ATLANTIC CANADA STUDY

Building Structure Cost Comparison

MULTI-RESIDENTIAL STRUCTURES

Study Sponsored by:

ATLANTIC MASONRY INSTITUTE

CANADA MASONRY DESIGN CENTRE

Canadian Concrete Masonry Producers Association
Region 6 of the National Concrete Masonry Association

CCMPA Building Strength

DISCLAIMER

The primary responsibility of the Canada Masonry Design Centre is to encourage the effective use of masonry through research, education and technical support. This study was developed to assist the designer and developer in understanding loadbearing masonry, how it compares to current construction practices, and how to build effectively with masonry. The discussion, costing data, and design recommendations are intended to assist with the beginning steps of a loadbearing masonry project.

The material presented does not cover all possible situations but is intended to represent some of the more common construction practices in Atlantic Canada. These construction practices, as well as building code requirements, can vary significantly in different localities. For this reason, the information contained in this study is of a general nature and represent design conditions, assumptions and procedures that are common in Atlantic Canada during the time the study was completed. The actual design of a loadbearing masonry building, preparation of working drawings, and similar tasks should be completed by a qualified architect or engineer familiar with local conditions and code requirements.

Care has been taken to ensure that the information included in this study is as accurate as possible. However, CMDC does not assume responsibility for errors or omission resulting from the use of this study.

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Executive Summary

A comparison of construction costs between loadbearing masonry, cast-in-place concrete and wood frame construction was undertaken for a prototype multi-residential building typical of Atlantic Canada. The city of Moncton, NB was selected, and a full design, scheduling and cost analysis was conducted by third-party firms. As a result, when the cost of the structure alone is compared, masonry was 11% more costly than wood frame in the building option with a parking garage and 24% more costly in the building option with a slab-on-grade. When considering the total (approximate) hard costs for the whole building loadbearing masonry was only 4% more expensive than the wood frame option in the building with an underground parking garage and 8% more expensive for slab-on-grade.

This nominal cost difference did not account for the added benefits associated with using masonry materials such as increased fire ratings, a non-combustible building structure, added sound insulation properties and reduced maintenance costs associated with a more durable building. Nor does this cost comparison account for relative cost differences that might occur if a masonry veneer had been selected and priced, if minor modifications to the wall layout were made to make it a more masonry friendly design and if a full architectural design for sound and fire was made. Total building cost was conservatively determined and applied equally to all materials in a manner that would be more punitive for the masonry option. Regardless, an upper bound 4% price differential (close to the cost difference determined in a previous study of 5%) supports the idea that developers can enjoy the plethora of benefits associated with concrete block masonry buildings for what is in effect a nominal cost increase from wood frame.

Introduction

Atlantic Canada has a demand for multi-residential structures. The reason for this demand is due to increasing populations (mostly through immigration[1]), increases in student populations at universities[2] (especially international students), and current vacancy rates on apartment rentals are some of the lowest in the country[2].

Table 1 Vacancy Rates by Atlantic Canada City (2019)[2]

City	Private Apartment Vacancy Rate (%)
Halifax	0.9%
Moncton	2.4%
Charlottetown	1.2%
Fredericton	1.4%

The increase in demand for rental units led to an increase in multi-residential construction. This, in turn, led to an increase in units under construction which continues to be matched by further increases in demand. Since the opening of the Atlantic Canada CMDC office we have received comments from the community on how the current building construction methods for multi-residential construction are limited in their ability to match the increase in demand, which are summarized below.

- **Wood frame construction** is typically limited by building code limitations as well as perceived and quantifiable concerns about its resilience and durability.
  - Regions in Atlantic Canada under the 2010 National Building Code of Canada (NBCC) are limited to 4-storeys for wood construction, while regions under the 2015 NBCC are limited to 6-storeys for wood construction.
  - Wood frame construction achieves fire and sound resistance via insulation and gypsum board products. This can often require complex detailing and may lead to long-term maintenance costs.
  - Wood frame construction is generally viewed as being less durable and resilient when compared to concrete and masonry construction, which has numerous built-in redundancies.
  - Moisture, specifically, is associated with long-term issues in wood frame construction due to differential movement, mould growth, susceptibility to pests and structural damage.
- **Cast-in-place concrete** construction is typically limited by workforce as well as construction costs.
  - Concrete finishers are relied upon in high-rise and commercial construction, which may take priority over relatively smaller residential projects. Delays or changes in demand in these other sectors have a trickle-down effect on low- and mid-rise residential construction schedules.
  - Increasing costs for concrete construction is one of the main reasons why developers have sought out other material options for multi-residential construction.

This study was developed in response to comments made from developers indicating the desire to upgrade to a non-combustible and more robust building material than conventional wood framing but without the significant increase in cost associated with cast in-place concrete construction. The purpose of this cost study is to introduce a new option for developers to consider. This study demonstrates that a **Loadbearing Masonry** structure provides developers with a building material that is non-combustible, low maintenance, and greater durability with a low initial cost of construction. It also pulls from a workforce that is not currently backlogged in the multi-residential market, and masonry can be constructed with an overall cost comparable to wood frame construction, as will be demonstrated.

Study Objectives

The objective of this study was to develop a cost model to evaluate the relative cost of construction for a mid-rise multi-residential building. The study investigated the relative costs using three different building materials and two model building options (with and without underground parking). The units in the model buildings are a typical size and layout as observed in recent construction within Atlantic Canada for apartments, condominiums and student housing amongst others.

In doing the cost analysis, this study sets out to quantify and demonstrate two main points:

1. Loadbearing masonry is a more cost-effective method of non-combustible construction than cast in-place concrete.
2. Loadbearing masonry provides all the added benefits (resiliency, durability, etc.) associated with non-combustible construction (e.g. cast-in-place concrete) without a significant increase in cost compared to conventional wood frame construction.

Figure 1 – Unit demising walls built out of loadbearing masonry provide excellent fire rating and sound proofing as well as being the main structural element of the building.

Study Methodology

Background

According to city by-laws in Moncton NB, the model building archetype analyzed in this study were designed to the code requirements of the ***2010 National Building Code of Canada***. The chosen floor layouts and room sizes are typical for new construction in Atlantic Canada.

The 3rd party design team for this study is comprised of:

Architectural Design: Spitfire Design Co.

Structural Analysis and Engineering: Valron Engineers Inc. a Gemtec Company

Cost and Timeline Estimation: Acadian Construction

Spitfire Design Co. is based out of Moncton, NB and is an interdisciplinary design firm, specializing in architectural design and design coordination of multi-unit buildings, restaurants and custom homes.

Valron Engineers Inc. a Gemtec Company is a civil engineering firm based out of Moncton, NB that specializes in structural engineering with extensive experience in design of structural steel, reinforced and prestressed concrete, masonry, timber and aluminum.

Acadian Construction is a locally owned private firm founded in 1958 that offers contracting and project management services in the institutional, retail, restaurant, office, commercial, light industrial, hotel and multi-residential sectors. They have experience building in Moncton, NB with both wood and concrete in the multi-residential sector.

Sponsors: This study is funded and supported through a collaborative effort by the Atlantic Masonry Institute (**AMI**), Canada Masonry Design Centre (**CMDC**) and Canadian Concrete Masonry Producers Association (**CCMPA**). Authorship of this report was carried out by the engineering staff at Canada Masonry Design Centre. The views and conclusions drawn within this report are solely those of AMI, CMDC and CCMPA. The 3rd party design team were not responsible for the body of the report and the additional conclusions and analysis drawn. The work of the 3rd party design team is presented within the appendices and distillation of the results are reported herein.

Model Building Architype

The building model used for the cost analysis was a 4-storey, 55-unit building with a rectangular footprint of just under 15,000 sq. ft located in Moncton, NB. The building consists of 11 One-Bedroom units, 28 interior Two-Bedroom units, and 16 corner Two-Bedroom units with floor areas of 759 sq. ft, 1,069 sq. ft, and 1,177 sq. ft respectively. The starting schematic floor plan used for each design can be found in **Appendix A**.

It was decided that for the purpose of this study, to compare costs for ONLY the building structure (and enclosure). The choices for building façade, interior finishes, electrical and HVAC were omitted in order to provide a true comparison for the chosen structural system alone.

It should be noted that the chosen building layout does not reflect the most cost-effective layout for any single option. The layout was chosen based on what would be seen in a “typical” construction in Atlantic Canada, after which each option was adapted to work with the chosen layout. For the most successful loadbearing masonry project, see the suggestions found in the section: **Masonry Friendly Design**. This section provides design strategies to help optimize the building layout for loadbearing masonry.

Building Design Options

The following buildings were designed and evaluated for construction timelines and costs:

- **1A** – Conventional wood framing and a wood floor system with underground parking
- **1B** – Conventional wood framing and a wood floor system with a slab-on-grade
- **2A** – Loadbearing concrete masonry construction with precast hollowcore plank flooring system and underground parking
- **2B** – Loadbearing concrete masonry construction with precast hollowcore plank flooring system with a slab-on-grade
- **3A** – Cast in-place reinforced concrete construction with underground parking
- **3B** – Cast in-place reinforced concrete construction with a slab-on-grade

Both loadbearing concrete masonry and cast in-place reinforced concrete buildings used light weight - 6 in. steel stud framing to enclose the building while the conventional wood construction used 2×6 in. dimensional lumber.

For the purposes of this study, model buildings both with and without underground parking were examined. Atlantic Canada has a larger variation from city-to-city with regards to population density. For example, a theoretical building in Halifax would have a much higher $/unit cost for an outdoor parking lot instead of underground parking. Alternatively, a building located in Dieppe may show savings in $/unit by doing a parking lot rather than underground parking. Loadbearing masonry can be a viable option for all multi-residential structures, and is not limited by the proposed location.

Figure 2 - Loadbearing masonry walls can be used for interior and exterior walls.

Study Results and Discussion

Building Structure Costs

The results for the construction cost study for the building **with underground parking (A)** and the building **with a slab-on-grade (B)** are presented in the tables below for the three different building materials as well as the construction timelines associated with erecting the building structure for each option.

Table 2 Construction Costs with Underground Parking (Structure Only)

Building System	Cost	Timeline
1A-Conventional Wood Framing	$3,709,807	42 Weeks
2A-Loadbearing Masonry	$4,390,216	28 Weeks
3A-Cast in-Place Concrete	$5,321,922	46 Weeks

Table 3 Construction Costs for Buildings with a Slab-on-Grade (Structure Only)

Building System	Cost	Timeline
1B-Conventional Wood Framing	$2,817,531	36 Weeks
2B-Loadbearing Masonry	$3,711,967	26 Weeks
3B-Cast in-Place Concrete	$4,406,129	42 Weeks

The results in **Table 2 and 3** confirms the information and concerns expressed to CMDC by developers in Atlantic Canada: conventional wood framing is the cheapest initial cost option. However, this would be expected as loadbearing masonry has added durability, resiliency, soundproofing, and fire-resistance properties that will be further examined in the **Masonry Benefits justify a small Premium** section later on in the document. That is to say, all options meet code minimums, but masonry and concrete generally meet and exceed many of these minimums without any additional special detailing otherwise required for wood frame construction.

When a developer is looking to finance the construction of a multi-unit residential building, a building that opens quicker brings in money quicker. ***Not only does an accelerated timeline allow for additional rent payments, but there are many other equally important costs to consider during the construction phase (builders risk insurance, interest on financing, etc.).***

When scheduled correctly (preferably not during winter conditions) loadbearing masonry was determined to have an accelerated timeline when compared to concrete and wood construction. Not only does the structure go up fast, but since the hollowcore planks do not require shoring, it allows for other trades to mobilize immediately so that electrical, mechanical, enclosures and partitions be installed while work on the structure above continues. Gantt Charts detailing the construction schedules that support this conclusion can be found in **Appendix B.**

Tables 4 and 5 compare the construction completion times for loadbearing masonry relative to conventional wood framing (1a and 1b), and Cast in-place Concrete (3a and 3b) respectively. The last column in the table is denoted as **"Loss of Rental Income"** which represents the rental income lost for the building based on an assumed rental revenue of $1.30/sq. ft and a 2% vacancy rate over the difference in construction timelines. These rent statistics represent typical values confirmed by **Spitfire Design Co**.

Table 4 Construction Completion Time and Loss of Rental Income for Buildings with Underground Parking

Building System	Timeline	Additional Time to Completion (vs. Masonry)	Loss of Rental Income
1A-Conventional Wood Framing	42 Weeks	+14 Weeks	$246,636
2A-Loadbearing Masonry	28 Weeks	-	-
3A-Cast in-Place Concrete	46 Weeks	+18 Weeks	$317,104

Table 5 Construction Completion Time and Loss of Rental Income for Buildings with Slab-on-Grade

Building System	Timeline	Additional Time to Completion (vs. Masonry)	Loss of Rental Income
1B-Conventional Wood Framing	36 Weeks	+10 Weeks	$176,169
2B-Loadbearing Masonry	26 Weeks	-	-
3B-Cast in-Place Concrete	42 Weeks	+16 Weeks	$281,870

The dollar values for the "Loss of Rental Income" are substantial and should be considered as a part of the building structure material selection process. In an effort to show the impact that scheduling can have on costs, **Table 6 and 7** take the building construction costs and add in the "Loss of Income" from the construction schedule as an added expense to conventional wood framing and cast in-place concrete. Costs are then normalized to wood frame (1A and 1B) and presented as a relative cost.

Table 6 Cost Comparison with Rental Income for Buildings with Underground Parking (Structure Only)

Building System	Cost	Relative Cost
1A-Conventional Wood Framing	$3,956,444	100
2A-Loadbearing Masonry	$4,390,216	111
3A-Cast in-Place Concrete	$5,639,027	143

Table 7 Cost Comparison with Rental Income for Buildings with Slab-on-Grade (Structure Only)

Building System	Cost	Relative Cost
1B-Conventional Wood Framing	$2,993,700	100
2B-Loadbearing Masonry	$3,711,967	124
3B-Cast in-Place Concrete	$4,688,000	157

With rental income in mind loadbearing masonry comes at only an 11% cost premium to conventional wood framing for the building structure alone (in the building option with underground parking).

Total Finished Building Costs

By the time the building is finished, how much will the choice of structural material affect the final construction cost? The cost for the remainder of the building will be highly dependent on many other hard and soft construction costs (e.g. HVAC system, veneer, landscaping, land acquisition, interior furnishings, marketing, etc.). Generally, the costs associated with finishing the building after the structure is erected is constant and does not vary based on the choice of structural material. Depending on those hard and soft costs for the type and location of the building, the associated cost of erecting the loadbearing building structure may account for approximately 15%-50% of the total building costs.

For the following analysis, since the total hard and soft costs are not known, the following assumptions are conservatively made for a fair comparison between structural material selection:

1. **The building structure (and enclosure) accounts for 40% of the total building costs.**
2. **Total building costs (aside from structure) are constant for all materials.**

Then, based on this assumption the building options with underground parking would have a total additional cost of **≈$6,585,000**. Whereas, building options with a slab-on-grade would have a total additional cost of **≈$5,568,000**.

The assumption that the cost to finish the building is constant between structural materials **is actually a conservative estimate and punitive to masonry structures**. Due to the inherent fire-resistance and sound-resistant properties of loadbearing masonry and hollowcore floor planks, minimal-to-no additional detailing is needed to meet fire or sound resistance requirements. Nevertheless, ignoring these benefits to masonry and adding total building costs to the data presented in **Tables 5 and 6**, a true comparison for total building costs between the structural materials can be inferred.

Table 8 Finished Building Cost with Underground Parking (Total Building)

Building System	Cost	Relative Cost
1A-Conventional Wood Framing	$10,541,444	100
2A-Loadbearing Masonry	$10,975,542	104
3A-Cast in-Place Concrete	$12,224,027	116

Table 9 Finished Building Cost with Slab-on-Grade (Total Building)

Building System	Cost	Relative Cost
1B-Conventional Wood Framing	$8,561,700	100
2B-Loadbearing Masonry	$9,279,918	108
3B-Cast in-Place Concrete	$10,256,000	119

Therefore, by the time one of these building options with underground parking is complete and ready for occupancy, loadbearing masonry would come at only a 4% premium over wood frame construction.

Masonry Benefits justify a small Premium

With the results from this cost comparison, a loadbearing masonry building comes with only a small cost premium. The detailed analysis and design found that for structure alone, loadbearing masonry was only an 11% increase in cost. By using the conservative assumption that the cost of completion is equal regardless of building material, loadbearing masonry is expected fall anywhere between equal price and a 4% premium. This section will look at the differences between wood construction and loadbearing masonry construction to determine what exactly a developer gets for this minimal price premium. For reference, full details of the structural designs including foundations, flooring systems, loadbearing walls, and building enclosure, are in **Appendix C**.

Exceeding Code Minimums

The National Building Code of Canada serves to ensure that all buildings constructed meet a minimum level of safety. The nuances of the building code and its requirements can be argued over by engineers and bureaucrats and inevitably changes from time to time. However, what does not change is that the building code is simply a minimum. Meaning that, if there is a fire in any building, occupants should have enough time to safely exit the building and (hopefully) firefighters have enough time to contain the fire. However, not all materials behave the same under fire conditions and **a fire in a wood frame structure is different from a fire in a masonry structure**.

Masonry and concrete are defined by the National Building Code of Canada as **Non-Combustible Materials**. That means they cannot add fuel to the fire. Masonry will heat up in a fire and after a fire has stopped it may show light spalling over time, but under even extreme fire testing they do not collapse and they do not combust. By contrast, wood frame construction can achieve similar “fire ratings” to masonry and concrete and meet code minimums for fire endurance (e.g. 1-hour fire rating) but they do not have the same fire performance.

Wood is combustible, once a fire has reached a time or even an intensity that exceeds its rating there is no code provision to prevent it from collapse and spreading the fire. **There is no built-in redundancy or resilience**. Observations of fire tests demonstrate that wood frame walls subject to fire hose streams will fall apart like paper[3], wood floor systems can collapse (risking firefighter safety[4]) and although residents have time to get to safety (the code minimum is achieved), all of their possessions and their home itself can be a complete loss.

By contrast, masonry provides what is known as “passive fire resistance.” Masonry walls separate and compartmentalize fires, containing them into the area where they start. Fires that exceed the time or intensity used to assess their code “rating” do not lead to collapse and in most cases have no discernable impact to users outside of where the fire starts in the building. **Life safety is achieved, and property damage is mitigated with masonry**. This is why many wood frame structures still require non-combustible materials, such as masonry fire walls, in certain locations because of their proven structural resilience and passive fire resistance properties.

Comparing Fire Ratings for the Building Designs

A fire rating is a prescribed amount of time that a wall system can resist a “standard fire” based on laboratory testing. Failure of a wall is defined as either degradation of the wall (smoke can pass through) or by temperature change on the “cold side” of the wall. The fire-resistance requirements for the building in this study is found under the National Building Code of Canada (NBCC) 2010 Cl. 3.2.2.52 where it states that floor assemblies and loadbearing walls shall require a 1-hour fire-resistance rating.

With conventional wood frame construction, the structural floor assembly is a 14 in. Open Web Wood Joist spaced at 19.2 in. o.c. with a 5/8 in. plywood top and R-20 Batt Insulation. To achieve a 1-hour fire resistance rating on this floor assembly by following the Table 9.10.3.1-B in NBCC, detail F25d would be required. This detail would require the following:

- Batt Insulation must be fibre processed from rock or slag
- Steel furring channels spaced at 600 mm o.c.
- 2 layers of 15.9 mm Type X gypsum board

The loadbearing walls in the wood frame building consisted of staggered 2×6 in. on a 2×8 in. base plate. Following W7 (a and b) from Table 9.10.3.1-B, with fiberglass insulation these walls would require 15.9 mm Type X gypsum board on both sides of the wall, if the insulation comes from fibre processed from rock or slag a 12.7 mm Type X gypsum board will suffice.

This is a complex system required to achieve a relatively low threshold for fire resistance. To achieve this rating, the wall cannot contain perforations without a fire seal, all gaps and seams must be properly sealed. **The expectation is that it has been installed properly and, over the long term, residents do not alter or damage the gypsum board (as any damage would degrade the fire rating).**

By contrast, in a loadbearing masonry building option, the 10 in. hollowcore floor planks provide a 2+ hr. fire rating for the floor system (topping layer of concrete and gypsum board ceilings could increase this). The loadbearing walls are constructed of 20 cm concrete masonry units and typical block has a fire rating of 1:49 hr. while use of light weight block (with aggregates conforming to building code requirements) or 60% solid normal weight units will achieve 2+ hr. fire ratings[5]. That is from the block alone, if walls are grouted solid a fire rating of 4+ hr. is achieved, if normal gypsum board is used to cover the block (often done in residential units anyways), a rating of 2+ hr. is achieved and if Type X gypsum board is added then a rating of 3+ hr. is achieved. It would be unlikely that a resident could damage a concrete block wall or hollowcore plank enough to alter its fire rating over the life of the building.

In summary, the building code provides a minimum level of safety, which both masonry and wood frame can meet. However, masonry walls are more durable, non-combustible, provide redundancy outside of code minimums and achieves all of this without added expensive detailing. Residents and owners can be assured that their lives and their property are safe.

Superior Sound-Proofing

Similar to the fire-resistance rating, sound-proofing requirements can be separated as code minimums typically met in wood frame construction through additional insulation materials and details versus masonry systems that, often without additional detailing, provide a more resilient system and a rating class above the code required minimums. Sound-proofing is often a selling point for multi-residential buildings and is key for maintaining long-term tenants. The typical measurement used for describing a materials ability to reduce the transmission of sound is the Sound Transmission Class (STC). The higher the STC rating, the more effective that material is at reducing sounds transmission. **Table 10** describes some typical STC ratings and their effectiveness in reducing the transmission of sound.

Table 10 STC Ratings and What they Mean[6]

Operable STC Rating	What can be Heard
STC - 40	Loud Speech quietly audible as a murmur
STC - 45	Loud speech heard but not audible
STC - 50	Loud sounds such as musical instruments or a stereo can be faintly heard
STC - 55	Minimal transmission of sound
STC - 60	Good sound-proofing and most sounds do not disturb

The STC rating for the structural floor assembly in the conventional wood framed building, using detail F25d from NBCC (which was explained above for fire-resistance ratings) is 45, this would be insufficient according to the National Building Code of Canada, which requires at least a STC rating of 50 to be used, and as a result additional detailing would be needed above that required for fire. As noted previously, the performance of this system would then be heavily dependent on the long-term durability and sustained performance of the materials over time. By contrast, a 10 in. hollowcore floor plank alone has a STC rating of 52 and when a 2 in. topping is included the STC rating increases to 56. The addition of gypsum board or other floor/ceiling details would only increase this.

Consider next, the unit demising walls constructed of wood frame. The conventional wood framed building specified here has walls built to detail W7 in the NBCC, and an STC rating of 45 and 47 depending on if 12.7 mm Type X gypsum or 15.9 mm Type X gypsum is used respectively. This would have to be increased, again, to meet a minimum of 50. **Normal-weight 20 cm concrete masonry units have a STC rating of 50 when hollow and 56 if grouted solid.** Placing an interior finish on one or both sides of a hollow block increases this to **at least 57 and up to 73**[7]. For instance, a wall with regular 12.7 mm gypsum board on both side (Detail B6e) has an STC rating of 57, increased to 60 with the 15.9 mm Type X gypsum board.

Additional Benefits

Concrete block masonry offers other benefits to users and owners in the long-term. The fact that is has an inherent durability ensures long-term fire and sound resistance is maintained, it means maintenance costs, especially those arising from extreme weather, are substantially smaller over the life span of the building. Concrete masonry does not rot and does not provide a source of food for mould. In typical residential buildings one the most costly types of damage is due to water leaks from unit-to-unit. There are no threats to the loadbearing elements of a masonry structure due to water, but water is an enemy of wood, and water damage in a wood frame structure may actually pose a threat to the structural elements as well as the fire and sound resisting elements. The Concrete Masonry Units (CMU) that comprise a loadbearing masonry wall are produced locally on demand. The raw material for CMU production is readily available locally throughout Canada from multiple sources and is not susceptible to material shortages and accompanying price fluctuations commonly seen with other building materials. Overall, masonry provides many quantifiable and tangible benefits over wood frame construction that justify a minimal cost premium.

Masonry Friendly Design

Loadbearing masonry construction utilizes walls built with Concrete Masonry Units (CMUs) that serve a dual function. The walls act as both as:

1. the loadbearing system, and
2. as the environmental separation (demising walls) between adjoining units and common elements.

Careful consideration during the design stage for a loadbearing masonry building is critical for an efficient design to take advantage of the material and will help reduce costs. This section will highlight some of the important considerations a designer should have, when planning their loadbearing masonry project.

Timing of Construction

It is preferable to time the start of masonry construction while nightly low temperatures are still above 4°C. When delayed to the winter months, masonry and concrete have additional costs for heating and hoarding overnight to ensure curing occurs properly. This, however, can be mitigated when masonry is also used for exterior walls. Due to the speed of construction with masonry, floors can be completed, and hollowcore planks put in place rather quickly allowing the structure to enclose itself to facilitate heating. With the building enclosed, all the interior work can continue over the winter and the building veneer finished come springtime.

Continuity of Loadbearing Walls

An important consideration in the design of a loadbearing masonry building is that walls need to be continuous all the way down to the foundation. This can create challenges for buildings that have underground parking and buildings that have commercial space at grade. These challenges can easily be overcome, however, by considering the following general details and layout options.

1. For buildings without underground parking, or where a transfer slab is used, essentially any walls in the structure can be loadbearing (demising walls, exterior walls, stairwell or elevator walls, etc.). Hollowcore plank spans and orientations would then be free to bear in the direction most convenient as all masonry walls would be part of the structure.
2. When an underground garage or open commercial space is used at the bottom of the structure and no transfer slab is present, enough loadbearing wall area must be able to extend all the way into the foundation. The challenge is that the architectural layout for commercial space and parking garages do not often have walls that line up with residential floor layouts. See the sub-section **Wall Location and Orientation** provides design advice to mitigate this.

Spacing Between Walls

The spacing between walls is dependent on the spanning capacity of the flooring system, in this case the precast hollowcore planks. The capacity of the planks is based on the amount of reinforcing, as well as the loading conditions but the following information can be used for typical maximum spans, although specific manufacturers and loading conditions may dictate different limits. The following span limits were provided by taking a typical residential floor load and using the span tables provided in the Stubbes Hollowcore Span Tables[8] :

- 8 in. thick hollowcore plank can typically span up to 28 ft.
- 10 in. thick hollowcore plank can typically span up to 38 ft.
- 12 in. thick hollowcore plank can typically span up to 48 ft.

