# BLUE MOUNTAIN RESIDENCE

**Golden, CO**

March 2020


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## ABSTRACT

The Blue Mountain Residence is a new, single family residence located in Jefferson County, Colorado, a suburb of Denver. It is located close to the front range at an elevation of 7,600 ft. The owner and architect of the residence is Cherie Goff of HMH Architecture in Boulder, Colorado. The house is mostly of wood construction with elements of steel and concrete. The structural project team includes a Cal Poly architectural engineering student and professional engineers in DLK Engineering in Lafayette, CO. This report contains the complete project description, structural design calculations, and stamped structural construction drawings. The report examines the greater context of the residence, including challenges, structural design, significant impacts, and the role of the various participants in the design team.

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**INTRODUCTION**

*Figure 1: Architectural Render*

Blue Mountain Residence is a new, single family home designed by Cherie Goff, the principal architect at HMH Architecture in Boulder, Colorado. The house is located in the foothills of Jefferson County, Colorado, in a suburb of Denver, and has excellent views of both the city and mountains. The residence consists of a wood, steel, and concrete gravity system, a wood shear wall lateral system, and a concrete foundation. With the help of professional engineers at DLK Engineering in Lafayette, CO, Marin Govett, a 4th year Architectural Engineering student at California Polytechnic University at San Luis Obispo, designed the structure of the home. Cherie, the architect, also contracted geotechnical, civil, and septic engineers, a landscape architect, and a local contractor.

**PROJECT DESCRIPTION**

Cherie and her husband currently live in downtown Boulder in a small, 850 sq ft condominium. Cherie has always dreamed of designing her own home, and the couple found an acre of land in the foothills of Golden, Colorado, about a half hour drive from Boulder. They picked the location for its beautiful views, and for the less expensive real estate value of the land compared to Boulder.

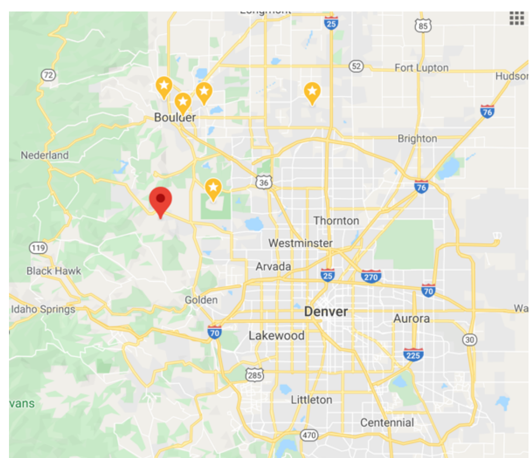



*Figure 2: Location of Blue Mountain Residence*

Cherie wanted to keep the design of the house relatively small, about 2,000 sq ft, and simple to reduce costs. To this end, Cherie made a number of decisions to help meet their budget, they decided against installing an air conditioning system. Even in the heat of the summer, the house will stay relatively cool because it sits at 7600

ft in elevation. The initial design of the house included a fireplace, which added an additional $10,000 to the project cost, so they decided against it. For heating, their two options were radiant floor heating or forced air. They found that the costs for both were about equal, and decided to use radiant floors with a 3-inch concrete topping. Additionally, the house is designed with regular sheathing on top of structural sheathing to both keep the house insulated and to meet the lateral structural design demands in an affordable way.

*Figure 3: View from Site*

The orientation of the house was dominated by the views of the surrounding area, and was designed to look and feel like a tree house. The living room is designed as a 10-foot cantilever, with windows on three sides to take advantage of the stunning views. Cherie laid out the house with the majority of the living space upstairs, including the kitchen, dining room, master bedroom, and TV room. The ground level consists of secondary space with less common space, including the garage, her husband's office, a guest room, and an exercise room. She settled on a layout with the primary space upstairs, because she knew she and her husband would want to spend the majority of their time upstairs with the views.

A variety of building materials were incorporated into the design to give it a raw look and feel. The ground floor consists of concrete and the upper floor consists of wood and steel. With the potential for fire danger in the foothills, Cherie purposefully designed the main floor with concrete to increase fire protection. Because the house is located on a steep, sloping hillside, a retaining wall design was required for stability on the west side of the garage. The garage is also designed on the downward sloping side of the hill, thus requiring less excavation.

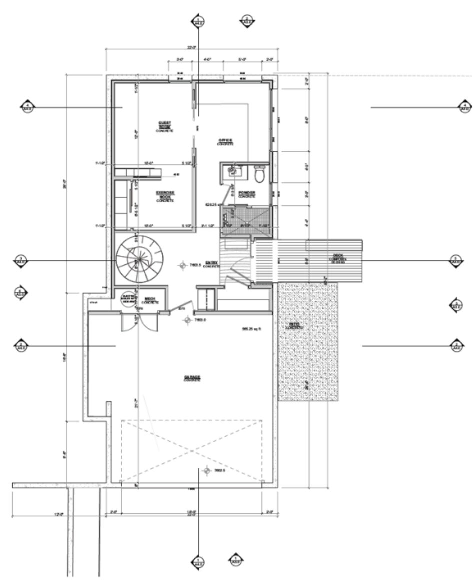


*Figure 4: Basement Architectural Plan*

The house is placed approximately 250 feet from the main road for privacy. Because the house is located in a wild land-urban interface zone, or WUI, meaning that it is built in natural terrain that has flammable vegetation, Cherie had to meet several fire safety code requirements. For instance, the Coal Creek Fire District, the local fire district for the area, mandated that the driveway must be long and wide enough to allow a fire truck to turn around.

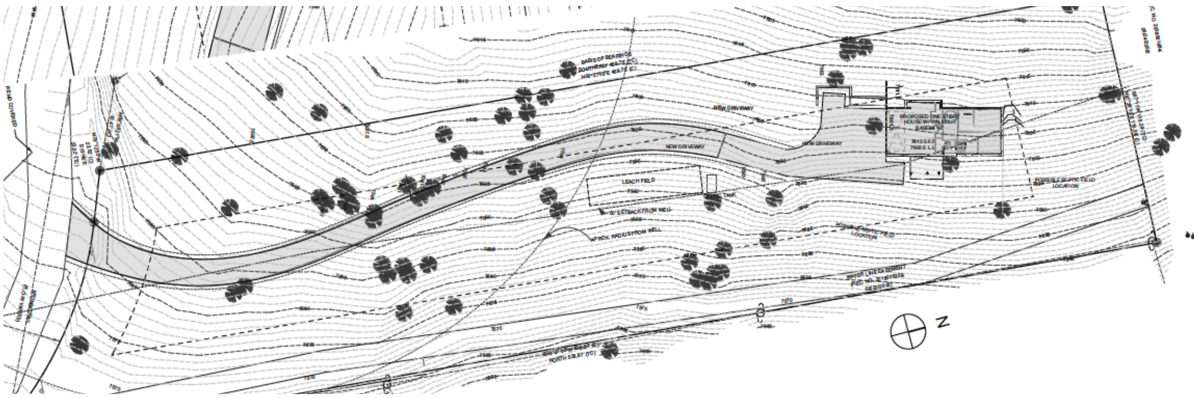


*Figure 5: Site Plan*

There was no real estate developer on the project, but Cherie contracted many colleagues and friends for the geotechnical, septic, civil, landscaping, general contracting, and structural design. Joe Kordziel from Kordziel Engineering, designed the geotechnical and septic systems, Sofie Black, a civil engineer from JVA Consulting Engineers, designed the driveway, Jeff Hindman from Cottonwood Custom builders was hired for general contracting, and Cherie consulted a friend for a few landscape questions. Once the house is complete, Cherie is planning to hire a landscaper for help with re-vegetation. DLK Engineering, specifically Marin Govett, with the help of professional engineers, designed the structure. DLK often works with HMH Architecture and is very familiar with Cherie's work.

*Figure 6: Architectural Render*

**DESCRIPTION OF DESIGN**

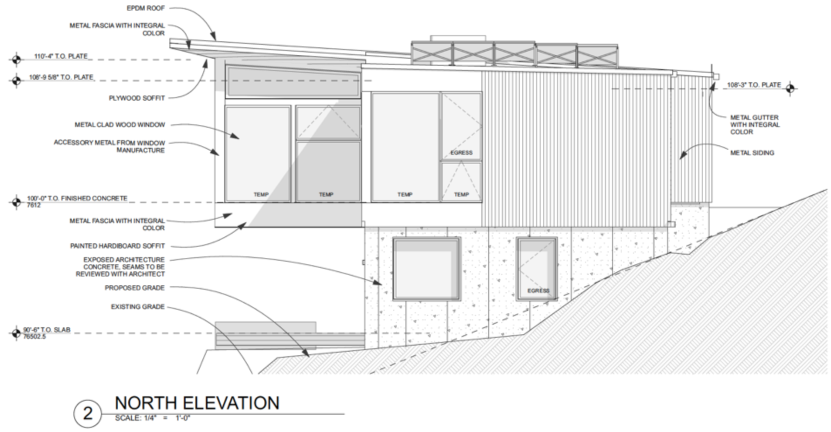



*Figure 7: North Elevation*

The gravity system is composed of Microllam LVL beams, steel wide flange beams, concrete walls, and steel pipe columns. The lateral force resisting system consists of plywood shear walls on the upper floor and concrete shear walls on the ground floor. The foundation is a non-structural slab on grade with spread and pad footings, designed for a maximum bearing pressure of 3000 psf. The existing soil contains 1 to 2 feet of silty sand and gravel, and is underlain by hard gneiss and granitic intrusions. The site has little to no swell based off the sample obtained from the site.

