td>
</tr>
</tbody>
</table>

Gross Area: 61.3m²
Total Area B: 78.8m²
Total Area C: 80.4m²

---

Gross Area: 61.3m²
Total Area B: 78.8m²
Total Area C: 80.4m²
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Elevation A

Elevation B

Project:
Right Side Mosul Buildings

Drawing:
Elevation A&B (Type B)

Location:
Mosul

Scale:
1:200

SN:
AR-Ele-01

Format:
A3

Arch:
Shahyan Lutfi

Approved by:
R. Almasri

Client:
UN-HABITAT

UN-HABITAT
FOR A BETTER URBAN FUTURE
Notes:
All dimensions are in centimeters unless otherwise noted.

Project:
Right Side Mosul Buildings

Drawing:
Sections AA & BB (Type B)

Location:
Mosul

Scale:
1/200

Format:
A3

Arch: Shahyan Lutfi

Client: UN-HABITAT

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UN-HABITAT

FOR A BETTER URBAN FUTURE

Section B-B

Section A-A
### Door Schedule and Drawings

**Right Side Mosul Buildings**

- **Location:** Mosul
- **Scale:** 1:50
- **Format:** A3
- **SN:** AR-DR-01

#### Notes:
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- This drawing is to be read in conjunction with all other relevant drawings.

#### Legend:

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<tr>
<th>Type</th>
<th>Quantity in one apartment</th>
<th>QTY in typical floor (Type B)</th>
<th>QTY one Building (Type B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D1</td>
<td>1</td>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>D2</td>
<td>2</td>
<td>16</td>
<td>50</td>
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<tr>
<td>D3</td>
<td>8</td>
<td>22</td>
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<tr>
<td>D4</td>
<td>1 (Handicap apartment)</td>
<td>2 (Handicap apartments)</td>
<td>2 (Handicap apartments)</td>
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**Arch:** Shahyan Lutfi

**Approved by:** R. Almasri

**Client:** UN-HABITAT

---

**Drawing:**

- **Type A:** 15-11-2018
- **Type B:** 16-12-2018
- **Type C:** 05-03-2019
- **Type D:** 27-03-2019
- **Type E:** 14-04-2019
- **Type F:** 16-06-2019

---

**Project:**

- **Location:** Mosul
- **Scale:** 1:50
- **Format:** A3

---

**Notes:**

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- This drawing is to be read in conjunction with all other relevant drawings.

---

**Legend:**

- **SN:** AR-DR-01
- **Arch:** Shahyan Lutfi
- **Approved by:** R. Almasri
- **Client:** UN-HABITAT
<table>
<thead>
<tr>
<th>Name</th>
<th>W2</th>
<th>Location</th>
<th>Bath rooms</th>
<th>Material</th>
<th>PVC window (blurred glass)</th>
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<tbody>
<tr>
<td>Dimension</td>
<td>40*60</td>
<td>Movement</td>
<td>One flap window</td>
<td></td>
<td></td>
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<table>
<thead>
<tr>
<th>Name</th>
<th>W1</th>
<th>Location</th>
<th>Main hall, Kitchen, Master bedroom, Bedroom</th>
<th>Material</th>
<th>PVC window</th>
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<tbody>
<tr>
<td>Dimension</td>
<td>120*100</td>
<td>Movement</td>
<td>Two flap window</td>
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<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity in one apartment</th>
<th>QTY in typical floor (Type B)</th>
<th>QTY One Building (Type B)</th>
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<tbody>
<tr>
<td>W1</td>
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<td>32</td>
<td>96</td>
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<tr>
<td>W2</td>
<td>1</td>
<td>8</td>
<td>24</td>
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Right Side Mosul
Low Cost House Units

2019-06-16
Sanitation Documents for Type B
# Sanitation
## LIST OF DRAWING

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<td>Typical Floor Sewage Plan - Type B</td>
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<td>SE-PL-03</td>
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<tr>
<td>WS-DPL-01</td>
<td>Ground Floor Water Supply Plan -Type B</td>
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<td>A3</td>
<td>REV - 06</td>
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<tr>
<td>WS-DPL-02</td>
<td>Typical Floor Water Supply Plan - Type B</td>
<td>1:200</td>
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<td>REV - 06</td>
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<td>WS-PL-03</td>
<td>Roof Floor Water Supply Plan - Type B</td>
<td>1:200</td>
<td>A3</td>
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<td>WS-PL-04</td>
<td>General Details 01</td>
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<td>WS-PL-05</td>
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<td>WS-PL-06</td>
<td>General Details 03</td>
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<td>WS-DPL-01</td>
<td>Ground Floor &amp; Typical Floor Water Supply Details-Type C &amp; D</td>
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## Project:
### Right Side Mosul Buildings