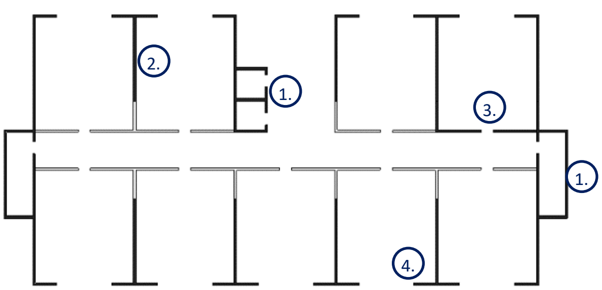
For this study in order to remove the need for a concrete transfer slab, the loadbearing walls were placed as unit demising walls to also take advantage of the fire and sound resisting properties of the masonry. The unit layout for this study was to have demising walls spaced at 38 ft. This is a typical for condos and rental units in Atlantic Canada. In order to use the 8 in. hollowcore planks for such a span, an intermediary loadbearing wall would be required. To avoid this a 10 in. plank was selected.

Wall Location and Orientation

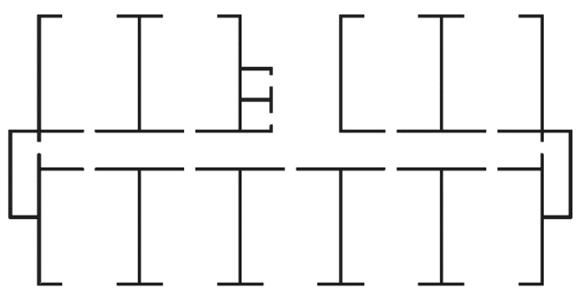
It is preferable to utilize loadbearing walls as demising walls between adjoining units and between units and common hallways as well as in exterior walls. This assures that the building will have walls orientated and possess strength when loaded by wind or earthquake forces along both axes (something that will greatly help with design). In the building used in this study only demising walls between units utilized loadbearing walls, which creates challenges from a masonry design perspective. Additional cost savings would be expected had the building layout been more masonry friendly as indicated in **Figure 3a)** and described below:

1. **Including stairwells and elevator shaft walls as loadbearing elements that continue over the full building height and oriented perpendicular to the unit demising walls.**
2. **Aligning unit demising walls with walls separating parking spaces or zones.**
3. **Aligning unit walls with mechanical, locker or bicycle storage rooms in the parking garage to create continuity in layout.**
4. **Utilizing window and door placement to assure that enough strong walls are created along the exterior to resist loads.**

As indicated in **Figure 3a)**, when no transfer slab is used and underground parking is required, it is relatively easy for designers to utilize the indicated loadbearing masonry walls (dark lines) in a parking garage based on the residential floor layouts. Walls used in upper floors that do not carry to the foundation (light lines) as loadbearing elements are not participating in the structural design, although they still serve an architectural function and act to provide fire and sound resistance. Indicated in **Figure 3b)** is the scenario when a transfer slab is used or the structure does not contain underground parking, all walls can be utilized as loadbearing elements over their height. In both cases walls are sufficiently orientated along both axes.



a) Underground Parking



b) Transfer Slab or No Underground Parking

Figure 3 Comparing loadbearing masonry wall layout for buildings with and without underground parking

Comparison to a Previous Study

The results of this current study can be used in conjunction with the results published by Walter G.M Schneider III titled "*Initial Cost of Construction: Multi-Residential Structures*[9]". Which was published in 2017 and included 23 American cities and 8 Canadian cities. This current study is compared to the published results reported for Halifax, NS in **Table 11**.

Table 11 Results Comparison to "Initial Cost of Construction: Multi-Residential Structures"

Building System	Relative Cost for Current Study (with Underground Parking)	Relative Cost for Previous Study[9]
Conventional Wood Framing	**100**	**100**
Loadbearing Masonry	**104**	**105**

The results from the two studies actually end up remarkably similar and both and show that a loadbearing masonry building is within 5% of the building cost for conventional wood framing. The differences between the studies are reported next.

Construction Location

The first main difference between the two studies is the location. The previous study looked at the cost of construction for Halifax, NS while the current study looked at the cost of construction for Moncton, NB. These locations are only 150 km from each other, but from a design perspective it can be quite different. Halifax is known to have strong soil conditions, this allows for a reduced seismic load in the structural design. Changes in the seismic load will have minimal difference for a low weight construction like conventional wood framing, but will be cause for a significant increase in seismic loading for heavier construction materials like loadbearing masonry and concrete. The other main difference between the two locations is the building codes. As of the time in writing this study, New Brunswick is operating under the 2010 Building Code, and Nova Scotia has adopted the 2015 Building Code. However, for the *Initial Cost of Construction* study, the buildings were designed to the 2005 International Building Code.

Scope of Study

Another difference between the studies is their scope. The previous study provided a full estimate of the hard costs for a finished building including interior finishes, HVAC, and building veneer. Whereas, the current study looked at the costs associated with the **structure and building enclosure only**. To establish a total building cost, a conservative estimate was made based on a fixed ratio of structure costs to total building costs. The scope of this study was limited in order to provide **a base cost of construction**, the choices for finishes and building veneer could then be up to the design team.

Building Layout

The conceptual building selected for each study were also fundamentally different. The previous study was conducted in 25 cities across North America and utilized the same 3-storey structure throughout (versus 4-storey building used in the current study). As a result, a building layout was selected that would not necessarily be expected in Atlantic Canada. The current study is based on a unit size that necessitated the use of a 10 in. hollowcore floor plank, whereas the previous study utilized 8 in. planks.

Conclusion

The cost estimates prepared by Acadian Construction shows that loadbearing masonry is a viable building material in the mid-rise multi-residential market for Atlantic Canada, and this study further strengthens the results published in the previous *Initial Cost of Construction: Multi-Residential Structure* study.

The primary objective of this study focused on the detailed cost estimates and construction timelines for the building structure and the exterior enclosure (studs and sheathing only) of the 4-storey model building in Atlantic Canada. Major takeaways from this study include;

1. The loadbearing masonry structures are substantially quicker to construct than conventional wood framing and cast in-place concrete structures. Loadbearing masonry was 14 weeks faster to build when a parking garage was included and 10 weeks faster to build without a parking garage compared to conventional wood framing. In addition, loadbearing masonry was 18 weeks faster to build when a parking garage was included and 16 weeks faster to build without a parking garage compared to cast in-place concrete.
2. In comparison with conventional wood framing, the loadbearing masonry structure was 11% higher in cost when a parking garage was included and 24% higher in cost without a parking garage.
3. In comparison with cast in-place concrete, the loadbearing masonry structure was 28% cheaper in cost when a parking garage was included and 26% cheaper in cost without a parking garage.

Further to the primary objective of investigating the construction cost construction timelines for the building structure and exterior enclosure, this study also demonstrated that even with conservative estimates of total building construction costs and utilizing a building layout that is not particularly masonry friendly, loadbearing masonry was within 4% and 8% of the costs for wood frame buildings with and without a parking garage, respectively. This outcome is consistent with previously published material "*Initial Cost of Construction: Multi-Residential Structures*[9]".

Finally, this study highlights some of the many benefits associated with masonry construction when compared to typical wood frame construction. This includes added durability and resilience for using non-combustible materials with added redundancy when subject to fire or moisture issues. It was demonstrated that although all structures meet code minimums, masonry typically exceeds these limits, and some cases, offers many times more fire resistance or noise mitigation than expected from even specially detailed wood frame construction.

In conclusion, for what would amount to as a nominal hard cost price differential between masonry and wood frame a developer would reap numerous tangible and intangible benefits. While loadbearing masonry is not a one-size-fits-all solution to all residential buildings, in this study it was demonstrated to be a viable and competitive option for Atlantic Canada.

References

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9. **Walter G. M. Schneider III, "Initial Cost of Construction: Multi-Residential Structures" Canadian Concrete Masonry Producers Association (https://ccmpa.ca/resources-publications/cost-analysis-studies/)**

Contact Info

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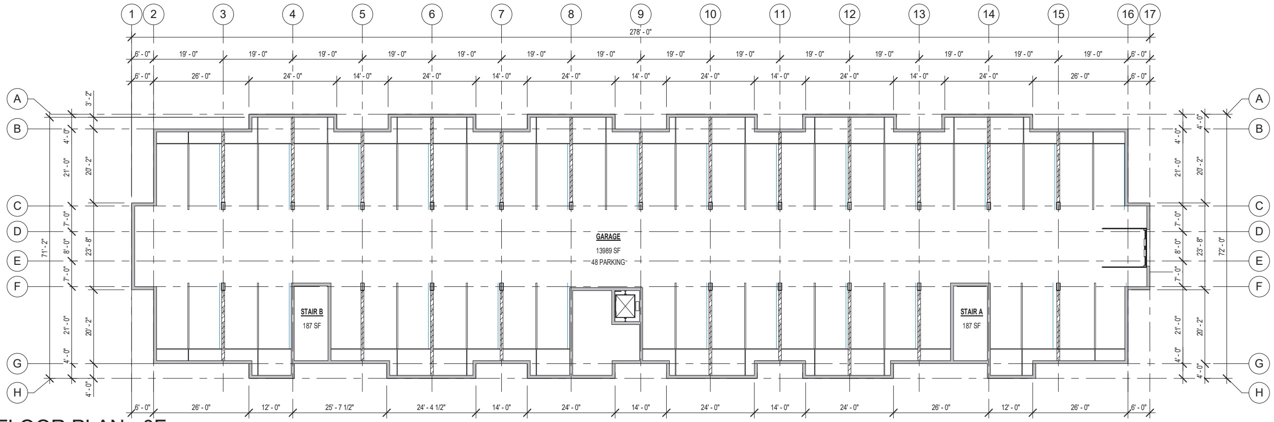
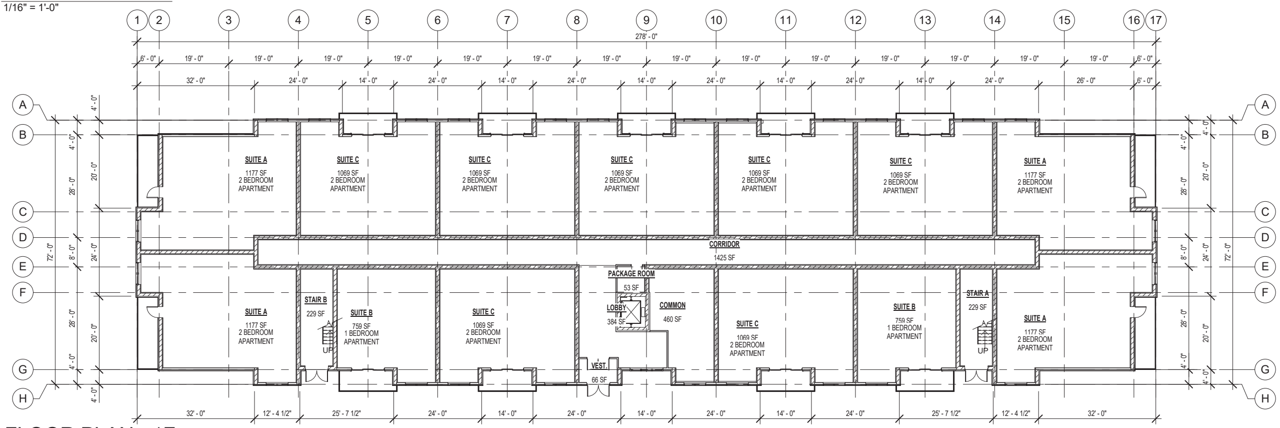
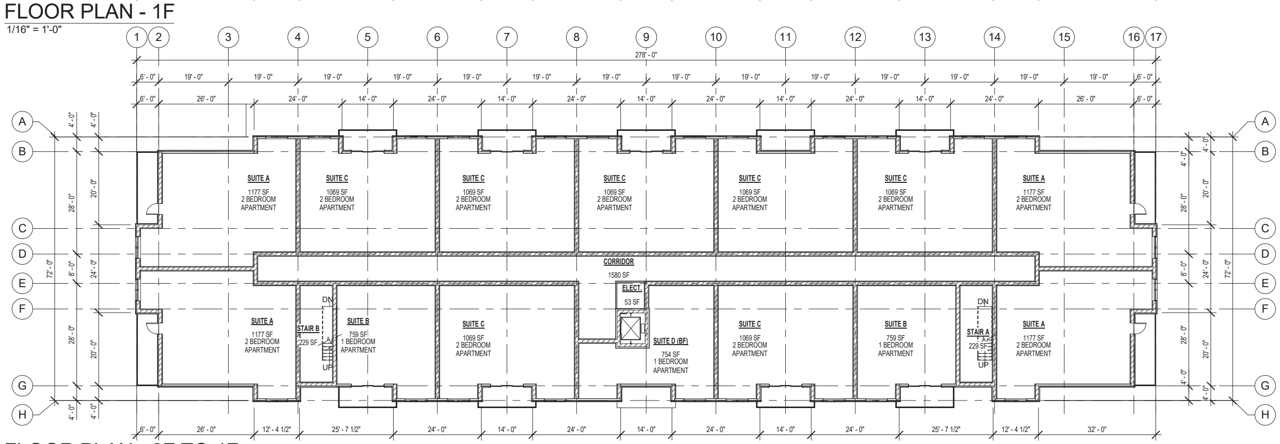
APPENDIX A – Floor Layout



FLOOR PLAN - 0F
1/16" = 1'-0"

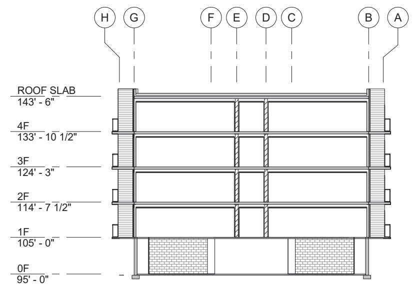


FLOOR PLAN - 1F
1/16" = 1'-0"



FLOOR PLAN - 2F TO 4F
1/16" = 1'-0"

WALL ASSEMBLIES
1" = 1'-0"



BUILDING SECTION
1/16" = 1'-0"

Preliminary
"Not For Construction"

ISSUE	DESCRIPTION	DATE
01	?	?

NOTES:

THIS DRAWING MAY NOT BE USED IN WHOLE OR IN PART FOR ANY PROJECT OTHER THAN THAT DESIGNATED HEREIN.

ANY CHANGES TO THIS DESIGN, PRIOR TO OR DURING CONSTRUCTION, MUST BE APPROVED BY THE ARCHITECT & ARCHITECTURAL DESIGNER.

ALL CONTRACTORS MUST CONFORM TO ALL REGULATIONS, MUNICIPAL AND PROVINCIAL BY-LAWS AND "THE NATIONAL BUILDING CODE OF CANADA".

ALL REQUIRED PERMITS MUST BE OBTAINED PRIOR TO ANY CONSTRUCTION.

Rev.#	Description	Date

Stamp:

Architectural Consultant:

Architectural Designer:

spitfire DESIGN CO.
171 Lutz Street, Moncton, NB E1C 5E8
Bus: (506) 855-3777 Cell: (506) 312-2777 eMail:

Client: -

Project: **55 Unit Residential c/w Parking Garage**

Drawing Title: Floor Plans, Section, Wall and Floor Construction

Date: Septembre 30, 2019

Checked by: -

Drawn by: SAB — Revision: -

Scale: AS NOTED

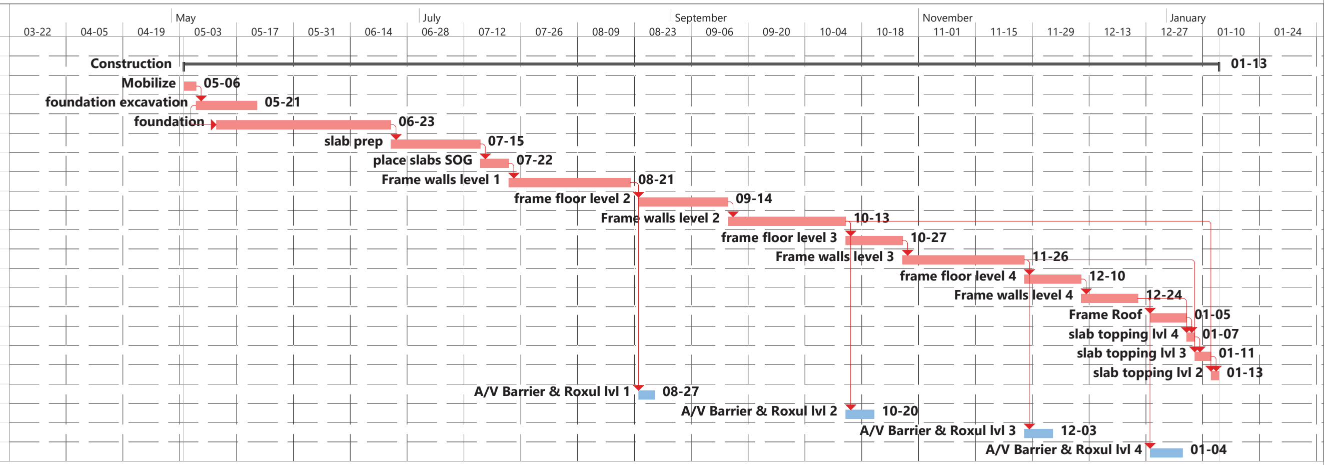
Sheet: A1.1 — Fileno: 4280

APPENDIX B – Construction Schedule

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM Wood No Parking Garage

ID	Task Mode	Task Name	Duration	Start	Finish
1					
2		**Construction**	**176 days**	**Mon 20-05-0**	**Wed 21-01-13**
3		Mobilize	3 days	Mon 20-05-0	Wed 20-05-06
4		foundation excavation	10 days	Thu 20-05-07	Thu 20-05-21
5		foundation	6 wks	Tue 20-05-12	Tue 20-06-23
6		slab prep	3 wks	Wed 20-06-2	Wed 20-07-15
7		place slabs SOG	1 wk	Thu 20-07-16	Wed 20-07-22
8		Frame walls level 1	21 days	Thu 20-07-23	Fri 20-08-21
9		frame floor level 2	15 days	Mon 20-08-2	Mon 20-09-14
10		Frame walls level 2	21 days	Tue 20-09-15	Tue 20-10-13
11		frame floor level 3	10 days	Wed 20-10-1	Tue 20-10-27
12		Frame walls level 3	21 days	Wed 20-10-2	Thu 20-11-26
13		frame floor level 4	10 days	Fri 20-11-27	Thu 20-12-10
14		Frame walls level 4	10 days	Fri 20-12-11	Thu 20-12-24
15		Frame Roof	6 days	Mon 20-12-2	Tue 21-01-05
16		slab topping lvl 4	2 days	Wed 21-01-0	Thu 21-01-07
17		slab topping lvl 3	2 days	Fri 21-01-08	Mon 21-01-11
18		slab topping lvl 2	2 days	Tue 21-01-12	Wed 21-01-13
19		A/V Barrier & Roxul lvl 1	4 days	Mon 20-08-2	Thu 20-08-27
20		A/V Barrier & Roxul lvl 2	5 days	Wed 20-10-1	Tue 20-10-20
21		A/V Barrier & Roxul lvl 3	5 days	Fri 20-11-27	Thu 20-12-03
22		A/V Barrier & Roxul lvl 4	5 days	Mon 20-12-2	Mon 21-01-04



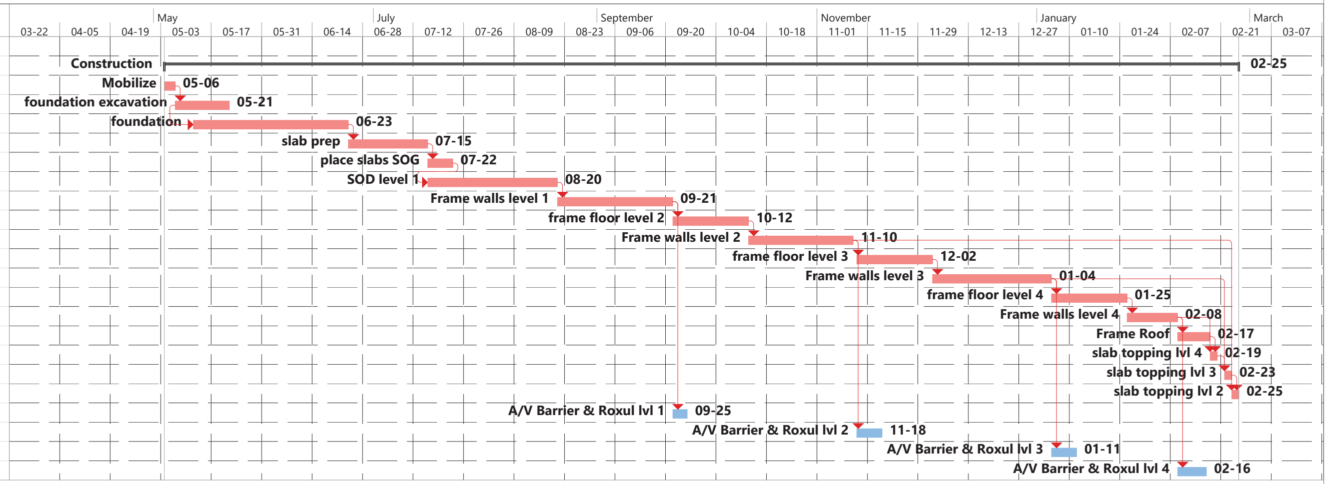
Project: ACL Schedule Wood no
Date: Fri 20-01-31

Task		Milestone	◆	Manual Task		Deadline		Critical Split		Manual Progress	
Split		Summary		Manual Summary		Critical		Progress			

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM Wood With Parking Garage

ID		Task Mode	Task Name	Duration	Start	Finish
1						
2			**Construction**	**206 days**	**Mon 20-05-0**	**Thu 21-02-25**
3			Mobilize	3 days	Mon 20-05-0	Wed 20-05-06
4			foundation excavation	10 days	Thu 20-05-07	Thu 20-05-21
5			foundation	6 wks	Tue 20-05-12	Tue 20-06-23
6			slab prep	3 wks	Wed 20-06-2	Wed 20-07-15
7			place slabs SOG	1 wk	Thu 20-07-16	Wed 20-07-22
8			SOD level 1	5 wks	Thu 20-07-16	Thu 20-08-20
9			Frame walls level 1	21 days	Fri 20-08-21	Mon 20-09-21
10			frame floor level 2	15 days	Tue 20-09-22	Mon 20-10-12
11			Frame walls level 2	21 days	Tue 20-10-13	Tue 20-11-10
12			frame floor level 3	15 days	Thu 20-11-12	Wed 20-12-02
13			Frame walls level 3	21 days	Thu 20-12-03	Mon 21-01-04
14			frame floor level 4	15 days	Tue 21-01-05	Mon 21-01-25
15			Frame walls level 4	10 days	Tue 21-01-26	Mon 21-02-08
16			Frame Roof	6 days	Tue 21-02-09	Wed 21-02-17
17			slab topping lvl 4	2 days	Thu 21-02-18	Fri 21-02-19
18			slab topping lvl 3	2 days	Mon 21-02-2	Tue 21-02-23
19			slab topping lvl 2	2 days	Wed 21-02-2	Thu 21-02-25
20			A/V Barrier & Roxul lvl 1	4 days	Tue 20-09-22	Fri 20-09-25
21			A/V Barrier & Roxul lvl 2	5 days	Thu 20-11-12	Wed 20-11-18
22			A/V Barrier & Roxul lvl 3	5 days	Tue 21-01-05	Mon 21-01-11
23			A/V Barrier & Roxul lvl 4	5 days	Tue 21-02-09	Tue 21-02-16



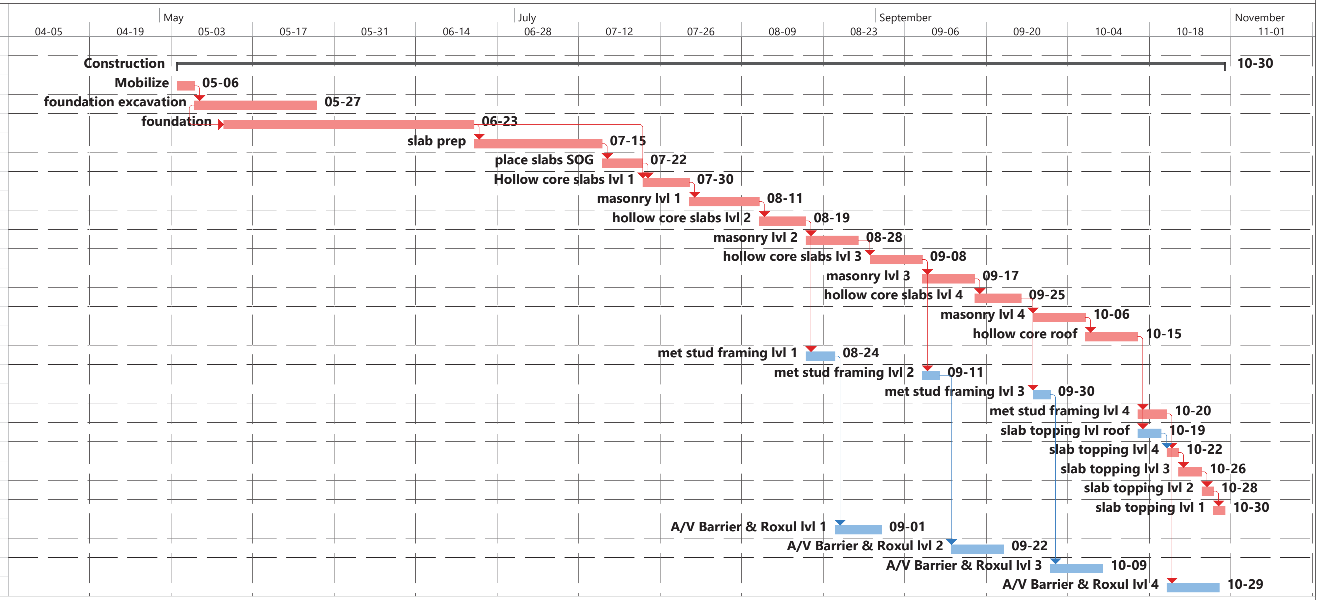
Project: ACL Schedule Wood w
Date: Fri 20-01-31

Task | Split | Milestone | Summary | Manual Task | Manual Summary | Deadline | Critical | Critical Split | Progress | Manual Progress

