STRUCTURAL DESIGN OF A SINGLE-FAMILY RESIDENCE IN CHILLIWACK, BC

(Ecohome, 2014)

Prepared for:

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Industry Projects Committee, BCIT Civil Engineering Department
Kian Karimi, PhD, PEng, PE, Faculty Advisor, BCIT Civil Engineering Department
Phyllis Chong, PEng, Instructor, BCIT Civil Engineering Department
Jacquie Russell, Instructor, BCIT Communications Department

Prepared by:

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Submitted on:

April 12, 2021

Civil Engineering Department
British Columbia Institute of Technology
Burnaby, BC

DISCLAIMER

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ACKNOWLEDGEMENTS

I would like to thank the following people who helped me with this project:

- Kian Karimi, who met with me regularly to answer my questions and assist me in my design process
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April 12, 2021

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Submission of Final Report on the Structural Design of a Single-Family Residence

Here is my final report for my structural design of a single-family residence in Chilliwack, BC. For this project, I designed the gravity load system and parts of the lateral load system. The design included the beams, columns, joists, wall studs, concrete bearing walls, footings, and shear wall sheathing and nail spacings. With my design. I developed structural drawings from the provided architectural drawings.

Using hand calculations, I sized the structural elements based on practicality and strength. I sized structural elements for each floor, starting at the main floor and going down to the foundation. After I finished sizing, I produced structural drawings for the main floor, lower floor, basement floor, and foundation plan. The design results are shown on the structural drawings either directly labelled or with a schedule. For this project, I spent 140 hours on the design and report creation. Since the hand calculations file was very large, I placed it in a separate volume.

From this project, I learned how the typical design of residential homes is carried out and I was introduced to industry-style structural drawings. This project improved my skills in identifying locations requiring support and how load transfer paths work. Thank you for sponsoring my project and taking the time to meet when needed and providing me with the materials for my design. I would also like to thank - for regularly meeting with me and assisting me greatly with the technical aspects of the project and Kian Karimi for always answering my questions.

You can be reach by phone at - for any questions or more information about this project.

Sincerely,

-

-

cc: Kian Karimi, Faculty Advisor
Jacquie Russell, Communications Instructor

Attachment: final report

SUMMARY

The purpose of this project was to complete the structural design of a single-family residence. The structural design of this project included designing the gravity load and lateral system and producing structural drawings. The residence is three stories, with the basement and lower floors partially underground. This is an actual project carried out - with the residence currently in -, excluding the design of shear walls under earthquake loads, details and sections, the design of the two-way slab and concrete beam under the garage, geotechnical considerations for the footings, and the design of connections.

For the gravity load system, I designed the beams, columns, joists, wall studs, concrete bearing walls, and footings. I started by determining which walls were load-bearing by using the truss layout. Next, I calculated the snow load and determined the live load both from NBCC. For the dead loads, I assumed 15 psf for the floor loads and member self-weight. The wind load acting on walls was also determined for the design of the exterior studs. Next, I used load combinations to determine the factored load for each member. I sized the main floor beams using the Wood Design Manual or Weyerhaeuser. Then I designed the columns/jack studs on each end of the beams and the wall studs were designed using timber members.

I checked moment resistance, shear resistance, deflection for the beams, compressive resistance for the columns and interior studs, and combined loads using the interactive equation for exterior studs. After, I transferred all the main floor loads down to the lower floor and then the basement floor and determined where loads would act and sized the members the same way. In addition, for the lower floor and basement, I designed the joists using Weyerhaeuser TJI 11-7/8 joists. Since the lower floor and basement are underground, I placed reinforced concrete bearing walls to support the gravity and lateral loads from the soil. Since concrete is heavy, I also calculated the self-weight and determined the wall thickness and required reinforcement. For construction purposes, I designed walls for various locations on the lower and basement floors and used the designed wall where loading was the greatest for the whole house.

The final gravity component was the footings. For simplicity, only strip footings were used along walls. I determined the area with the greatest loads and used that footing for that section of wall. Using the allowable soil bearing capacity from -, I determined the footing width, thickness, and required reinforcement. The footings were designed to only support loads from columns, wall studs, and concrete walls. For the lateral system, I only designed the sheathing and nail spacings for the top and bottom plates of each shear wall. To do this, I first determined the wind load on all surfaces of the residence and chose which walls would be shear walls. Finally, I calculated the force in each shear wall and used the governing wind load for my design.

Finally, I took the architectural drawings and developed structural drawings using all the designed structural components and removing unnecessary information. I either indicated the designed element by directly labelling it on the drawing or using a schedule. I developed the main, lower, and basement floor drawings as well as the foundation pan. In addition, the footings on the foundation plan are shown to scale relative to the drawing to emphasize areas of greater loading. For my design, I used general reasoning for how far some footings would span.

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1.0 INTRODUCTION

This project involves the structural design process of a three-story single-family residence in Chilliwack, BC. My contacts for the project are -, my main sponsor, and -, the structural engineer who walked me through the project's technical part. I completed this project for -. - typical projects are residential houses, where they do the structural and geotechnical design. - wanted to show me how a typical wood-frame construction project is carried out and better prepare me when I graduate and join the workforce.

This residence is an actual project completed by - as the leading structural designer. The residence is located at -, a new residential area in Chilliwack. The residence has recently begun construction, with the foundations completed and framings in progress. The residence is being built on an approximate slope of 15%, with the lower floor and basement partially underground. The lot area is about 5460 sq. ft with a proposed floor area of 3270 sq. ft and a proposed height of 26.7 ft. - revised the architectural drawings for this project twice from the original drawings provided in the proposal. Revisions such as this are common in the industry. Refer to Appendix B, Figure B1, the residence site plan, for information about the floor areas and slopes.

Figure 1 illustrates the proposed cross-section view with better visualization of each floor and what type of loads to consider.

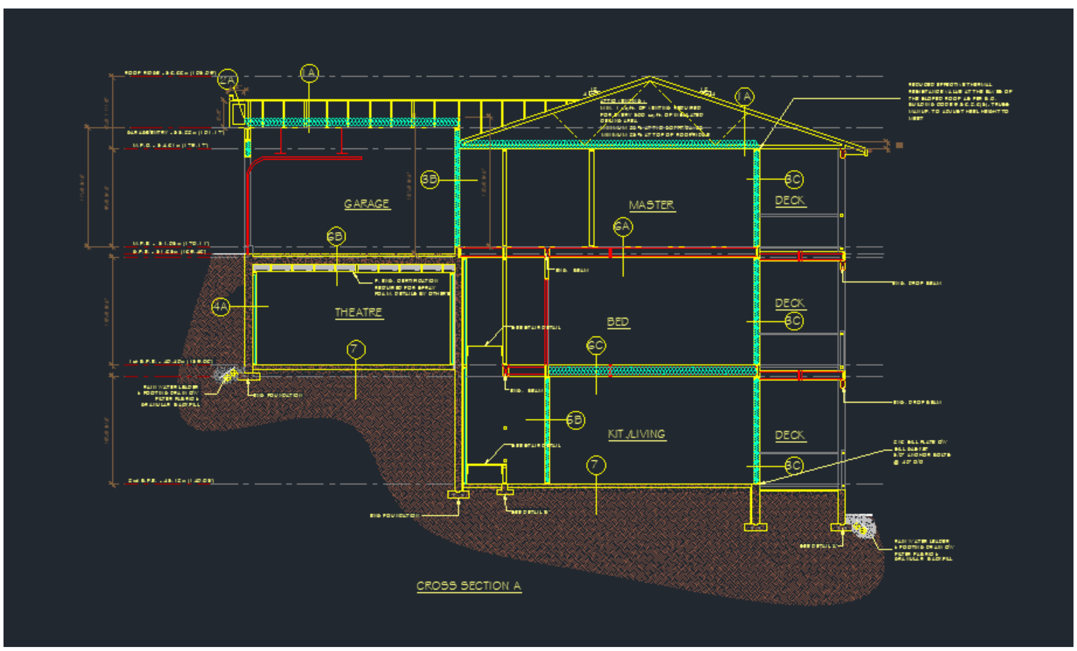


Figure 1: Cross Section of Residence[1] (-, 2020)

Footnotes:
[1]Image provided by sponsor, -

The objectives of this project include:

- determining the location of load-bearing walls and beams
- designing the wood framings
- designing the reinforced concrete bearing walls and foundations
- designing the shear walls under wind loads only
- developing structural drawings

The complete design of this residence is an advanced process and beyond the scope of a second-year student with some topics taught in later years. As such, certain structural tasks including the design of the two-way slab and concrete beam above the theatre, design of the shear walls under earthquake loads, design of connections, details, and sections were not included in my design. Any geotechnical considerations such as the soil bearing capacity and foundations subject to lateral soil pressure was excluded from this project. For simplicity, the design of all the shear wall components, such as the hold-downs and chords, were also excluded from this project. In addition, the design of the slab on grades was not required as in residential projects; they can sit on top of the soil without transferring much load.