The initial design of the house involved a joint collaboration between Cherie, Cottonwood Contracting, and DLK Engineering to create a structural layout with materials and rough member sizes. The structural design began by referencing The Jefferson County Development and Transportation official website to obtain the ASD wind and snow loading design values. Because there was no existing structure on the property, the address of the house did not yield an exact snow load. Instead, the address of the closest neighboring house was used. The 2018 International Building Code (IBC) was also referenced to relate the ASD wind speed to the ultimate wind speed.

The lateral design was governed by wind rather than seismic forces due to the location and proximity to the mountains. The ultimate wind speed, found using the IBC, was 129 mph and 3 second gust was 100 mph (ASCE 7-16). Snow loads were designed at 48 psf ground snow and 68 psf roof snow. The ground snow load was used on the exterior decks on both the upper level and ground. Additional wind and snow loading information can be found in the structural calculations in Appendix C.

Much of the design consists of Microllam LVL Beams (Laminated Veneer Lumber) for the wood design. Microllams, as opposed to dimensional lumber, were chosen for their uniformity, predictability, higher strength, and resistance to splitting and warping. LVL's are a typical DLK office standard and are used on almost all residential projects. Steel wide flange beams were placed in a few select locations where additional strength and stiffness were required.

Forte, a professional engineering software by Weyerhaeuser, was used for many of the gravity calculations and sizing of joists and beams. The program uses skip loading and TJ-Pro Rating, a system that takes into account the average customer satisfaction for the stiffness of the floor. RISA 2D was used for steel design, particularly the design of the cantilevered living room. DLK custom company spreadsheets were used as a design aid and calculation check for lateral design loads, king stud design, and concrete beam design. Calculations on Risa 2D and Forte can be found in the structural calculations in Appendix C.

The geotechnical report from the soils engineer was used to design the foundation and safely transfer the structural loads into the ground. The soils report contained detailed information including the existing site conditions, subsurface conditions, recommendations for structural design, site grading, and drainage. The report also specified maximum bearing pressure, a key value for structural foundation design. The maximum bearing pressure can be found on page 1 of the soils report in Appendix D.

## PROJECT TEAMS

The main structural engineer on the project is Marin Govett, an Architectural Engineering student at Cal Poly. Marin has interned with DLK Engineering for two years. Delchi Fafach, principle engineer at DLK, and Luis Duque, a structural engineer at DLK, aided in portions of the structural design and checked the structural calculations.

Cherie hired Cottonwood Custom Builders in Boulder for the general contracting, a company she has worked with for many years. They consulted on the schematic design, helped coordinate sub contractors for mechanical, electrical, civil, and septic, and the design of a future swamp cooler. The contracting team at Cottonwood consists of the lead contractor, Jeff Hindman, about six carpenters, laborers, and a few office managers. Before the schematic design began, Jeff visited

the site with Cherie to offer his thoughts on the benefits and drawbacks of different locations of the house on the site. Initially, Cherie thought about placing the house closer to the road to decrease the length of the driveway, but realized that the house would be too close to the neighboring house below, blocking the neighbor's view and intruding on privacy. After the schematic design was completed, Jeff provided Cherie with an estimation of contracting costs at $1,00,000. Throughout the remainder of the design phase, Jeff provided feedback on the layout, engineering, and potential constructability complications.

This is a design-build project (typical for many residential projects), where the project is streamlined through a single contract team. Design-Build is advantageous for residential projects because it often results in cost savings, better quality work, faster completion, and reduced risk. An HVAC contractor (heating, ventilation, air conditioning) was hired within Cottonwood, and a civil engineer (JVA Consulting Engineers) and a solar panel company were hired by Cherie, but coordinated by Cottonwood. Due to Cottonwood's years of residential building experience and the size of the project, no additional mechanical or electrical engineers were required.

Cottonwood Custom Builders is one of Boulder's leading custom green home builders. They make the effort to use local, renewable and non-toxic materials, construct energy efficient building envelopes, and recycle material waste as much as possible. The lumber and framing came from Boulder Lumber, the timber was sourced from the Pacific Northwest, and the steel came from Denver. To reduce the amount of heating and cooling required, Cottonwood designs extremely tight building envelopes with proper air sealing, insulation, and ventilation. They also use smaller dumpsters on the job site (as opposed to the huge dumpsters typically seen) to make it easier for workers to find reusable scraps. The majority of their construction debris is recycled, saving tons of waste from filling local landfills.

For environmental and financial reasons, the house will use only electricity from existing lines in the area and solar panels on the roof, negating the need for gas lines. An existing electrical utility line runs along the property 50 ft from the house, making the connection very easy. Cable, telephone, and internet will be provided by connecting to existing lines 350 ft from the house. Water will be supplied from a community well, which will require the installation of water lines.

The septic and geotechnical were designed by Joe Kordziel at Kordziel Engineering, and began by taking soil samples at the site. The samples were used to find the percolation rate (speed at which water flows through soil), determine the type of leach field, and create the geotechnical report, a key component of the foundation and civil design. A new septic line will be installed to run from the house to the waste processing plant on site, about 5 ft away. The size of the tank is regulated by Jefferson County, based of the size of the house, and is required to have two compartments. The existing shallow bed rock and soil on site readily accepts water, but has no capability to filter effluent. As a result, the bed rock will be removed and replaced with a 3 ft sand filter.

The waste is pumped from the house to a concrete tank, where the solids settle to the bottom and greases and lighter solids float to the top (effluent waste). As the heavy solids settle to the bottom, bacterial action begins to partially decompose the waste. Eventually, the solids will build up and will need to be pumped out (hired separately by Cherie in the future). Once the solids settle, the effluent waste is pumped into a second compartment containing the sand filter. Sand filters consists of a network of small diameter pipes in a gravel-filled bed on top of the sand. The effluent is pumped under low pressure and distributed uniformly over the gravel. The effluent trickles through the gravel and sand, and eventually discharges to a leaching field. Once installed, the tank will require a site visit by Joe Kordziel for verification. The septic tank also requires a permit, which is regulated by Jefferson County OWTS (On-Site Wastewater Treatment Systems). Among many requirements, OWTS specifies a minimum 200 ft setback from neighboring wells, proper maintenance, disposal, and inspections for the septic tank.

The driveway and site drainage were designed by JVA Consulting Engineers in Boulder. The main objective of site grading is to allow surface water to flow and drain away from the foundation of the house. Jefferson County does not specify many drainage requirements as long as water continues to follow natural drainage patterns. To reduce costs and avoid cutting and filling of soil to achieve a specified slope angle, Cherie worked with Jefferson County to accept a slightly steeper slope above the code allowance. Mountain sites are typically much steeper than the code allowance for drainage, which often results in large amounts of earthwork and extra expenses. Cherie also added a swale, a depressed area that prevents water from running across

the driveway. The swale will also help to reduce the risk of water freezing on the driveway in the winter.

Fire codes for the property are dictated by the Coal Creek Fire District. Appendix Z was recently added to the fire code, taking effect January 1st, 2020. Because Cherie received her building permit in 2019, she was not required to follow the new fire code. Appendix Z was driven by the fire district and added fire resistant specifications to increase the amount of time for occupants to escape a burning building. Appendix Z specified Class A roofing systems, protection of roof valleys and eaves, exterior walls, decks, and more. Cottonwood Custom Builders typically builds to Boulder County's fire codes because Boulder has one of the strictest codes in the area and Cottonwood is very familiar with Boulder's standards. Even if some areas have less stringent codes, Cottonwood wants to ensure that every house has strong fire protection. Even though Appendix Z did not apply, the house was built to Boulder's stronger codes. For mountain homes, Jefferson County requires consultation with a Wildfire Mitigation specialist. The specialists usually recommend removing nearby trees, cutting lower tree limbs to eliminate the proximity of branches to the ground, and using fire proof exterior materials (metal and concrete). Once the civil, septic, and structural designs were completed, the plans were given to Cherie to submit to the County for permit.

## COST ESTIMATE

The total cost for construction is $1,000,000, the septic and geotechnical are estimated at $60,000, the structural at $40,000, and the civil at $45,000. Construction began in October 2019 and will finish in about one year if construction stays on schedule.

*Figure 8: Construction (January 2020)*

Figure 9: Construction (April 2020)

**PERMITING PROCESS**

Permitting for residential projects is either submitted by the architect or by the contractor. In this case, Cherie submitted the documents to the Jefferson County Planning and Zoning Division to avoid the additional cost of paying Cottonwood to submit it. The application for a permit in Jefferson County requires proof of ownership, construction documents and a site plan to scale. In addition, proof of adequate access to water and sanitation, private road approval for onsite driveways, and an application fee of about $1,000 are required. The submitted construction documents include the architectural, structural, civil, septic, and geotechnical designs. Potable water permits are issued through Blue Mountain Water District and septic permits are issued through Jefferson County Public Health.

Once all of the permits have been issued and the application is reviewed by the Planning and Zoning Department, typically a month-long process, the project is given a permitting number and passed to the Building Safety Department. Once the Building Safety Department reviews the architectural, structural and construction plans, construction can begin.

