STRUCTURAL ANALYSIS AND DESIGN REPORT

PROPOSED 2-STOREY RESIDENCE

Purok 5, Sta. Fe, Gen. Luna, Surigao del Norte

Owner:

MARLOU A. VIOLA

Calculations Report by:

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Report date: \_\_\_\_\_\_\_\_\_\_\_\_  
Rev: 00

1. Structural Design Criteria
   1. Codes and Standards
      1. Governing Codes
         1. National Structural Code of the Philippines – NSCP 2015
         2. American Concrete Institute – ACI 318-14
         3. American Institute of Steel Construction – AISC 9th Edition
      2. Governing Standard

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| --- | --- |
| ASTM A36 | Specification for Structural Steel |
| ASTM A53 | Standard Specification for Pipe, Steel, Black and Hot-dipped, Zinc-Coated, Welded, and Seamless |
| ASTM A611 | Specification for Steel, Sheet, Carbon, Cold Rolled, Structural Quality |
| ASTM A616 | Specification for Deformed and Plain Billet-steel Bars for Concrete Reinforcement |
| PNS 49 | Steel Bars for Concrete Reinforcement Specification |
| ASTM C33/  PNS 49 | Standard Specification for Concrete Aggregates |
| ASTM C39 | Standard Test Method for Compressive Strength of Cylindrical Concrete Specimen |
| ASTM C94/  PNS 46 | Standard Specification for Ready-Mix Concrete |
| ASTM C150/  PNS 07 | Specification for Portland Cement |
| PNS 16 | Philippine National Standard for Concreter Hollow Blocks |
| SG 671 | Specification for the Design of Cold-formed Steel,  Structural Members by AISC |

* 1. Material Specifications
     + - 1. Normal weight concrete 28th day compressive strength  
            (Unless indicated otherwise on the drawings)

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| --- | --- | --- |
| 2.1.1 | Suspended slab | 21 MPa (3,000 psi) |
| 2.1.2 | Beams and Girders | 21 MPa (3,000 psi) |
| 2.1.3 | Slab on grade, | 21 MPa (3,000 psi) |
| 2.1.4 | Columns, Stairs, | 21 MPa (3,000 psi) |
| 2.1.3 | Footings | 21 MPa (3,000 psi) |

* + - * 1. Reinforcing steel yield, fy

|  |  |  |
| --- | --- | --- |
| 2.2.1 | For bars 16 mm diameter and smaller | 276 MPa (40,000 psi) |
| 2.2.2 | For bars 20 mm diameter and larger | 414 MPa (60,000 psi) |

* + - * 1. Structural steel yield, Fy

|  |  |  |
| --- | --- | --- |
| 2.3.1 | For rolled shapes | 250 MPa (36,000 psi) |

* + - * 1. Masonry Concrete Compressive Strength, fm 7.8 MPa (700 psi)
        2. Masonry Grout Compressive Strength, fc’ 13.8 MPa (2,000 psi)
        3. Lean Concrete 28th day compressive strength, fc’ 10.4 MPa (1,500 psi)
  1. Loading Criteria
     1. Dead Load, DL

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| --- | --- |
| Concrete | 24.00 kN/m3 |
| Steel | 77.00 kN/m3 |
| SDL (tiles, ceiling) | 1.20 kPa |

* + 1. Live Load, LL

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| --- | --- |
| Residential Area | 1.90 kPa |
| Stairs | 2.40 kPa |
| Exterior Balconies | 2.40 kPa |

* + 1. Wind Load, WL

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| --- | --- | --- |
| *qz = 47.3x10-6KzKztKdV2Iw*(kPa)  where | | [Eq. 207-15] |
|  | *qz*=velocity pressure at mean roof height, h |  |
|  | *Kzt*=topographic factor |  |
|  | *Kd*=wind directionality factor |  |
|  | *V*=basic wind speed |  |
|  | *Iw*=importance factor |  |