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM CMU No Parking Garage

ID	Task Mode	Task Name	Duration	Start	Finish
1					
2		**Construction**	**126 days**	**Mon 20-05-04**	**Fri 20-10-30**
3		Mobilize	3 days	Mon 20-05-04	Wed 20-05-06
4		foundation excavation	14 days	Thu 20-05-07	Wed 20-05-27
5		foundation	6 wks	Tue 20-05-12	Tue 20-06-23
6		slab prep	3 wks	Wed 20-06-24	Wed 20-07-15
7		place slabs SOG	1 wk	Thu 20-07-16	Wed 20-07-22
8		Hollow core slabs lvl 1	6 days	Thu 20-07-23	Thu 20-07-30
9		masonry lvl 1	7 days	Fri 20-07-31	Tue 20-08-11
10		hollow core slabs lvl 2	6 days	Wed 20-08-12	Wed 20-08-19
11		masonry lvl 2	7 days	Thu 20-08-20	Fri 20-08-28
12		hollow core slabs lvl 3	6 days	Mon 20-08-31	Tue 20-09-08
13		masonry lvl 3	7 days	Wed 20-09-09	Thu 20-09-17
14		hollow core slabs lvl 4	6 days	Fri 20-09-18	Fri 20-09-25
15		masonry lvl 4	7 days	Mon 20-09-28	Tue 20-10-06
16		hollow core roof	7 days	Wed 20-10-07	Thu 20-10-15
17		met stud framing lvl 1	3 days	Thu 20-08-20	Mon 20-08-24
18		met stud framing lvl 2	3 days	Wed 20-09-09	Fri 20-09-11
19		met stud framing lvl 3	3 days	Mon 20-09-28	Wed 20-09-30
20		met stud framing lvl 4	3 days	Fri 20-10-16	Tue 20-10-20
21		slab topping lvl roof	2 days	Fri 20-10-16	Mon 20-10-19
22		slab topping lvl 4	2 days	Wed 20-10-21	Thu 20-10-22
23		slab topping lvl 3	2 days	Fri 20-10-23	Mon 20-10-26
24		slab topping lvl 2	2 days	Tue 20-10-27	Wed 20-10-28
25		slab topping lvl 1	2 days	Thu 20-10-29	Fri 20-10-30
26		A/V Barrier & Roxul lvl 1	6 days	Tue 20-08-25	Tue 20-09-01
27		A/V Barrier & Roxul lvl 2	7 days	Mon 20-09-14	Tue 20-09-22
28		A/V Barrier & Roxul lvl 3	7 days	Thu 20-10-01	Fri 20-10-09
29		A/V Barrier & Roxul lvl 4	7 days	Wed 20-10-21	Thu 20-10-29



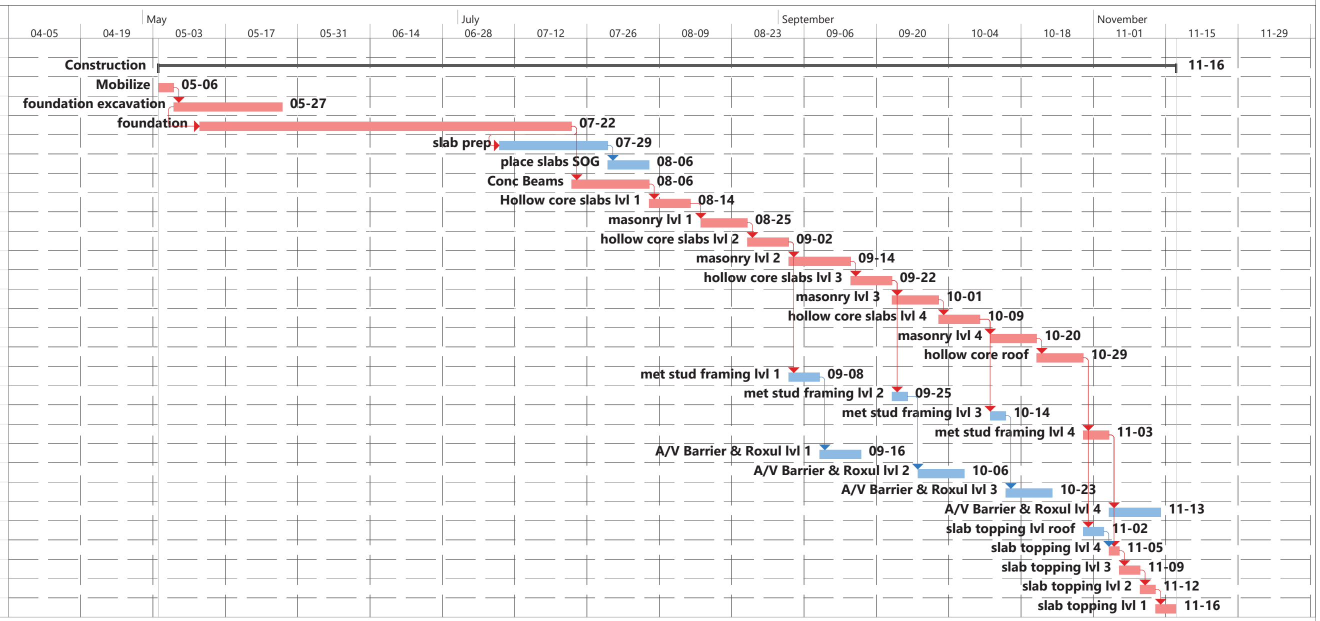
Project: ACL Schedule CMU no
Date: Fri 20-01-31

Task | Milestone | Manual Task | Deadline | Critical Split | Manual Progress
Split | Summary | Manual Summary | Critical | Progress

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM CMU with Parking Garage

ID		Task Mode	Task Name	Duration	Start	Finish
1						
2			**Construction**	**136 days**	**Mon 20-05-04**	**Mon 20-11-16**
3			Mobilize	3 days	Mon 20-05-04	Wed 20-05-06
4			foundation excavation	14 days	Thu 20-05-07	Wed 20-05-27
5			foundation	10 wks	Tue 20-05-12	Wed 20-07-22
6			slab prep	3 wks	Thu 20-07-09	Wed 20-07-29
7			place slabs SOG	1 wk	Thu 20-07-30	Thu 20-08-06
8			Conc Beams	2 wks	Thu 20-07-23	Thu 20-08-06
9			Hollow core slabs lvl 1	6 days	Fri 20-08-07	Fri 20-08-14
10			masonry lvl 1	7 days	Mon 20-08-17	Tue 20-08-25
11			hollow core slabs lvl 2	6 days	Wed 20-08-26	Wed 20-09-02
12			masonry lvl 2	7 days	Thu 20-09-03	Mon 20-09-14
13			hollow core slabs lvl 3	6 days	Tue 20-09-15	Tue 20-09-22
14			masonry lvl 3	7 days	Wed 20-09-23	Thu 20-10-01
15			hollow core slabs lvl 4	6 days	Fri 20-10-02	Fri 20-10-09
16			masonry lvl 4	7 days	Mon 20-10-12	Tue 20-10-20
17			hollow core roof	7 days	Wed 20-10-21	Thu 20-10-29
18			met stud framing lvl 1	3 days	Thu 20-09-03	Tue 20-09-08
19			met stud framing lvl 2	3 days	Wed 20-09-23	Fri 20-09-25
20			met stud framing lvl 3	3 days	Mon 20-10-12	Wed 20-10-14
21			met stud framing lvl 4	3 days	Fri 20-10-30	Tue 20-11-03
22			A/V Barrier & Roxul lvl 1	6 days	Wed 20-09-09	Wed 20-09-16
23			A/V Barrier & Roxul lvl 2	7 days	Mon 20-09-28	Tue 20-10-06
24			A/V Barrier & Roxul lvl 3	7 days	Thu 20-10-15	Fri 20-10-23
25			A/V Barrier & Roxul lvl 4	7 days	Wed 20-11-04	Fri 20-11-13
26			slab topping lvl roof	2 days	Fri 20-10-30	Mon 20-11-02
27			slab topping lvl 4	2 days	Wed 20-11-04	Thu 20-11-05
28			slab topping lvl 3	2 days	Fri 20-11-06	Mon 20-11-09
29			slab topping lvl 2	2 days	Tue 20-11-10	Thu 20-11-12
30			slab topping lvl 1	2 days	Fri 20-11-13	Mon 20-11-16



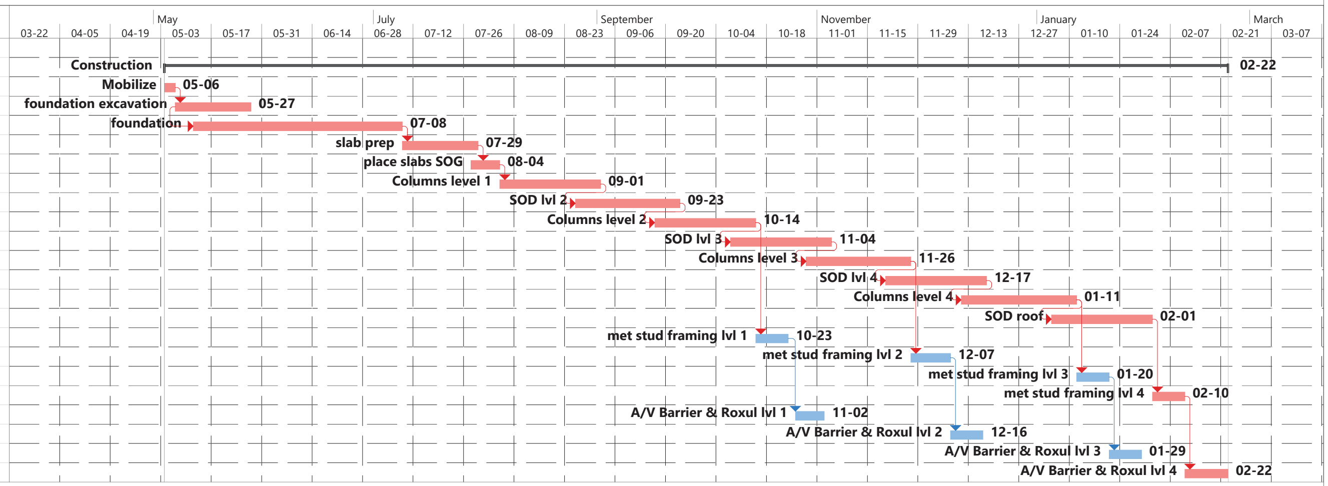
Project: ACL Schedule CMU pkn
Date: Fri 20-01-31

Task	Milestone	Manual Task	Deadline	Critical Split	Manual Progress
Split	Summary	Manual Summary	Critical	Progress	

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM Concrete No Parking Garage

ID	Task Mode	Task Name	Duration	Start	Finish
1					
2		**Construction**	**203 days**	**Mon 20-05-0**	**Mon 21-02-22**
3		Mobilize	3 days	Mon 20-05-0	Wed 20-05-06
4		foundation excavation	14 days	Thu 20-05-07	Wed 20-05-27
5		foundation	8 wks	Tue 20-05-12	Wed 20-07-08
6		slab prep	3 wks	Thu 20-07-09	Wed 20-07-29
7		place slabs SOG	1 wk	Tue 20-07-28	Tue 20-08-04
8		Columns level 1	4 wks	Wed 20-08-0	Tue 20-09-01
9		SOD lvl 2	4 wks	Wed 20-08-2	Wed 20-09-23
10		Columns level 2	4 wks	Thu 20-09-17	Wed 20-10-14
11		SOD lvl 3	4 wks	Thu 20-10-08	Wed 20-11-04
12		Columns level 3	4 wks	Thu 20-10-29	Thu 20-11-26
13		SOD lvl 4	4 wks	Fri 20-11-20	Thu 20-12-17
14		Columns level 4	4 wks	Fri 20-12-11	Mon 21-01-11
15		SOD roof	4 wks	Tue 21-01-05	Mon 21-02-01
16		met stud framing lvl 1	7 days	Thu 20-10-15	Fri 20-10-23
17		met stud framing lvl 2	7 days	Fri 20-11-27	Mon 20-12-07
18		met stud framing lvl 3	7 days	Tue 21-01-12	Wed 21-01-20
19		met stud framing lvl 4	7 days	Tue 21-02-02	Wed 21-02-10
20		A/V Barrier & Roxul lvl 1	6 days	Mon 20-10-2	Mon 20-11-02
21		A/V Barrier & Roxul lvl 2	7 days	Tue 20-12-08	Wed 20-12-16
22		A/V Barrier & Roxul lvl 3	7 days	Thu 21-01-21	Fri 21-01-29
23		A/V Barrier & Roxul lvl 4	7 days	Thu 21-02-11	Mon 21-02-22



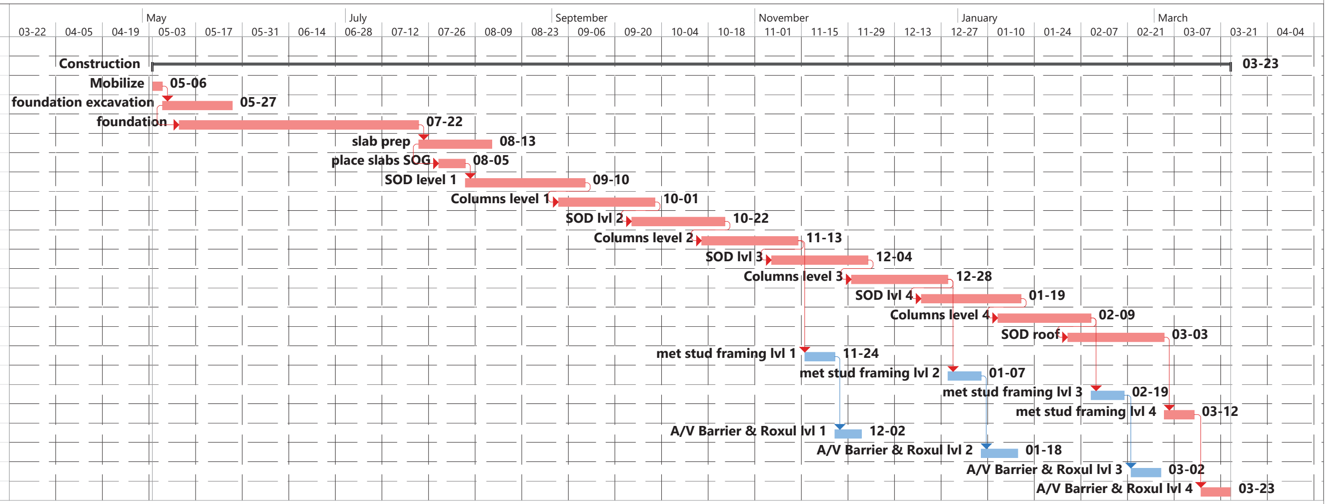
Project: ACL Schedule Concrete
Date: Fri 20-01-31

Task		Milestone	◆	Manual Task		Deadline		Critical Split		Manual Progress	
Split		Summary		Manual Summary		Critical		Progress			

ACADIAN CONSTRUCTION ACADIENNE

Project 19-131 LBM Concrete With Parking Garage

ID		Task Mode	Task Name	Duration	Start	Finish
1						
2			**Construction**	**224 days**	**Mon 20-05-0**	**Tue 21-03-23**
3			Mobilize	3 days	Mon 20-05-0	Wed 20-05-06
4			foundation excavation	14 days	Thu 20-05-07	Wed 20-05-27
5			foundation	10 wks	Tue 20-05-12	Wed 20-07-22
6			slab prep	3 wks	Thu 20-07-23	Thu 20-08-13
7			place slabs SOG	1 wk	Wed 20-07-2	Wed 20-08-05
8			SOD level 1	5 wks	Thu 20-08-06	Thu 20-09-10
9			Columns level 1	4 wks	Thu 20-09-03	Thu 20-10-01
10			SOD lvl 2	4 wks	Fri 20-09-25	Thu 20-10-22
11			Columns level 2	4 wks	Fri 20-10-16	Fri 20-11-13
12			SOD lvl 3	4 wks	Fri 20-11-06	Fri 20-12-04
13			Columns level 3	4 wks	Mon 20-11-3	Mon 20-12-28
14			SOD lvl 4	4 wks	Mon 20-12-2	Tue 21-01-19
15			Columns level 4	4 wks	Wed 21-01-1	Tue 21-02-09
16			SOD roof	4 wks	Wed 21-02-0	Wed 21-03-03
17			met stud framing lvl 1	7 days	Mon 20-11-1	Tue 20-11-24
18			met stud framing lvl 2	7 days	Tue 20-12-29	Thu 21-01-07
19			met stud framing lvl 3	7 days	Wed 21-02-1	Fri 21-02-19
20			met stud framing lvl 4	7 days	Thu 21-03-04	Fri 21-03-12
21			A/V Barrier & Roxul lvl 1	6 days	Wed 20-11-2	Wed 20-12-02
22			A/V Barrier & Roxul lvl 2	7 days	Fri 21-01-08	Mon 21-01-18
23			A/V Barrier & Roxul lvl 3	7 days	Mon 21-02-2	Tue 21-03-02
24			A/V Barrier & Roxul lvl 4	7 days	Mon 21-03-1	Tue 21-03-23

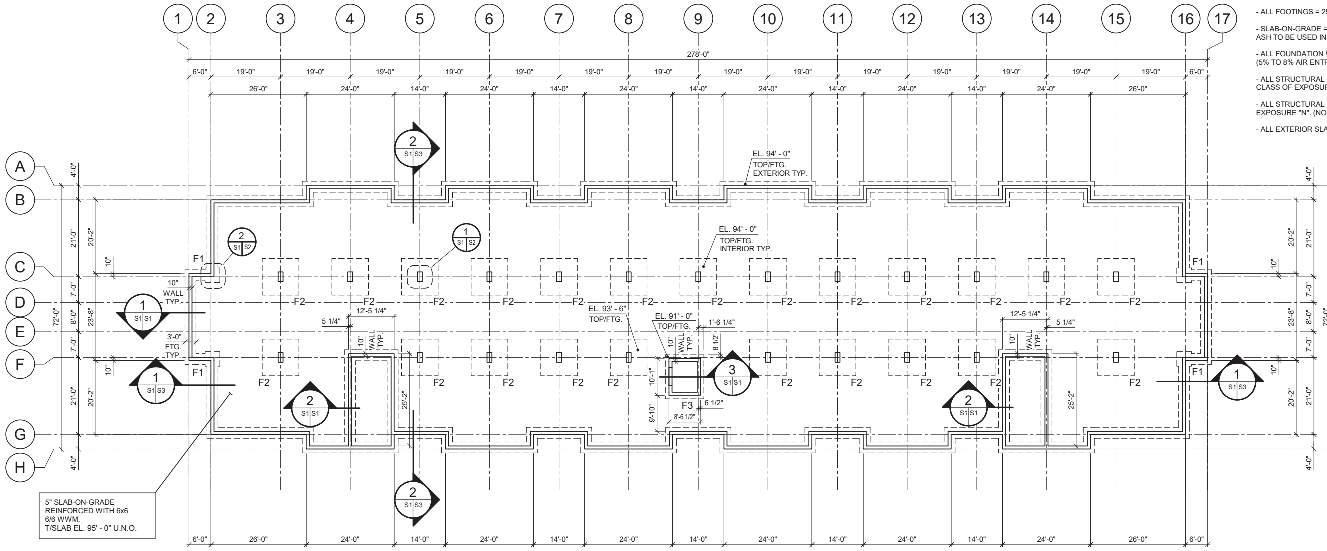


Project: ACL Schedule Concrete
Date: Fri 20-01-31

Task	Milestone	Manual Task	Deadline	Critical Split	Manual Progress
Split	Summary	Manual Summary	Critical	Progress	

APPENDIX C – Structural Drawings

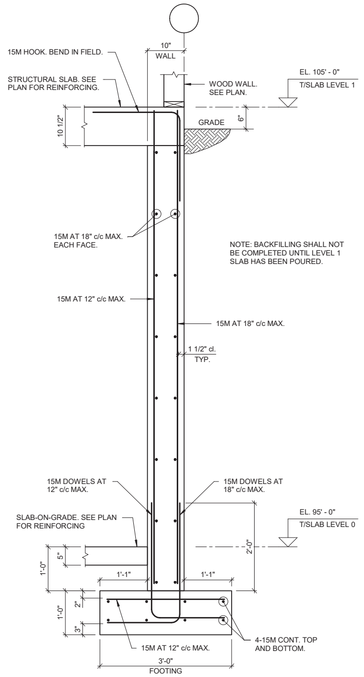
- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL SLABS AND BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".



FOUNDATION PLAN - LEVEL 0

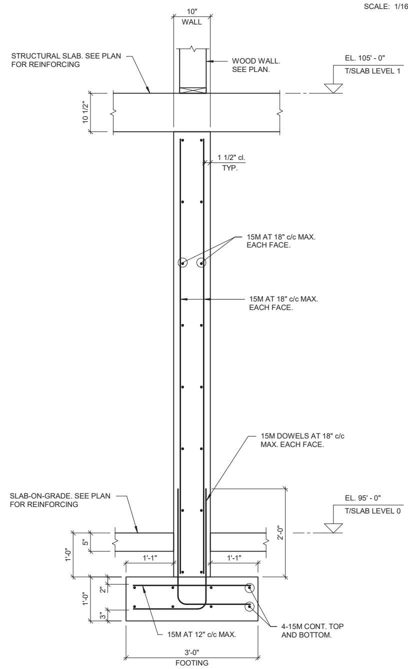
SCALE: 1/16" = 1'-0"

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F1	4' - 0" x 4' - 0" x 1' - 0"	6-15M EACH WAY, TOP AND BOTTOM
F2	10' - 0" x 10' - 0" x 2' - 0"	14-25M EACH WAY, TOP AND BOTTOM
F3	12' - 0" x 10' - 6" x 1' - 4"	20M AT 16" c/c EACH WAY, TOP AND BOTTOM



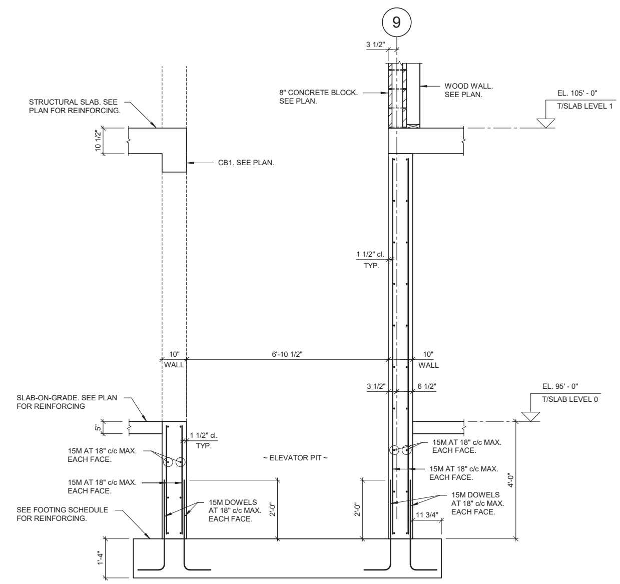
TYPICAL WALL SECTION

SCALE: 3/4" = 1'-0"



TYPICAL WALL SECTION THRU STAIRS

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 1/2" = 1'-0"

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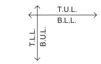
Client

Project: 55 Unit Residential
c/w Parking Garage
Wood Construction

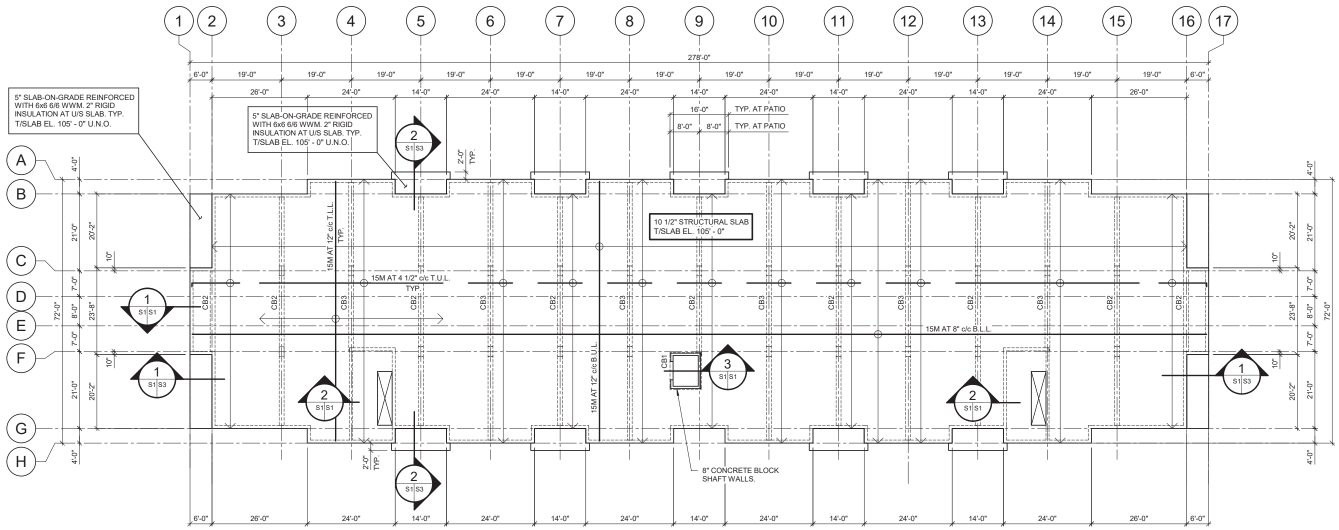
Drawing Title: FOUNDATION PLAN - LEVEL 0 AND SECTIONS

Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision
Scale: As indicated
Sheet: S1
Flight no:

T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER



REINFORCING PLACEMENT



FLOOR PLAN - LEVEL 1

SCALE: 1/16" = 1'-0"

NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14 FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.