All the original tasks stated in the proposal were completed, including the partial design of shear walls under wind loads which was an uncertainty originally. In addition, I designed reinforced concrete bearing walls which was not originally stated but required to design the foundations. The architectural drawings and truss layout in this report are provided by -, the truss supplier. I developed all structural drawings for this project; however, the base drawings were provided by -. In addition, all the reinforced concrete design followed examples in the Reinforced Concrete Design: A Practical Approach.

The remaining sections of this report include the structural design process I used, the major findings and recap of the project, references I used for my project, and appendices for the final structural drawings, architectural drawings, and design tables.

2.0 STRUCTURAL DESIGN PROCESS OF A SINGLE-FAMILY RESIDENCE

For this project, I was going to design the gravity load system, lateral load system, and produce structural drawings. The gravity load system included the beams, columns, wall studs, joists, concrete bearing walls, basement walls, and foundations. For the lateral load system, this was the components of shear walls which included nail spacings and sheathing. For the structural drawings, I was attempting to produce industry-style drawings for the main floor, lower floor, basement floor, and foundation plans.

2.1 Design of the Wood Framings under Gravity Loads

The first step was determining which walls were load-bearing to design the wood framings under gravity loads. To do this, I used the truss layout provided by -, the truss manufacturer for the project. The truss layout shows the plan view and the direction of the trusses. Any walls perpendicular in the direction of the trusses can be load-bearing, except for exterior walls, which are almost always load-bearing.

After I determined which walls were load-bearing, I decided which areas required support. Figure 2 shows the direction of trusses for the residence.

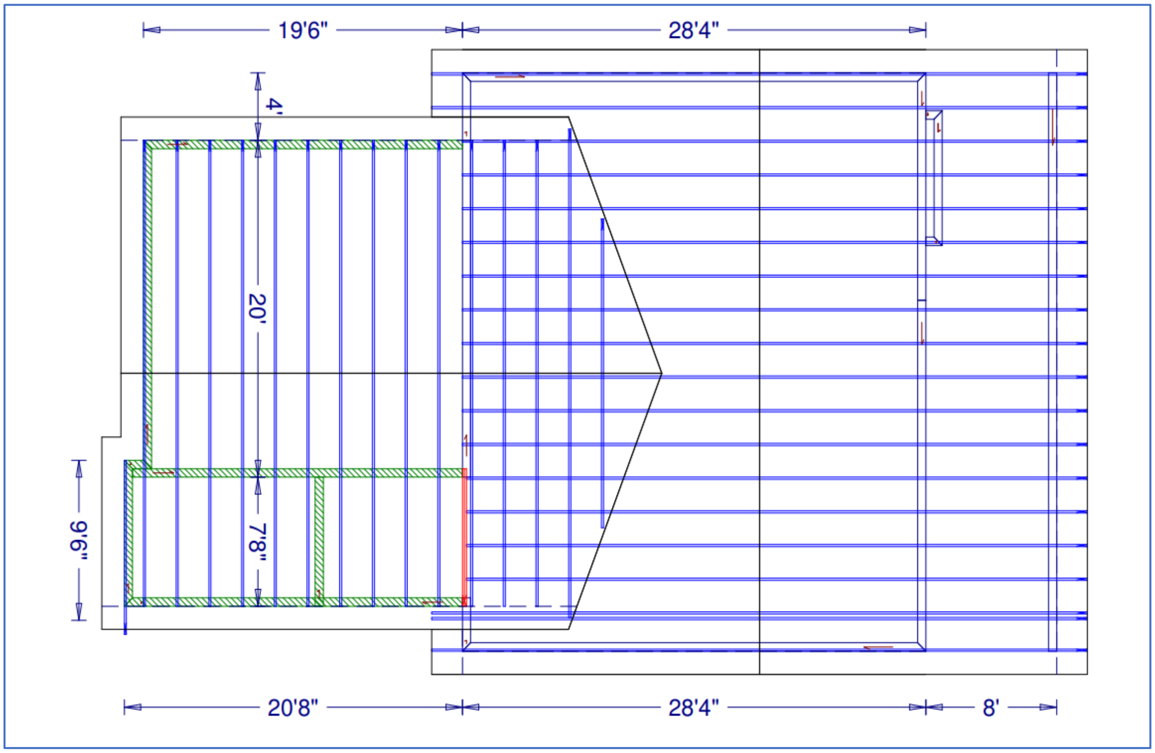


Figure 2: Truss Layout of Residence

2.1.1 Determining Gravity Loads

After knowing which walls were load-bearing, I determined the gravity loads. First, I calculated the snow load using equations and factors from NBCC. I determined the snow load for two roof surfaces, one above the garage and one above the master bedroom. The equation below shows the formula I used to calculate the snow load:

$$S = I_S[S_S(C_bC_WC_SC_a) + S_r]$$

After, I calculated the approximate dead load for a floor using the section view notes in the architectural drawings. See Appendix B, Figure B6, the cross-section view, for components of all the floors. Overall, all the dead loads were around 10-12 psf, but I assumed 15 psf for the dead load of floors, trusses, and self-weight of members to save time calculating these. This value is common for residential framing projects and still conservative. I accounted for partition walls if the wall was directly above a beam or wall and used 20 psf (1 kPa). From NBCC, the live load was given as 1.9 kPa for residential structures. Before sizing any component, I used load combinations from NBCC to determine the factored forces using snow loads, dead loads, and live loads. See Table 1 for the load combinations from NBCC's structural design commentary.

Table 1: NBCC Load Combination Cases (The National Building Code of Canada, 2015, Vol. 1, Part 4.1.2)

Case	Load Combination(1)	
	Principal Loads	Companion Loads
1	1.4D(2)	—
2	(1.25D(3) or 0.9D(4)) + 1.5L(5)	1.0S(6) or 0.4W
3	(1.25D(3) or 0.9D(4)) + 1.5S	1.0L(6)(7) or 0.4W
4	(1.25D(3) or 0.9D(4)) + 1.4W	0.5L(7) or 0.5S
5	1.0D(4) + 1.0E(8)	0.5L(6)(7) + 0.25S(6)

2.1.2 Design of Wood Framings Subject to Gravity Loads

Following the load calculations, I started to design the wood framings under gravity loading. I labelled areas where a beam was required and developed the beam layout. For the main floor, anywhere there was an opening parallel to a load-bearing wall, I designed a header beam and placed it to carry the loads. Due to the openings, wall studs cannot be placed, and the header beam must carry the floor load down a floor(s). I also put beams at the end of the deck to carry half the deck area down a floor(s).

Figure 3 illustrates a case where a header beam is required due to an opening along a load-bearing wall.

Figure 3: Opening with a Header Beam (Fratzel, 2009)

After determining the beam layout for the main floor, I calculated the factored shear force and factored bending moment using statics and load combination cases from NBCC. I assumed main floor beams are only subject to uniformly distributed loads and simply supported.

I sized the beams to carry the loads using equations and values from the Wood Design Manual and in accordance with CSA 086-14. I checked for shear resistance, moment resistance, and deflection. Besides strength, I sized my beams for practicality and cost. As such, I used built-up Spruce Pine Fir (SPF) members for shorter and lower loaded beams. I assumed all beams were laterally supported due to joists or cripple studs.

I used Weyerhaeuser design guides for longer and higher loaded beams and chose the lightest size. Using Weyerhaeuser would occur if more than 3-ply members were required. Depending on the loading, I chose TimberStrand LSL, Microllam LVL, or Parallam PSL and used the allowable design properties, including the modulus of elasticity and moment of inertia.

After I sized all the main floor beams, I determined the reaction forces on each end of the beams. Columns would carry these reaction forces down on each end. As such, I sized columns on each end of beams to be able to carry the load down a floor(s). These columns are also known as trimmer or jack studs. I used built-up SPF members using the compression parallel to grain formula in the Wood Design Manual. I checked for strong-axis buckling for columns on exterior walls or weak-axis buckling for interior walls.

I assumed sheathing prevents weak-axis buckling for exterior walls, pin-pin connections, and ignored wind loads for these columns as gravity governs in these cases. The columns were also sized to match the wall thickness. See Appendix C for the formulas and factors I used when sizing the wood framings under gravity loads, as well as the reference to CSA 086-14.

The next step was designing the load-bearing walls. These walls are studs spaced at intervals to carry and transfer the floor load from the joists and the above wall(s) down to the foundation. Since exterior walls are subject to lateral loads, I used the interactive equation from the Wood Design Manual, which accounts for combined axial and bending forces to design exterior studs. I determined the bending moments using the factored wind load acting on one surface of a structure from NBCC's figures and formulas.

I used the same compression parallel to grain formula as the columns for interior studs. Like the columns, I assumed exterior studs were sheathed, and strong-axis buckling governed the design. I assumed interior studs had weak-axis buckling governing the design. Figure 4 below shows the components of exterior wall wood framings previously discussed.