- **Drawing**: List of Drawings - Architectural Works
- **Location**: Mosul
- **Scale**: N/A
- **Format**: SN: AR-LD-00
- **Arch**: Shahyan Luttfi
- **Approved by**: R. Almasri
- **Client**: UN-HABITAT
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Legend:

Project:
Right Side Mosul Buildings

Drawing:
Typical Floor Sewage Plan-Type B

Location:
Mosul

Scale:
1/200

Format:
A3

Arch: Shahyan Lutfi
Approved by: R. Almasri

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Legend:

Project:
Right Side Mosul Buildings

Drawing:
Roof Floor Sewage Plan-Type B

Location:
Mosul

Scale: 1/200
Format A3

Rev. Description Date
4 Tendering 05-03-2019
5 Tendering 05-03-2019
6 Tendering 27-03-2019
7 Tendering 14-04-2019
8 Concept Design 15-11-2018

Arch: Shahyan Lutfi
Approved by: R. Almasri
Client: UN-HABITAT

SN: SE-PL-03
Un-Habitat

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Legend:

Project:
Right Side Mosul Buildings

Drawing:
Type B - Typical Floor-Water supply plan

Location:
Mosul

Scale:
1/200

Format:
A3

SN: WS-DPL-02

Date

Rev.

Description

Arch:
Shahyan Lutfi

Approved by:
R. Almasri

Client:
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Data

SN: WS-PL-05

Project:
Right Side Mosul Buildings

Location:
Mosul

Scale:
N/V

Format:
A3

Legend:

Arch: Shahyan Lutfi
Approved by: R. Almasri
Client: UN-HABITAT
**WS EQUIPMENTS**

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<td>Ball Valve</td>
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<td>Float Valve</td>
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<td>Sound Valve</td>
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<tr>
<td>Two-Way Valve</td>
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<td>Three-Way Valve</td>
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<td>Globe Valve</td>
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<td>Pressure Reducing Valve</td>
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<td>Chrome Plated Valve</td>
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<td>Butterfly Valve</td>
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<td>Safety Valve</td>
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<td>Strainer</td>
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<td>Valve Box</td>
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<td>Expansion Joint</td>
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<td>Water Tank</td>
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<td>Automatic Air Vent</td>
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<tr>
<td>U.V. Intensity</td>
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<td>Pump in Line Circulator</td>
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<tr>
<td>Pump</td>
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<td>Electric Water Heater</td>
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<td>Tank (Vertical)</td>
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<tr>
<td>Fuel Boiler</td>
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<tr>
<td>Boiler Electric</td>
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<td>Booster</td>
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**WATER SUPPLY PIPES**

**DRAINAGE PIPES & EQUIPMENT**

**FIRE FIGHTING PIPES**

**EQUIVALENT PIPES DIAMETERS**

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<th>Galvanized Steel Pipe</th>
<th>Multi-layer Pipe (PVC-AL-PEX)</th>
<th>Polyethylene Pipe (PPR - PN10)</th>
<th>Polypropylene Pipe (PPR - PN20)</th>
<th>PPR-C Pipe (CPVC - PN20)</th>
<th>PVC-C Pipe (CPVC - PN20)</th>
<th>PVC-C Pipe (CPVC - PN20)</th>
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<td>Inside Diameter (mm)</td>
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<td>(in)</td>
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<td>(mil)</td>
<td>(mil)</td>
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*Architect: Shahyan Lutfi*
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Project: Right Side Mosul Buildings
Drawing: Ground Floor & Typical Floor - Water Supply Details - Type B
Location: Mosul
Arch: Sara Faruq
Approved by: R.Almasri
Client: UN-HABITAT

Legend:

<table>
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<th>Description</th>
<th>Date</th>
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<tbody>
<tr>
<td>WS-DPL-01</td>
<td>Ground Floor &amp; Typical Floor - Water Supply Details - Type B</td>
<td>15-11-2018</td>
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<tr>
<td></td>
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<td>16-12-2018</td>
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<td>19-06-2019</td>
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<td>21-12-2019</td>
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Notes:

Detail No. 01
Detail No. 02
Detail No. 03
Detail No. 04
Right Side Mosul
Low Cost House Units
2019-06-16
Electrical Documents for Type B
# Electrical

## LIST OF DRAWING

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<td>REV - 06</td>
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<tr>
<td>ELE-PL-01</td>
<td>Type B - Ground Floor Sockets and Lighting</td>
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<td>REV - 06</td>
</tr>
<tr>
<td>ELE-PL-02</td>
<td>Type B - Typical Floor Sockets and Lighting</td>
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<td>A3</td>
<td>REV - 06</td>
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<td>ELE-PL-03</td>
<td>SDB Panel</td>
<td>N/A</td>
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<td>REV - 06</td>
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<td>ELE-PL-04</td>
<td>DB5-1 to DB5-2</td>
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Legend:
- SN: AR-LD-00
- Format: A3