**CHALLENGES**

It was difficult to begin the structural design while the architecture was in progress and subject to change. The initial structural design was based on Cherie's preliminary ideas, but had to be altered multiple times as she updated her plans. At one point when the structural calculations were almost complete, Cherie decided to add an opening and change the location of a few walls. Although the changes were small, the calculations in a few areas had to be completely redone and the loads to the foundation re-traced. Additionally, most of the structural details were drafted before Cherie finished her architectural details. DLK's structural details gave Cherie different

options, but ultimately resulted in the revision of about one third of the structural details once she decided what she wanted. For future projects, I would prefer to begin the structural details once the architects finish their design. Luckily though, I did not feel like I spent excessive time redoing details and calculations.

Another challenge was designing the cantilevered living room to be strong enough to withstand both the lateral and gravity loads. A W14x109 and W14x90 steel beams were placed for gravity support. These beams could have been much smaller, but Cherie wanted a 16" maximum floor depth to maximize the height of the first floor. To support the high lateral loads on the cantilevered living room, triple LVL stud packs were placed between the windows, connecting from the high diaphragm to the second story floor. Refer to S1.3 on the structural drawings in Appendix B for the design, and Appendix C for the structural calculations. Additional flatwise members were placed about three-quarters of the way up the wall for out-of-plane bending. This design is shown on S1.3 of the structural calculations in Appendix C. For additional visuals of the cantilevered living room design, refer to A3.0 architectural drawings in Appendix A.

*Figure 10: View of W14x109 (April 2020)*

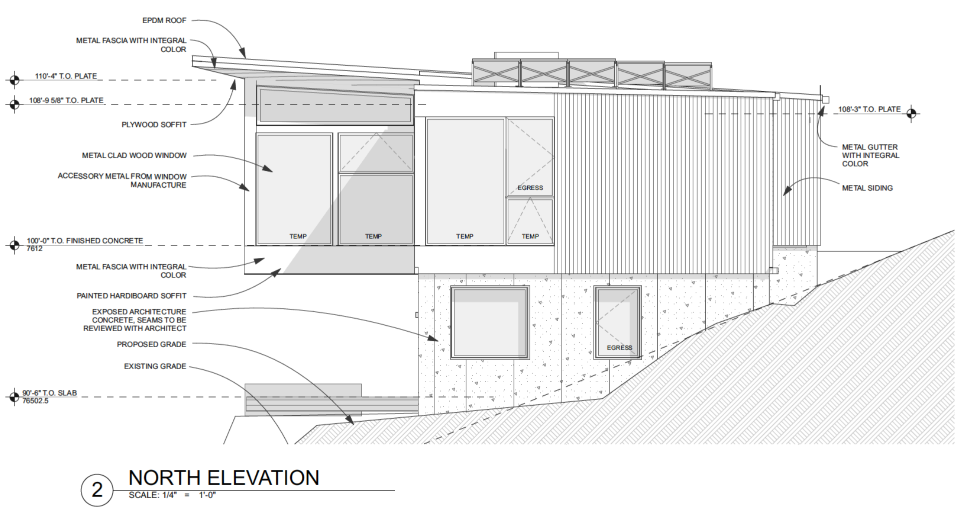



*Figure 11: North Elevation*

**IMPACTS:**

As with all new construction, the residence will have economic, environmental, global, social, and political impacts.

Economic Impacts:

Building the house in a remote location rather than in a subdivision, where waste treatment, electricity, running water and cable are more accessible, results in greater overall costs. Cherie and her husband specifically wanted to live in the mountains and were willing to make the effort and pay additional costs to have these necessities brought to the site.

A multitude of jobs were created through the design and construction of the house, including the hiring of architects, engineers, designers, general contractors, laborers, and more. In addition, material manufacturers will benefit from the construction of the house with the purchase of materials. During the construction phase, the project will create jobs for local laborers, workers, and inspectors. When repairs or additions are needed in the future, local workers will once again be employed. The collaboration between designers, contractors, and engineers will create lasting relationships and foster future economic growth.

Environmental Impacts:

There are many environmental concerns that affect the design of a new building. For example, foundation excavation, septic and electrical line installation, and transportation of materials to and from the site can have significant impacts on the environment. The house is located on a dirt road in the mountains, about a mile off of the main paved road, creating additional carbon emissions from the transportation of materials and labor. The materials used in the project also have considerable impacts. For example, the erection of steel used in the building creates significant carbon emissions during manufacture, the harvesting of wood used in the structure causes a multitude of problems such as loss of biodiversity and soil erosion, and the extraction of fuels used for transportation and construction cause environmental degradation and carbon emissions. Concrete is also a toxic and environmentally damaging material because it requires large amounts of water, raw materials (gravel and sand), and cement, a highly energy-intensive product that creates greenhouse gases and water pollution in its manufacture.

Existing wildlife habitats and ecosystems are impacted because new construction often results in a loss of biodiversity, a decrease in open space, and the disruption of animal habitats. The new driveway, foundation, and retaining walls will require excavation and removal of material, which impacts the natural soil conditions and ecosystem. The existing well in the area will experience faster depletion of water as more people begin to use the water for landscaping and residential use. In an effort to be as environmentally friendly as possible, Cherie designed the house to rely on only solar panels for electricity, allowing her to completely omit gas lines and reduce additional greenhouse gases and construction.

Global Impacts:

Cherie and her husband may decide to buy more products online because of the remote location of the house. Online shopping makes it much easier to access products from anywhere in the world and support global businesses, but makes it much more difficult for local retailers to stay in business. It can also increase environmental impacts due to the additional packaging and emission of greenhouse gases required for transportation.

The materials and labor are locally sourced within the United States, something other countries may envy. Smaller or developing countries often do not have this luxury because it is difficult to find locally-sourced materials, designers, and laborers in many countries. Even in the United States, many laborers have emigrated from other countries, and possibly may not be legal citizens. There are negative and positive impacts of immigrant laborers. While they may be taking jobs away from non-immigrants, they often send money back home to their families, which strengthens our economic ties to these countries.

The residence can also serve as a precedent project for modern architecture. It will bring new architectural and construction techniques to the area since many of the houses were built years ago. The residence is very modern, designed with no headers, windows flush to the roof, and large openings to take advantage of the stunning views. The house may also appear in modern architecture magazines, inspiring others around the world.

Societal Impacts:

New construction can have a large impact on the surrounding homes and neighborhoods. During the construction phase, work begins early in the morning and continues throughout the day. People who work from home or spend a large portion of their day at home may be impacted by seemingly endless construction. Once the house is complete, Cherie and her husband can contribute and strengthen the local community through their relationships, new ideas and support of the community. As stated earlier, construction of this residence will also require collaboration between designers, contractors, and engineers and laborers, create lasting relationships.

Many of the existing homes in the area were built in the 1970s and 1980s, often designed with gable style mountain roofs. The house may encourage and inspire modern construction and new architectural designs in the area. It is unclear if the existing neighbors will enjoy the modern architecture and change of style or will want to maintain the older architectural look. Another impact of new construction is that it changes the skyline and view for neighboring houses. Despite Cherie's efforts to build farther from other residences, neighboring houses may have a portion of their view blocked.

Political Impacts:

Affordable housing is a hot commodity in the Boulder/Denver area. Cherie and her husband were forced to move out of Boulder due to the expensive real estate. By buying a property outside of Denver and vacating Boulder, the market price of an apartment in Boulder has the opportunity to increase. This would make it harder for middle to low-income residents of Boulder to afford housing, and potentially draw more high income residents to Boulder. This supports over-priced real estate and fuels the market prices to increase. Buying housing in the greater Denver area also supports the competitive housing market, possibly increasing future prices.

Jefferson County is also impacted through the increasing infrastructure in the mountains. The permitting process for a new structure is very involved and is related to the current political climate. County commissioners have control over the permitting process and often do not agree on how or whether infrastructure should increase in the mountains. While infrastructure increases revenue, it has an irreversible impact on open space and the environment.

Figure 12: Construction (April 2020)

**CONCLUSION**

This senior project has provided a wonderful learning opportunity and a rewarding experience for myself and all of the designers involved. I enjoyed learning about the different design disciplines involved in the construction of a residential home and the permitting process. The senior engineers at DLK Engineering and the architect, Cherie Goff, are honored to have contributed to a senior project and have enjoyed teaching and guiding me to complete the design. The house is projected to be completed in one year, by the fall of 2020, if construction and permitting stay on schedule. DLK Engineering will continue to stay involved until its completion, with site visits for the foundation and framing (bearing wall, beam, column, joist, and connections) to ensure compliance with structural specifications.  Even after the completion of my senior project, I am excited to stay connected with the project and designers, and visit the property periodically through completion.

**REFLECTION**

DLK Engineering, HMH Architecture, and other professionals provided a wonderful learning opportunity for me to gain a greater understanding of the residential design process. It was valuable to learn about and interact with the different designers and engineers involved in the project.