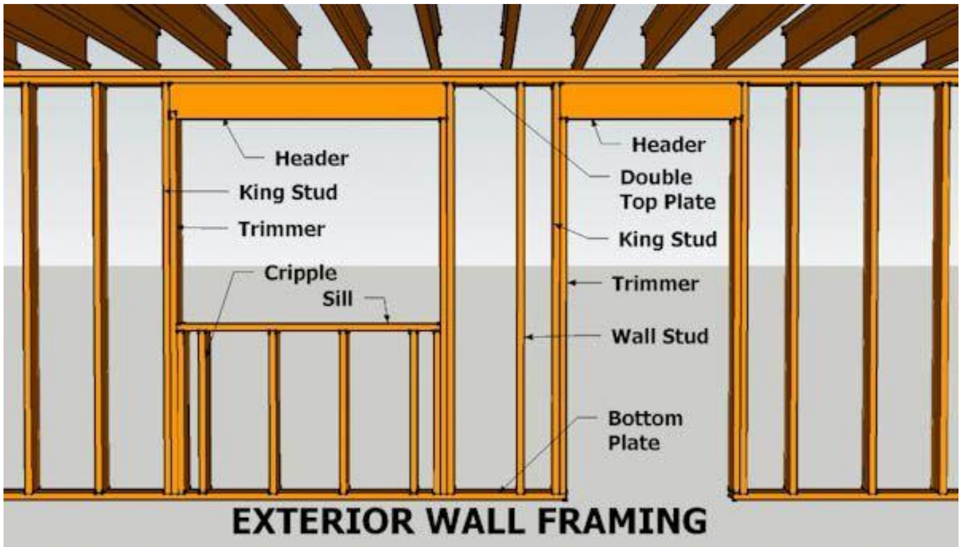


Figure 4: Structural Components of an Exterior Wall (Icreatables, 2021)

The final structural element designed was the joists. I 11-7/8" TJI floor joists for interior joists and 2x10 deck joists for the exterior joists on the lower and basement floor plans. These are common types of joists in residential homes. Then, I determined the factored bending moment and shear force using statics and load combinations for dead and live loads combined. I assumed all the joists were laterally supported due to blocking.

I sized the TJI joists using design tables provided by Weyerhaeuser. I checked shear resistance, moment resistance, and deflection using the equation provided by Weyerhaeuser and allowable deflection from the Wood Design Manual. For the deck joists, 2x10 is common in the industry, and I checked to ensure they had sufficient moment capacity, shear capacity, and deflection passed the code check.

2.1.3 Load Transfer Paths and Lower and Basement Floor Framings

After sizing all the main floor framings, I transferred the loads down each column (jack stud) and wall down a floor. If the point load from the column acted on another beam, the beam must be designed to withstand the floor load and point load. If the point load were acting on a stud wall, I added a column that would project directly underneath the floor that would then transfer the load down a floor or to the foundation.

The wall studs also transfer line loads from joists and an above wall or trusses, which also must go to foundations. For example, I designed the lower floor wall studs to carry the floor load on the lower floor and the loads from above wall studs.

I sized the beams, columns, and wall studs for the basement and lower floor the same way as I did for the main floor using Weyerhaeuser and the Wood Design Manual in my design. I also designed beams at the top and bottom of stairs for the lower floor and basement, which would transfer its loads onto bearing walls. Figure 5 illustrates load transfer paths for wall studs going down a floor and load transfers from a header beam.

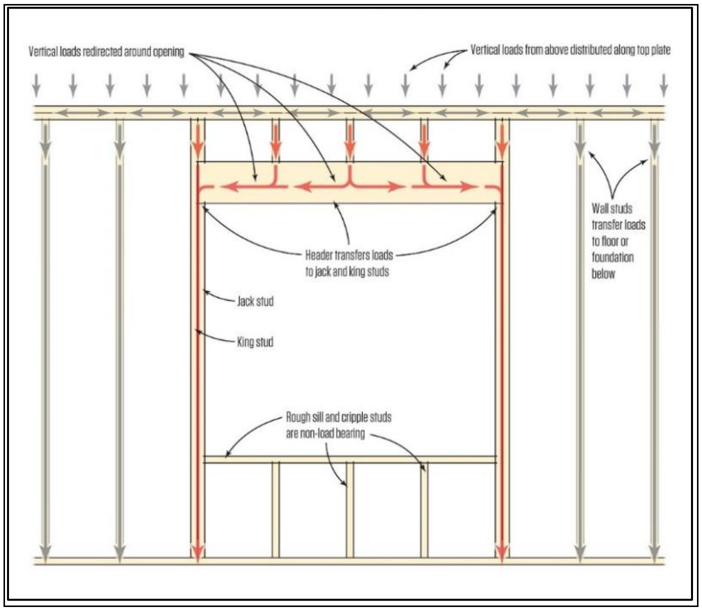


Figure 5: Load Transfer Paths Along a Wall (Osborn, 2017)

2.2 Design of the Reinforced Concrete Walls

For this project, I designed two types of reinforced concrete bearing walls in accordance with CSA A23.3 following examples in the Reinforced Concrete Design handbook. I designed bearing walls only under gravity loads and basement walls under combined gravity loads and lateral loads due to soil. I first started by determining the load acting on the two-way slab under the garage and transferred it to each side of the wall around the perimeter. Since reinforced concrete is heavy, I used a unit weight of 156 pcy and assumed conservative dimensions to start. Figure 6 below shows the load transfer for a two-way slab.

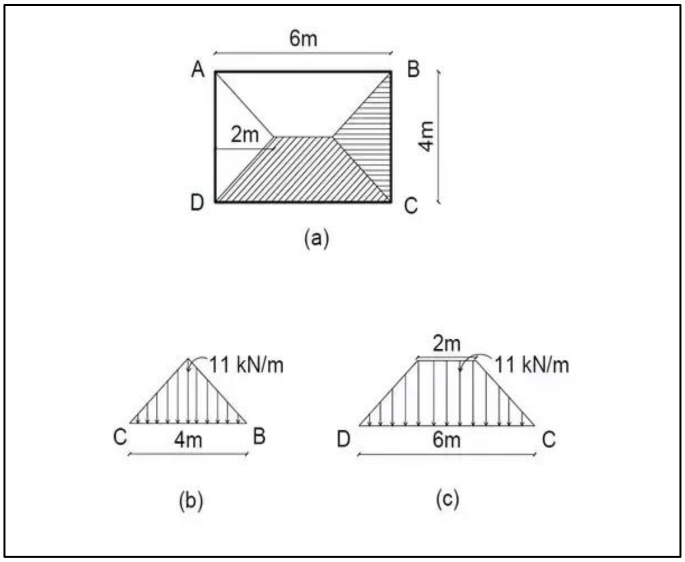


Figure 6: How a Two-Way Slab Transfers Loads (Kumar, 2018)

For basement walls, I assumed concentric loading and neglected axial loads because axial compression reduces the flexural tensile stresses and required amount of flexural reinforcement (Brzev & Pao, 2018). Using design examples from the Reinforced Concrete Design handbook, I determined the:

- design bending moments and shear forces due to soil pressure
- combined effects of flexure and axial loads, which determined the vertical reinforcement and thickness of the wall
- design shear, which determined the horizontal reinforcement

For the basement walls, which act as retaining walls, I determined the required thickness and reinforcements for different areas and levels. I used the largest thickness and most conservative reinforcement for all the wall segments for construction purposes and simplicity. The basement wall with the greatest soil pressure was W4 for the basement, which I designed as two separate walls even though it spanned on two floors. The soil pressure was trapezoidal and thus required the most reinforcement and governed the design.

Refer to Appendix B, Figure B6, the cross-section of the residence for how I determined the soil pressure for W4. See Figure 7 below for a general illustration of a basement wall.

Figure 7: Typical Basement Wall Configuration (EverDry, 2018)

For bearing walls, I assumed concentric loading and a conservative thickness to get a dead load like the basement wall. Bearing walls are not subject to lateral soil pressure and only subject to gravity loads. I included the self-weight and weight and loads of the above wall(s). For my design, I only checked the section of wall that carried the greatest loads since the other sections would work. Because the reinforcement from the basement wall governed, I still checked the following:

- wall thickness
- bearing resistance
- factored axial resistance
- distributed and concentrated wall reinforcement

2.3 Foundation Design

For this project, there were three types of shallow foundations to consider. I designed the footings in accordance with CSA A23.3. Under a column, a spread footing is required; under a wall, a strip footing is required, or a mix of both. For simplicity, I only designed strip footings along a section of a wall using the 1m unit strip method. I determined the area with the greatest point load(s) along a section of wall and used that type of footing for the whole section of wall. See Figure 8 below for the type of footing I used in my design.

