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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Rev: 00

I. Structural Design Criteria

1.0 Codes and Standards

3.1 Governing Codes

1.1.1	National Structural Code of the Philippines – NSCP 2015
1.1.2	American Concrete Institute – ACI 318-14
1.1.3	American Institute of Steel Construction – AISC 9th Edition

3.2 Governing Standard

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

2.0 Material Specifications

2.1 Normal weight concrete 28th day compressive strength
(Unless indicated otherwise on the drawings)

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)

2.2 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)

2.3 Structural steel yield, Fy

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

2.4 Masonry Concrete Compressive Strength, fm	7.8 MPa (700 psi)
2.5 Masonry Grout Compressive Strength, fc’	13.8 MPa (2,000 psi)
2.6 Lean Concrete 28th day compressive strength, fc’	10.4 MPa (1,500 psi)

3.0 Loading Criteria

3.1 Dead Load, DL

Concrete	24.00 kN/m^3
Steel	77.00 kN/m^3
SDL (tiles, ceiling)	1.20 kPa

3.2 Live Load, LL

Residential Area	1.90 kPa
Stairs	2.40 kPa
Exterior Balconies	2.40 kPa

3.3 Wind Load, WL

$q_z = 47.3x10^{-6}K_zK_{zt}K_dV^2I_w$ (kPa) [Eq. 207-15]

where

q_z=velocity pressure at mean roof height, h
K_{zt}=topographic factor
K_d=wind directionality factor
V=basic wind speed
I_w=importance factor

3.4 Seismic Load, EL

Total design base shear

$$V = C_vIW / RT$$

The total design base shear need not exceed the following:

$$V = 2.5C_aIW / R$$
$$V = 0.8ZN_vIW / R$$

The total design base shear shall be less than:

$$V = 0.11C_aIW$$

where:

V = total design shear at the base of the structure
C_v = 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
N_v = near source factor as set forth in Table 208-5 and 208-6

II. Construction Notes

1.0 General

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

1.2 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.

1.3 All dimensions are in millimeters unless otherwise noted.

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

1.5 All dimensions are in millimeters unless otherwise noted.

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

2.0 Concrete and Reinforcing Steel

2.1 Minimum cover to all reinforcing bars shall be as follows:

2.1.1	Concrete cast against and permanently exposed to earth	75 mm
2.1.2	Formed surfaces exposed to earth or weather	
	Diameter 16 mm bars or smaller	40 mm
	Other bars	50 mm
2.1.3	Formed surfaces not exposed directly to weather or earth	
	Slabs and walls	20 mm
	Beams	40 mm
	Columns	50 mm

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

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

2.4 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.

2.5 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.

2.6 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.

2.7 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.

2.8 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.

3.0 Structural Steel

3.1 All materials and workmanship shall conform to the ninth edition of the American Institute of Steel Construction (AISC) Manual unless otherwise shown or noted.

3.2 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.

3.3 Welding shall be in accordance with the American Welding Society Code AWS D1.1 unless indicated otherwise. Welding electrodes shall be E70XX.

3.4 All bolts and threaded fasteners shall be ASTM A307 unless indicated otherwise.

4.0 Masonry

4.1 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.

4.2 All cells shall be solidly filled with concrete grout.

5.0 Foundation

5.1 All foundations are spread footings with tie beams.

5.2 Footings for CHB walls and other minor structures shall be embedded at least 600 mm from the finish grade line unless indicated otherwise.

5.3 All foundations should have compacted gravel course 100 mm thick or 50 mm thick lean concrete unless indicated otherwise.

6.0 Load Combinations

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)

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

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