* + 1. Seismic Load, EL

|  |  |  |
| --- | --- | --- |
| Total design base shear | | |
|  | *V = CvIW / RT* |  |
| The total design base shear need not exceed the following: | | |
|  | *V = 2.5CaIW / R* |  |
|  | *V = 0.8ZNvIW / R* |  |
| The total design base shear shall be less than: | | |
|  | *V = 0.11CaIW* |  |
| where: |  |  |
|  | V = total design shear at the base of the structure | |
|  | Cv = seismic coefficient as set forth in Table 208-8 | |
|  | I = Importance factor given in Table 208-1 | |
|  | W = Total dead load defined in Section 208.5.1.1 | |
|  | R = ductility coefficient set forth in Table 208-11 or 208-13 | |
|  | T = fundamental period of vibration | |
|  | Z = seismic zone factor as given in Table 208-3 | |
|  | Nv = near source factor as set forth in Table 208-5 and 208-6 | |

1. Construction Notes  
   1. General

The structural drawings shall be used in conjunction with the specifications, the architectural, mechanical, electrical and civil drawings.

The contractor shall verify all dimensions and conditions at the site, which shall include the location and dimensions of openings, grooves, reglets, pipe sleeves, conduits, embedded or attached to concrete, etc.

All dimensions are in millimeters unless otherwise noted.

All bar diameters and spacing are in millimeters unless otherwise noted.

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* 1. Concrete and Reinforcing Steel

Minimum cover to all reinforcing bars shall be as follows:

Concrete cast against and permanently   
exposed to earth 75 mm

Formed surfaces exposed to earth or weather  
Diameter 16 mm bars or smaller 40 mm  
Other bars 50 mm

Formed surfaces not exposed directly to weather or earth  
Slabs and walls 20 mm  
Beams 40 mm  
Columns 50 mm

Reinforcing bars shall be free of rust, grease of other materials likely to impair bond.

All reinforcing bars shall be accurately and securely placed before pouring concrete or applying mortar or grout.

Bar splices shall be securely wired together. Splices in reinforced concrete beams, columns and walls, shall be as shown in the details. For Non-structural walls, masonry walls and slabs, splices shall lap a minimum of 40 bar diameters and shall be staggered whenever possible.

Splices required in the reinforcement of beams/girders framing into columns shall not be located within the column or within a distance of twice the beam/girder depth from the face of the column.

Lap splices shall be provided within the center half of column height, and the splice length shall not be less than 1.3 times the required development length.

Contractor shall not be allowed to start placement/installation of reinforcing bars for footings, beams walls, columns, slabs, and other reinforced-concrete structural elements without submittal and approval of placing drawings. Only the structural engineer on record and/or the owner’s engineer are authorized to approve placing drawings which should be submitted and received by the office of the structural engineer on record at least two (2) days prior to start of structural concrete works. Placing drawings must follow the same drawing standards as used in the working drawings of this project and only certified by the contractor’s registered civil or structural engineer.

Definition of placing drawings: Placing drawings are working drawings for fabrication and placing of reinforcing steel. These drawing must comprise the following: bar lists, schedules, bending details, placing details, placing plans and elevations, grade, size, spacing, length of each bar, splices and their locations and any necessary additional information that must be supplied by the contractor concerning field conditions, field measurements, construction joints, and sequence of placing concrete.

* 1. Structural Steel
     1. All materials and workmanship shall conform to the ninth edition of the American Institute of Steel Construction (AISC) Manual unless otherwise shown or noted.
     2. Contractor shall furnish all plates, clip angles, connectors, etc. required for completion of the structure even if every such item is not shown on the contract drawings.
     3. Welding shall be in accordance with the American Welding Society Code AWS D1.1 unless indicated otherwise. Welding electrodes shall be E70XX.
     4. All bolts and threaded fasteners shall be ASTM A307 unless indicated otherwise.
  2. Masonry

All concrete hollow blocks masonry walls shall be laid back in running bond. (interlocking course) with full mortar bedding. Stack bond shall be used only when specified.

All cells shall be solidly filled with concrete grout.