I especially enjoyed talking to the general contractor, Jeff Hindman, about his experience in contracting, and hearing his tips for aspiring structural engineers. When I asked if he had any suggestions that structural engineers could implement to make contracting easier, he suggested

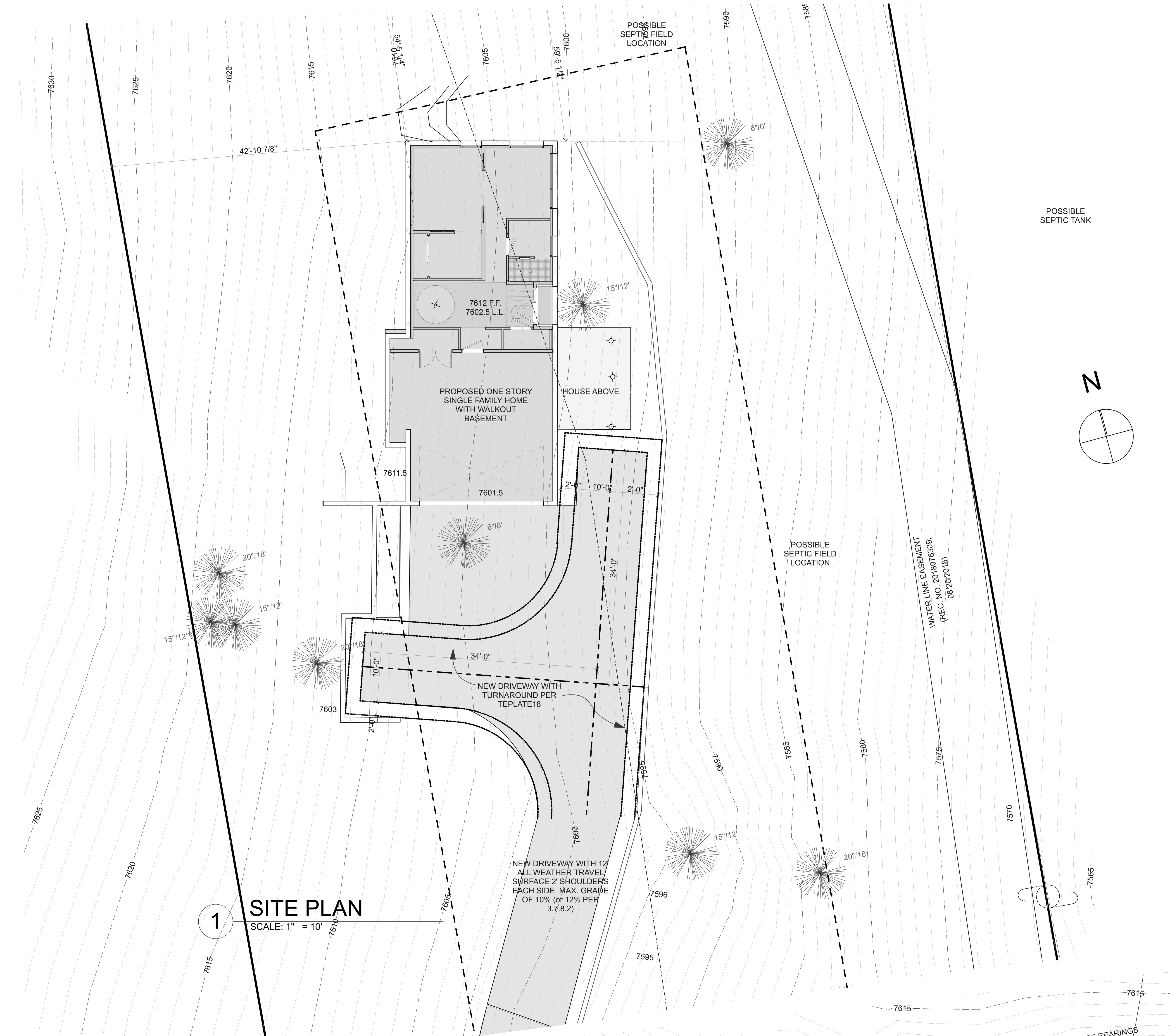
that all structural engineers should be required to work for a year in the field before becoming a licensed engineer. He finds that with young engineers, buildings are often over-designed and contain elements that are unbuildable or overly complicated. I know that I, among many other Cal Poly students, would greatly benefit from a year in the field.

If I were to repeat this project, I would spend more time doing outside research on wind loading before beginning the lateral design. As I mentioned before, much of the wind loading design I learned was while I was in the office. I spent a large portion of time studying ASCE 7-16 and talking to other engineers in the office about wind. It would have been helpful to have studied the different wind methods beforehand so I had a clearer understanding of what wind procedures I needed to consider.

Aside from a few of the lateral and foundation connections, I designed the majority of the house myself using the knowledge from my classes at Cal Poly. For the more complicated connections, I found I often needed the design experience of other engineers, such as the connection between the two roof diaphragms. Refer to details 2 and 3 in S1.3 of the Structural Drawings in Appendix B for visuals of the final details.

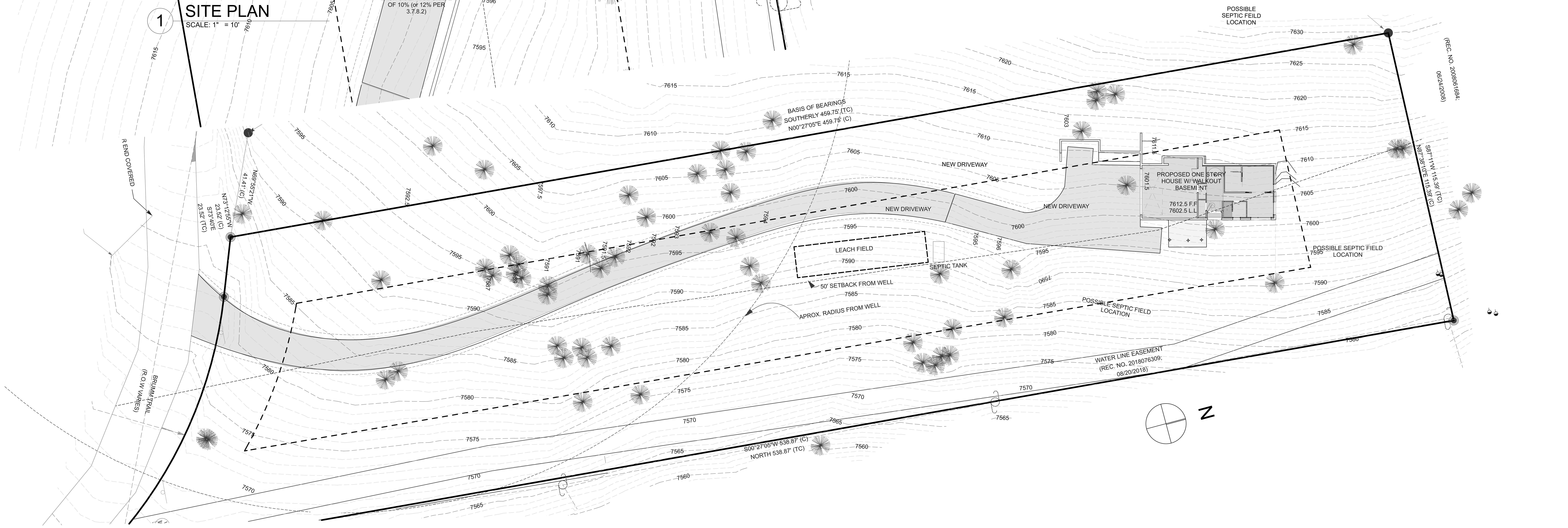
Quite a few elements of the architecture changed during the design phase and I found myself recalculating the structure multiple times. It ended up being a good opportunity to recheck my calculations, but I wasted valuable time. I would not have done the initial design differently, but with more experience, I could have completed the initial design more quickly and been more efficient adapting to design changes.

This project was a great opportunity to work with professional designers and engineers, and use the knowledge from my undergraduate classes. I am excited to continue growing in the structural engineering field and to foster new connections within in the design world after I graduate.




1 SITE PLAN

SCALE: 1" = 10'





HMH ARCHITECTURE + INTERIORS

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# BLUE MOUNTAIN PRELIMINARY

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#Contact City, #Contact Country

DATE: 6/25/19

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CHECKED BY: INITIALS
PROJECT # #

SITE PLAN

G1.1

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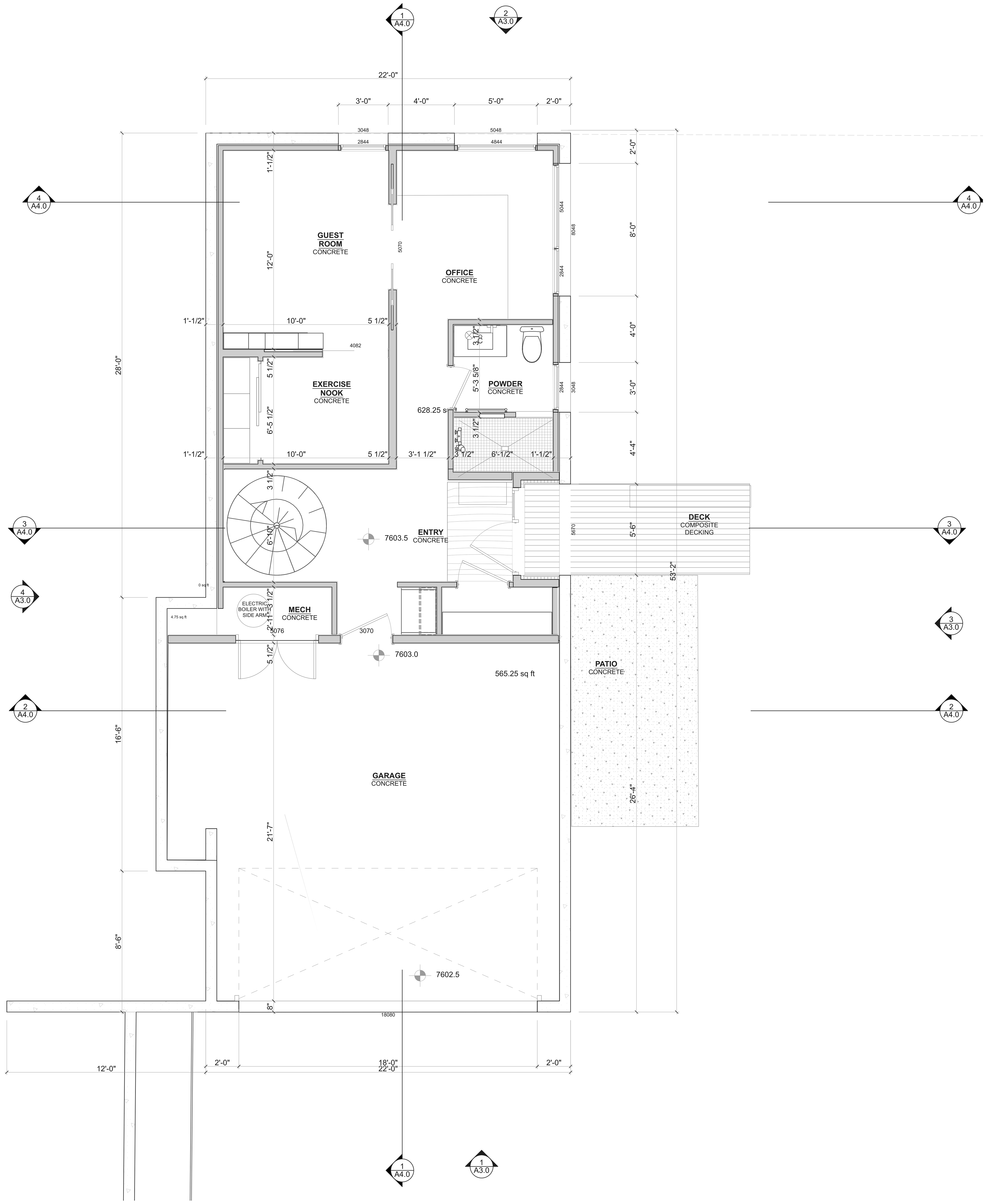