Project:
- Right Side Mosul Buildings

Drawing:
- List of Drawings - Electrical Works

Location:
- Mosul

Scale:
- N/A

Revision:
- Description | Date
  - Tendering | 26-06-2018
  - Tendering | 21-03-2019
  - Tendering | 27-03-2019
  - Tendering | 14-04-2019
  - Tendering | 19-06-2019

Arch: Shahyan Lutfi

Approved by: R. Almasri

Client: UN-HABITAT
SDB PANEL (Typical)
FROM: W/39
4XJS 1.25 mm² (copper)
CU/PVC/PVC

- MCCB = 100/3

<table>
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<tr>
<th>CIRCUIT (Busbar No.)</th>
<th>K</th>
<th>S</th>
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CIRCUIT BREAKER

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</thead>
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Table: 1.5 mm² Copper, 1.25 mm² PVC/PVC

Connector Load: 69.6 KW
Demand Load: 30 KW

DB5-1 = DB5-2 PANEL (Typical)
EXCAVATION PLAN B

Notes:
- All dimensions are in centimeters unless noted.
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- This drawing is to be read in conjunction with all other relevant drawings.

Legend:
- REFER TO THE GENERAL STRUCTURAL NOTES ON DRAWING NO. ST-001
- REFER TO THE GENERAL STRUCTURAL DETAILS ON DRAWING NO. ST-002
- CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
- REINFORCEMENT FY400
- THE FOUNDATIONS DESIGN IS BASED ON THE ALLOWABLE BEARING PRESSURE OF (4 Kg/CM²)

Project:
- Right Side Mosul Buildings

Drawing:
- Foundation Plan -(ST-01) (Type B)

Location:
- Mosul

Scale:
- 1/100

SN:
- ST-SP-01

Format:
- A3

Arch:
- Shahyan Lutfi

Approved by:
- R. Almasri

UN-HABITAT
EXCAVATION PLAN B
The foundations design is based on the allowable bearing pressure of (4 Kg/CM²)
Right Side Mosul
Low Cost House Units

17/09/2019
UPDATE STRUCTURAL PACKAGES
TYPE B
## Structural List of Drawings

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<thead>
<tr>
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<th>Title</th>
<th>Scale</th>
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<td>Stair Details</td>
<td>A1</td>
<td>REV - 01</td>
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Notes:
- All dimensions are in centimeters unless noted.
- The copyright of this drawing remains with UN-HABITAT architects and may not be reproduced without prior written consent.
- This drawing is to be read in conjunction with all other relevant drawings.

Legend:
- A: Concept Design
- B: Draft
- C: Tendering
- D: Tendering
- E: Tendering
- F: Tendering
- G: Tendering
- H: Tendering
- I: Tendering

Project:
- Right Side Mosul Buildings

Drawing:
- List of Drawings (Type B)

Location:
- Mosul

Scale:
- 1/100

Format:
- A3

Arch:
- Shahyan Lutfi

Approved by:
- R. Almasri

Client:
- UN-HABITAT
A - GENERAL NOTES:

1. ALL DIMENSIONS ARE IN MILLIMETERS, EXCEPT WHERE INDICATED.
2. SCALE 1:100, UNLESS NOTED.
3. NOTES SHOWN ON THE DRAWING ARE IN PICTURE CAPTIONS.
4. UNLESS OTHERWISE SHOWN, SECTIONS SHOWN ON THE DRAWING ARE IN CONCRETE.
5. CONCRETE Projects:

   a. Project: Mosul
   b. Location: Right Side Mosul

D - CONSTRUCTION JOINTS AND SHRINKAGE STRIPS:

1. CONCRETE JOINTS TO BE PLACED ADEQUATELY AND CONNECTED IN A MANUFACTURED AND CONSULTANT APPROVED MANNER.

C - GROUND BEARING SLABS:

1. BACKFILL IS TO COMPRSHED GRADE MATERIALS PLACED IN LAYERS 250MM THICK AND COMPACTED TO A MINIMUM TURBIDITY OF 85,000 PA.
2. SLABS ARE TO BE PLACED ADEQUATELY AND CONNECTED IN A MANUFACTURED AND CONSULTANT APPROVED MANNER.

F - CAMBER NOTES:

1. UNLESS OTHERWISE STATED, ALL CONCRETE JOINTS AND SHULKAGE STRIPS MUST BE PLACED AND CONNECTED IN A MANUFACTURED AND CONSULTANT APPROVED MANNER.