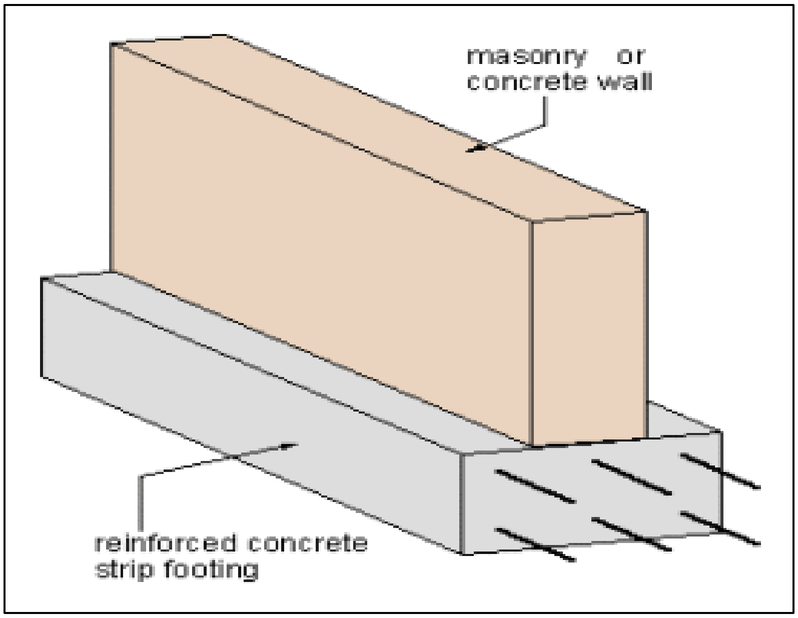


Figure 8: Strip Footing Under a Wall (Irfanbhatblog, 2016)

Since many parts of the concrete walls are subject to soil, I ignored the effects of overturning moments to simplify my design which is part of the geotechnical design. If there was a wall on top of the footing, I added the self-weight of the wall (concrete or wood) as well as the loads it transfers. From - the allowable soil bearing capacity was 75 kPa, and the factored soil bearing capacity was 100 kPa which I used for my design. Since the shear walls were designed last, I assumed the loads from the shear walls did not act on the foundations.

Following the design examples from the Reinforced Concrete Design handbook, I determined the:

- footing width
- required footing thickness based on shear design requirements
- required flexural reinforcement and bar spacing for flexural design
- minimum reinforcement in the longitudinal direction

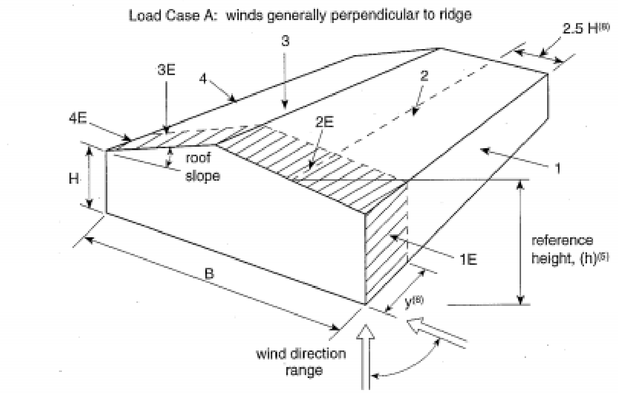
Since soil pressure acts on many surfaces of the basement and lower floors, I added footings everywhere to support the soil or gravity loads. I made assumptions about how far some footings would span, based on the height of the wall underground and gravity loads.

2.4 Shear Wall Design

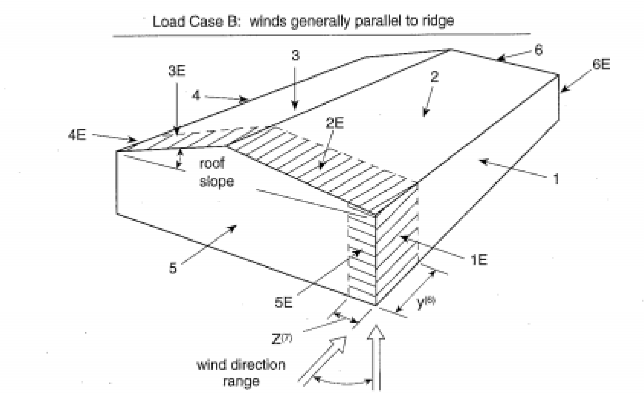
For my shear wall design, I only designed the sheathing and nail spacing components. First, I determined the wind load acting on all surfaces of the house. I used the code equations from NBCC and determined the wind load using the following equation:

$P = I_W q C_e C_t (C_p C_g)$

To determine the C_pC_g values, I used the figures from NBCC and determined the wind load on various surfaces of the structure. Figure 9 shows the peak C_pC_g values for wind parallel and perpendicular to the ridge.



Roof Slope	Building Surfaces							
	1	1E	2	2E	3	3E	4	4E
0° to 5°	0.75	1.15	-1.3	-2.0	-0.7	-1.0	-0.55	-0.8
20°	1.0	1.5	-1.3	-2.0	-0.9	-1.3	-0.8	-1.2
30° to 45°	1.05	1.3	0.4	0.5	-0.8	-1.0	-0.7	-0.9
90°	1.05	1.3	1.05	1.3	-0.7	-0.9	-0.7	-0.9



Roof Slope	Building Surfaces											
	1	1E	2	2E	3	3E	4	4E	5	5E	6	6E
0° to 90°	-0.85	-0.9	-1.3	-2.0	-0.7	-1.0	-0.85	-0.9	0.75	1.15	-0.55	-0.8

EG00920B

Figure 9: External Peak CpCg for Surfaces of a Structure (The National Building Code of Canada, 2015, Vol. 1, Part 4.1.2)

I then determined the wind load on each side of the residence and calculated the force per meter in each wall using the side, front, and rear elevation views. From the wind load and reasoning, I chose which walls were shear walls. Since the house is partially underground with concrete bearing walls, I chose the walls perpendicular to the trusses and joists as they are already designed as load-bearing. There were five shear walls for the main floor, and for the other floors, there was only one shear wall. See Appendix B, Figure B4 for the front and right elevations and Figure B5 for the left and rear elevations.

Next, I used code equations from the Wood Design Manual and the greatest factored wind load to determine the required sheathing. I found the force per meter length in each shear wall and used load combinations to find the factored wind load in each wall. I used the following equation for my sheathing design:

$V_{rs} = \phi V_d J_D J_{us} J_s J_{hd} L_s$

For my design, I used 9.5mm or 12.5mm sheathing and 3.25mm or 2.84mm nails for the sheathing. I then determined the required nail spacing for the bottom and top plate of each shear wall.

2.5 Structural Drawings

The structural drawings were the final part of the design. It shows all the designed elements for each floor. To complete these drawings, I first took the floor plans from architectural drawings and removed any unnecessary information. I then labelled components I designed, including the beams, the columns (including jack studs and exterior posts), wall studs, joists, concrete bearing walls, shear walls, and foundations. The results of the designed members are shown on each floor plan with each element clearly labelled or with a schedule. See Appendix B, Figure B2, the foundation and basement floor plan, and Figure B3, the main floor and lower floor plans. These are the architectural drawings I used to develop the structural drawings.

See Appendix A for the results of my design shown as structural drawings. Figure A1 shows the main floor plan, Figure A2 shows the lower floor plan, Figure A3 shows the basement floor plan, and Figure A4 shows the foundation plan. The results of the shear walls for the entire residence are indicated on the main floor plan as a schedule. I indicated the sheathing and types of nails and their spacings onto the schedule as well the wall it applies to.

3.0 CONCLUSION

For this project, I designed the gravity load system and parts of the lateral load system. For the gravity system, I designed beams, columns, joists, wall studs, concrete bearing walls, and strip footings. For the lateral load system, I designed the sheathing and required nail spacings. I first determined the snow, dead, and live loads and used NBCC load combinations and designed each structural element to withstand these loads. For the gravity system, I transferred the loads down each floor to the foundations and sized each structural element as I went down. I either used equations and values from the Wood Design Manual or design tables from Weyerhaeuser.

In addition, I designed reinforced concrete bearing walls to withstand both lateral soil pressure and gravity loads. After knowing the size and loads from the concrete walls, I designed spread footings all along the house using the allowable and factored soil bearing capacities. Next, for the lateral load system, I first determined the wind load acting on every surface of the home. I then decided to choose which walls were shear walls based on the wind load and configuration of the walls. Lastly, I determined what sheathing and nail spacing for the top and bottom plates was required.

Finally, I took the architectural drawings and produced structural drawings by showing all my designed structural elements by either labelling them on the drawings or using a schedule. I developed the main floor plan, lower floor plan, basement floor plan, and foundation floor plan drawings as well as general notes relevant to each drawing.