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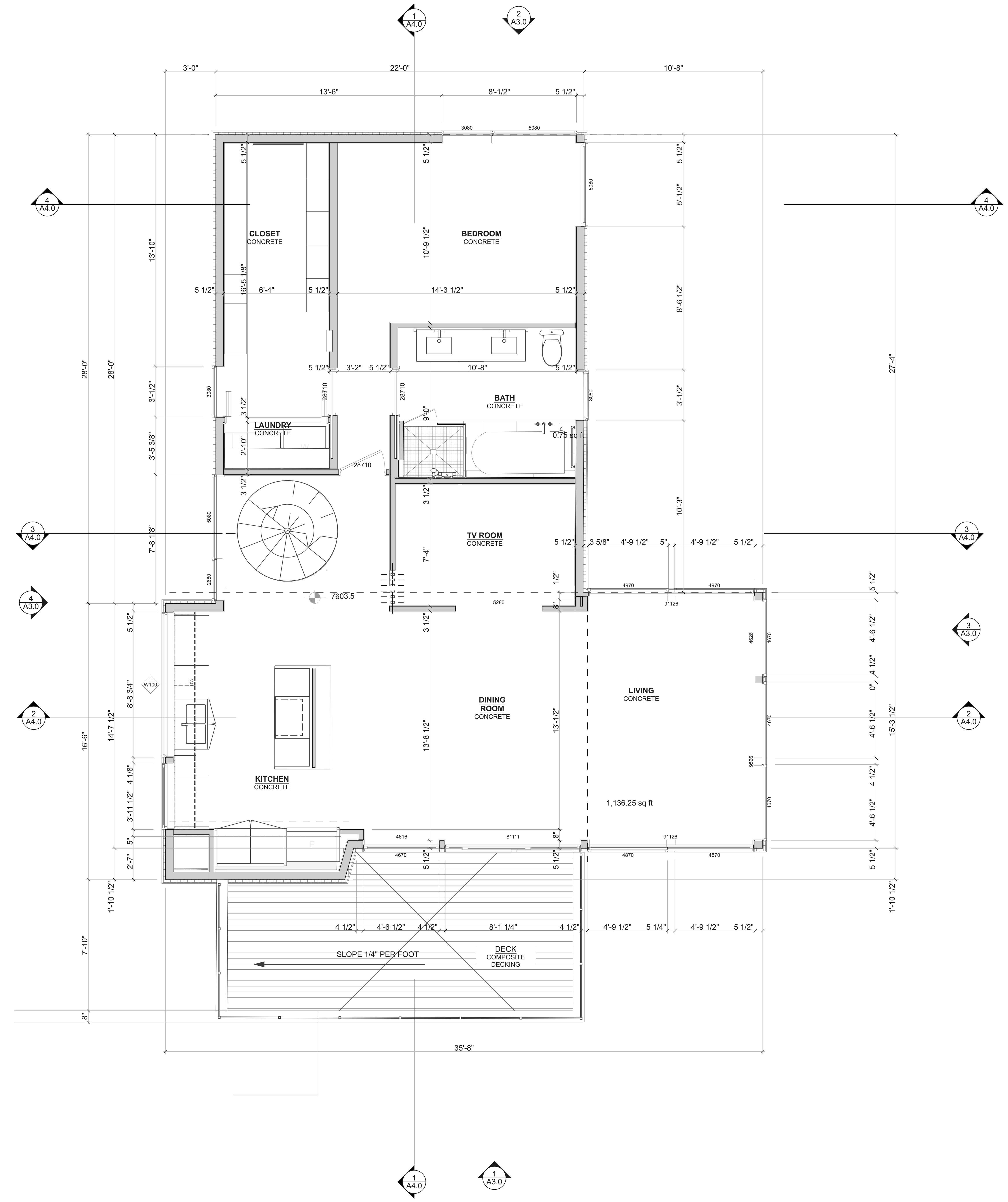


2 FIRST FLOOR
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FLOOR PLANS

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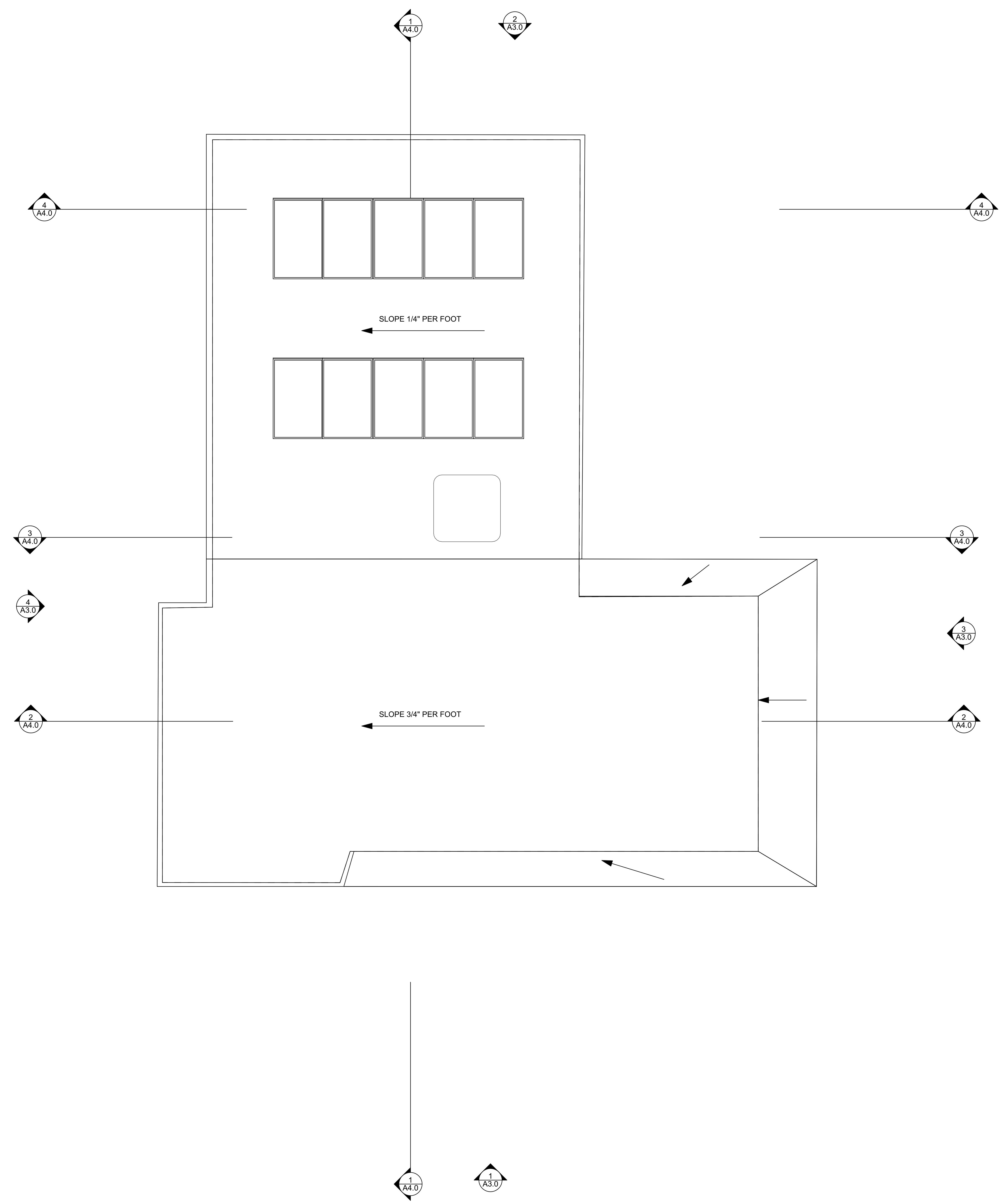