REV. DESCRIPTION

A - GENERAL REQUIREMENTS FOR CONCRETE:

1. CEMENT:
   a. Type:Portland Cement
   b. Specific Gravity: 3.15
   c. Blending: 3.15

2. Aggregates:
   a. Coarse Aggregate: Maximum Size 20mm
   b. Fine Aggregate: Maximum Size 5mm

3. WATER:
   a. Specific Gravity: 1.00
   b. Blending: 1.00

4. REINFORCEMENT:
   a. Type: Deformed Bars
   b. Diameter: 16mm
   c. Spacing: 200mm
   d. Length: 2500mm

5. SUBSTRUCTURE:
   a. Type: Slab
   b. Thickness: 200mm

G - FOUNDATIONS:

1. FOUNDATIONS TO BE PLACED ADEQUATELY AND CONNECTED IN A MANUFACTURED AND CONSULTANT APPROVED MANNER.

H - CONCRETE:

1. CEMENT:
   a. Type: Portland Cement
   b. Specific Gravity: 3.15
   c. Blending: 3.15

2. REINFORCEMENT:
   a. Type: Deformed Bars
   b. Diameter: 16mm
   c. Spacing: 200mm
   d. Length: 2500mm

3. SLABS:
   a. Type: Slab
   b. Thickness: 200mm

I - REINFORCEMENT:

1. STEEL TO BE SPECIFIED IN THE DRAWING.

NOTE:

ALL DIMENSIONS ARE IN CENTIMETERS, UNLESS NOTED.

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THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELATE DRAWINGS.

ARCHITECT: Shahyan Lutfi
DRAWING: List of Drawings (Type B)
LOCATION: Mosul
PROJECT: Right Side Mosul Buildings
SCALE: 1:100
FORMAT: ST-LD-01
DATE: 12-12-2019
ARCHITECT: Shahyan Lutfi
DRAWING: List of Drawings (Type B)
LOCATION: Mosul
PROJECT: Right Side Mosul Buildings
SCALE: 1:100
FORMAT: ST-LD-01
DATE: 12-12-2019
Approved by: R. Almasri
UN-HABITAT FOR A BETTER FUTURE
**SCHEDULE OF IN SITU LINTELS UNO.**

<table>
<thead>
<tr>
<th>Size</th>
<th>Max. Span</th>
<th>Reinforcement A (Bot)</th>
<th>Reinforcement B (Top)</th>
<th>Links</th>
<th>Details</th>
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<td>100X200</td>
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<td>1#14</td>
<td>#8/150</td>
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<td>3000</td>
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<td>1#18</td>
<td>#8/150</td>
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<tr>
<td>150X200</td>
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<td>1#16</td>
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<td>3000</td>
<td>3#16</td>
<td>3#16</td>
<td>#8/150</td>
<td></td>
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</table>

**NOTES:**

1. BEARING ON BLOCK WALL ON EITHER SIDE OF OPENING SHALL BE AT LEAST EQUAL TO THE OVERALL DEPTH OF THE UNTEL.
2. OVERALL LINTEL DEPTHS COULD BE INCREASED TO SUIT BLOCKWORK COURSING.
Project: Right Side Mosul Buildings

Drawing: Foundation Plan -(ST-01) (Type B)

Location: Mosul

Scale: 1/100

Format: A3

Legend:

- Refer to the General Structural Notes on Drawing No.: ST-001
- Refer to the General Structural Details on Drawing No.: ST-002
- Concrete C30 for vertical elements & C25 for others
- Reinforcement FY400
- The foundations design is based on the allowable bearing pressure of (4 Kg/cm²)

REFERENCES:

- CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
- REINFORCEMENT FY400
- THE FOUNDATIONS DESIGN IS BASED ON THE ALLOWABLE BEARING PRESSURE OF (4 Kg/CM²)

Notes:

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- This drawing is to be read in conjunction with all other relevant drawings

AUTHOR:

- Shahyan Lutfi

DATE:

- Concept Design: 16-11-2018
- Tender: 04-03-2019
- Tendering: 17-09-2019
- Tendering: 23-06-2019
- Tendering: 16-12-2019

SCALE:

- 1/100

DATE:

- 01/10/2019

PROJECT:

- Location: Mosul
- Scale: 1/100
- Format: A3

ARCHITECT:

- Shahyan Lutfi

APPROVED BY:

- R. Almasri

CLIENT:

- UN-HABITAT
REFERENCE:
REFER TO THE GENERAL STRUCTURAL NOTES ON DRAWING NO.: ST-001
REFER TO THE GENERAL STRUCTURAL DETAILS ON DRAWING NO.: ST-002
CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
REINFORCEMENT Fy400
THE FOUNDATIONS DESIGN IS BASED ON THE ALLOWABLE BEARING PRESSURE OF (4 Kg/CM²)