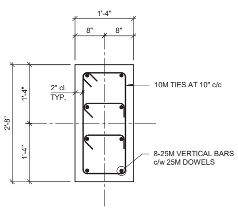
- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL SLABS AND BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)
DL = SELF WEIGHT + 12 psf (BALCONIES)

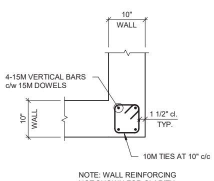
CONCRETE BEAM SCHEDULE

TYPE	SIZE	REINFORCING
CB1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
CB2	1'-4" WIDE BY 2'-2" HIGH	REFER TO CONCRETE BEAM REINFORCING DETAILS
CB3	1'-4" WIDE BY 2'-4" HIGH	REFER TO CONCRETE BEAM REINFORCING DETAILS



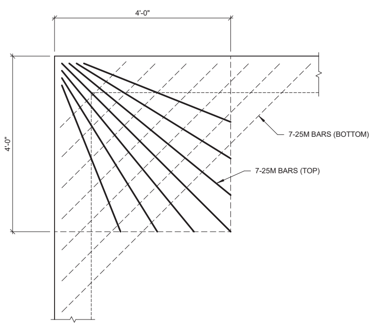
TYPICAL COLUMN DETAIL 1 S1|S2

SCALE: 3/4" = 1'-0"



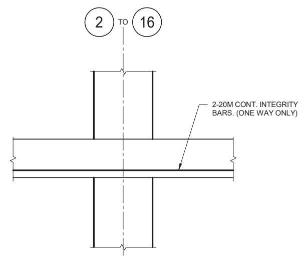
REINFORCING DETAIL AT CORNERS C-2, C-16, F-2, F-16 2 S1|S2

SCALE: 3/4" = 1'-0"



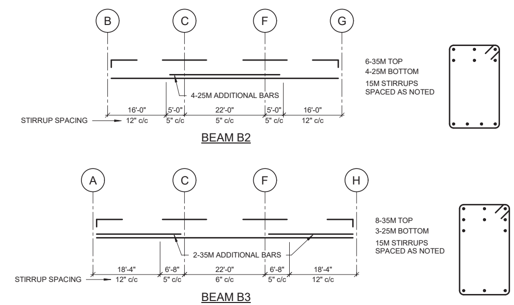
SLAB REINFORCING DETAILS AT CORNER BEARING ON FOUNDATION WALLS 3 S2

SCALE: 3/4" = 1'-0"



INTEGRITY BARS DETAIL 4 S2

SCALE: 3/4" = 1'-0"



CONCRETE BEAM REINFORCING DETAILS 5 S2

SCALE: 1/16" = 1'-0"

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Client

Project
55 Unit Residential
c/w Parking Garage
Wood Construction

Drawing Title
FLOOR PLAN - LEVEL 1 AND DETAILS

Date: November 19, 2019
Checked by: JAR
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Revision
Scale: As indicated
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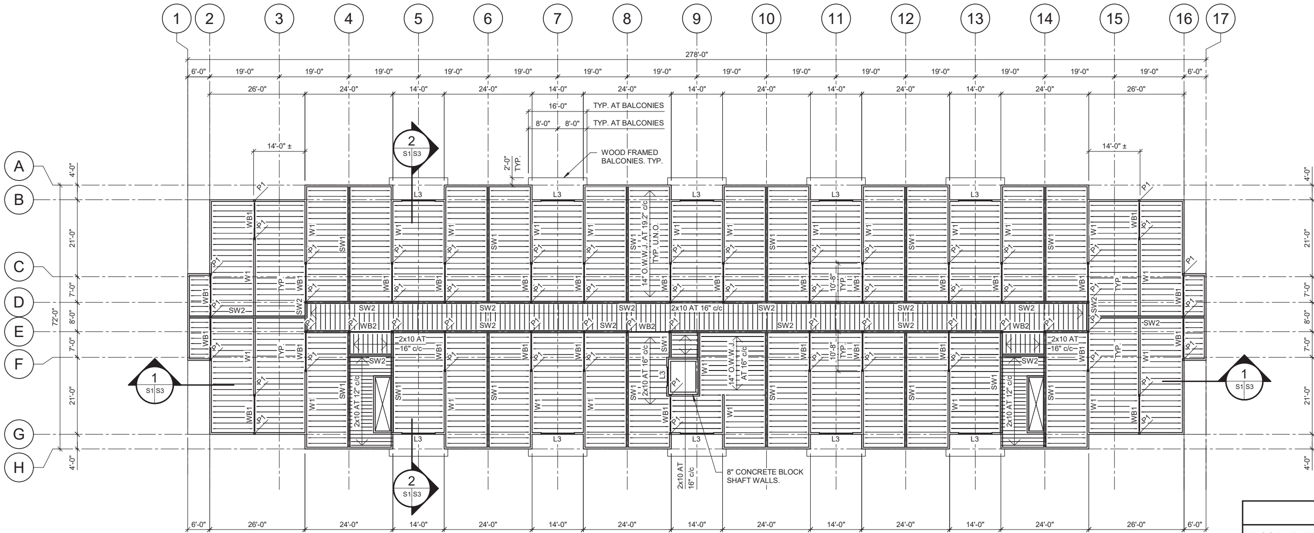
Flight no:



FLOOR FRAMING PLAN
- LEVEL 2 TO 4

SCALE: 1/16" = 1'-0"

* FLOOR SHEATHING TO BE 5/8" OSB.

<u>FLOOR DESIGN LOAD U.N.O. (SPECIFIED)</u>

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)
DL = SELF WEIGHT + 12 psf (BALCONIES)

POST SCHEDULE

FLOOR LEVEL	P1
4	N/A
3	3 PLY 2x6 SPF No.1/2
2	4 PLY 2x6 SPF No.1/2
1	5 1/4" x 5 1/2" LVL (2900Fb-2.0E) POST

LINTEL SCHEDULE

TYPE	LINTEL	END SUPPORT
L1	2 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L2	3 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L3	3 PLY 2x10 SPF No.1/2	2 - 2x6 SPF No.1/2 JACK POST EACH END

* ALL LINTELS ARE 2 PLY 2x10 SPF No. 1/2 U.N.O.

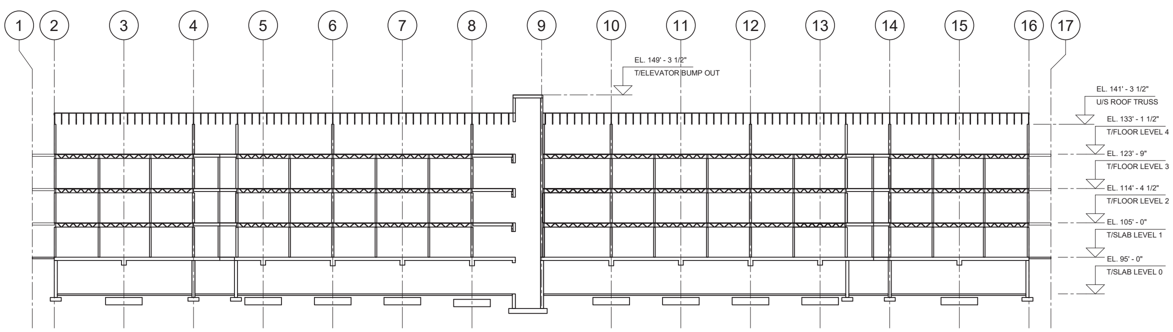
BEAM SCHEDULE

TYPE	BEAM	END SUPPORT
WB1	2 PLY 14" LVL (2900Fb-2.0E)	SEE PLAN
WB2	3 PLY 9 1/4" LVL (2900Fb-2.0E)	SEE PLAN

STUD WALL SCHEDULE

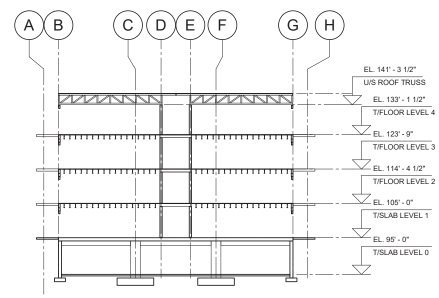
FLOOR LEVEL	W1	SW1	SW2
4	N/A	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
3	2x6 SPF No.1/2 AT 16" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
2	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
1	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 2'-8"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"

* EXTERIOR WALLS ARE ALL 2x6 SPF No.1/2 FRAMING AT 16" c/c WITH 7/16" OSB ON EXTERIOR FACE.



BUILDING SECTION 1 S1|S3

SCALE: 1/16" = 1'-0"



BUILDING SECTION 2 S1|S3

SCALE: 1/16" = 1'-0"

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1	ISSUED FOR PRICING	NOV. 19/19

Rev.#	Description	Date

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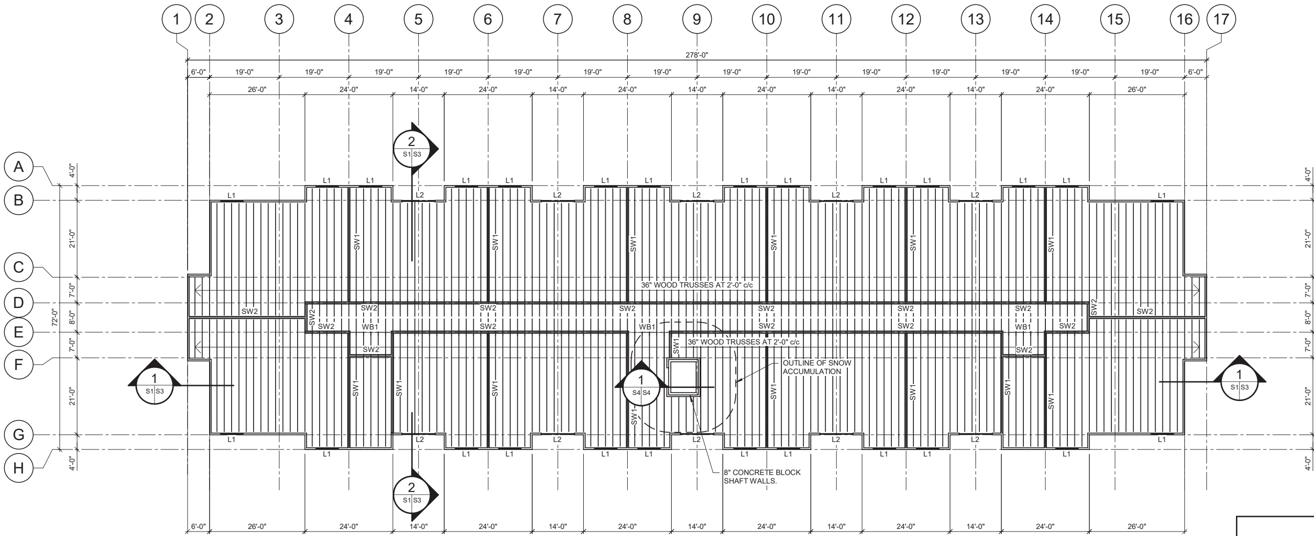
Client

Project
55 Unit Residential
c/w Parking Garage
Wood Construction

Drawing Title
FLOOR FRAMING PLAN - LEVEL 2 TO 4, SCHEDULES AND SECTIONS

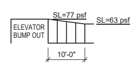
Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S3
Flight no:



ROOF FRAMING PLAN

SCALE: 1/16" = 1'-0"

* ROOF SHEATHING TO BE 5/8" OSB.



SNOW BUILD-UP DIAGRAM

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = SELF WEIGHT + 20 psf (INCLUDING MECHANICAL LOADS)

POST SCHEDULE

FLOOR LEVEL	P1
4	N/A
3	3 PLY 2x6 SPF No.1/2
2	4 PLY 2x6 SPF No.1/2
1	5 1/4" x 5 1/2" LVL (2900Fb-2.0E) POST

LINTEL SCHEDULE

TYPE	LINTEL	END SUPPORT
L1	2 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L2	3 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L3	3 PLY 2x10 SPF No.1/2	2 - 2x6 SPF No.1/2 JACK POST EACH END

* ALL LINTELS ARE 2 PLY 2x10 SPF No. 1/2 U.N.O.

BEAM SCHEDULE

TYPE	BEAM	END SUPPORT
WB1	2 PLY 14" LVL (2900Fb-2.0E)	SEE PLAN
WB2	3 PLY 9 1/4" LVL (2900Fb-2.0E)	SEE PLAN

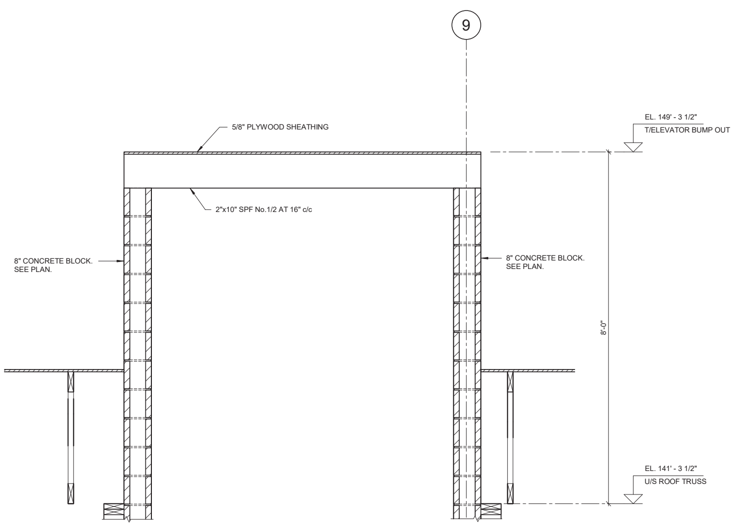
STUD WALL SCHEDULE

FLOOR LEVEL	W1	SW1	SW2
4	N/A	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
3	2x6 SPF No.1/2 AT 16" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
2	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
1	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 2'-8"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"

* EXTERIOR WALLS ARE ALL 2x6 SPF No.1/2 FRAMING AT 16" c/c WITH 7/16" OSB ON EXTERIOR FACE.

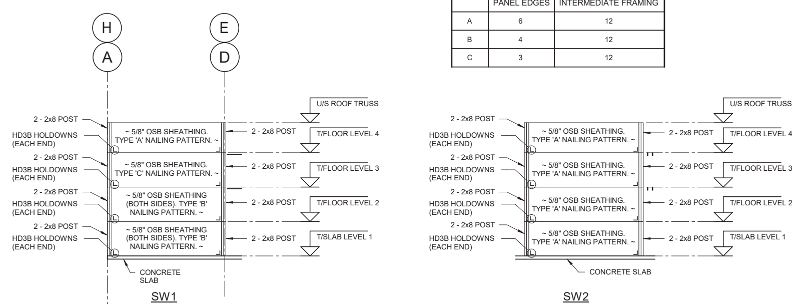
NAILING PATTERNS

TYPE	NAILING SPACING (INCHES)	
	PANEL EDGES	INTERMEDIATE FRAMING
A	6	12
B	4	12
C	3	12



ELEVATOR SHAFT BUMP OUT

SCALE: 3/4" = 1'-0"



SHEAR WALL DETAILS

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Job No. 18378

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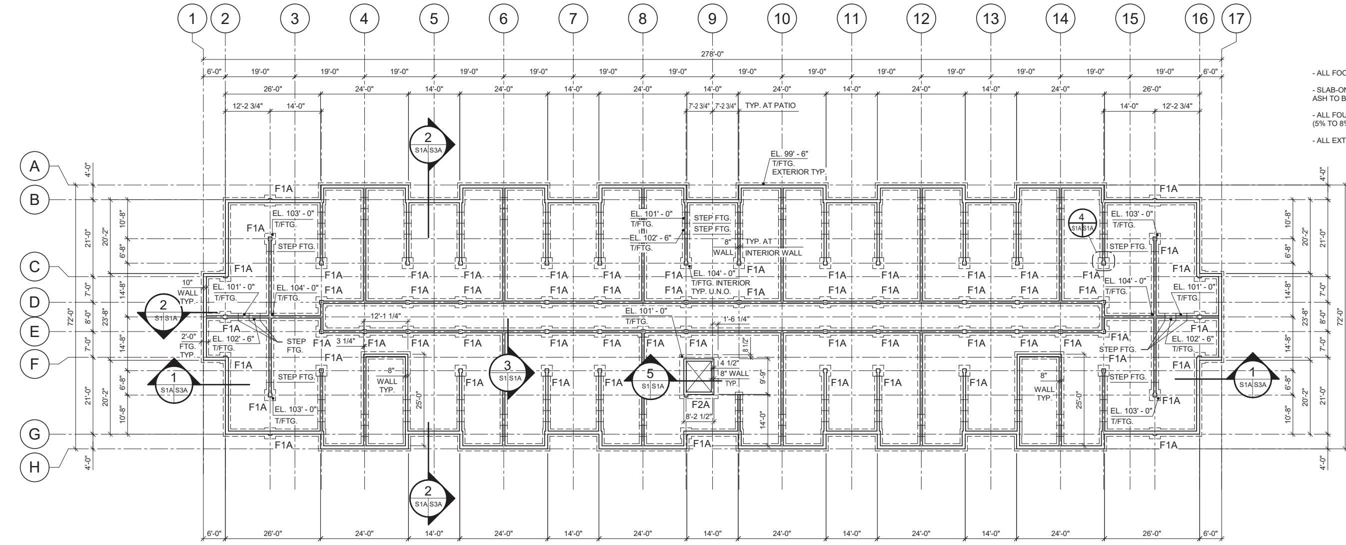
Client

Project
55 Unit Residential
c/w Parking Garage
Wood Construction

Drawing Title
ROOF FRAMING PLAN, SCHEDULES AND SHEAR WALL DETAILS

Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision
Scale: As indicated
Sheet: S4
Flight no:

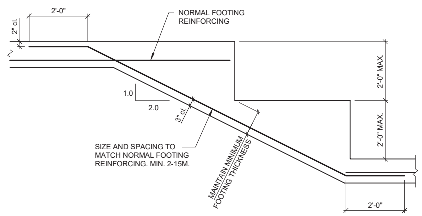


FOUNDATION PLAN

SCALE: 1/16" = 1'-0"

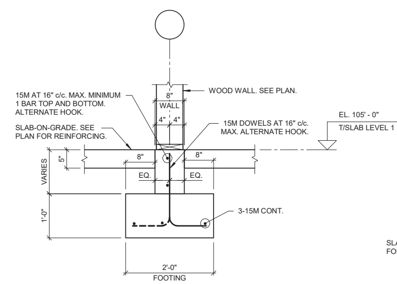
- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F1A	3' - 0" x 3' - 0" x 1' - 0"	4-15M EACH WAY, BOTTOM
F2A	12' - 0" x 10' - 6" x 1' - 4"	20M AT 16" c/c EACH WAY, TOP AND BOTTOM



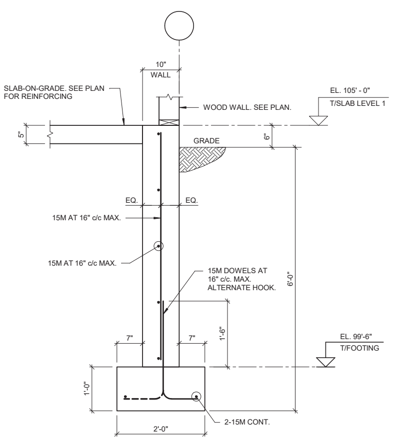
STEP FOOTING DETAIL

SCALE: 1/2" = 1'-0"



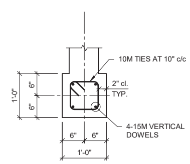
TYPICAL INTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



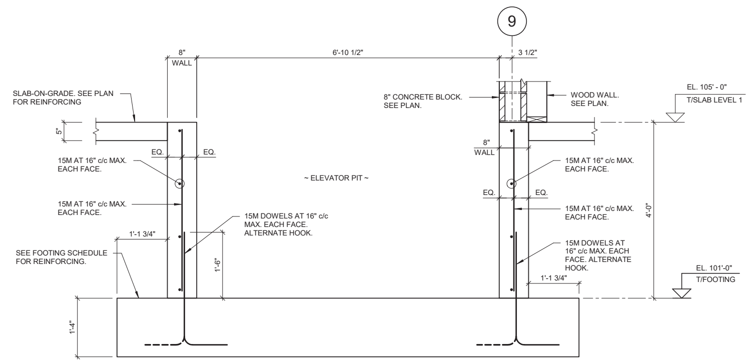
TYPICAL WALL SECTION

SCALE: 3/4" = 1'-0"



TYPICAL PILASTER DETAIL

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 3/4" = 1'-0"

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Client

Project
55 Unit Residential
No Parking Garage
Wood Construction

Drawing Title
FOUNDATION PLAN - LEVEL 0 AND SECTIONS

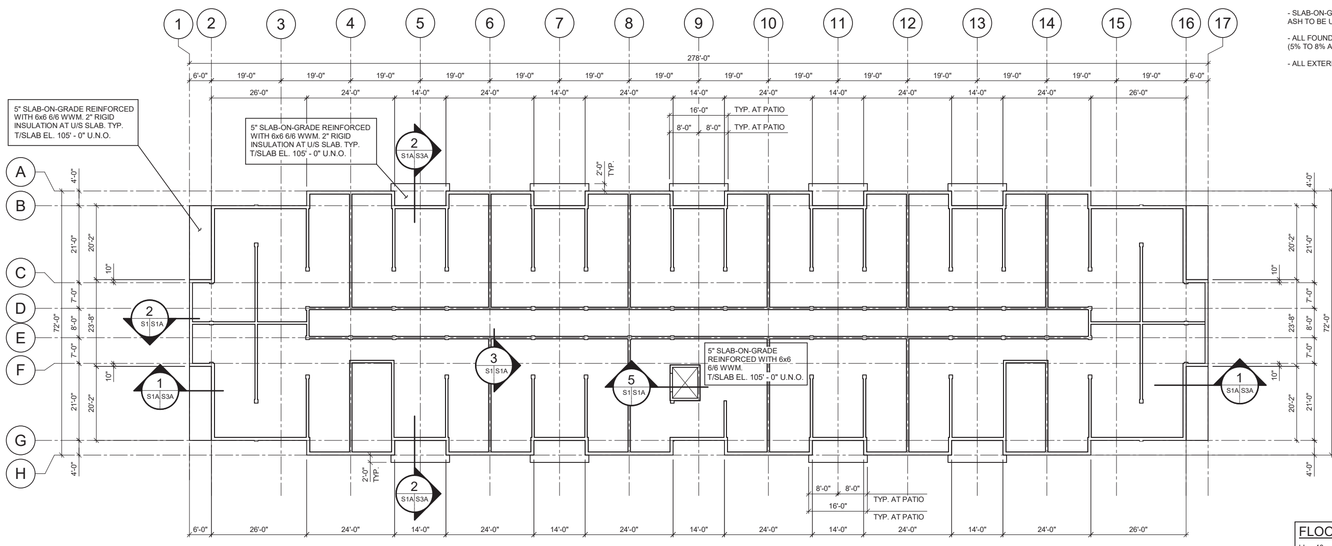
Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision
Scale: As indicated
Sheet: S1A
Flight no:

- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".

- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).

- ALL FOUNDATION WALLS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).

- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".



FLOOR PLAN - LEVEL 1

SCALE: 1/16" = 1'-0"

FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)
DL = SELF WEIGHT + 12 psf (BALCONIES)

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	NOV. 19/19

Rev.#	Description	Date

Job No. 18378

Ingénieurs en structure
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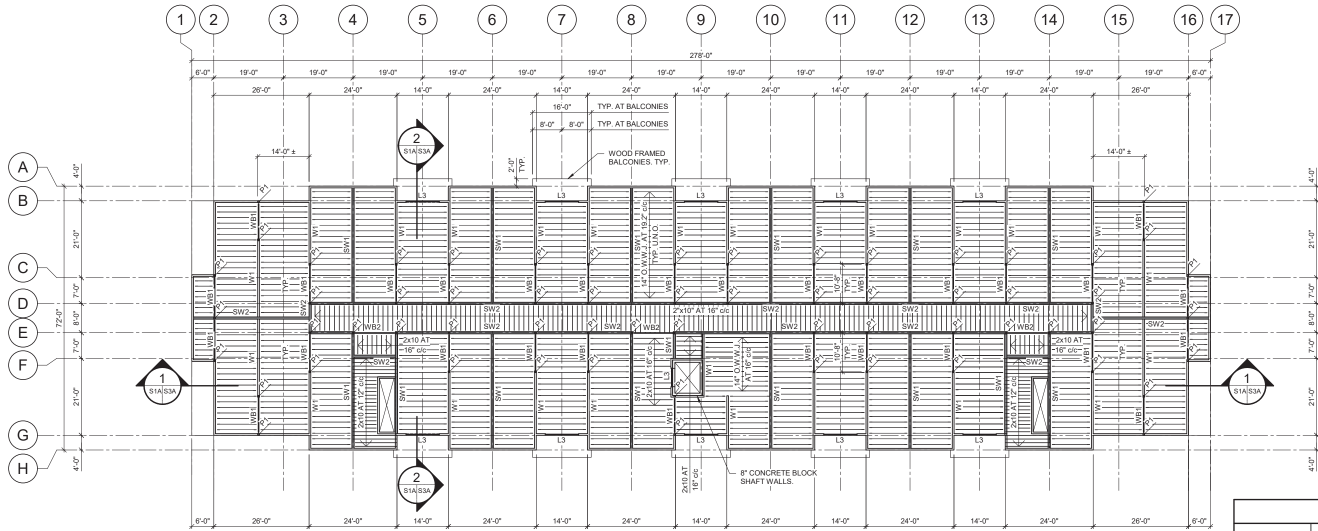
Bus: (506) 855-3777 Cell: (506) 312-2777 eMail:

Client

Project
55 Unit Residential
No Parking Garage
Wood Construction

Drawing Title
FLOOR PLAN - LEVEL 1 AND DETAILS

Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision
Scale: As indicated
Sheet: S2A
Flight no:



FLOOR PLAN - LEVEL 2 TO 4

SCALE: 1/16" = 1'-0"

* FLOOR SHEATHING TO BE 5/8" OSB.

FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)
DL = SELF WEIGHT + 12 psf (BALCONIES)

POST SCHEDULE

FLOOR LEVEL	P1
4	N/A
3	3 PLY 2x6 SPF No.1/2
2	4 PLY 2x6 SPF No.1/2
1	5 1/4" x 5 1/2" LVL (2900Fb-2.0E) POST

LINTEL SCHEDULE

TYPE	LINTEL	END SUPPORT
L1	2 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L2	3 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L3	3 PLY 2x10 SPF No.1/2	2 - 2x6 SPF No.1/2 JACK POST EACH END

* ALL LINTELS ARE 2 PLY 2x10 SPF No. 1/2 U.N.O.

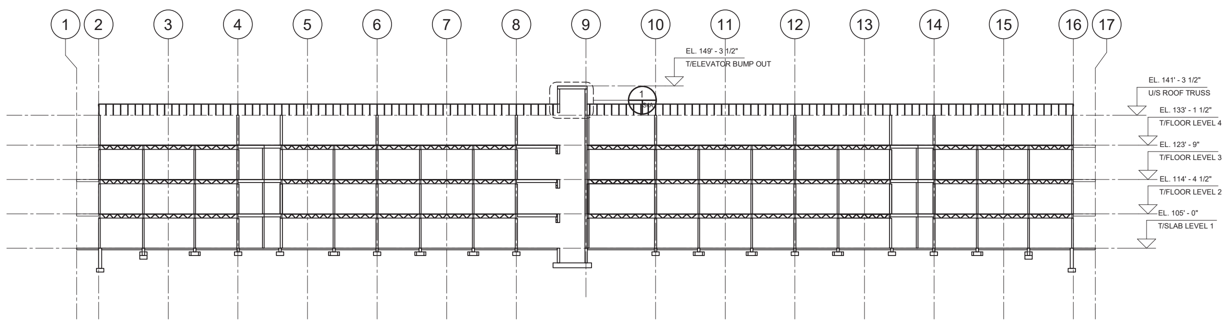
BEAM SCHEDULE

TYPE	BEAM	END SUPPORT
WB1	2 PLY 14" LVL (2900Fb-2.0E)	SEE PLAN
WB2	3 PLY 9 1/4" LVL (2900Fb-2.0E)	SEE PLAN

STUD WALL SCHEDULE

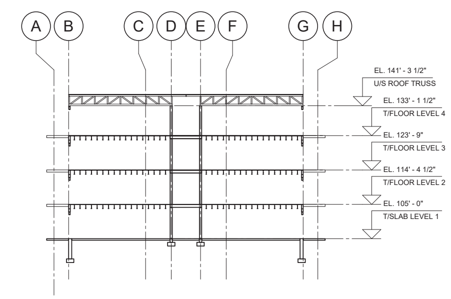
FLOOR LEVEL	W1	SW1	SW2
4	N/A	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
3	2x6 SPF No.1/2 AT 16" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
2	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
1	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 2'-8"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"

* EXTERIOR WALLS ARE ALL 2x6 SPF No.1/2 FRAMING AT 16" c/c WITH 7/16" OSB ON EXTERIOR FACE.