1 ROOF PLAN
SCALE: 1/4" = 1'-0"

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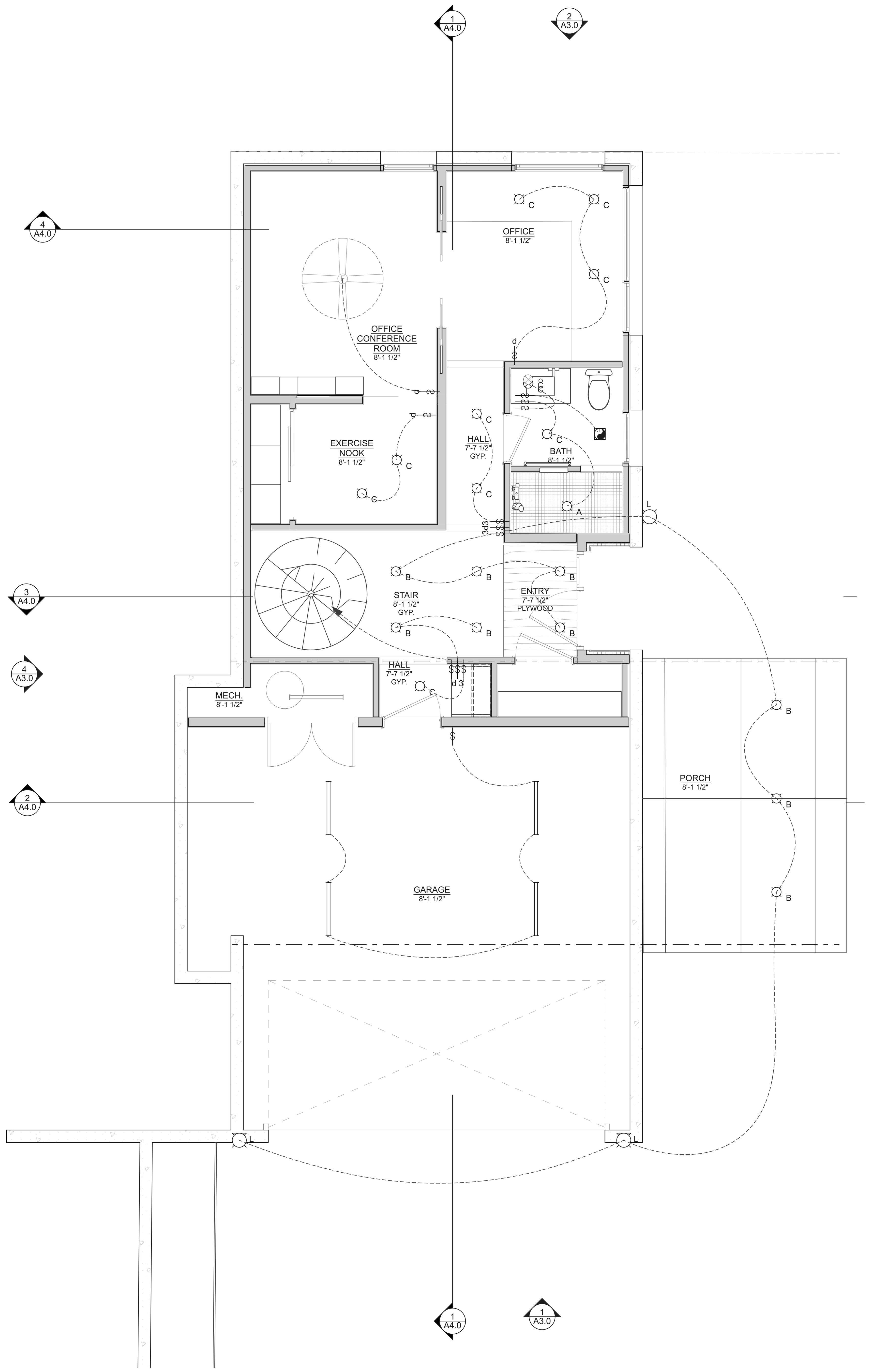
Roof Plan

A2.1




.4 Basement Reflected Ceiling Plan

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


.5 First Floor Reflected Ceiling Plan

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

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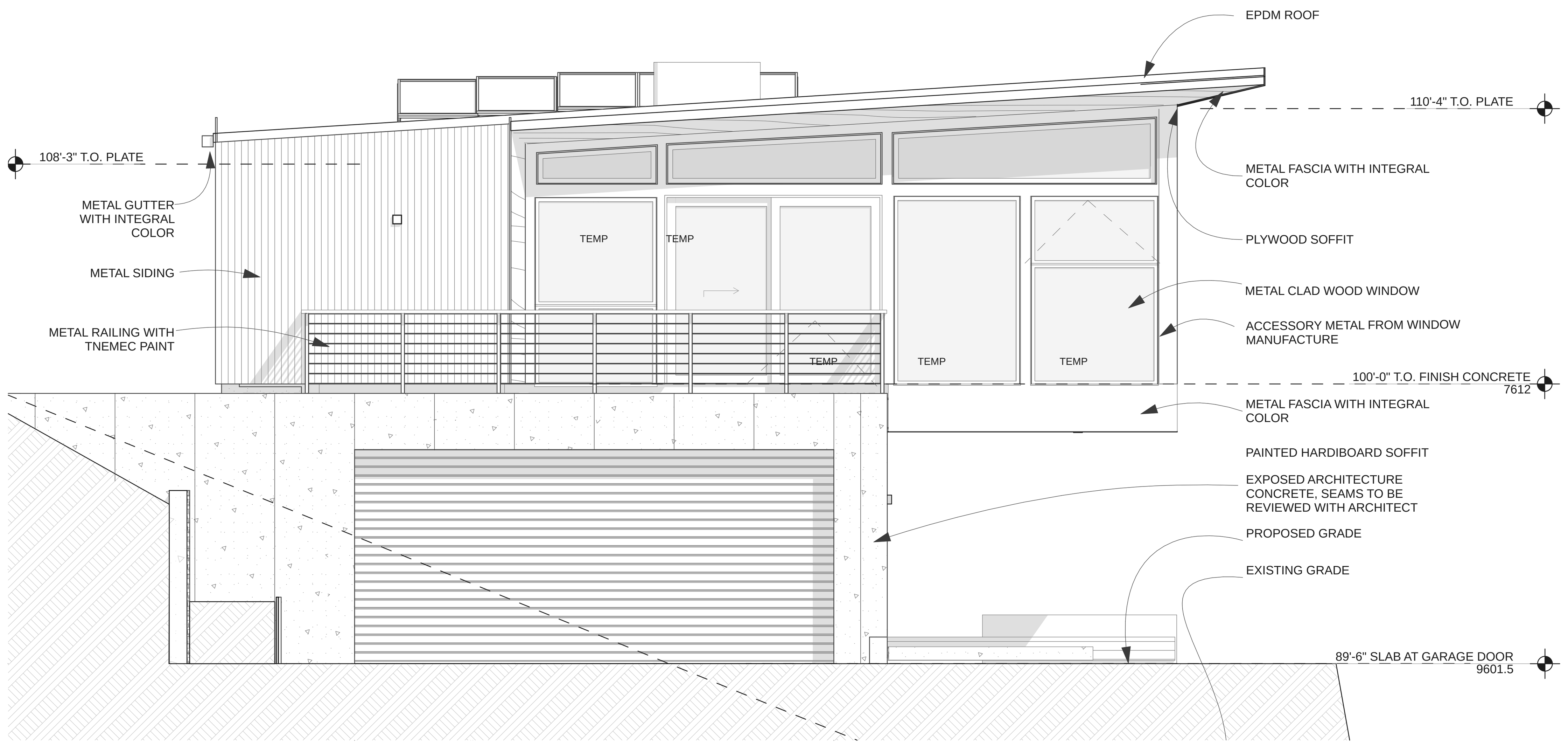
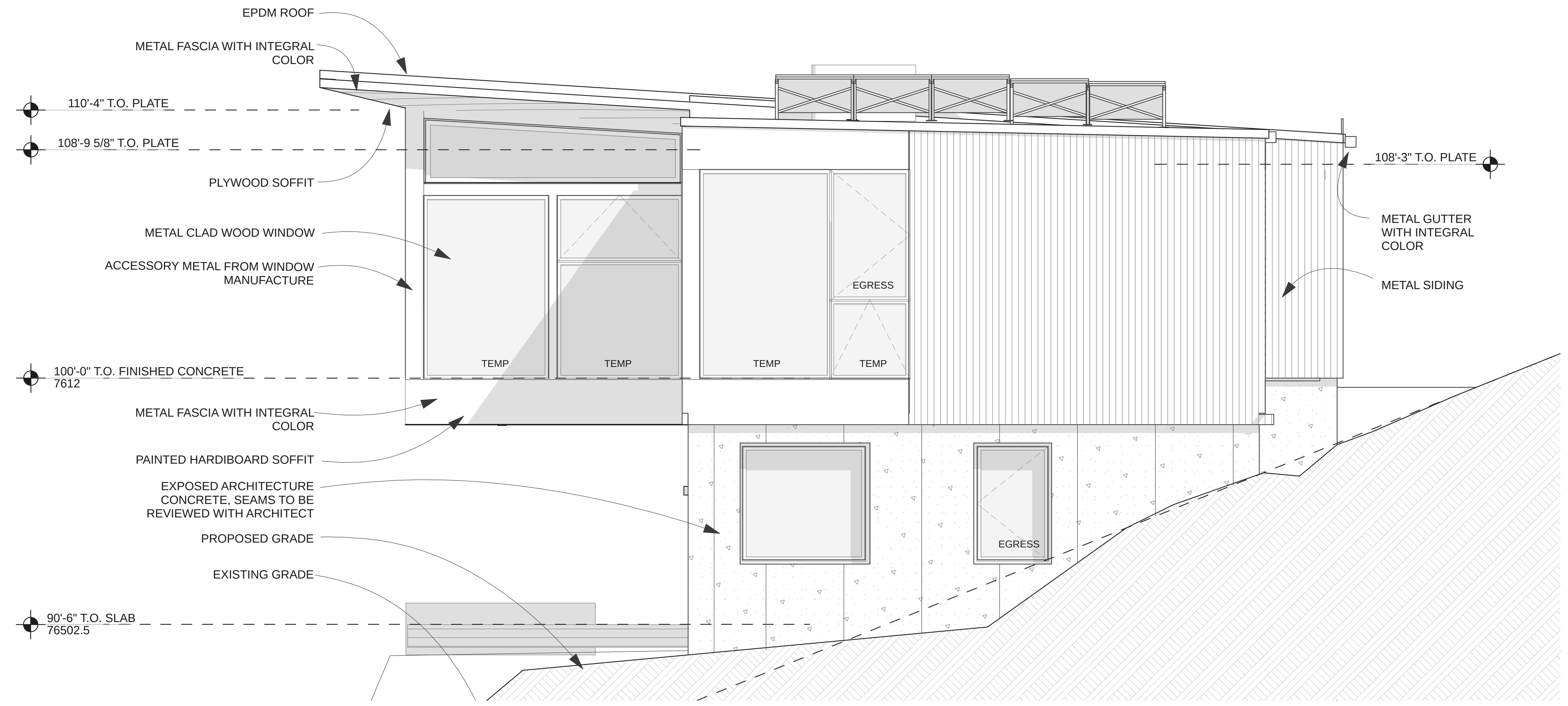
Reflective Ceiling Plan