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Appendix A: Structural Drawings

List of Contents:

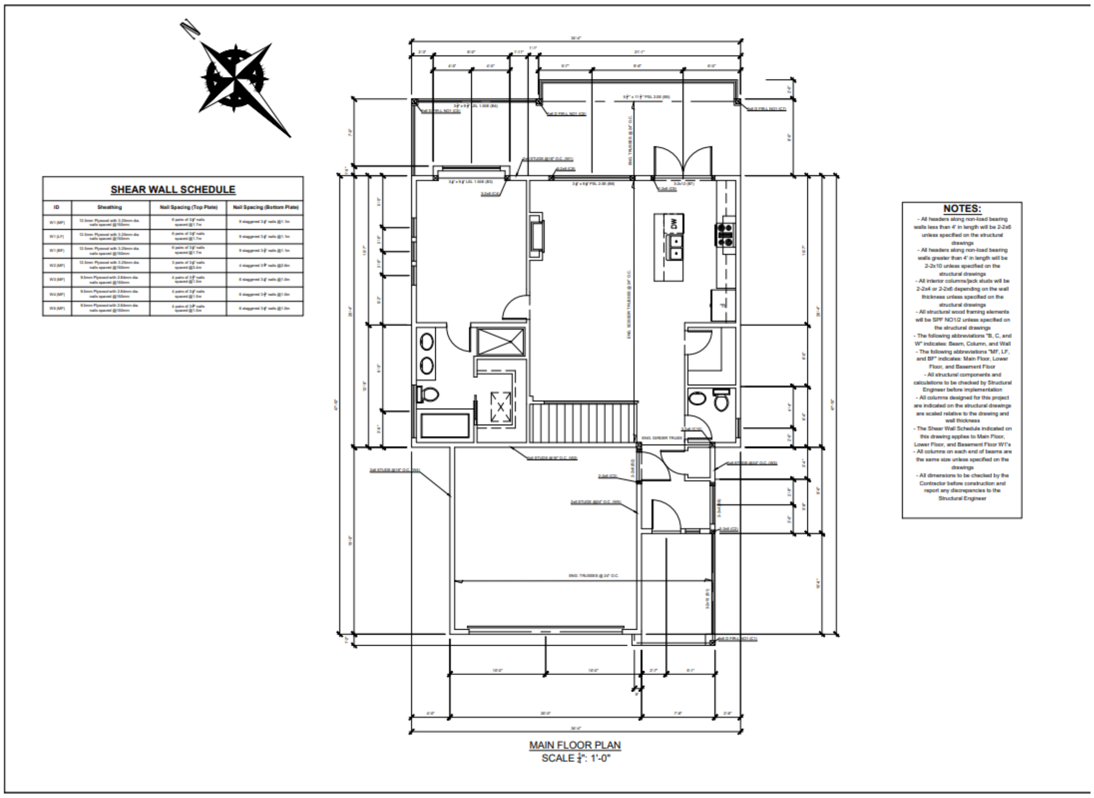

*Figure A1: Main Floor Plan**

***** Clearer digital files available. Please email me at - if needed.

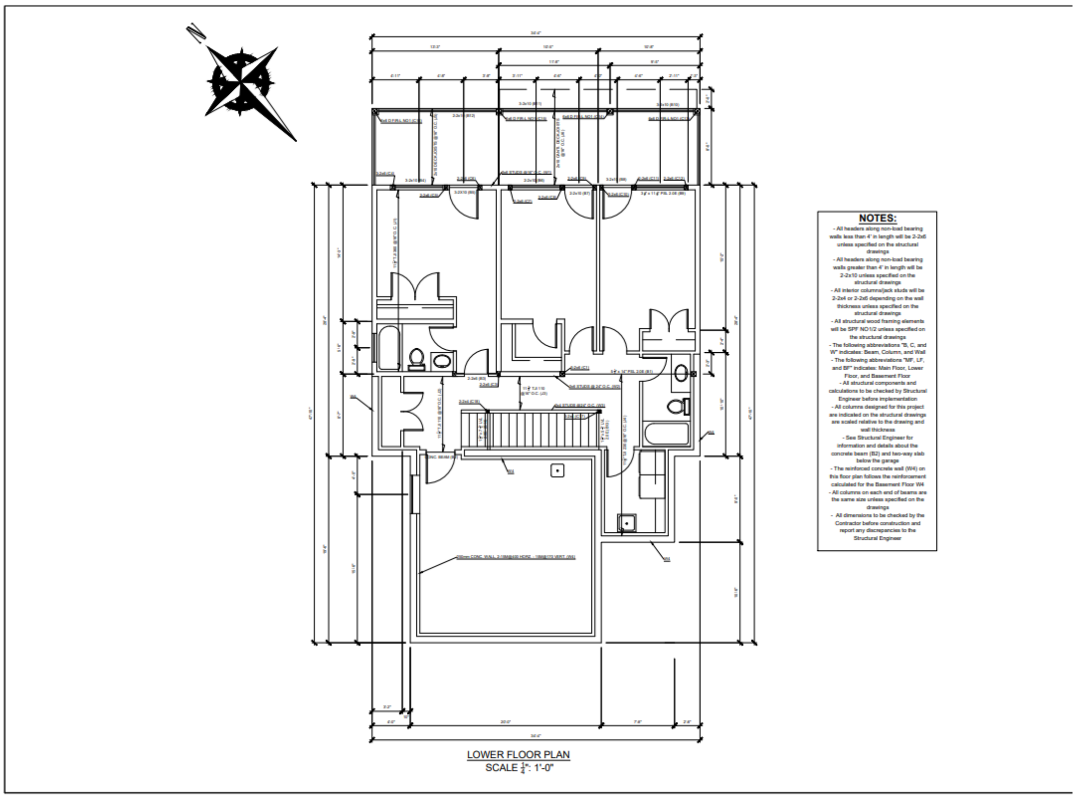

*Figure A2: Lower Floor Plan**

***** Clearer digital files available. Please email me at - if needed.

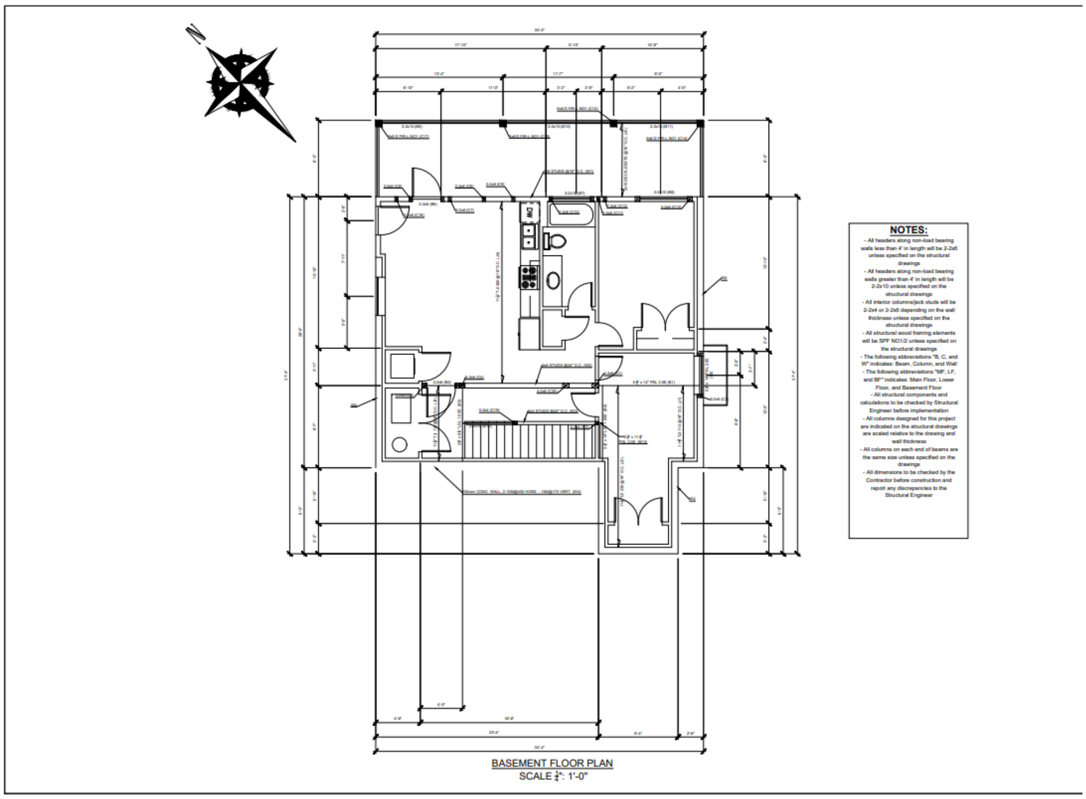

*Figure A3: Basement Floor Plan**

***** Clearer digital files available. Please email me at - if needed.

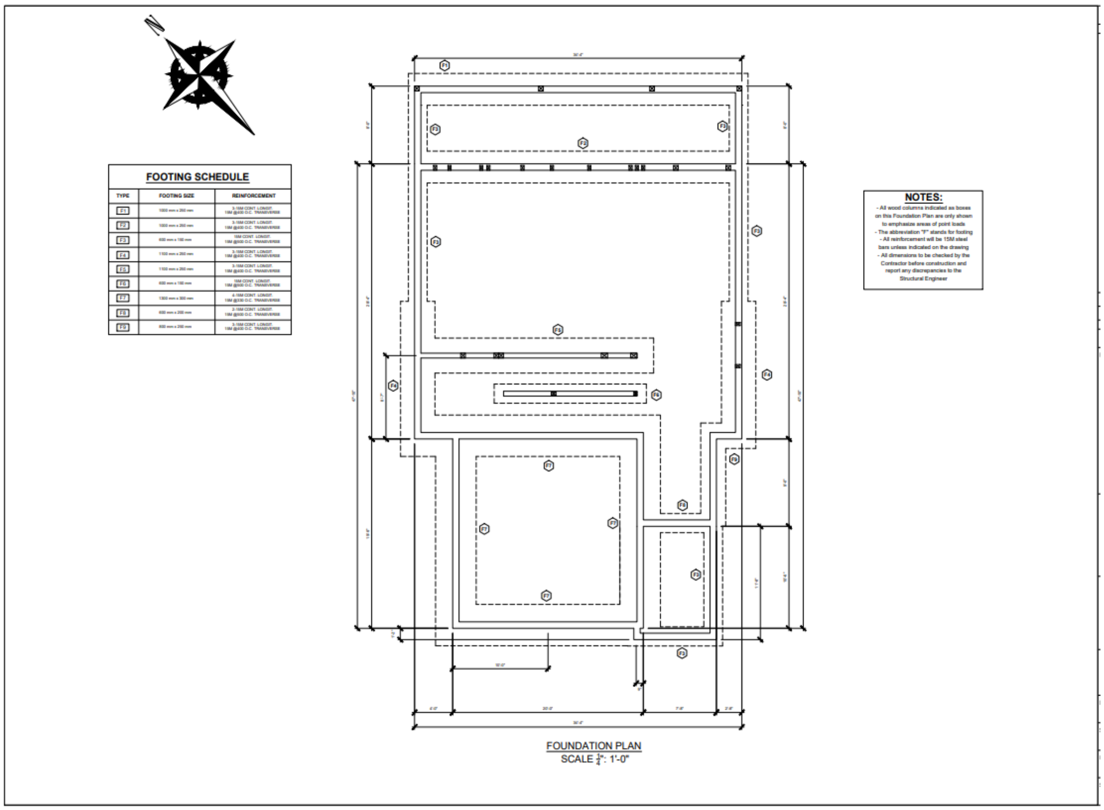

*Figure A4: Foundation Plan**

***** Clearer digital files available. Please email me at - if needed.

Appendix B: Architectural Drawings

List of Contents:

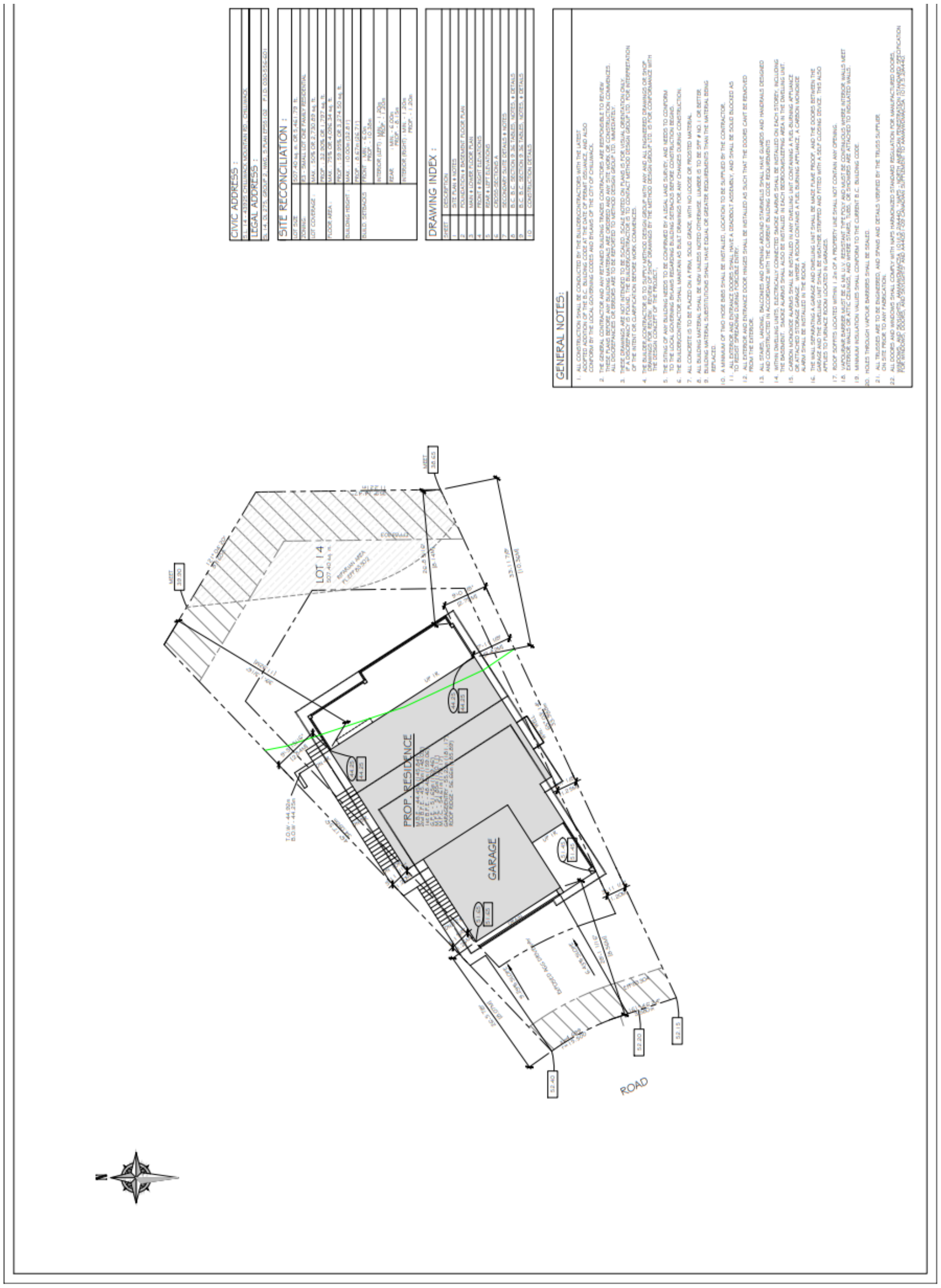

*Figure B1: Site Plan**

***** Clearer digital files available. Please email me at - if needed.

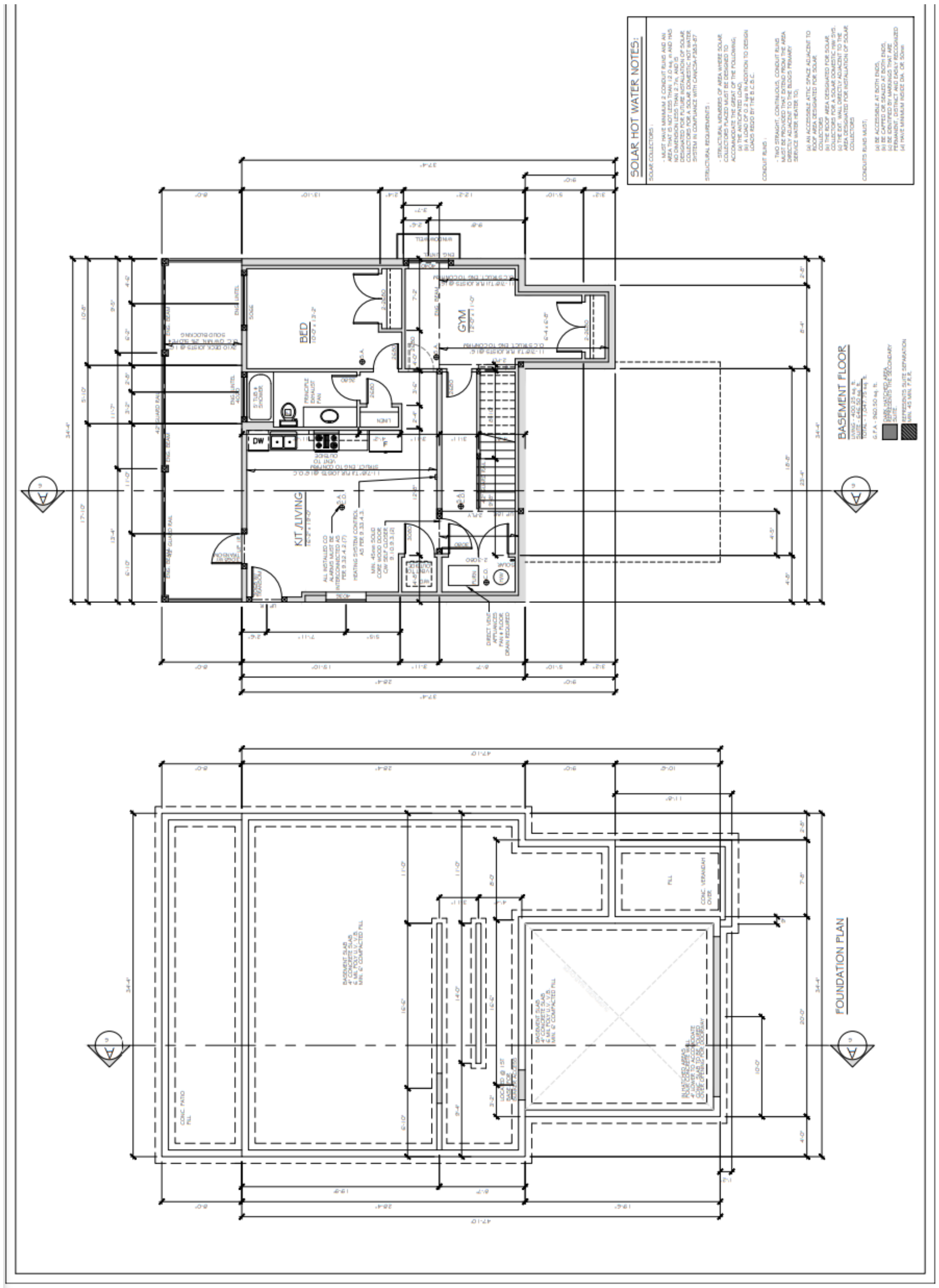

*Figure B2: Foundation and Basement Floor Plan**

***** Clearer digital files available. Please email me at - if needed.

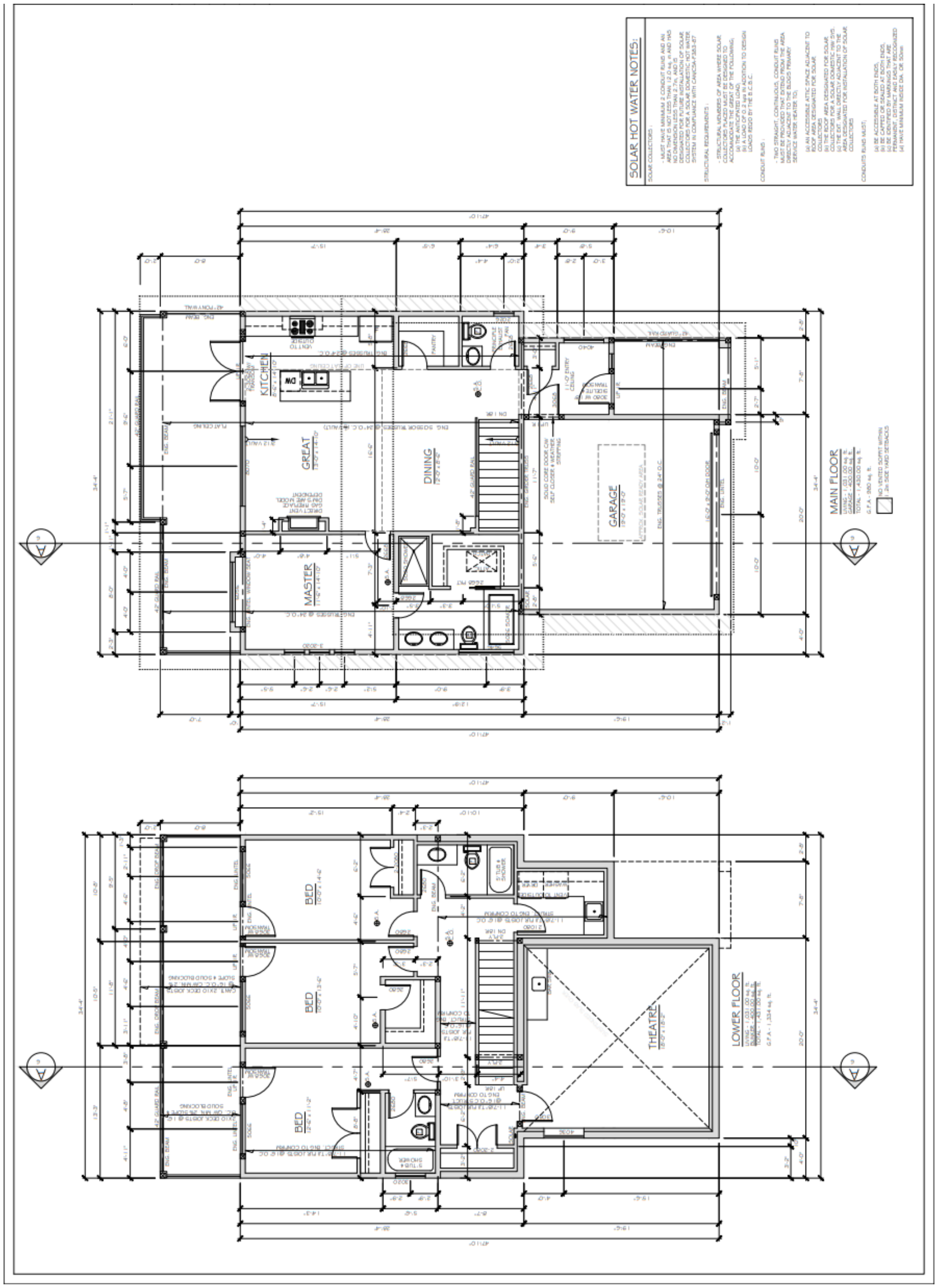

*Figure B3: Main and Lower Floor Plan**

***** Clearer digital files available. Please email me at - if needed.

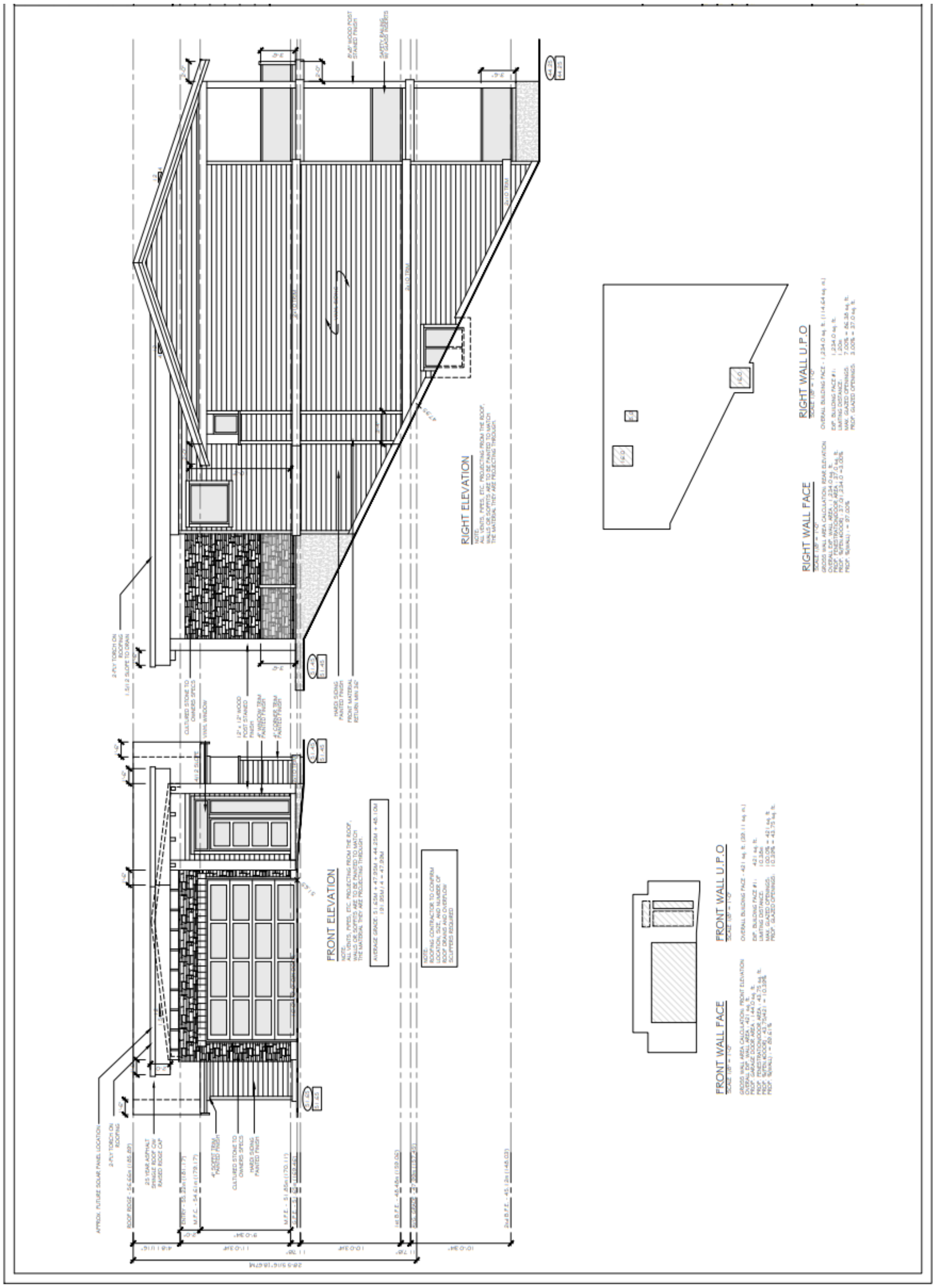

*Figure B4: Front and Right Elevations**

***** Clearer digital files available. Please email me at - if needed.

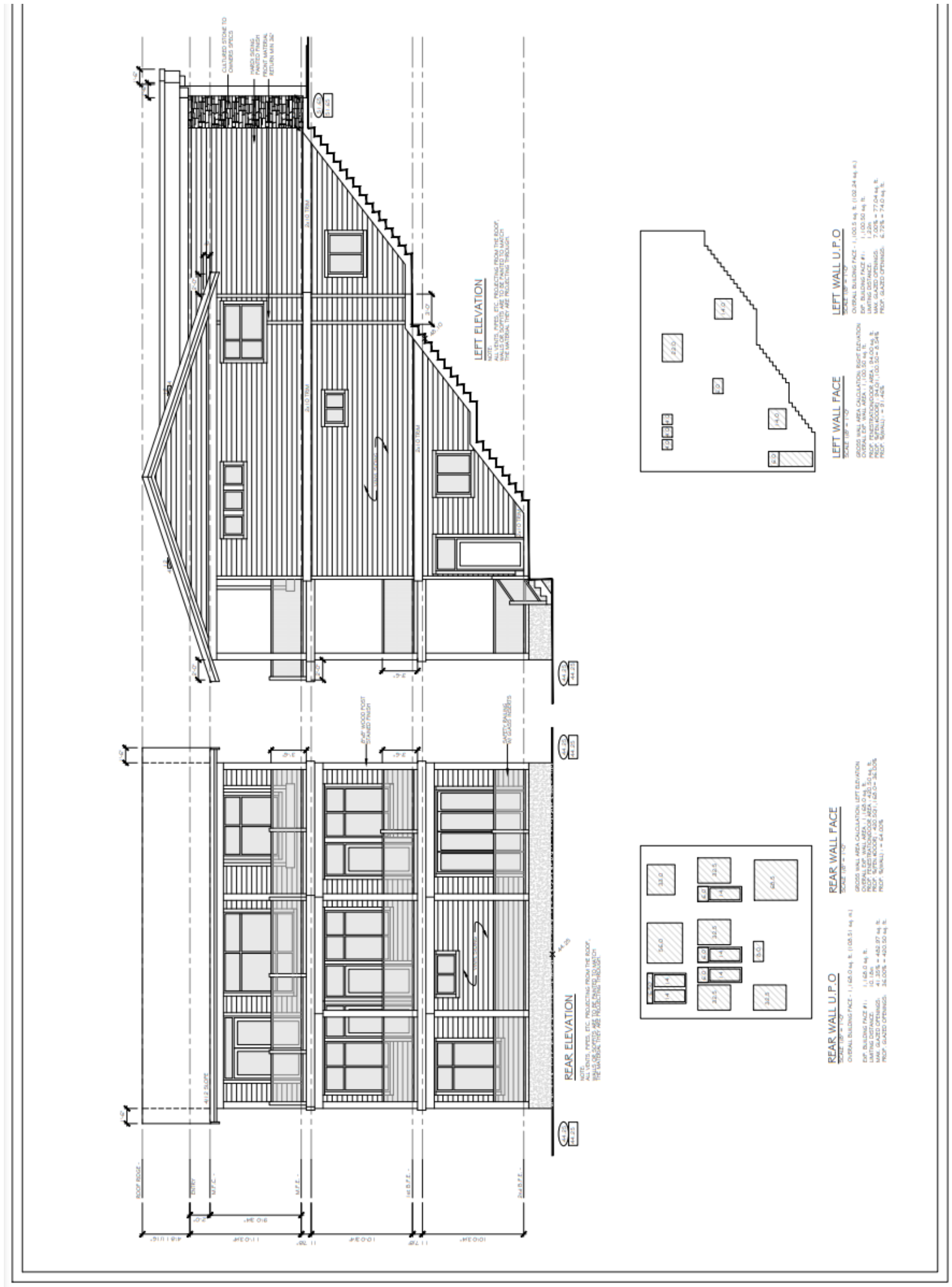