UN-HABITAT

Right Side Mosul Buildings

Drawing
Foundation Details-(ST-01)
(Type B)

Location:
Mosul

Scale: 1/100
SN: ST-DT-02
Format: A3

Rev. Description Date
E Tendering 17-09-2019
D Tendering 23-06-2019
C Tendering 04-03-2019
B Tendering 23-06-2019
A Concept Design 15-11-2018

Arch: Shahyan Lutfi
Approved by: R. Almasri
Client: UN-HABITAT
Columns Details

Axial Columns

SCALE 1:100

TYPE B

Notes:
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Legend:
REFERENCE:
REFER TO THE GENERAL STRUCTURAL NOTES ON DRAWING NO.: ST-001
REFERENCE:
REFER TO THE GENERAL STRUCTURAL DETAILS ON DRAWING NO.: ST-002
CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
REINFORCEMENT FY400

Project:
Right Side Mosul Buildings

Drawing:
A: Is of Columns : Details-(ST-03)-(Type B)

Location:
Mosul

Scale:
1:100

Format:
ST-03

SN:

Right Side Mosul
Buildings

Arch: Shahyan Lutfi

Approved by:
R. Almasri

Client:
UN-HABITAT
Notes:
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The right side Mosul buildings

Ground, First & Second Framing Plan (ST-05) (Type B)

REFERENCE:
REFER TO THE GENERAL STRUCTURAL NOTES ON DRAWING NO. ST-001
REFER TO THE GENERAL STRUCTURAL DETAILS ON DRAWING NO. ST-002
CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
REINFORCEMENT FY400

Arch: Shahyan Luttfi
Approved by: R. Almasri

UN-HABITAT
FOR A BETTER URBAN FUTURE
Notes:
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Legend:
- For materials, refer to the general structural notes on drawing no. ST-001.

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Project:
Right Side Mosul Buildings

Drawing:
Ground & First Beam Details (ST-08) (Type B)

Legend:
- A: Concept Design 15-11-2018
- B: Tendering 16-12-2018
- C: Tendering 04-03-2019
- D: Tendering 23-06-2019
- E: Tendering 17-09-2019

Arch: Shahyan Lutfi
Approved by: R. Almasri

UN-HABITAT
For a better urban future.
Notes:
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Legend:
REFERENCE: REFER TO THE GENERAL STRUCTURAL NOTES ON DRAWING NS: ST-001
REFER TO THE GENERAL STRUCTURAL DETAILS ON DRAWING NO.: ST-002
CONCRETE C30 FOR VERTICAL ELEMENTS & C25 FOR OTHERS
REINFORCEMENT FY400

Project:
Right Side Mosul Buildings
Drawing:
Second Beam Details.
(ST-10)-(Type B)
Location:
Mosul
Scale:
1/200
Format:
A3

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<th>Ref</th>
<th>Description</th>
<th>Date</th>
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<tr>
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<td>Concept Design</td>
<td>15-11-2018</td>
</tr>
<tr>
<td>B</td>
<td>Tendering</td>
<td>16-12-2018</td>
</tr>
<tr>
<td>C</td>
<td>Tendering</td>
<td>04-03-2019</td>
</tr>
<tr>
<td>D</td>
<td>Tendering</td>
<td>23-06-2019</td>
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<td>E</td>
<td>Tendering</td>
<td>17-09-2019</td>
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Arch: Shahyan Lutfi
Approved by: R. Almasri
Client: UN-HABITAT
TYPE B
Notations:
All dimensions are in centimeters unless noted.
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This drawing is to be read in conjunction with all other relevant drawings.

Legend:
... structural notes on drawing No. ST-001
... structural details on drawing No. ST-002
Concrete C30 for vertical elements & C25 for others
Reinforcement FY400
--- Top reinforcement
--- Bottom reinforcement

Project:
Right Side Mosul Buildings

Drawing:
Ground Floor: Second Reinforcement
Plan: Y Direct (ST-07) (Type B)

Location:
Mosul

Scale:
1:100

Format:
ST-11

Arch:
Shahyan Lutfi

Approved by:
R. Almasri

Client:
UN-HABITAT

Notes:
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<th>No.</th>
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<td>Concept Design</td>
<td>15-11-2018</td>
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<td>E</td>
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<td>17-09-2019</td>
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SCALE 1/100

TYPE B
Calculation Sheet of

Residential building (8)
## Contents

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1 Introduction:

The project consists of three residential stories and as shown below.