A2.2

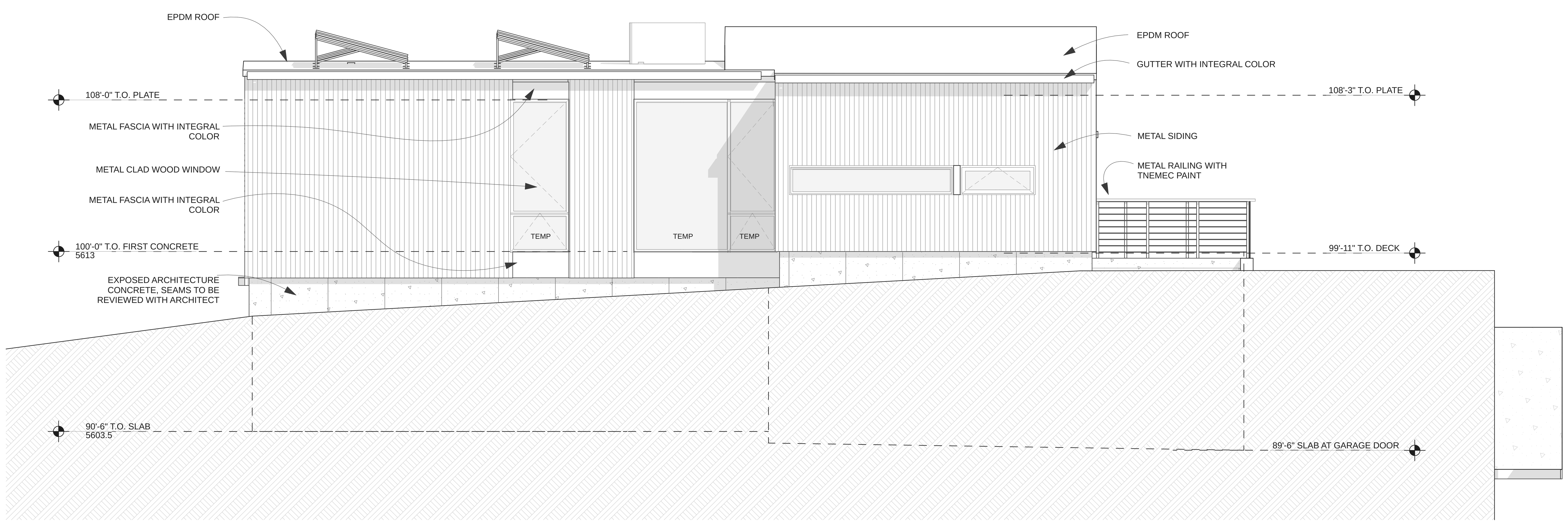



1 SOUTH ELEVATION
SCALE: 1/4" = 1'-0"




2 NORTH ELEVATION
SCALE: 1/4" = 1'-0"


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




4 WEST ELEVATION
SCALE: 1/4" = 1'-0"

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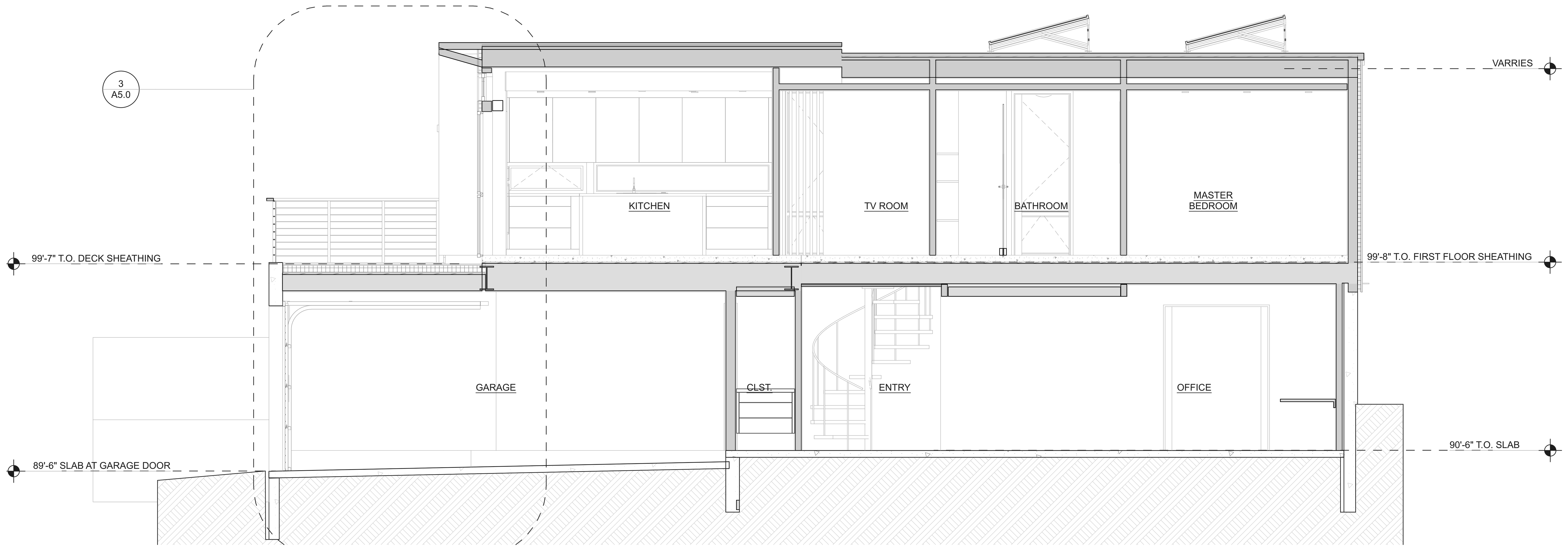
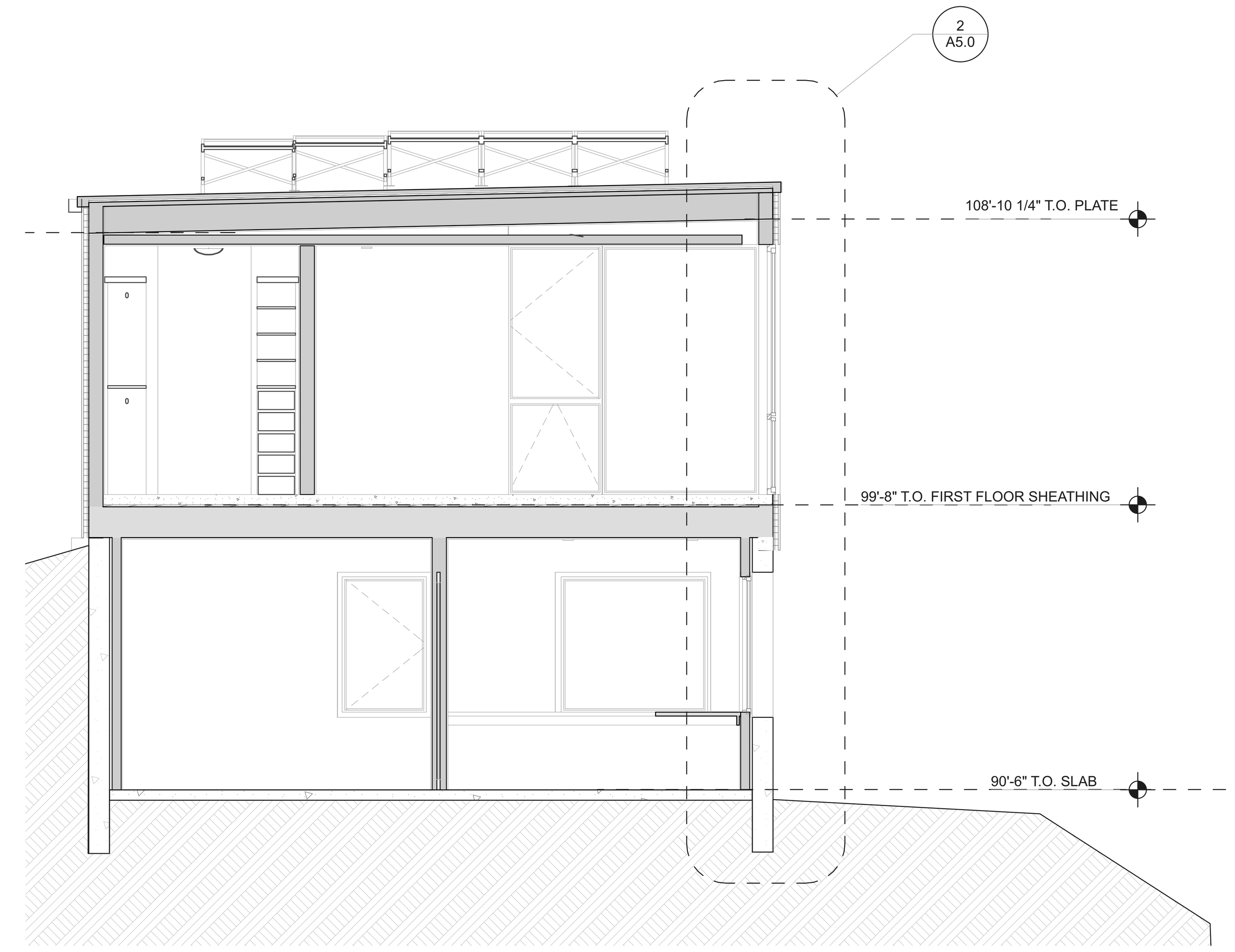
Elevations