BUILDING SECTION 1 (S1A S3A)

SCALE: 1/16" = 1'-0"



BUILDING SECTION 2 (S1A S3A)

SCALE: 1/16" = 1'-0"

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1	ISSUED FOR PRICING	NOV. 19/19

Rev.#	Description	Date

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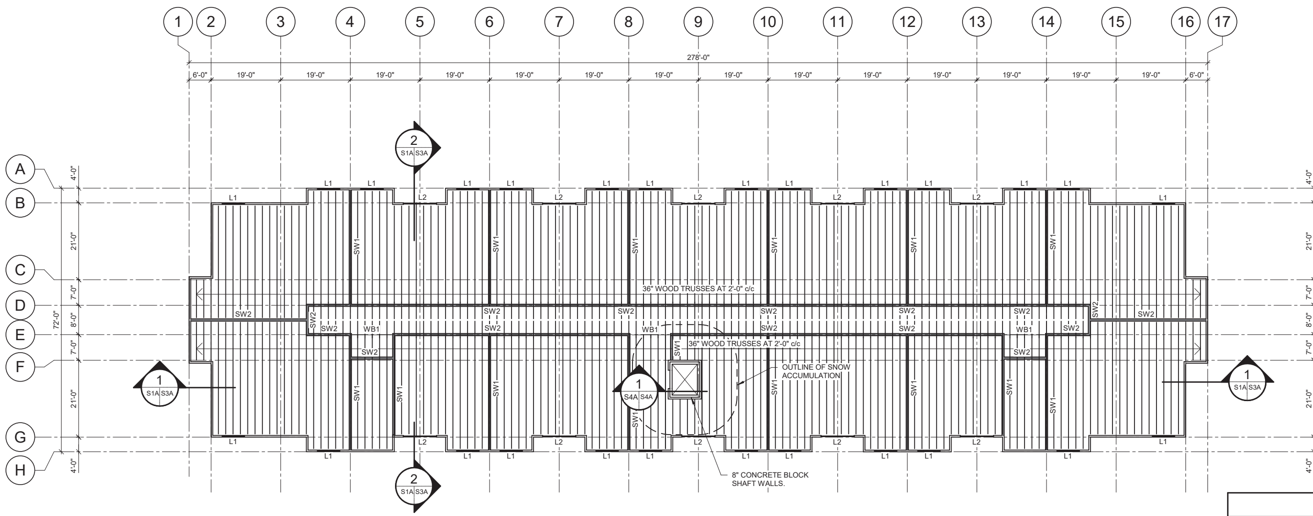
Client

Project
55 Unit Residential
No Parking Garage
Wood Construction

Drawing Title
FLOOR FRAMING PLAN - LEVEL 2 TO 4, SCHEDULES AND SECTIONS

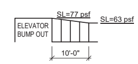
Date: November 19, 2019
Checked by: JAR
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S3A
Flight no:



ROOF PLAN

SCALE: 1/16" = 1'-0"

* ROOF SHEATHING TO BE 5/8" OSB.



SNOW BUILD-UP DIAGRAM

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = SELF WEIGHT + 20 psf (INCLUDING MECHANICAL LOADS)

POST SCHEDULE

FLOOR LEVEL	P1
4	N/A
3	3 PLY 2x6 SPF No.1/2
2	4 PLY 2x6 SPF No.1/2
1	5 1/4" x 5 1/2" LVL (2900Fb-2.0E) POST

LINTEL SCHEDULE

TYPE	LINTEL	END SUPPORT
L1	2 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L2	3 PLY 9 1/2" LVL (2900Fb-2.0E)	2 - 2x6 SPF No.1/2 JACK POST EACH END
L3	3 PLY 2x10 SPF No.1/2	2 - 2x6 SPF No.1/2 JACK POST EACH END

* ALL LINTELS ARE 2 PLY 2x10 SPF No. 1/2 U.N.O.

BEAM SCHEDULE

TYPE	BEAM	END SUPPORT
WB1	2 PLY 14" LVL (2900Fb-2.0E)	SEE PLAN
WB2	3 PLY 9 1/4" LVL (2900Fb-2.0E)	SEE PLAN

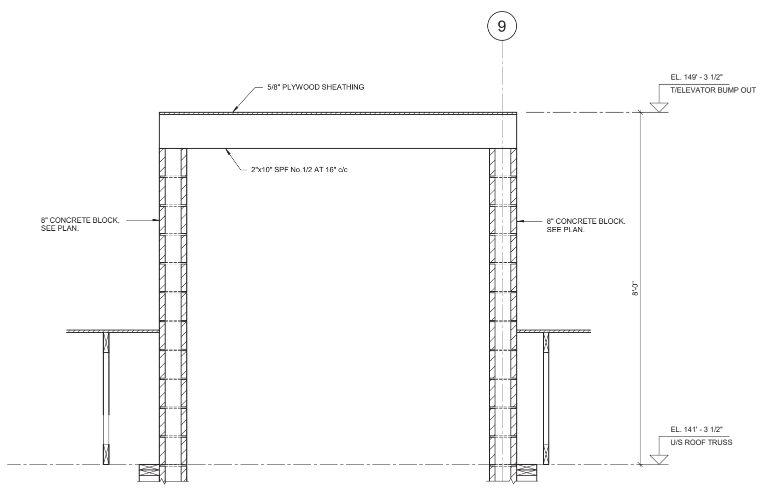
STUD WALL SCHEDULE

FLOOR LEVEL	W1	SW1	SW2
4	N/A	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
3	2x6 SPF No.1/2 AT 16" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
2	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"
1	2x6 SPF No.1/2 AT 12" c/c, WOOD BLOCKING AT 2'-8"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"	2x6 SPF No.1/2 STAGGERED STUDS AT 16" c/c, 2x8 TOP/BOTTOM PLATES, WOOD BLOCKING AT 4'-0"

* EXTERIOR WALLS ARE ALL 2x6 SPF No.1/2 FRAMING AT 16" c/c WITH 7/16" OSB ON EXTERIOR FACE.

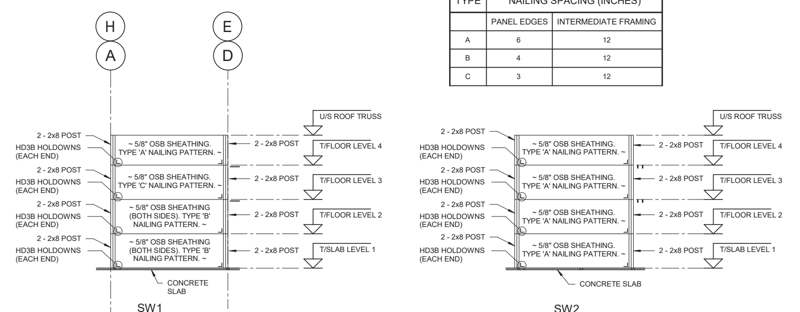
NAILING PATTERNS

TYPE	NAILING SPACING (INCHES)	
	PANEL EDGES	INTERMEDIATE FRAMING
A	6	12
B	4	12
C	3	12



ELEVATOR SHAFT BUMP OUT

SCALE: 3/4" = 1'-0"



SHEAR WALL DETAILS

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	NOV. 19/19

Rev.#	Description	Date

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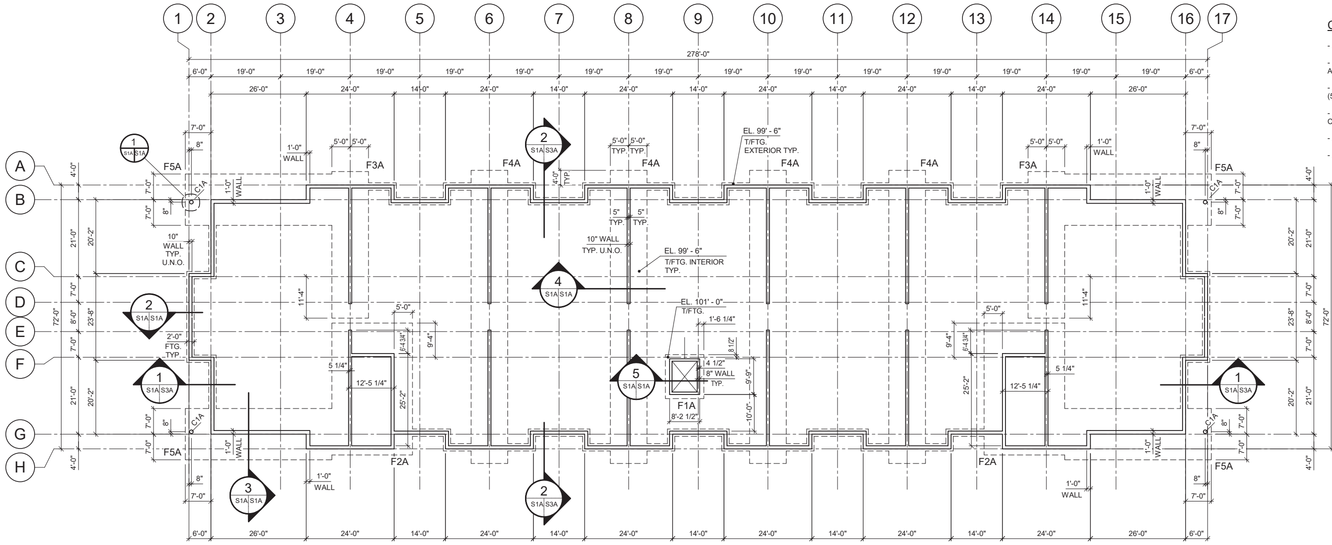
Client

Project
55 Unit Residential
No Parking Garage
Wood Construction

Drawing Title
ROOF FRAMING PLAN, SCHEDULES AND SHEAR WALL DETAILS

Date November 19, 2019
Checked by: JAR
Drawn by: MH
Revision
Scale: As indicated
Sheet S4A
Flight no:



FOUNDATION PLAN

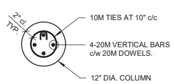
SCALE: 1/16" = 1'-0"

CONCRETE CONSTRUCTION NOTES:

- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

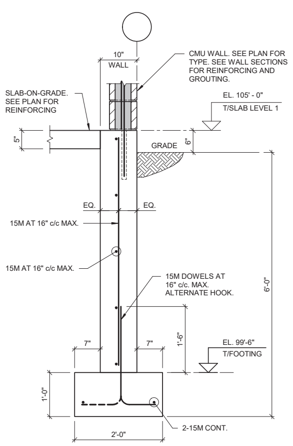
FOOTING SCHEDULE

TYPE	SIZE	REINFORCING
F1A	12' - 0" x 10' - 6" x 1' - 4"	20M AT 16" c/c EACH WAY, TOP AND BOTTOM
F2A	36' - 0" x 22' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F3A	40' - 0" x 10' - 0" x 4' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F4A	80' - 0" x 10' - 0" x 4' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F5A	40' - 0" x 14' - 0" x 5' - 0"	20M AT 8" c/c EACH WAY TOP, 30M AT 8" c/c EACH WAY BOTTOM



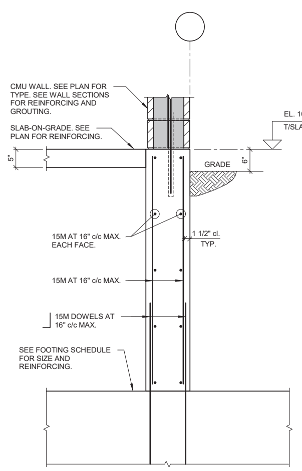
C1A - COLUMN DETAIL

SCALE: 3/4" = 1'-0"



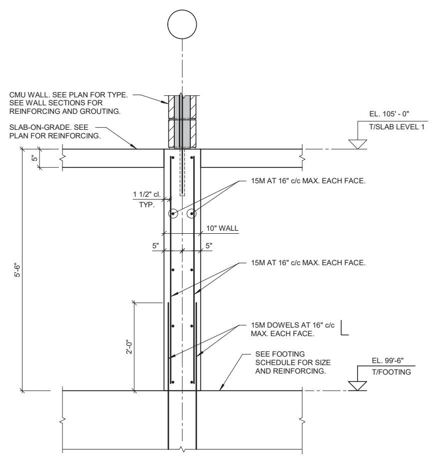
TYPICAL 10" EXTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



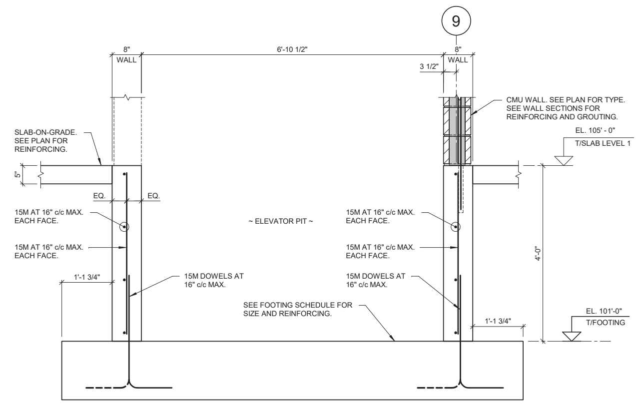
TYPICAL 12" EXTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



TYPICAL INTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 3/4" = 1'-0"

ISSUE	DESCRIPTION	DATE
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Rev.#	Description	Date

Job No. 18378

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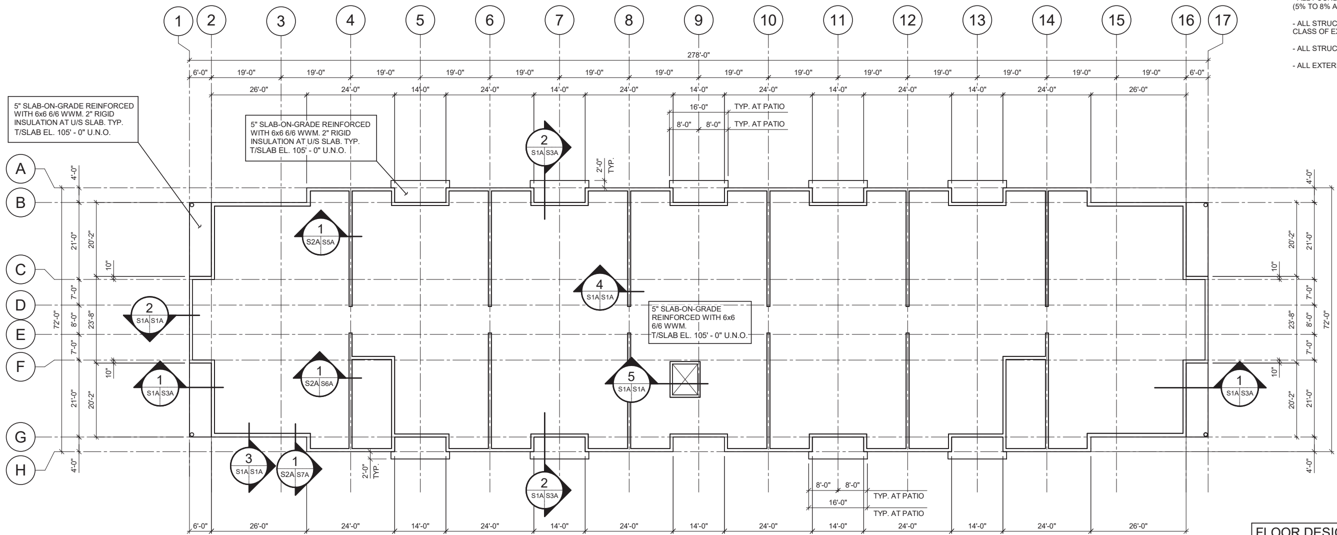
Client

Project
55 Unit Residential
No Parking Garage
Concrete Block Construction

Drawing Title
FOUNDATION PLAN - LEVEL 0 AND SECTIONS

Date	January 14, 2020
Checked by:	SL, SA
Drawn by:	MH
Revision	
Scale:	As indicated
Sheet	S1A
Flight no:	



FLOOR PLAN - LEVEL 1

SCALE: 1/16" = 1'-0"

CONCRETE CONSTRUCTION NOTES:

- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf (SUITES)
LL = 100 psf (CORRIDORS, STAIRS, COMMON AREAS AND BALCONIES)
DL = 85 psf (INCLUDING 20 psf PARTITION LOAD ALLOWANCE)

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	JAN. 14/20

Rev.#	Description	Date

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No Parking Garage
Concrete Block Construction

Drawing Title
FLOOR PLAN - LEVEL 1 AND DETAILS

Date: January 14, 2020
Checked by: SL, SA
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S2A
Flight no:

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.

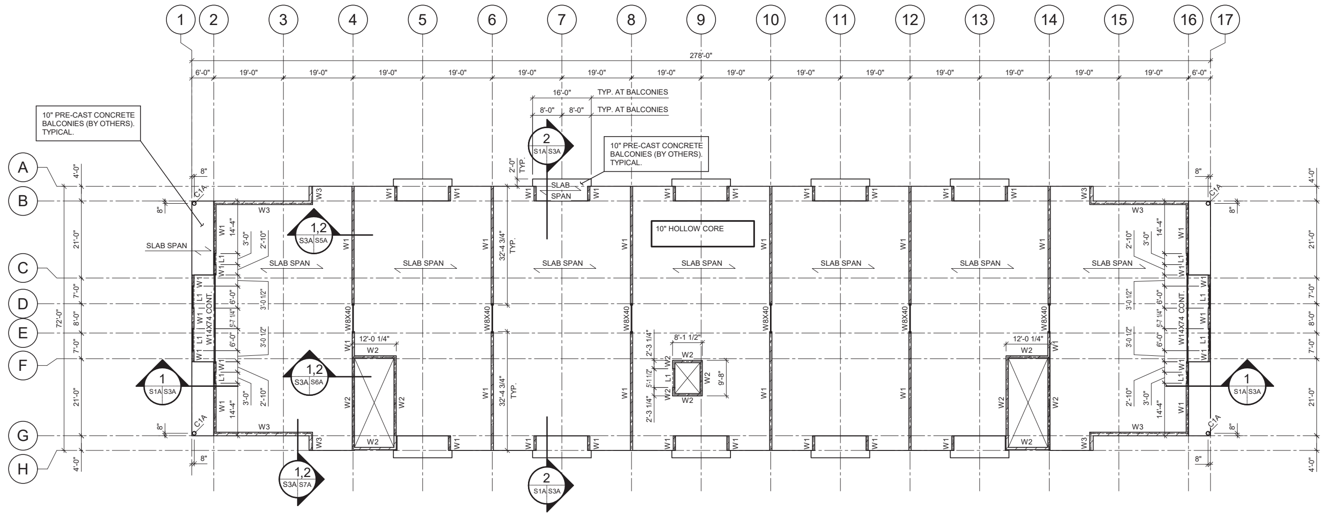
- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

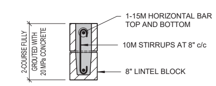


FLOOR PLAN - LEVEL 2 TO 4

SCALE: 1/16" = 1'-0"

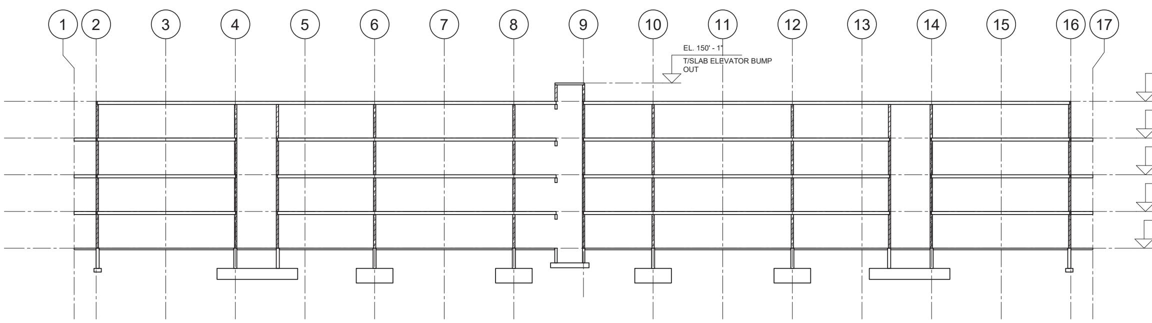
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf (SUITES)
LL = 100 psf (CORRIDORS, STAIRS, COMMON AREAS AND BALCONIES)
DL = 133 psf (INCLUDING 10" HOLLOW CORES AND 20 psf PARTITION LOAD ALLOWANCE)



TYPICAL LINTEL L1 DETAIL

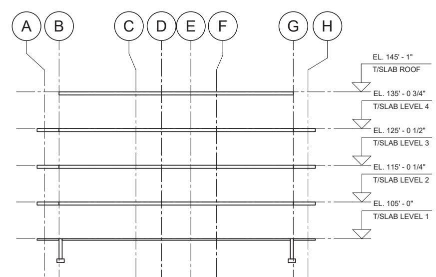
SCALE: 3/4" = 1'-0"



BUILDING SECTION

1 S1A S3A

SCALE: 1/16" = 1'-0"



BUILDING SECTION

2 S1A S3A

SCALE: 1/16" = 1'-0"

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1	ISSUED FOR PRICING	JAN. 14/20

Rev.#	Description	Date

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No Parking Garage
Concrete Block Construction

Drawing Title
FLOOR PLAN - LEVEL 2 TO 4, SCHEDULES AND SECTIONS

Date	January 14, 2020		
Checked by:	SL, SA		
Drawn by:	MH	Revision	
Scale:	As indicated		
Sheet	S3A	Flight no:	

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.

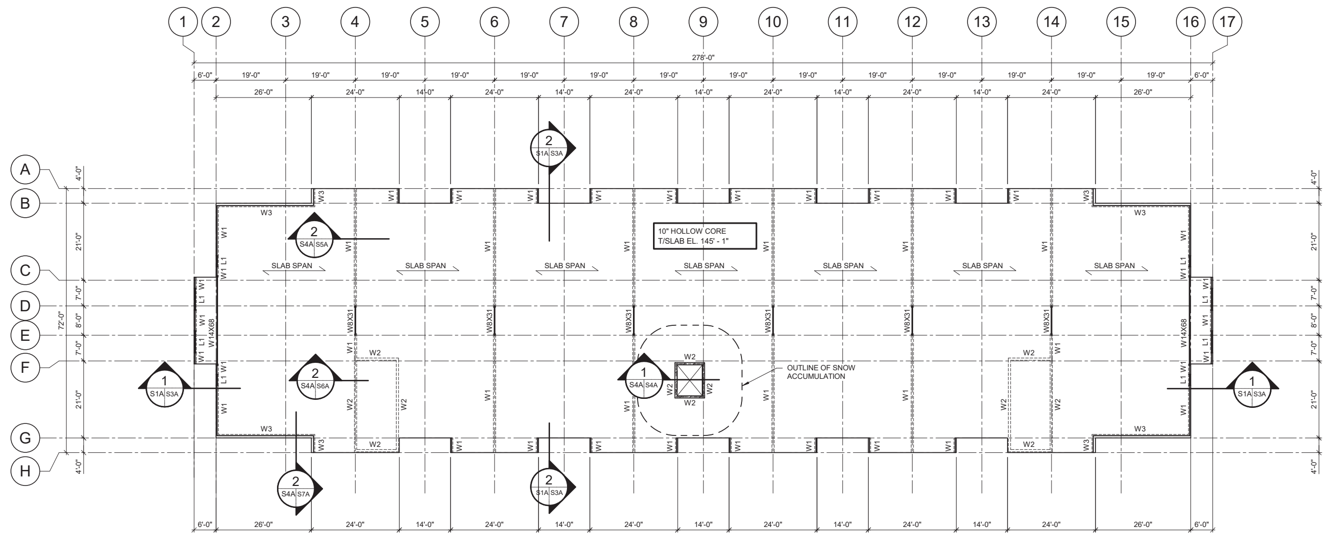
- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

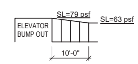


ROOF PLAN

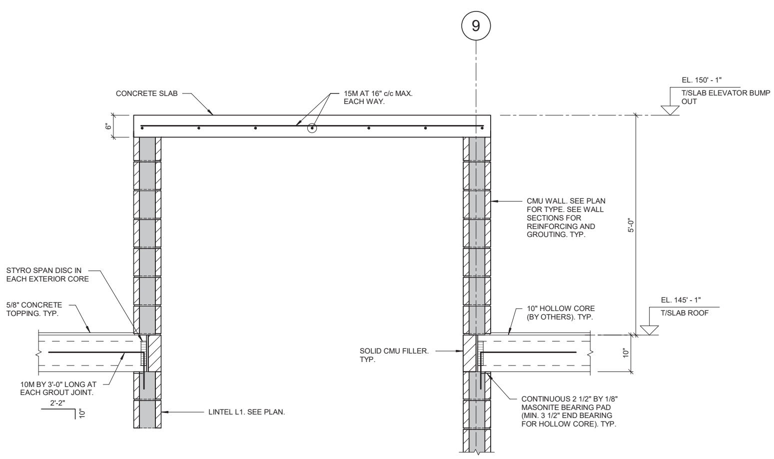
SCALE: 1/16" = 1'-0"

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = 94 psf (INCLUDING 10" HOLLOW CORE WEIGHT)

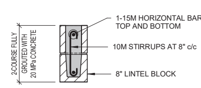


SNOW BUILD-UP DIAGRAM



ELEVATOR SHAFT BUMP OUT

SCALE: 3/4" = 1'-0"



TYPICAL LINTEL L1 DETAIL

SCALE: 3/4" = 1'-0"

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	JAN. 14/20

Rev.#	Description	Date

Job No. 18378

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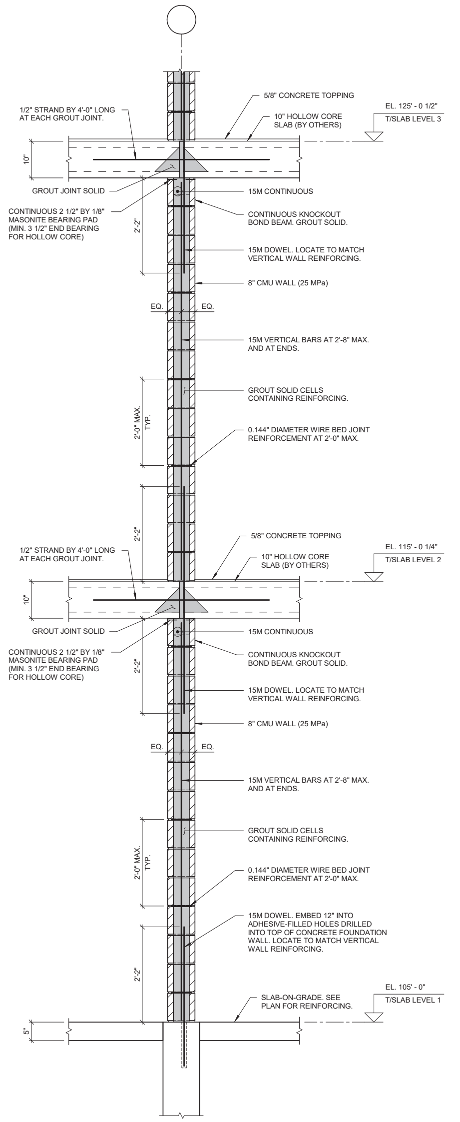
Client

Project
55 Unit Residential
No Parking Garage
Concrete Block Construction

Drawing Title
ROOF PLAN, SCHEDULES AND SHEAR WALL DETAILS

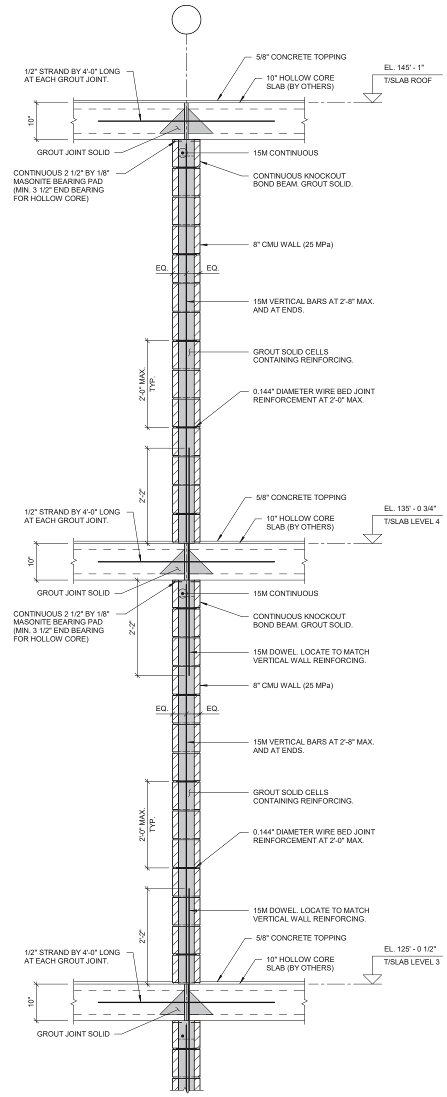
Date: January 14, 2020
Checked by: SL, SA
Drawn by: MH
Revision
Scale: As indicated
Sheet: S4A
Flight no:



CMU WALL W1 SECTION - LEVEL 1 AND LEVEL 2

SCALE: 3/4" = 1'-0"

1 S2A,S3A S5A



CMU WALL W1 SECTION - LEVEL 3 AND LEVEL 4

SCALE: 3/4" = 1'-0"

2 S3A,S4A S5A

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.

- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

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Drawing Title
CMU WALL W1 SECTIONS

Date: January 14, 2020
Checked by: SL, SA
Drawn by: MH
Revision:
Scale: As Indicated
Sheet: S5A
Flight no:

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

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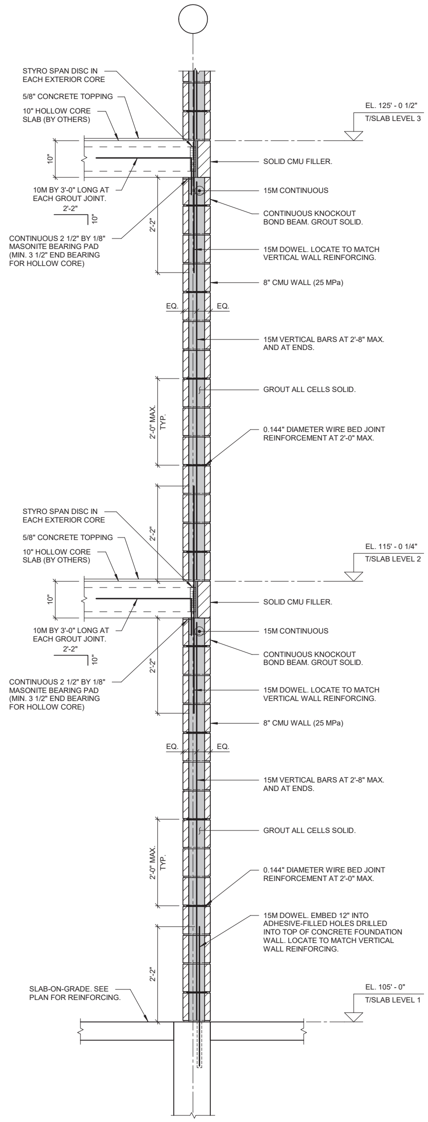
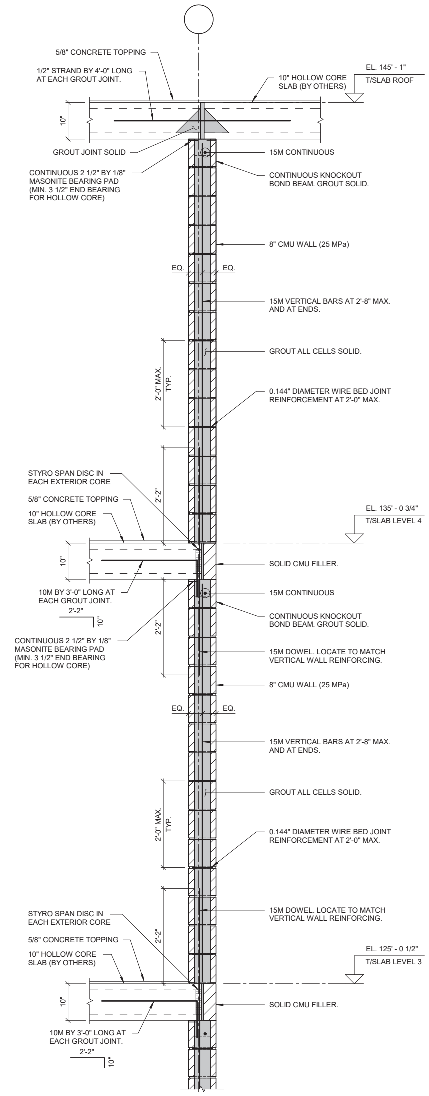
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.



CMU WALL W2 SECTION - LEVEL 1 AND LEVEL 2

SCALE: 3/4" = 1'-0"

1 — S2A,S4A / S6A



CMU WALL W2 SECTION - LEVEL 3 AND LEVEL 4

SCALE: 3/4" = 1'-0"

2 — S2A,S4A / S6A

ISSUE	DESCRIPTION	DATE
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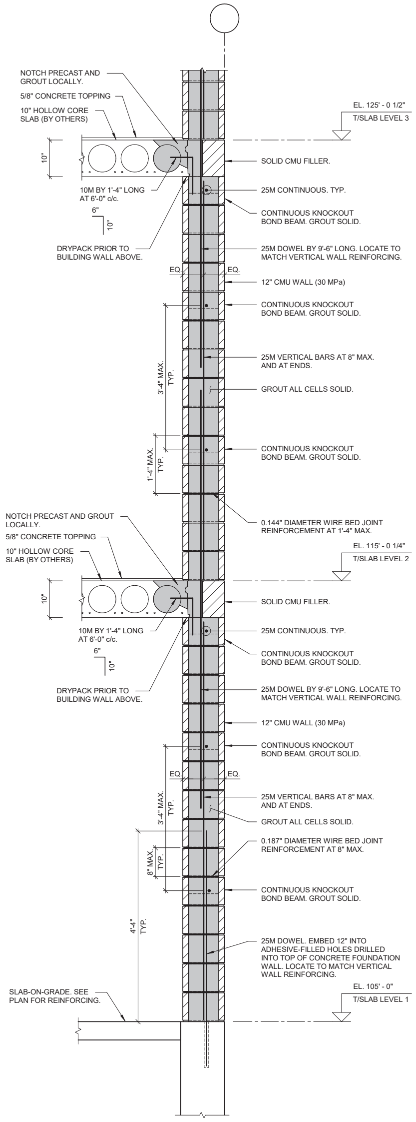
Drawing Title
CMU WALL W2 SECTIONS

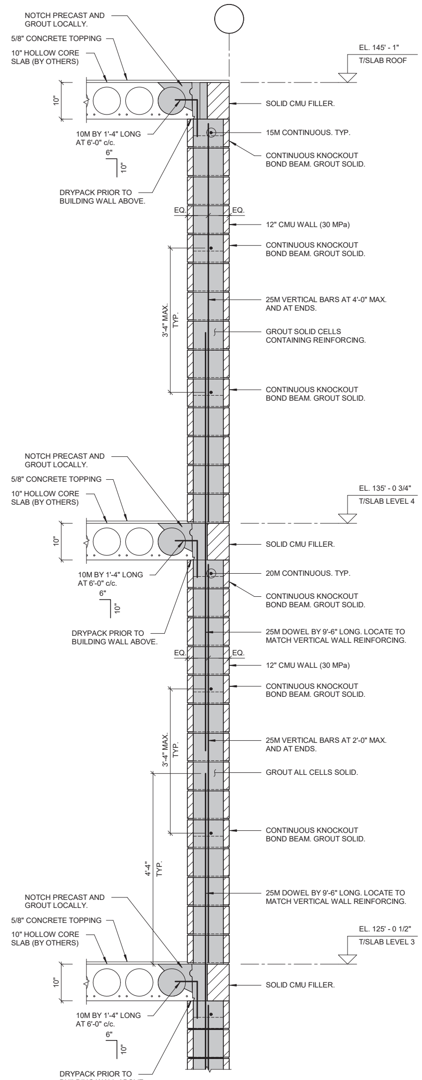
Date: January 14, 2020
Checked by: SL, SA
Drawn by: MH — Revision
Scale: As Indicated
Sheet: S6A — Flight no:



CMU WALL W3 SECTION - LEVEL 1 AND LEVEL 2

SCALE: 3/4" = 1'-0"

1 S2A,S3A S7A



CMU WALL W3 SECTION - LEVEL 3 AND LEVEL 4

SCALE: 3/4" = 1'-0"

2 S3A,S4A S7A

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

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- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

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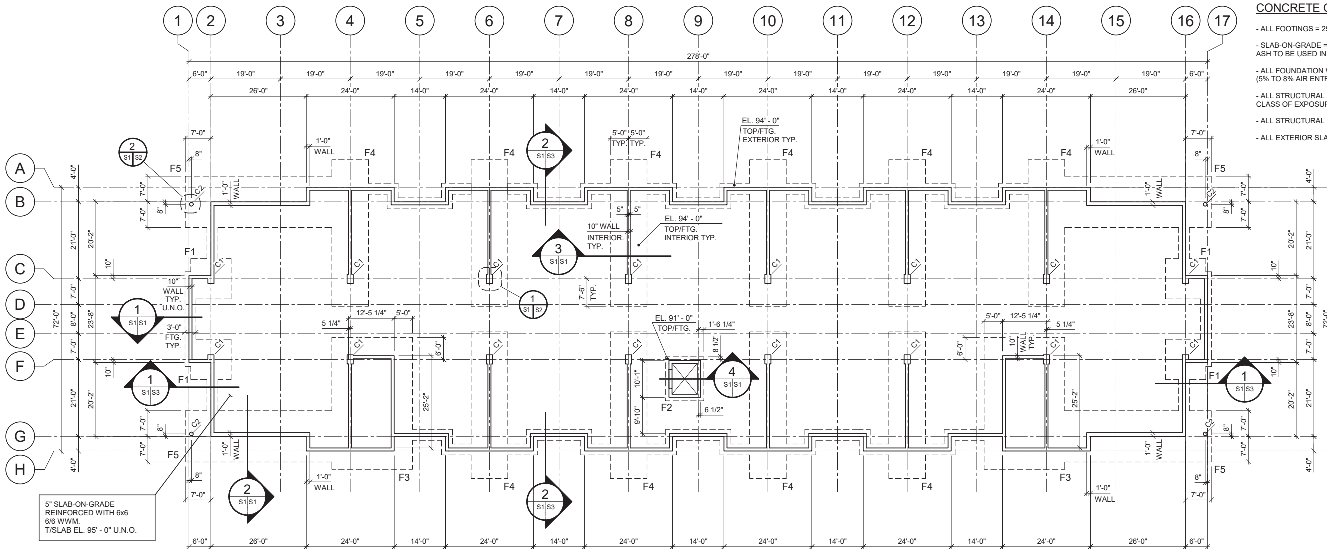
Drawing Title
CMU WALL W3 SECTIONS

Date	January 14, 2020		
Checked by:	SL, SA		
Drawn by:	MH	Revision	
Scale:	As Indicated		
Sheet	S7A	Flight no:	



FOUNDATION PLAN - LEVEL 0

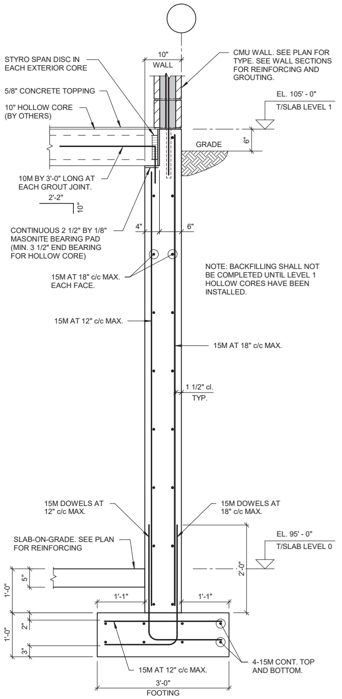
SCALE: 1/16" = 1'-0"

CONCRETE CONSTRUCTION NOTES:

- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

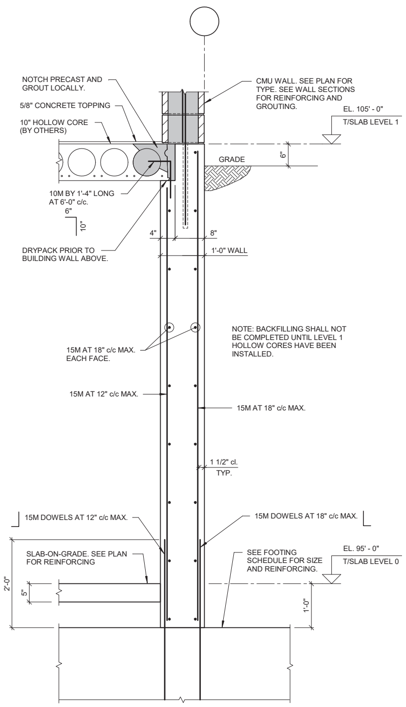
FOOTING SCHEDULE

TYPE	SIZE	REINFORCING
F1	11' - 0" x 11' - 0" x 2' - 0"	14-25M EACH WAY, TOP AND BOTTOM
F2	12' - 0" x 10' - 6" x 1' - 4"	20M AT 16" c/c EACH WAY, TOP AND BOTTOM
F3	36' - 0" x 22' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F4	40' - 0" x 10' - 0" x 4' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F5	40' - 0" x 14' - 0" x 5' - 0"	20M AT 8" c/c EACH WAY TOP, 30M AT 8" c/c EACH WAY BOTTOM



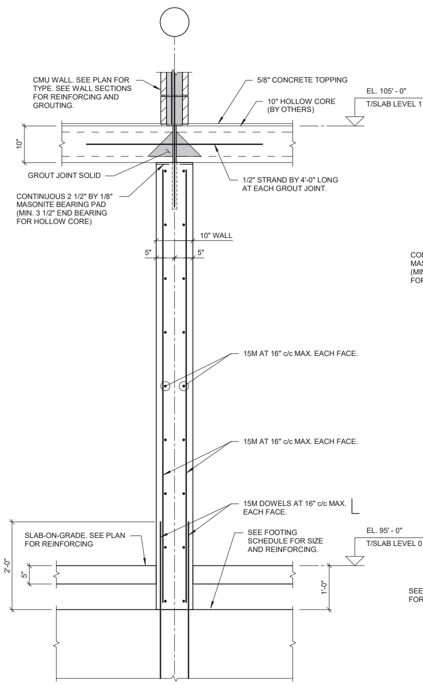
TYPICAL 10" EXTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



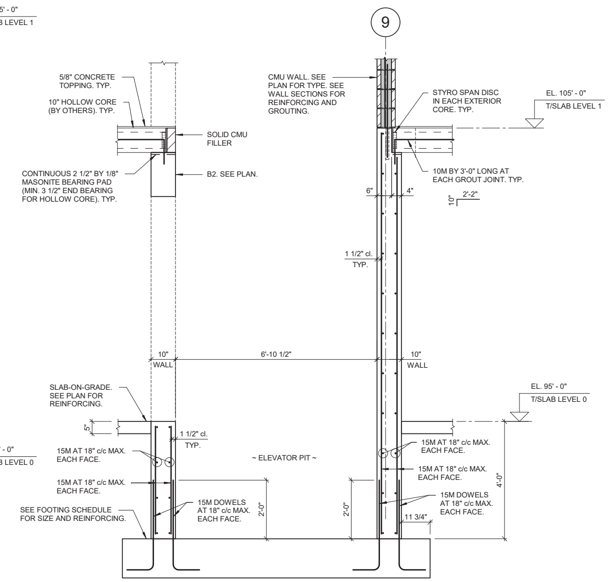
TYPICAL 12" EXTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



TYPICAL INTERIOR WALL SECTION

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 1/2" = 1'-0"

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Rev.#	Description	Date

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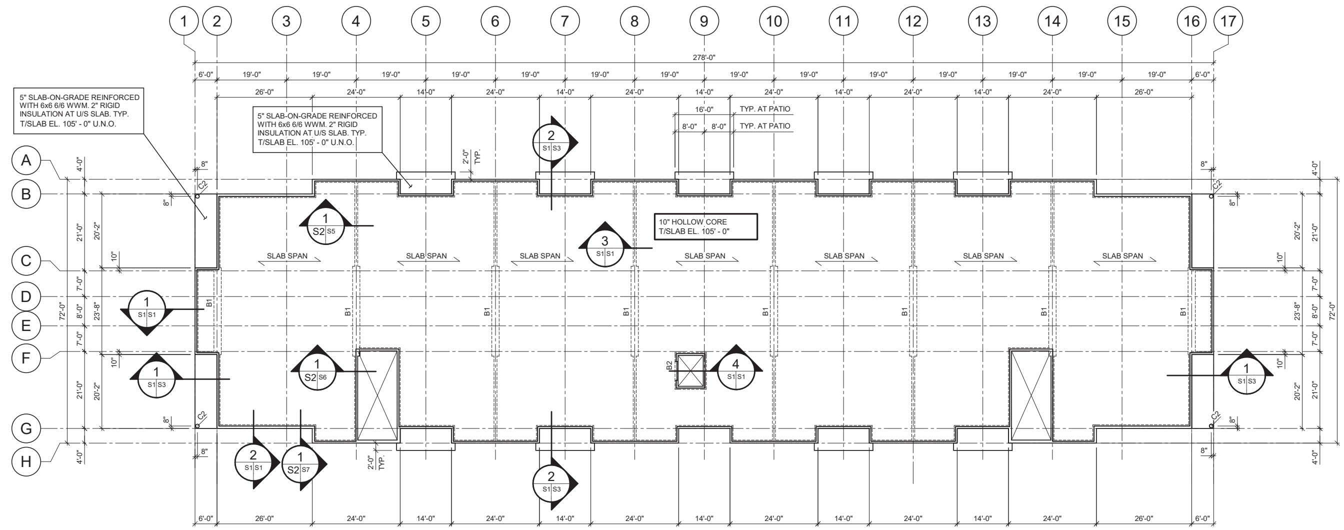
Client

Project
55 Unit Residential
c/w Parking Garage
Concrete Block Construction

Drawing Title
FOUNDATION PLAN - LEVEL 0 AND SECTIONS

Date: January 13, 2020
Checked by: SL, SA
Drawn by: MH | Revision
Scale: As indicated
Sheet: S1 | Flight no:



FLOOR PLAN - LEVEL 1

SCALE: 1/16" = 1'-0"

CONCRETE CONSTRUCTION NOTES:

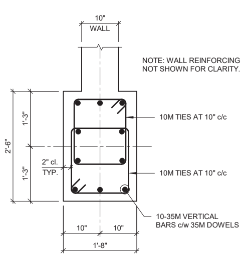
- ALL FOOTINGS = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- SLAB-ON-GRADE = 25 MPa AT 28 DAYS, CLASS OF EXPOSURE "N". (NO FLY ASH TO BE USED IN MIX FOR SLAB).
- ALL FOUNDATION WALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2". (5% TO 8% AIR ENTRAINEMENT).
- ALL STRUCTURAL COLUMNS AND SHEARWALLS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL STRUCTURAL BEAMS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "N".
- ALL EXTERIOR SLABS = 32 MPa AT 28 DAYS, CLASS OF EXPOSURE "C-2".

FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf (SUITES)
LL = 100 psf (CORRIDORS, STAIRS, COMMON AREAS AND BALCONIES)
DL = 133 psf (INCLUDING 10" HOLLOW CORES AND 20 psf PARTITION LOAD ALLOWANCE)

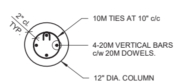
BEAM SCHEDULE

TYPE	SIZE	REINFORCING
B1	2'-0" WIDE BY 2'-8" HIGH	REFER TO CONCRETE BEAM REINFORCING DETAIL
B2	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c



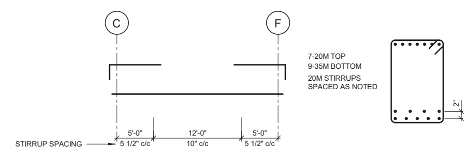
C1 - COLUMN DETAIL

SCALE: 3/4" = 1'-0"



C2 - COLUMN DETAIL

SCALE: 3/4" = 1'-0"



BEAM B1 REINFORCING DETAIL

SCALE: 1/8" = 1'-0"

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	JAN. 13/20

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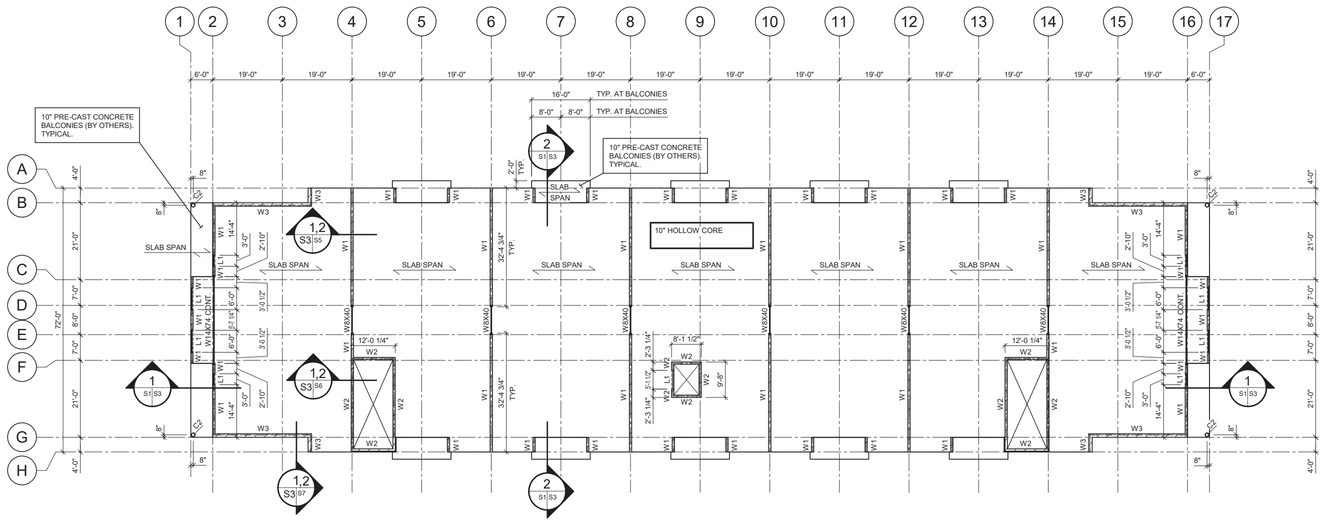
Client

Project
55 Unit Residential
c/w Parking Garage
Concrete Block Construction

Drawing Title
FLOOR PLAN - LEVEL 1 AND DETAILS

Date: January 13, 2020
Checked by: SL, SA
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S2
Flight no:



FLOOR PLAN - LEVEL 2 TO 4

SCALE: 1/16" = 1'-0"

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.
- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.
- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.
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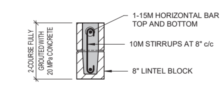
- MORTAR SHALL CONFORM TO CSA A179.
- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.
- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
  MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

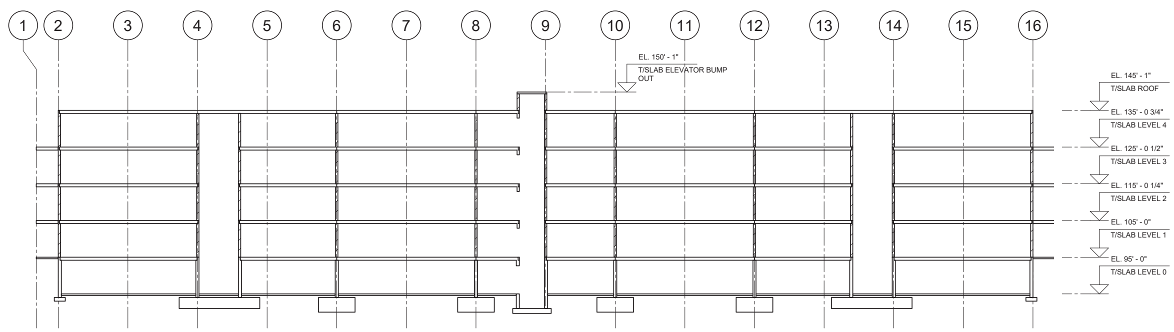
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf (SUITES)
LL = 100 psf (CORRIDORS, STAIRS, COMMON AREAS AND BALCONIES)
DL = 133 psf (INCLUDING 10" HOLLOW CORES AND 20 psf PARTITION LOAD ALLOWANCE)



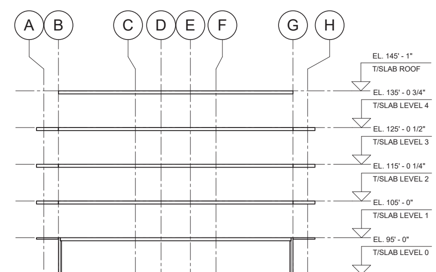
TYPICAL LINTEL L1 DETAIL

SCALE: 3/4" = 1'-0"



BUILDING SECTION 1 S1|S3

SCALE: 1/16" = 1'-0"



BUILDING SECTION 2 S1|S3

SCALE: 1/16" = 1'-0"

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55 Unit Residential
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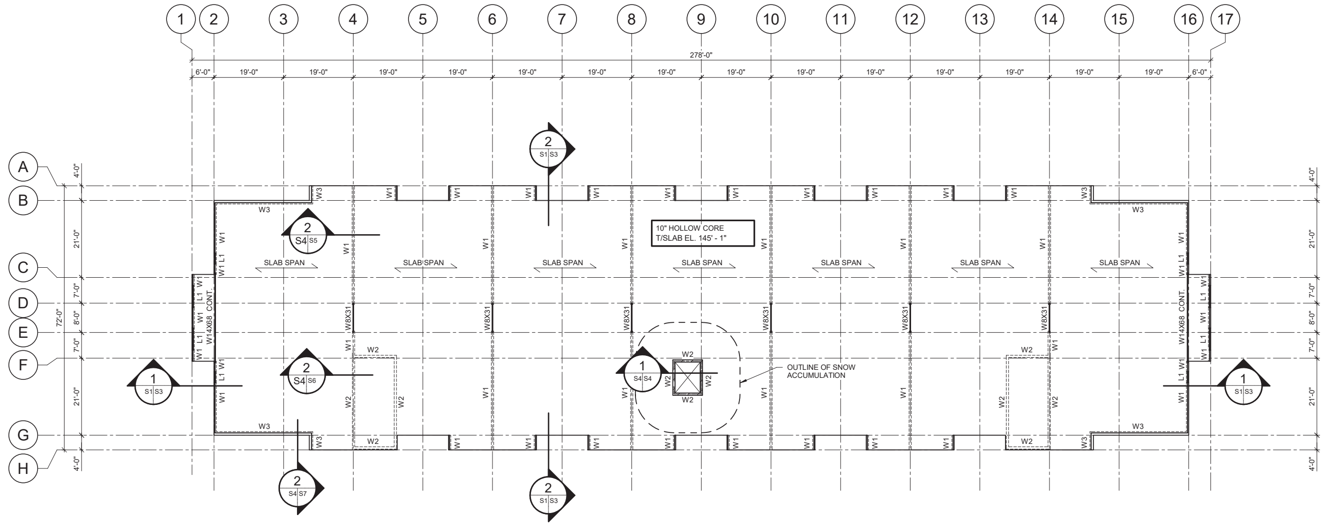
Concrete Block Construction

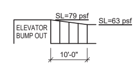
Drawing Title
FLOOR PLAN - LEVEL 2 TO 4, SCHEDULES AND SECTIONS

Date	January 13, 2020
Checked by:	SL, SA
Drawn by:	MH
Revision	
Scale:	As indicated
Sheet	S3
Flight no:	

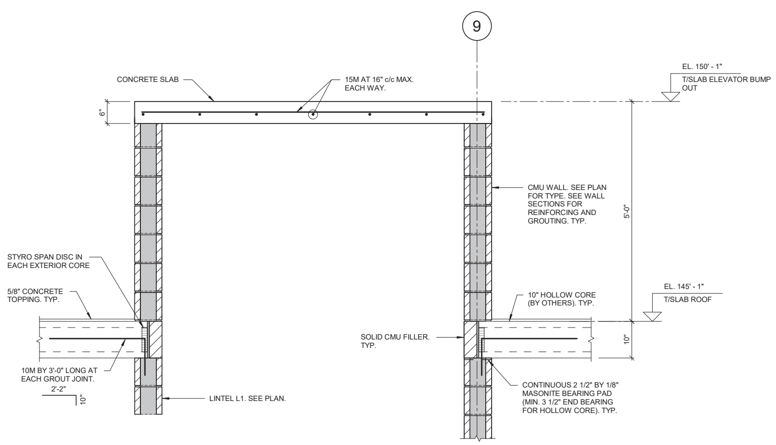


ROOF PLAN

SCALE: 1/16" = 1'-0"

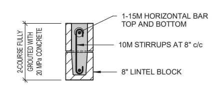


SNOW BUILD-UP DIAGRAM



ELEVATOR SHAFT BUMP OUT 1 S4 S4

SCALE: 3/4" = 1'-0"



TYPICAL LINTEL L1 DETAIL

SCALE: 3/4" = 1'-0"

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

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- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

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- MORTAR SHALL CONFORM TO CSA A179.