---

2 Materials:

Introduction:

The design was prepared considering the following Materials like reinforcement steel and Concrete

Material characteristics:

The modulus of elasticity is based on the cylinder strength of the concrete based on the formula from the ACI 318-08
\[ E_c = 4700 \cdot \sqrt{f_c} \]

### TABLE: Material Properties - Summary

<table>
<thead>
<tr>
<th>Name</th>
<th>Type</th>
<th>E (kN/m²)</th>
<th>(v)</th>
<th>Weight (kN/m³)</th>
<th>Design Strengths</th>
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<tr>
<td>FY400</td>
<td>Rebar</td>
<td>200000000</td>
<td>0.3</td>
<td>76.9729</td>
<td>Fy=400000 kN/m²</td>
</tr>
<tr>
<td>F'c=25MPa</td>
<td>Concrete</td>
<td>23500000</td>
<td>0.2</td>
<td>25</td>
<td>Fc=25000 kN/m²</td>
</tr>
<tr>
<td>F'c=30Mpa</td>
<td>Concrete</td>
<td>25743000</td>
<td>0.2</td>
<td>25</td>
<td>Fc=30000 kN/m²</td>
</tr>
</tbody>
</table>

### TABLE: Material List by Element Type

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<th>Element Type</th>
<th>Material</th>
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<tr>
<td>Column</td>
<td>F'c=30Mpa</td>
</tr>
<tr>
<td>Beam</td>
<td>F'c=25MPa</td>
</tr>
<tr>
<td>Floor</td>
<td>F'c=25MPa</td>
</tr>
</tbody>
</table>

### 3 Loads:

#### Introduction:

For the structural design of this building Dead, super dead loads (walls+ finishes), Live loads and their combinations have been used.

#### 3.1 Static load cases:
### TABLE: Load Patterns

<table>
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<tr>
<th>Name</th>
<th>Type</th>
<th>Self Weight Multiplier</th>
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<td>Dead</td>
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</tr>
<tr>
<td>LL</td>
<td>Live</td>
<td>0</td>
</tr>
</tbody>
</table>

3.2 Load Combination:

### TABLE: designing Load Combinations

<table>
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<th>Name</th>
<th>LOAD</th>
<th>Type</th>
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<tbody>
<tr>
<td>MAIN</td>
<td>1.4DL+1.7LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>CLASSIC</td>
<td>DL+LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EX1P</td>
<td>1.4 DL +1.1EX1+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EX1N</td>
<td>1.4 DL -1.1EX1+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EX2P</td>
<td>1.4 DL +1.1EX2+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EX2N</td>
<td>1.4 DL -1.1EX2+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EY1P</td>
<td>1.4 DL +1.1EY1+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EY1N</td>
<td>1.4 DL -1.1EY1+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EY2P</td>
<td>1.4 DL +1.1EY2+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EY2N</td>
<td>1.4 DL -1.1EY2+0.55LL</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EXX1P</td>
<td>0.89 DL +1.1EX1</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EXX1N</td>
<td>0.89 DL -1.1EX1</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EXX2P</td>
<td>0.89 DL +1.1EX2</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EXX2N</td>
<td>0.89 DL -1.1EX2</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EYY1P</td>
<td>0.89 DL +1.1EY1</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EYY1N</td>
<td>0.89 DL -1.1EY1</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EYY2P</td>
<td>0.89 DL +1.1EY2</td>
<td>Linear Add</td>
</tr>
<tr>
<td>EYY2N</td>
<td>0.89 DL -1.1EY2</td>
<td>Linear Add</td>
</tr>
</tbody>
</table>

3.3 Loads on various areas

<table>
<thead>
<tr>
<th>Area</th>
<th>Value (KN/m²)</th>
<th>Area</th>
<th>Value (KN/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrace</td>
<td>LL=3 &amp; SDL=3</td>
<td>Bed room</td>
<td>LL=2 &amp; SDL=2</td>
</tr>
<tr>
<td>Stair case</td>
<td>LL=3 &amp; SDL=4</td>
<td>Dressing room</td>
<td>LL=2 &amp; SDL=2</td>
</tr>
</tbody>
</table>
4 Model Description:

Introduction

For the detailed analysis of the building a structural model has been made of the Chalet. The model is used to retrieve results for all the structural elements of the building.