* 1. Foundation

1. All foundations are spread footings with tie beams.
2. Footings for CHB walls and other minor structures shall be embedded at least 600 mm from the finish grade line unless indicated otherwise.
3. All foundations should have compacted gravel course 100 mm thick or 50 mm thick lean concrete unless indicated otherwise.
   1. Load Combinations

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| --- | --- | --- |
| 6.1 | Steel (Design) |  |
|  | U = 1.4DL | (DSTL1) |
|  | U = 1.2DL + 1.6LL | (DSTL2) |
|  | U = 1.2DL + 0.5LL + 1.3WX | (DSTL3) |
|  | U = 1.2DL + 0.5LL + 1.3WY | (DSTL5) |
|  | U = 0.9DL + 1.3WX | (DSTL7) |
|  | U = 0.9DL + 1.3WY | (DSTL9) |
|  | U = 1.2DL + 0.5LL + EX | (DSTL11) |
|  | U = 1.2DL + 0.5LL + -EX | (DSTL12) |
|  | U = 1.2DL + 0.5LL + EY | (DSTL13) |
|  | U = 1.2DL + 0.5LL + -EY | (DSTL14) |
|  | U = 0.9DL + EX | (DSTL15) |
|  | U = 0.9DL + -EX | (DSTL16) |
|  | U = 0.9DL + EY | (DSTL17) |
|  | U = 0.9DL + -EY | (DSTL18) |

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| 6.2 | Concrete (Design) |  |
|  | U = 1.4DL |  |
|  | U = 1.2DL + 1.6LL |  |
|  | U = 1.2DL + 1.0LL + 1.6WX |  |
|  | U = 1.2DL + 1.0LL + -1.6WX |  |
|  | U = 1.2DL + 1.0LL + 1.6WY |  |
|  | U = 1.2DL + 1.0LL+ -1.6WY |  |
|  | U = 1.2DL + 0.8WX |  |
|  | U = 1.2DL + -0.8WX |  |
|  | U = 1.2DL + 0.8WY |  |
|  | U = 1.2DL + -0.8WY |  |
|  | U = 0.9DL + 1.6WX |  |
|  | U = 0.9DL - 1.6WX |  |
|  | U = 0.9DL + 1.6WY |  |
|  | U = 0.9DL - 1.6WY |  |
|  | U = 1.2DL + 1.0LL + 1.0EX |  |
|  | U = 1.2DL + 1.0LL + -1.0EX |  |
|  | U = 1.2DL + 1.0LL + 1.0EY |  |
|  | U = 1.2DL + 1.0LL + -1.0EY |  |
|  | U = 0.9DL + 1.0EX |  |
|  | U = 0.9DL + -1.0EX |  |
|  | U = 0.9DL + 1.0EY |  |
|  | U = 0.9DL + -1.0EY |  |

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| 6.3 | Steel (Serviceability) |  |
|  | U = 1.0DL |  |
|  | U = 1.0DL + 1.0LL |  |
|  | U = 1.0DL + 0.6WX |  |
|  | U = 1.0DL + -0.6WX |  |
|  | U = 1.0DL + 0.6WY |  |
|  | U = 1.0DL + -0.6WY |  |
|  | U = 1.0DL + 0.75LL + 0.45WX |  |
|  | U = 1.0DL + 0.75LL + -0.45WX |  |
|  | U = 1.0DL + 0.75LL + 0.45WY |  |
|  | U = 1.0DL + 0.75LL + -0.45WY |  |
|  | U = 0.6DL + 0.6WX |  |
|  | U = 0.6DL + -0.6WX |  |
|  | U = 0.6DL + 0.6WY |  |
|  | U = 0.6DL + -0.6WY |  |
|  | U = 1.0DL + 0.75LL + 0.53EX |  |
|  | U = 1.0DL + 0.75LL + -0.53EX |  |
|  | U = 1.0DL + 0.75LL + 0.53EY |  |
|  | U = 1.0DL + 0.75LL + -0.53EY |  |
|  | U = 0.6DL + 0.7EX |  |
|  | U = 0.6DL + -0.7EX |  |
|  | U = 0.6DL + 0.7EY |  |
|  | U = 0.6DL + -0.7EY |  |