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- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = 94 psf (INCLUDING 10" HOLLOW CORE WEIGHT)

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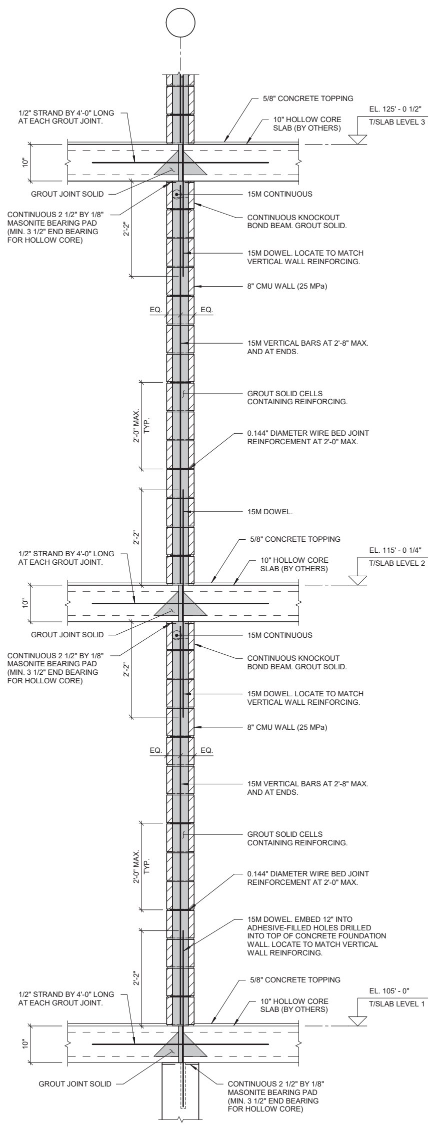
Bus: (506) 855-3777 Cell: (506) 312-2777 eMail:

Client

Project
55 Unit Residential
c/w Parking Garage
Concrete Block Construction

Drawing Title
ROOF PLAN, SCHEDULES AND SHEAR WALL DETAILS

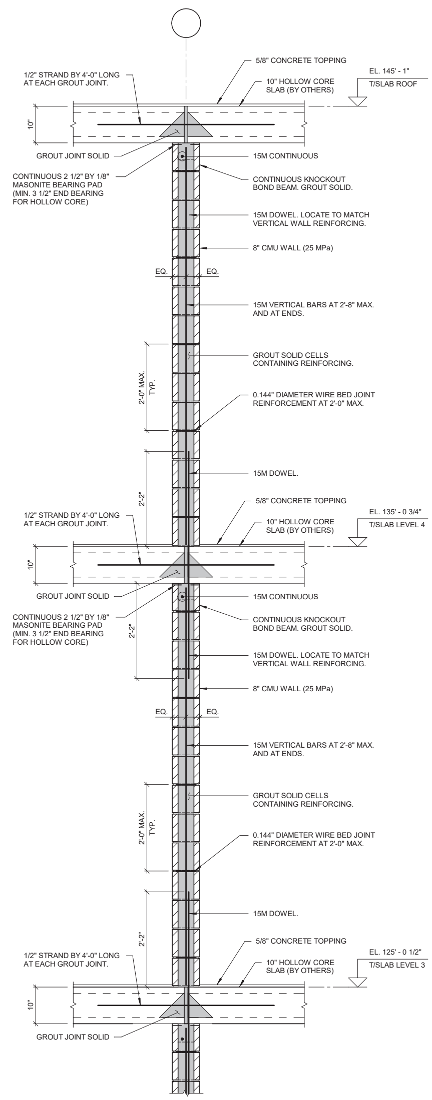
Date: January 13, 2020
Checked by: SL, SA
Drawn by: MH
Revision
Scale: As indicated
Sheet: S4
Flight no:



CMU WALL W1 SECTION - LEVEL 1 AND LEVEL 2

SCALE: 3/4" = 1'-0"

1 S5



CMU WALL W1 SECTION - LEVEL 3 AND LEVEL 4

SCALE: 3/4" = 1'-0"

2 S5

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.

- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

ISSUE	DESCRIPTION	DATE
1	ISSUED FOR PRICING	JAN. 13/20

Rev.#	Description	Date

Job No. 18378

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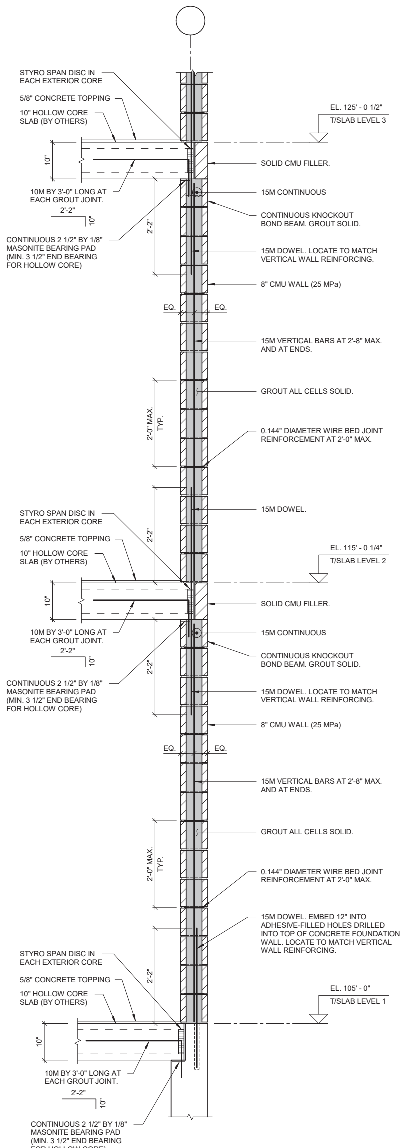
55 Unit Residential
c/w Parking Garage
Concrete Block Construction

Drawing Title
CMU WALL W1 SECTIONS

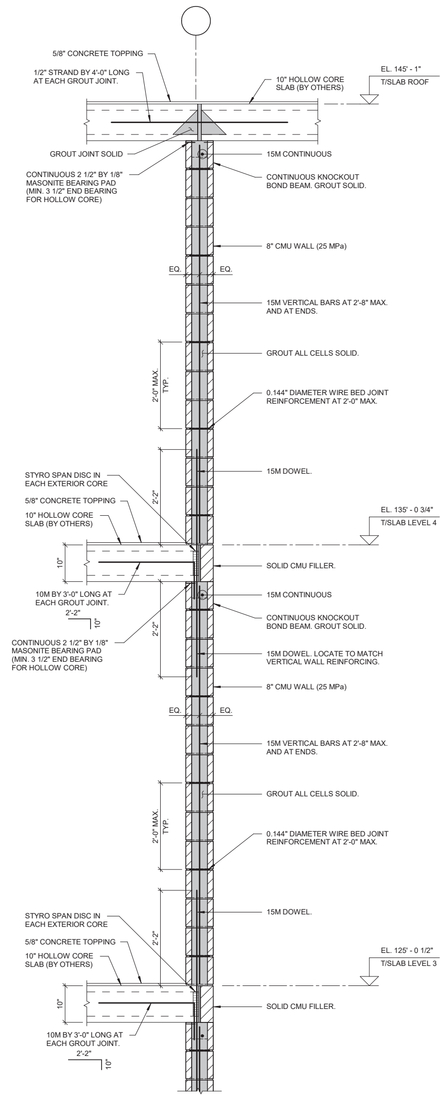
Date	January 13, 2020
Checked by:	SL, SA
Drawn by: MH	Revision
Scale:	As Indicated
Sheet S5	Flight no:



CMU WALL W2 SECTION - LEVEL 1 AND LEVEL 2

1 S2.53 S6

SCALE: 3/4" = 1'-0"



CMU WALL W2 SECTION - LEVEL 3 AND LEVEL 4

2 S3.54 S6

SCALE: 3/4" = 1'-0"

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.

- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.

- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.

- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.

- MORTAR SHALL CONFORM TO CSA A179.

- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.

- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

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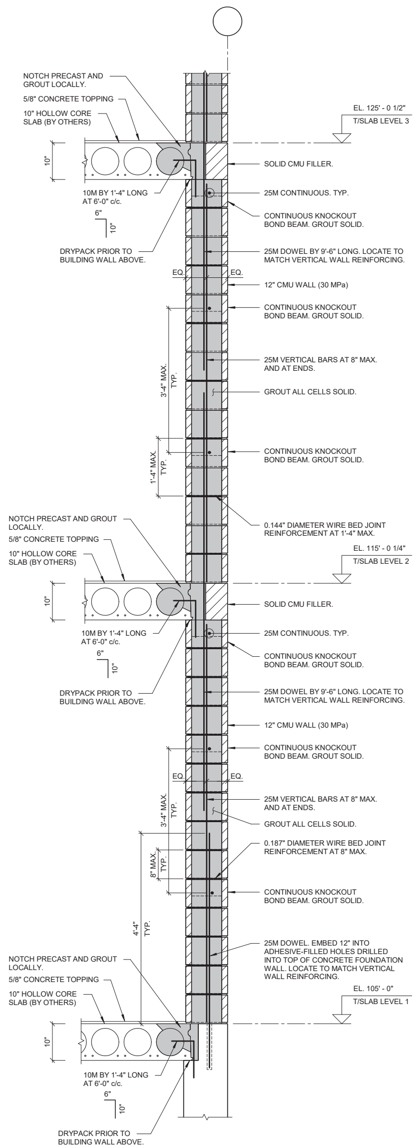
c/w Parking Garage
Concrete Block Construction

Drawing Title
CMU WALL W2 SECTIONS

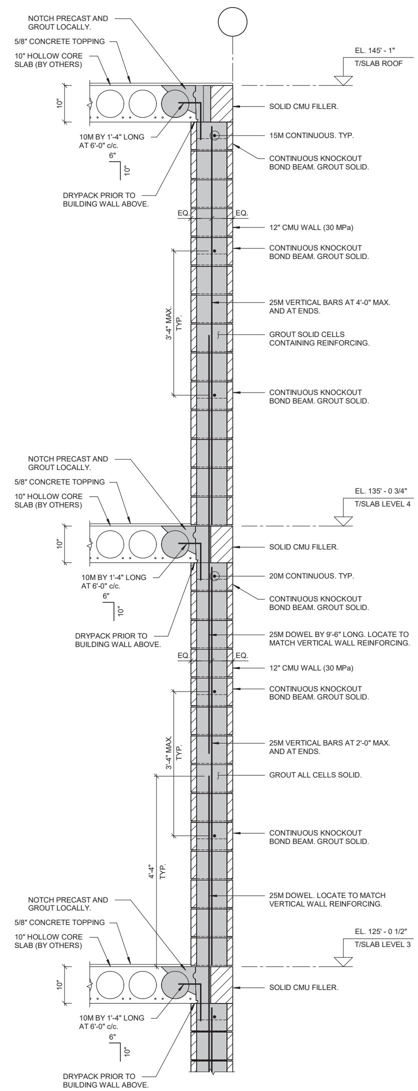
Date	January 13, 2020		
Checked by:	SL, SA		
Drawn by:	MH	Revision	
Scale:	As Indicated		
Sheet	S6	Flight no:	



CMU WALL W3 SECTION - LEVEL 1 AND LEVEL 2

SCALE: 3/4" = 1'-0"

1 S2.S3 S7



CMU WALL W3 SECTION - LEVEL 3 AND LEVEL 4

SCALE: 3/4" = 1'-0"

2 S3.S4 S7

MASONRY CONSTRUCTION NOTES:

- STANDARD CONCRETE BLOCK UNITS: TO CSA A165 SERIES:
  CLASSIFICATION: - FOR 8" CMU WALL: H/25/A/M.
  - FOR 12" CMU WALL: H/30/A/M.
- BAR REINFORCEMENT: TO CSA A371 AND CSA G30.18, CARBON STEEL, GRADE 400 DEFORMED BARS.
- WIRE REINFORCEMENT: TO CSA A371 AND CSA G30.18, HIGH TENSILE STRENGTH STEEL WIRE, LADDER TYPE, HOT DIP GALVANIZED AFTER FABRICATION TO ASTM A153.
- HORIZONTAL REINFORCEMENT: FOR SINGLE WYTHE CONCRETE BLOCK MASONRY: BL-10 LADDER REINFORCEMENT OR APPROVED ALTERNATE, HOT DIP GALVANIZED.
- MORTAR SHALL CONFORM TO CSA A179.
- MORTAR FOR STRUCTURAL CONCRETE MASONRY BLOCK: TYPE S IN ACCORDANCE WITH CSA A179.
- GROUT SHALL CONFORM TO CSA A179, TABLE 3.
  MINIMUM COMPRESSIVE STRENGTH OF GROUT TO BE 15 MPa AT 28 DAYS.

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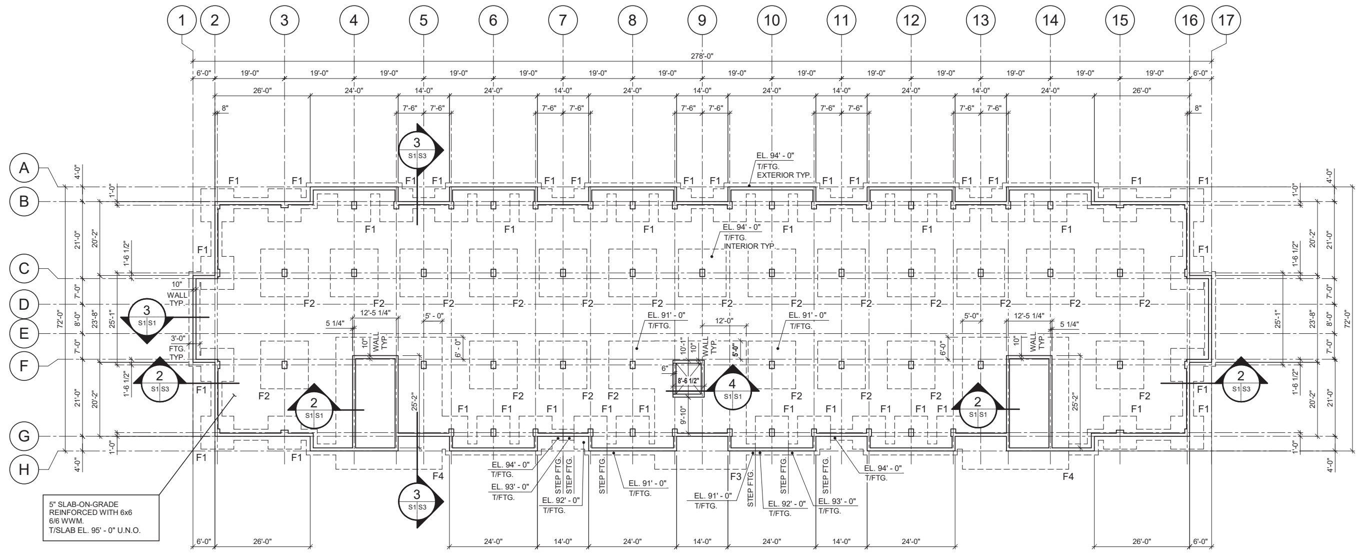
Drawing Title
CMU WALL W3 SECTIONS

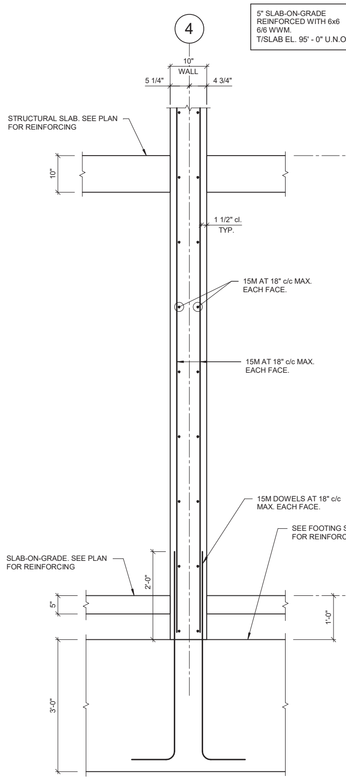
Date: January 13, 2020
Checked by: SL, SA
Drawn by: MH
Revision
Scale: As Indicated
Sheet: S7
Flight no:



FOUNDATION PLAN - LEVEL 0

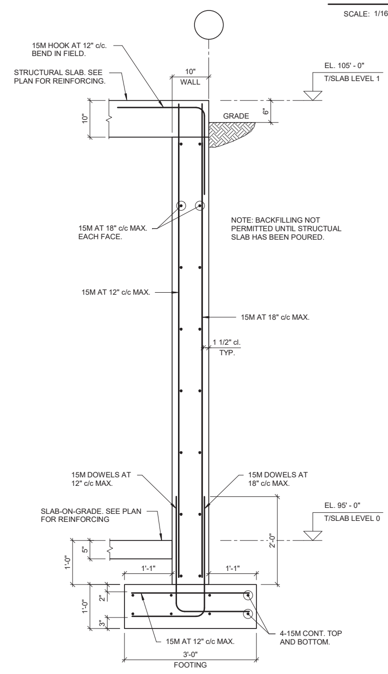
SCALE: 1/16" = 1'-0"

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F1	9' - 0" x 9' - 0" x 1' - 4"	9-25M EACH WAY, TOP AND BOTTOM
F2	13' - 0" x 13' - 0" x 2' - 0"	10-30M EACH WAY, TOP AND BOTTOM
F3	35' - 0" x 25' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F4	36' - 0" x 29' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM



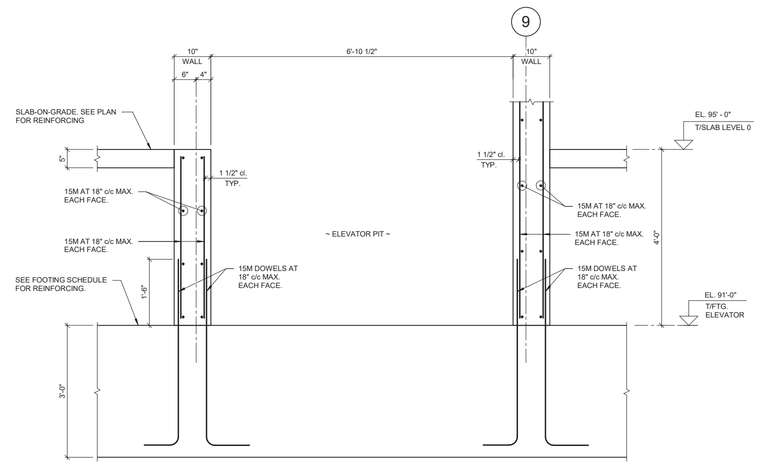
TYPICAL WALL SECTION THRU STAIRS

SCALE: 3/4" = 1'-0"



TYPICAL WALL SECTION

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 3/4" = 1'-0"

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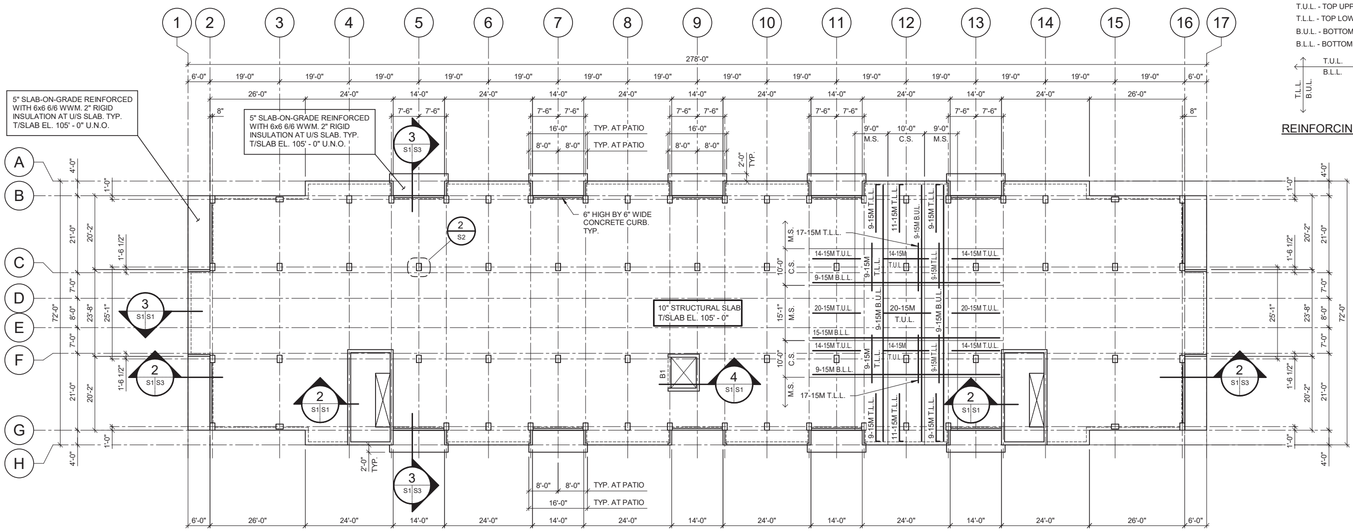
Project
55 Unit Residential
c/w Parking Garage
Concrete Construction

Drawing Title
FOUNDATION PLAN - LEVEL 0

Date November 14, 2019
Checked by: SL
Drawn by: MH
Revision
Scale: As indicated
Sheet S1
Flight no:

C.S. - COLUMN STRIP
M.S. - MIDDLE STRIP
T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER

REINFORCING PLACEMENT



FLOOR PLAN - LEVEL 1

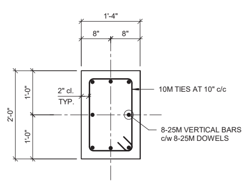
SCALE: 1/16" = 1'-0"

NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14 FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.