*Figure B5: Rear and Left Elevations**

***** Clearer digital files available. Please email me at - if needed.

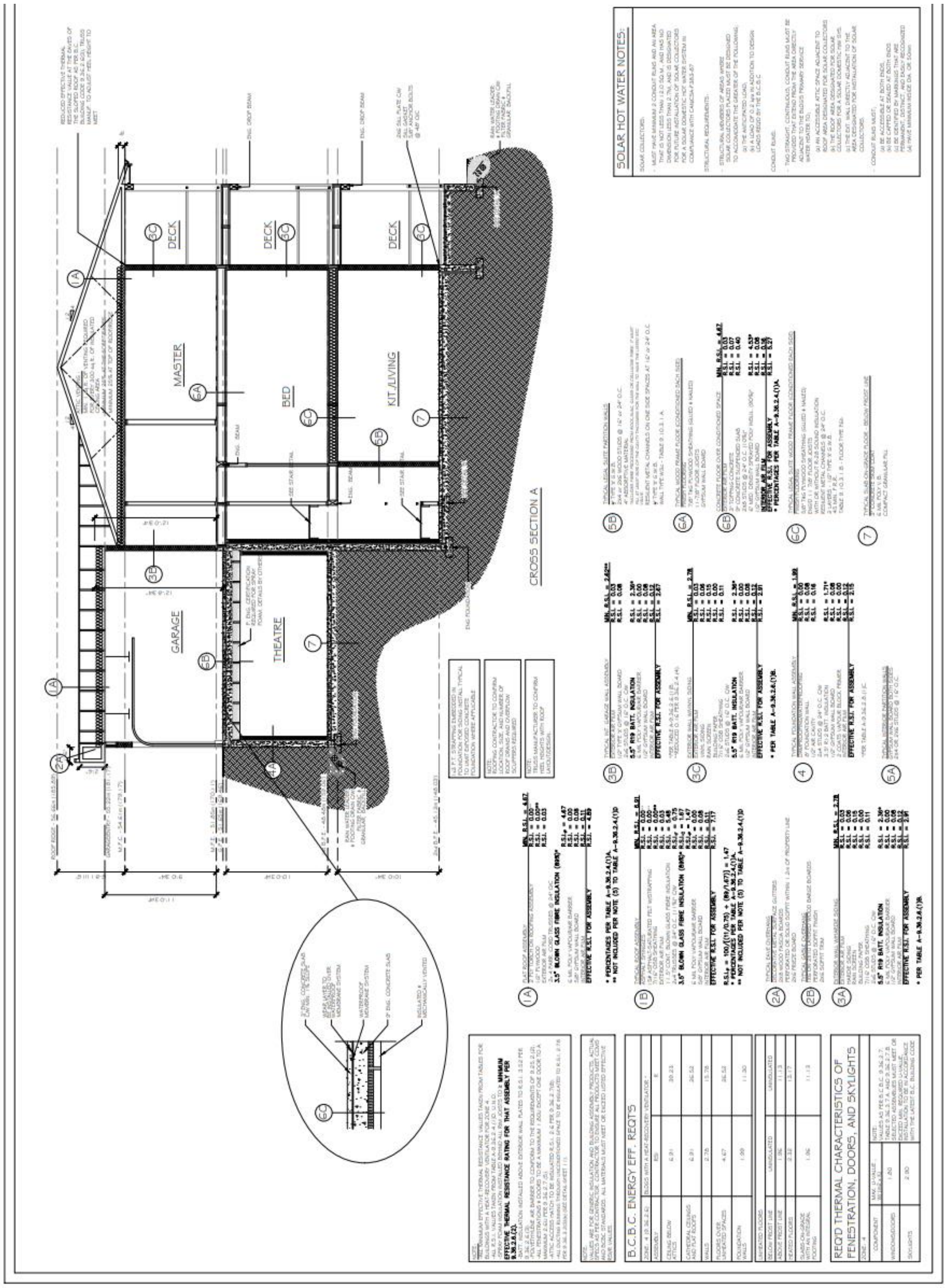

*Figure B6: Cross Section A**

***** Clearer digital files available. Please email me - if needed.

Appendix C: Wood Framing Design Criteria and Common Values Used

Shear Resistance (Clause 6.5.5)

$$V_r = \phi F_V(⅔)A_n K_{Zv} = \phi f_V(K_D K_H K_{Sv} K_T)(⅔)A_n K_{Zv}$$

Table C1: Shear Resistance Factors and Code References

Factor/Variable	Code Reference (CSA 086-14)
f_V	Table 6.3.1A-D
K_D	Table 5.3.2.2
K_H	Clause 6.4.4
K_{Sv}	Table 6.4.2
K_T	Table 6.4.3
K_{Zv}	Table 6.4.5

Moment Resistance (Clause 6.5.4)

$$M_r = \phi F_b S K_{Zb} K_L = \phi f_b(K_D K_H K_{Sb} K_T) S K_{Zb} K_L$$

Table C2: Moment Resistance Factors and Code References

Factor/Variable	Code Reference (CSA 086-14)
f_b	Table 6.3.1A-D
K_D	Table 5.3.2.2
K_H	Clause 6.4.4
K_{Sb}	Table 6.4.2
K_T	Table 6.4.3
K_{Zb}	Table 6.4.5
K_L	Clause 6.5.4.2

Compressive Resistance Parallel to Grain (Clause 6.5.6.2.3)

$$P_r = \phi F_C A K_{Zc} K_C = \phi f_C(K_D K_H K_{Sc} K_T) A K_{Zc} K_C$$

Table C3: Compressive Resistance Factors and Code References

Factor/Variable	Code Reference (CSA 086-14)
f_C	Table 6.3.1A-D
K_D	Table 5.3.2.2
K_H	Clause 6.4.4
K_{Sc}	Table 6.4.2
K_T	Table 6.4.3
K_{Zc}	Clause 6.5.6.2.3
K_C	Clause 6.5.6.2.4