4.1 Procedure:

The following procedure has been followed for all the elements analysis in Etabs:

1. Build 3D model
2. Define all slabs, beams and walls
3. Reduce element stiffness appropriately.
4. Define element releases, support conditions etc.
5. Define loads (Section 3.1)
   a. Self-weight (SW)
   b. Dead Load (DL)
   c. Live Load
6. Design elements (floors, beams and columns)

4.2 Model:

The finite element models are built using Etabs 2016 ver16.0.0 (Fig 1). The model was built as a 3D model

The following model files are used:

BUILDING(8).EDB
Frame elements are used for all beams & columns, and shell elements are used for slabs. The shell elements have a constant thicknesses throughout which are defined in the next table.
**TABLE:** Shell Sections - Slab

<table>
<thead>
<tr>
<th>Name</th>
<th>Material</th>
<th>Slab Type</th>
<th>Element Type</th>
<th>Slab Thickness</th>
<th>One-Way Load Distribution?</th>
</tr>
</thead>
<tbody>
<tr>
<td>S10</td>
<td>$F'c=25\text{MPa}$</td>
<td>Uniform</td>
<td>Shell-Thin</td>
<td>10 cm</td>
<td></td>
</tr>
<tr>
<td>S12</td>
<td>$F'c=25\text{MPa}$</td>
<td>Uniform</td>
<td>Shell-Thin</td>
<td>15 cm</td>
<td></td>
</tr>
<tr>
<td>S20</td>
<td>$F'c=25\text{MPa}$</td>
<td>Uniform</td>
<td>Shell-Thin</td>
<td>20 cm</td>
<td></td>
</tr>
</tbody>
</table>

Beam Elements sections are defined as next depending on framing plans in Etabs as figures (2 to 4)
Fig (2): Ground Floor Framing Plan
Fig (3): first Floor Framing Plan
Fig (4): second Floor Framing Plan
5 Sections Analysis:

Introduction

After retrieving all element results from the structural model, every element in the building can be checked against the relevant combinations of loads. For the different elements the capacity is calculated and compared to the actual combination of section forces as found in the model.

5.1 General methodology for slabs, beams and walls

As a tool to check the floor slabs, walls and beams in the building, they have to be compared with maximum capacity of the section which calculated as following depending on ACI 318-08:

5.1.1 Design of Flexure:

\[ \phi = 0.90 \]  
Flexure strength reduction factor (Tension-controlled section)

**Section at Balance case:**

![Diagram of balanced strain condition in flexure]

\[ \varepsilon_c = 0.003 \]
\[ \varepsilon_s = \varepsilon_y = \frac{f_y}{E_s} \]
\[ d_t = H - d_c \]
\[ C_b = \left[ \varepsilon_c \left( \varepsilon_c + \varepsilon_y \right) \right] d_t \]
\[ 0.85 \geq \beta = 0.85 - 0.05\left( \frac{f_c - 28}{7} \right) \geq 0.65 \]
\[ Y_b = \beta \cdot C_b \]
\[ A_{sb} = \left( 0.85 \times f_c \cdot B \cdot Y_b / f_y \right) \]
\[ M_{ub} = \phi^2 \left( 0.85 \times f_c \cdot B \cdot Y_b \right) \left( d_t - \frac{Y_b}{2} \right) \]

Concrete ultimate compressive strain
Reinf. tensile strain
Effective depth
Neutral axis depth
Equivalent depth factor
Equivalent compressive block depth
Balanced area of steel
Balanced resistance moment, where \( \phi = 0.65 \)

Singly Reinforced Section (Tension-Controlled Section)
Doubly Reiforced Section (Tension-Controlled Section)

\[
\begin{align*}
ec &= 0.003 \\
es &= 0.005 \\
dt &= H - dc \\
Ct &= \frac{ec}{(ec+es)} dt \\
0.85 &\geq \{\beta = 0.85-0.05[(f'c-26)/7]\} = 0.65 \\
Y &= \beta \times Ct \\
A_s &= \{0.85^{*}f'c^{*}B^{*}y/y\} \\
Mu &= \phi^{*}\{0.85^{*}f'c^{*}B^{*}y^{*}[dt-(y/2)]\} \\
\end{align*}
\]

Concrete compressive strain
Reinf. tensile strain
Effective depth
Neutral axis depth
Equivalent depth factor
Equivalent compressive block depth
Maximum area of steel for singly reinforced section
Maximum resistance moment for singly reinforced section
5.1.2 Design of Shear:

\[
\phi = 0.75 \quad \text{Shear strength reduction factor}
\]

Concrete shear strength

\[
V_{cn} = \phi \times 0.17 \sqrt{f_c} B_d
\]

Check sufficient of section

\[
V_{sn(\max)} = \phi \times 0.66 \sqrt{f_c} B_d \quad \text{Maximum shear force can be carried by shear reinforcement}
\]

\[
V_n(\max) = V_{cn} + V_{sn(\max)} \quad \text{Maximum shear force can be carried by section}
\]

5.1.3 Design of Torsion:

\[
\phi = 0.75 \quad \text{Strength reduction factor}
\]