BEAM SCHEDULE		
TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

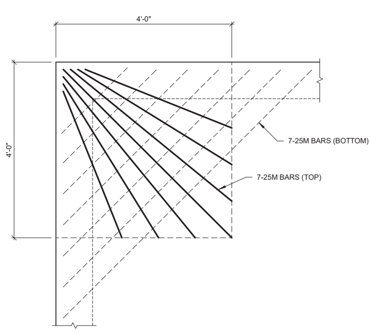
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)



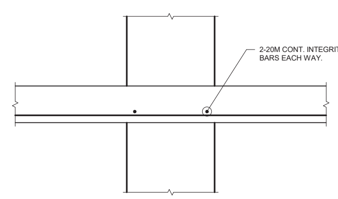
TYPICAL COLUMN DETAIL

SCALE: 3/4" = 1'-0"



SLAB REINFORCING DETAILS AT CORNER BEARING ON FOUNDATION WALLS

SCALE: 3/4" = 1'-0"



INTEGRITY BARS DETAIL

SCALE: 3/4" = 1'-0"

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55 Unit Residential
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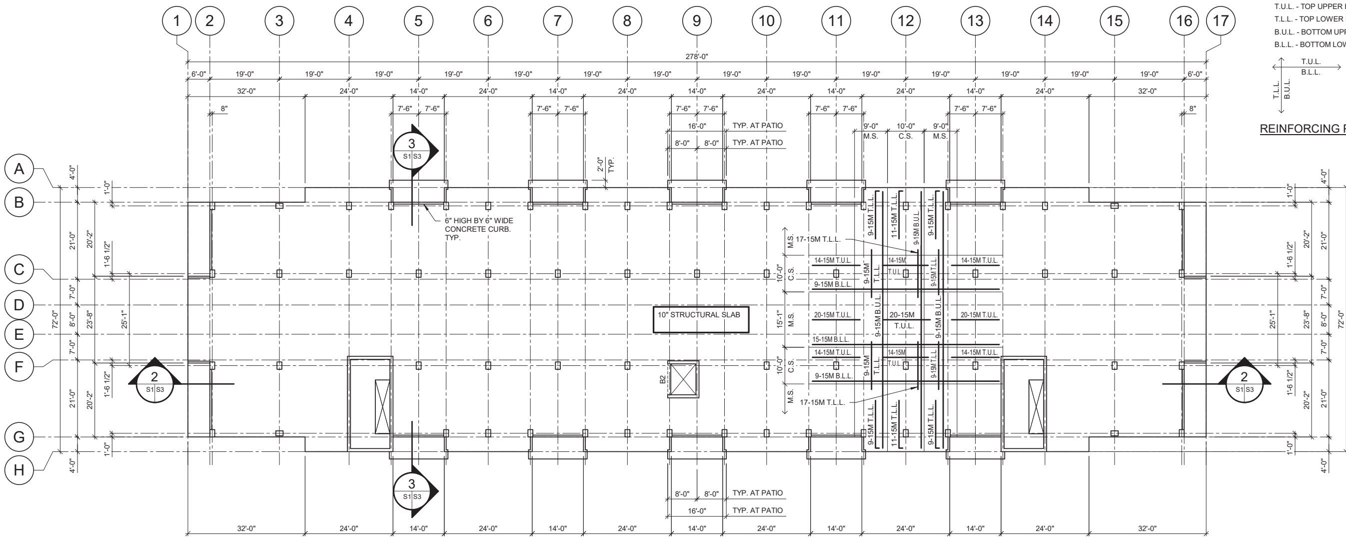
Concrete Construction

Drawing Title
FLOOR PLAN - LEVEL 1

Date: November 14, 2019
Checked by: SL
Drawn by: MH
Revision
Scale: As indicated
Sheet: S2
Flight no:



C.S. - COLUMN STRIP
M.S. - MIDDLE STRIP
T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER

REINFORCING PLACEMENT

FLOOR PLAN - LEVEL 2 TO 4 (1 / S3)

SCALE: 1/16" = 1'-0"

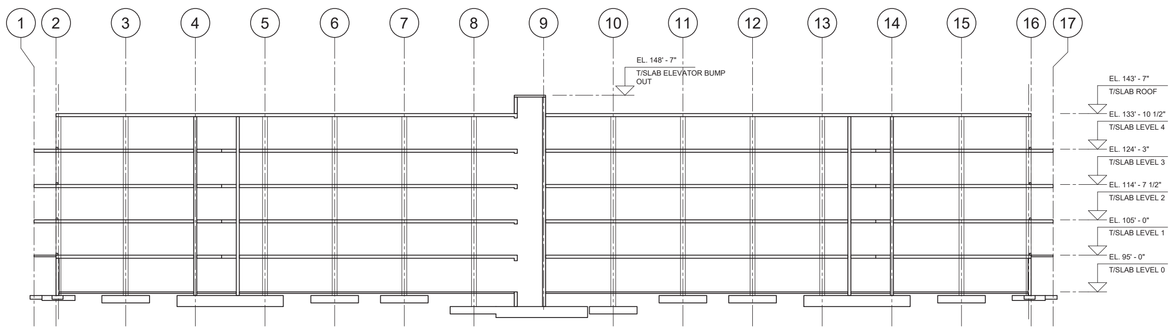
NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14 FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.

BEAM SCHEDULE

TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

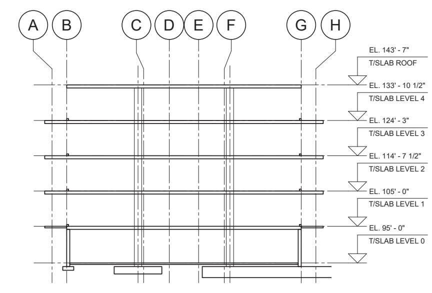
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)



BUILDING SECTION (2 / S1 S3)

SCALE: 1/16" = 1'-0"



BUILDING SECTION (3 / S1 S3)

SCALE: 1/16" = 1'-0"

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Client

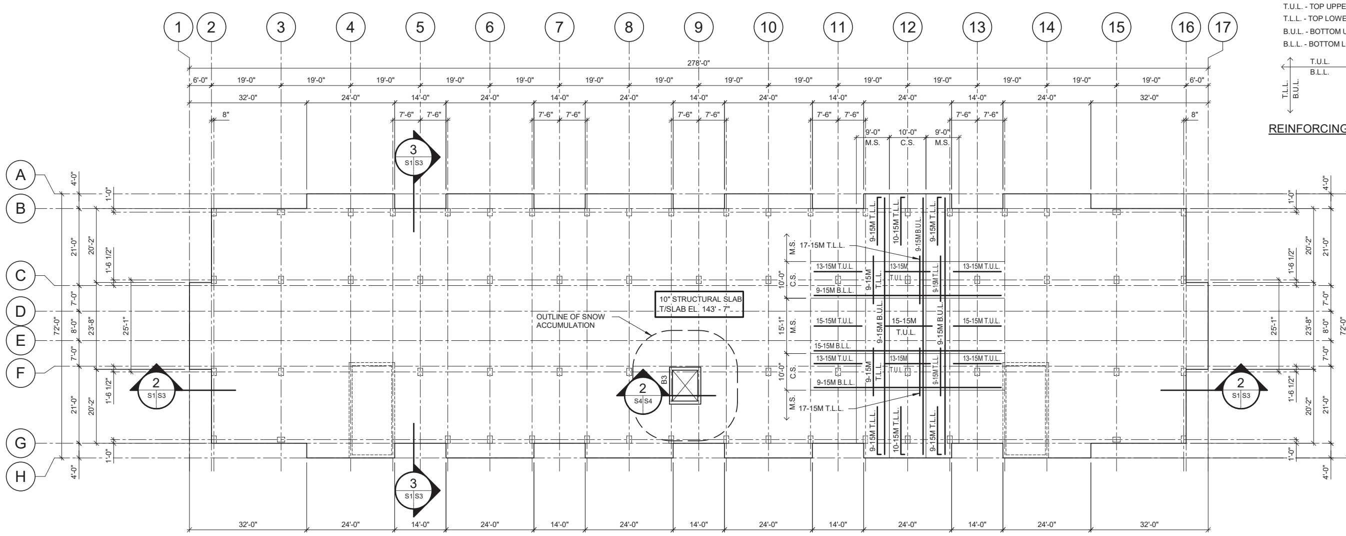
Project
55 Unit Residential
c/w Parking Garage
Concrete Construction

Drawing Title
FLOOR PLAN - LEVEL 2 TO 4

Date: November 14, 2019
Checked by: SL
Drawn by: MH
Revision
Scale: As indicated
Sheet: S3
Plot no:

C.S. - COLUMN STRIP
M.S. - MIDDLE STRIP
T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER

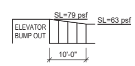
REINFORCING PLACEMENT



ROOF PLAN

SCALE: 1/16" = 1'-0"

NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14 FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.

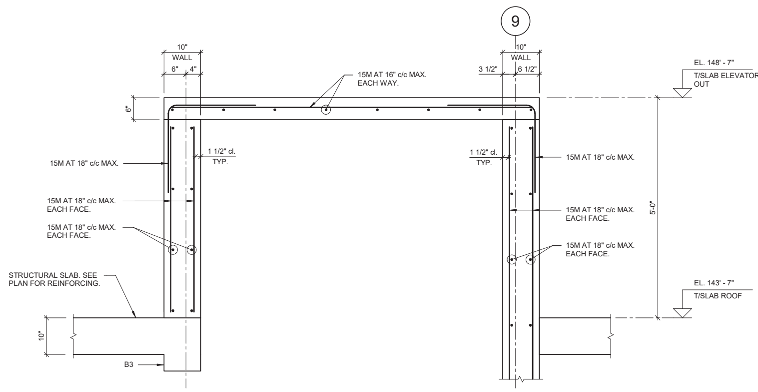


SNOW BUILD-UP DIAGRAM

BEAM SCHEDULE		
TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = SELF WEIGHT + 20 psf (INCLUDING MECHANICAL LOADS)



ELEVATOR SHAFT BUMP OUT

SCALE: 3/4" = 1'-0"

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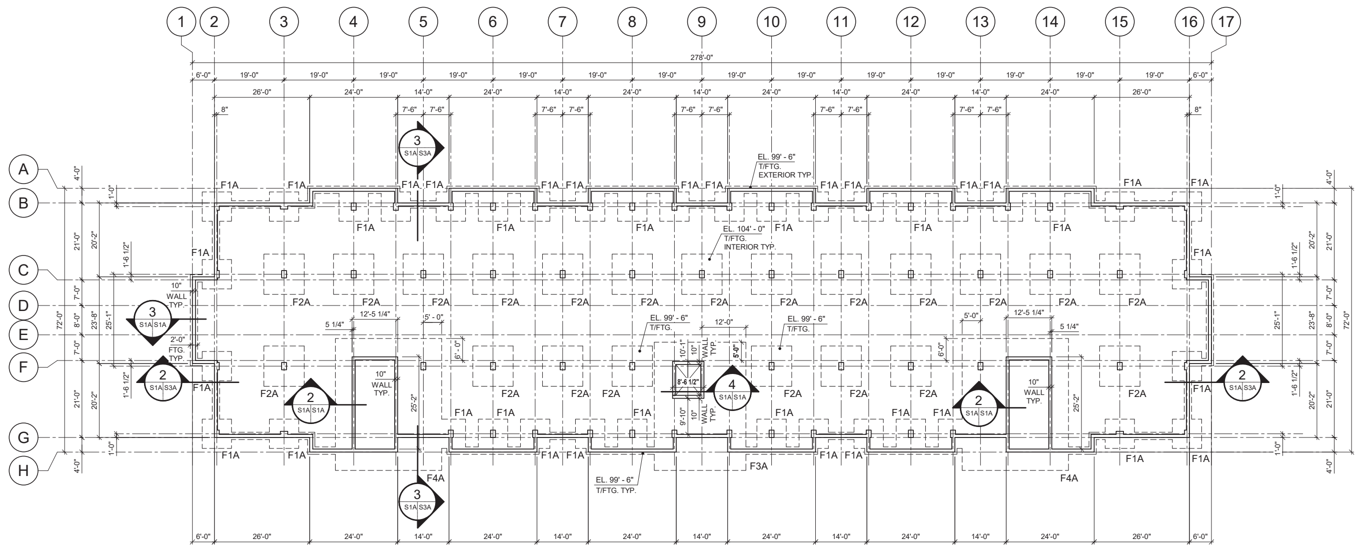
Drawing Title
ROOF PLAN

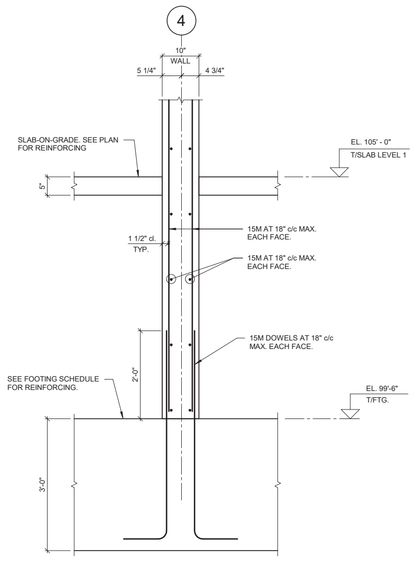
Date: November 14, 2019
Checked by: SL
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S4
Flight no:



FOUNDATION PLAN - LEVEL 0

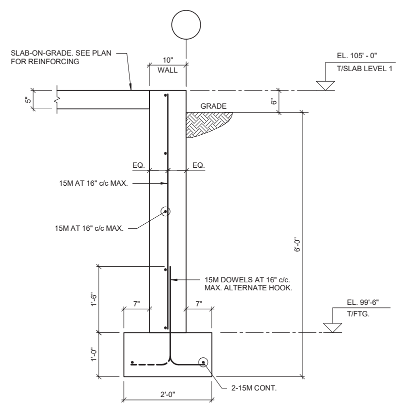
SCALE: 1/16" = 1'-0"

FOOTING SCHEDULE		
TYPE	SIZE	REINFORCING
F1A	8' - 0" x 8' - 0" x 1' - 4"	10-20M EACH WAY, TOP AND BOTTOM
F2A	11' - 0" x 11' - 0" x 2' - 0"	11-25M EACH WAY, TOP AND BOTTOM
F3A	35' - 0" x 25' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM
F4A	36' - 0" x 29' - 0" x 3' - 0"	20M AT 8" c/c EACH WAY TOP, 25M AT 8" c/c EACH WAY BOTTOM



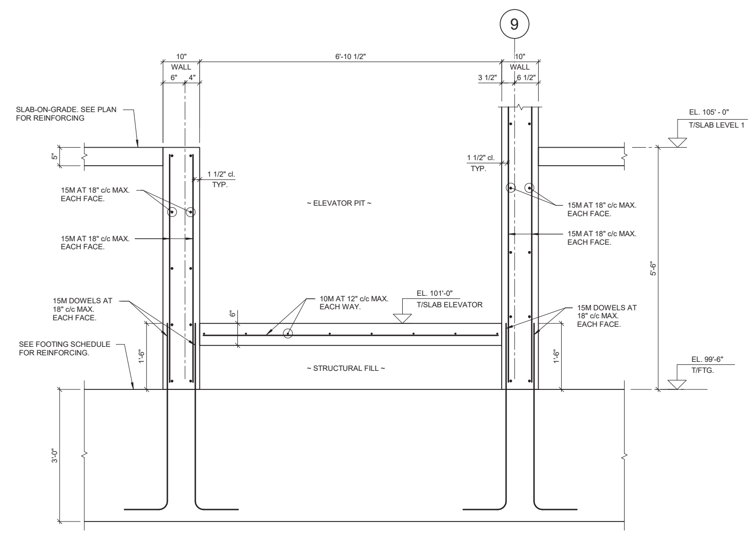
TYPICAL WALL SECTION THRU STAIRS

SCALE: 3/4" = 1'-0"



TYPICAL WALL SECTION

SCALE: 3/4" = 1'-0"



SECTION THRU ELEVATOR SHAFT

SCALE: 3/4" = 1'-0"

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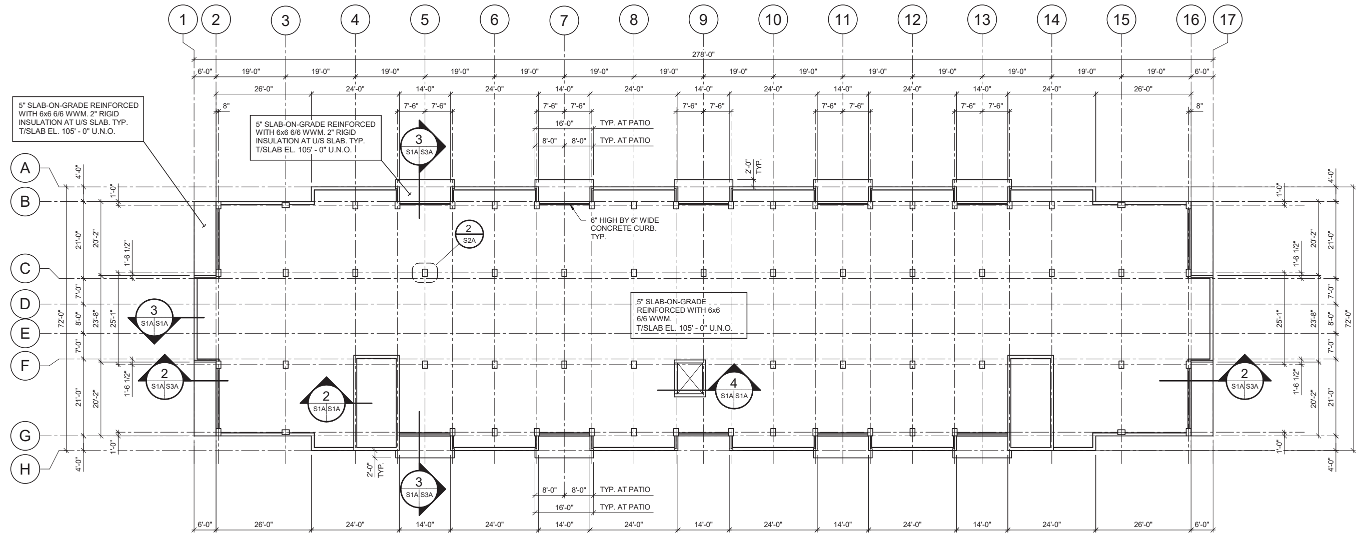
Client

Project
55 Unit Residential
No Parking Garage
Concrete Construction

Drawing Title
FOUNDATION PLAN - LEVEL 0

Date: November 14, 2019
Checked by: SL
Drawn by: MH
Revision:
Scale: As indicated
Sheet: S1A
Flight no:



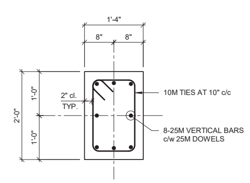
FLOOR PLAN - LEVEL 1

SCALE: 1/16" = 1'-0"

BEAM SCHEDULE		
TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

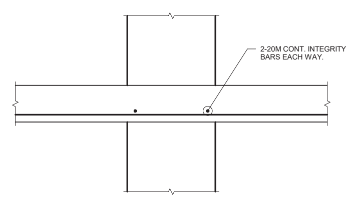
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)



TYPICAL COLUMN DETAIL

SCALE: 3/4" = 1'-0"



INTEGRITY BARS DETAIL

SCALE: 3/4" = 1'-0"

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Rev.#	Description	Date

Job No. 18378

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Client

Project
55 Unit Residential
No Parking Garage
Concrete Construction

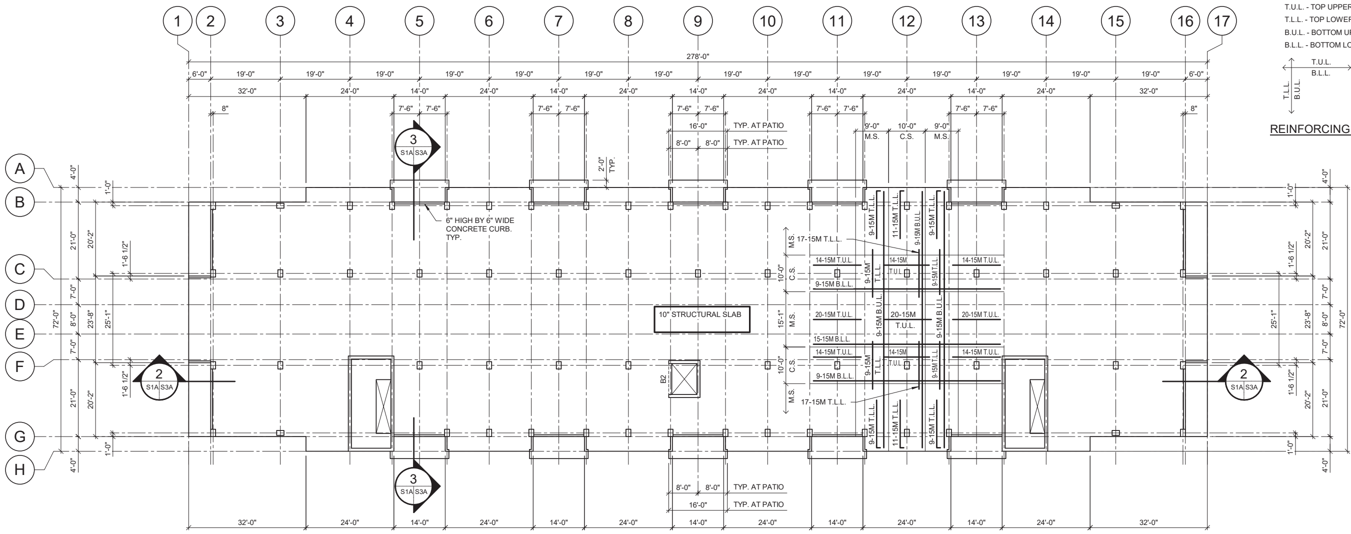
Drawing Title
FLOOR PLAN - LEVEL 1

Date	November 14, 2019
Checked by:	SL
Drawn by:	MH
Revision	
Scale:	As indicated
Sheet	S2A
Flight no:	

C.S. - COLUMN STRIP
M.S. - MIDDLE STRIP
T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER

T.U.L.
B.L.L.
T.L.L.
B.U.L.

REINFORCING PLACEMENT



FLOOR PLAN - LEVEL 2 TO 4

SCALE: 1/16" = 1'-0"

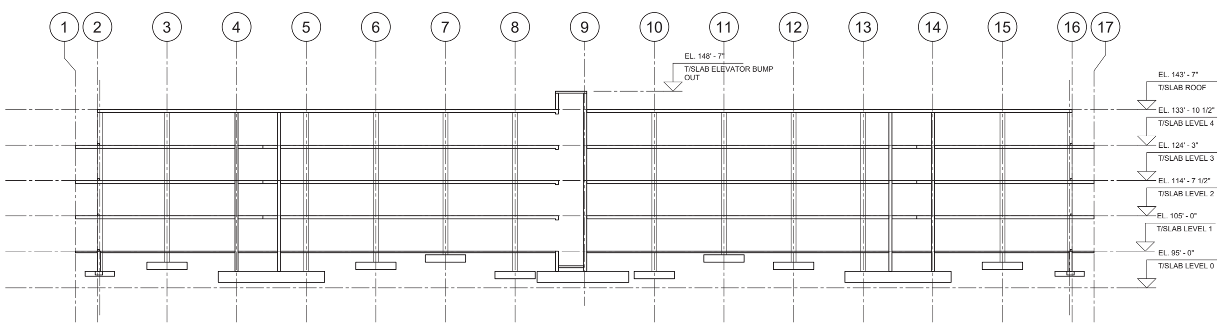
NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14 FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.

BEAM SCHEDULE

TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

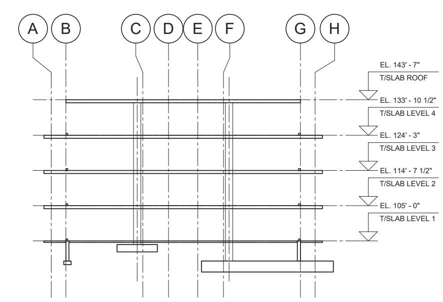
FLOOR DESIGN LOAD U.N.O. (SPECIFIED)

LL = 40 psf U.N.O.
LL = 100 psf (CORRIDOR, STAIRS, COMMUN AREAS AND BALCONIES)
DL = SELF WEIGHT + 50 psf (INCLUDING MECHANICAL LOADS)



BUILDING SECTION

SCALE: 1/16" = 1'-0"



BUILDING SECTION

SCALE: 1/16" = 1'-0"

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Client

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No Parking Garage
Concrete Construction

Drawing Title
FLOOR PLAN - LEVEL 2 TO 4

Date	November 14, 2019		
Checked by:	SL		
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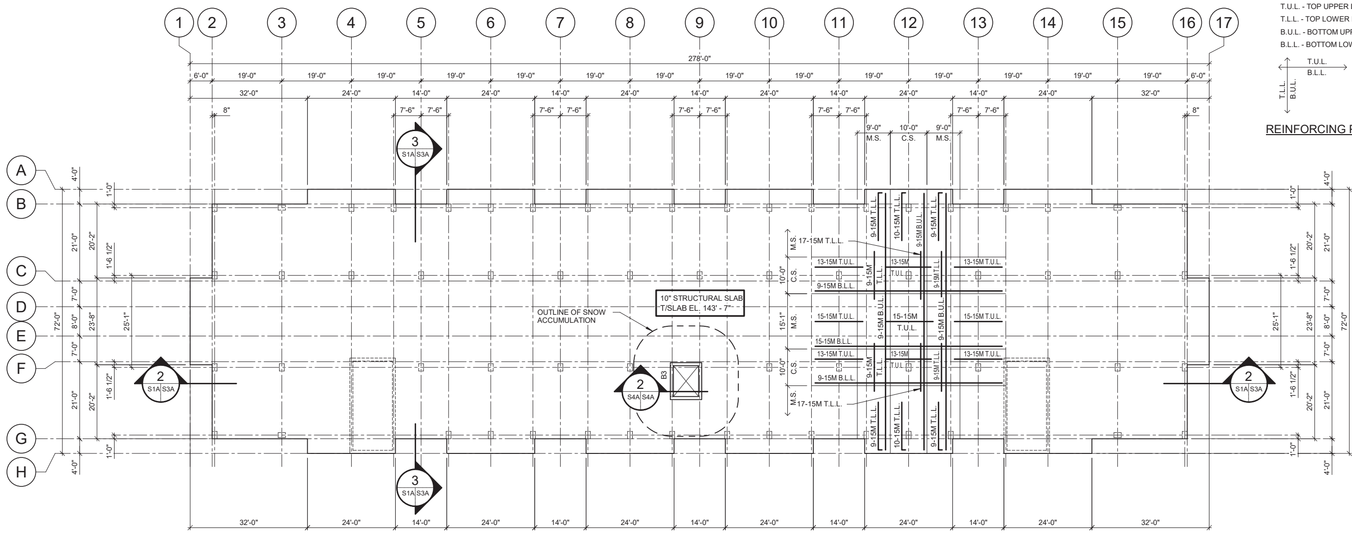
Scale:	As indicated		
Sheet	S3A	Flight no:	

C.S. - COLUMN STRIP
M.S. - MIDDLE STRIP
T.U.L. - TOP UPPER LAYER
T.L.L. - TOP LOWER LAYER
B.U.L. - BOTTOM UPPER LAYER
B.L.L. - BOTTOM LOWER LAYER

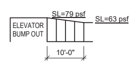
T.U.L.
B.L.L.
T.L.L.
B.U.L.

REINFORCING PLACEMENT



ROOF PLAN
SCALE: 1/16" = 1'-0"

NOTE: REFER TO FIGURE 13.1 IN CSA A23.3-14
FOR STRUCTURAL SLAB BAR LENGTH SCHEDULE.



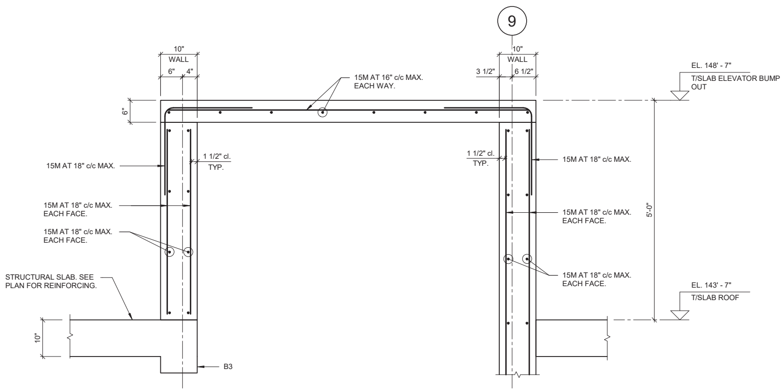
SNOW BUILD-UP DIAGRAM

BEAM SCHEDULE

TYPE	SIZE	REINFORCING
B1	10" WIDE BY 1'-6" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B2	10" WIDE BY 1'-1 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c
B3	10" WIDE BY 1'-2 1/2" HIGH	2-25M TOP AND BOTTOM, 10M STIRRUPS AT 10" c/c

ROOF DESIGN LOAD U.N.O. (SPECIFIED)

SL = 63 psf U.N.O.
DL = SELF WEIGHT + 20 psf (INCLUDING MECHANICAL LOADS)



ELEVATOR SHAFT BUMP OUT
SCALE: 3/4" = 1'-0"

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Drawing Title
ROOF PLAN

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