Threshold torsion

\[
T_s = T_{cr}/4 = \phi \times 0.083 \sqrt{f_c} \gamma (A_c p^2 / P_{cp}) \quad \text{Threshold torque = one-quarter of cracking torque}
\]

Check sufficient of section size

\[
\text{Size of section should be sufficient to reduce unsightly cracking and prevent crushing of concrete compression struts}
\]

\[
v_{u,\max} = \phi \times 0.83 \sqrt{f_c} \quad \text{Maximum allowable stresses due to combined shear and torsion}
\]

\[
v_u = \sqrt{(V_u/(B_d)^2 + ((T_u)/(1.7 A_{oh}^2))^2)} \quad \text{applied stresses due to combined shear and torsion}
\]

\[
A_{oh} = X_o \times Y_o \quad \text{Area enclosed by centerline of outermost closed transverse torsional reinforcement}
\]

5.1.4 Deflection:

*Maximum Allowable Deflection

Immediate deflection due to live load

Floors not supporting or attached to nonstructural elements likely to be damaged by large deflection (L/360)

Total deflection due to sustained loads and additional live load

Roof or floor construction supporting or attached to nonstructural elements not likely to be damaged by large deflections (L/240)
5.2 Floor Slabs:

There are two types of slabs, which are one way solid slab and two way solid slab.

All slabs have been checked according to the steps described in Paragraph 5.1,

Slabs elastic deflections is under service loads and Moment diagrams under factored loads are clarified on figures (5 to 13) depending on ETABS 2016 Results as next

![Ground Floor Deflection Contour (mm)](image)

Fig (5): Ground Floor Deflection Contour (mm)
Fig (6): Ground Floor Moment Diagram-M11 (t.m/m)
Fig (7): Ground Floor Moment Diagram-M22 (t.m/m)
Fig (8): First Floor deflection contour - (mm)
Fig (9): First Floor Moment Diagram-M11 (t.m/m)
Fig (10): First Floor Moment Diagram-M22 (t.m/m)

Fig (11): Second Floor Deflection contour (mm)
Fig (12): Second Floor Moment Diagram-M11 (t.m/m)
5.3 Beams:

All beams are designed and checked according to the same procedures, which are very similar to the procedures followed for the floor slabs as per Paragraph 5.1.

Beams Moment and shear diagrams are clarified on figures (14 to 19) depending on Etabs Results as next
Fig (14): Ground Floor Beam Moment diagram (M3-t.m)
Fig (15): Ground Floor Shear diagram (Shear2-2-t)
Fig (16): 1st Floor Beam Moment diagram (M3-t.m)
Fig (17): 1st Floor Shear diagram (Shear2-2-t)
Fig (18): 2nd Floor Beam Moment diagram (M3-t.m)
Fig (19): 2nd Floor Shear diagram (Shear2-2-t)
5.4 Columns

The columns & walls sections are designed in Etabs Model, and the following column & Walls sizes in figures (20 to 30), reinforcement are used throughout in the building. Please refer to the structural plans and sections for locations.

Fig (20): Columns on grid A dimensions (cmXcm) & Column P-M-M interaction Ratio
Fig (21): Columns on grid B dimensions (cmXcm)& Column P-M-M interaction Ratio
Fig (22): Columns on grid C dimensions (cmXcm) & Column P-M-M interaction Ratio
Fig (23): Columns on grid D dimensions (cmXcm) & Column P-M-M interaction Ratio
Fig (24): Columns on grid E dimensions (cmXcm)& Column P-M-M interaction Ratio
Fig (25): Columns on grid F dimensions (cmXcm)& Column P-M-M interaction Ratio
Fig (26): Columns on grid G dimensions (cmXcm) & Column P-M-M interaction Ratio
Fig (27): Columns on grid H dimensions (cmXcm) & Column P-M-M interaction Ratio
Fig (28): Columns on grid I dimensions (cmXcm) & Column P-M-M interaction Ratio
6 Ground Works:

Introduction
For ground works the results from the Safe ver 16.0.0 model have been used to check the foundation according to provided soil investigation report (Bearing Capacity 40 t/m²), The capacity of the foundation elements is compared to the resulting loads and the foundation is designed accordingly.

6.1 foundation
Foundations are isolated with thickness = 50cm (Fig 31), Please refer to the structural plans and sections for locations.

Design for flexure under combination of factored loads, where figures (33 & 34) are clarifying bending moments in the foundations.
Fig (31): Foundations Thicknesses (cm)
Fig (32): FOUNDATION Soil Pressure (t/m²)

Fig (33): FOUNDATION Moment M11 (t.m/m):
Fig (34): FOUNDATION Moment M22 (t.m/m):