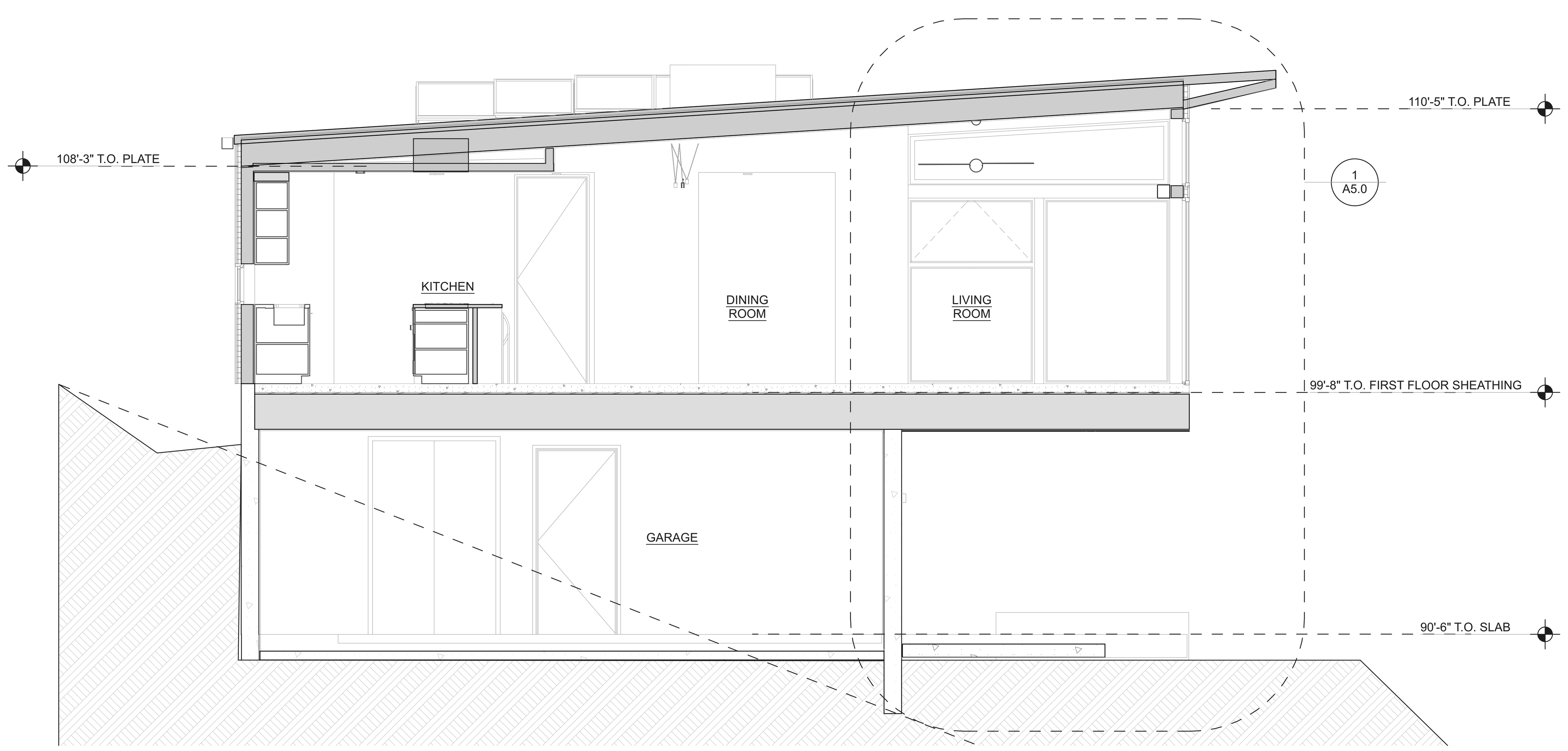
A3.0



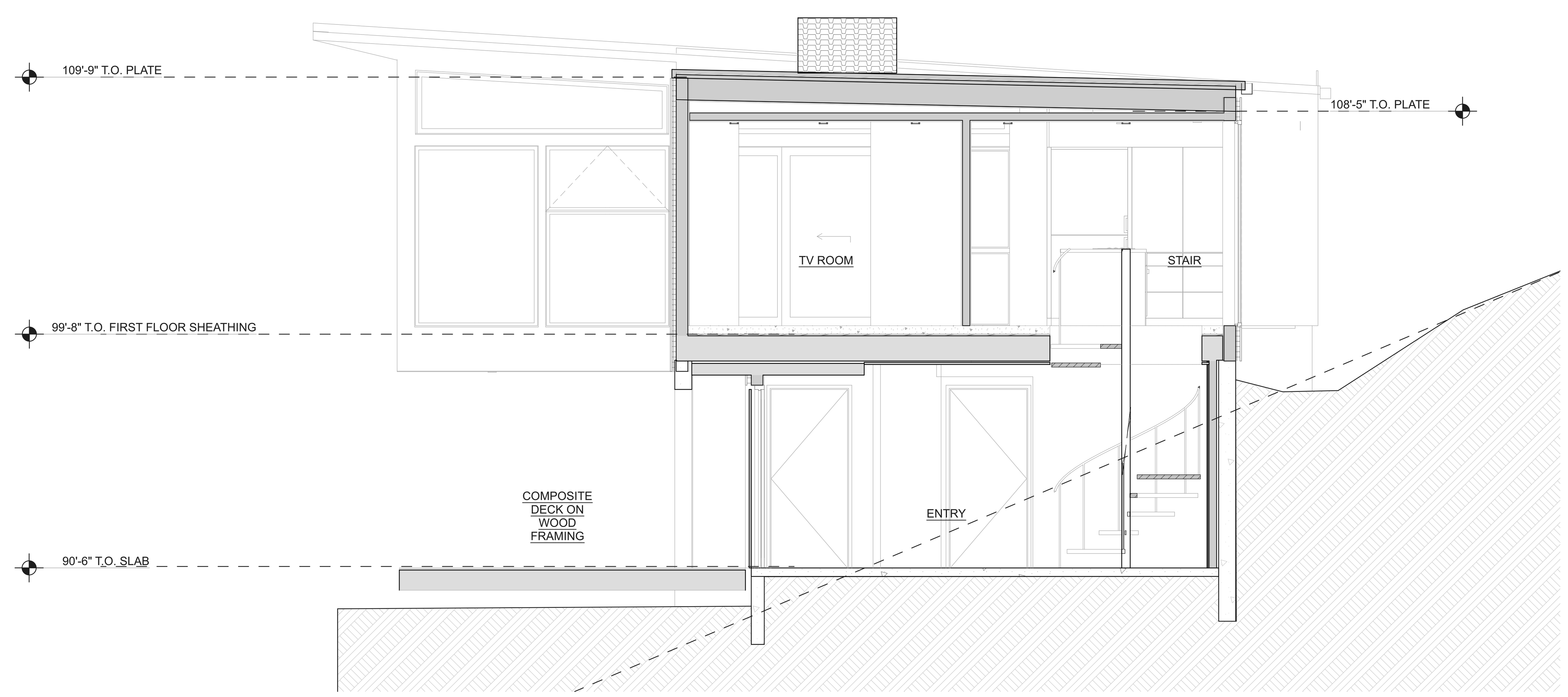

1 NORTH/SOUTH SECTION
SCALE: 1/4" = 1'-0"




4 W/E SECTION THROUGH MASTER
SCALE: 1/4" = 1'-0"




2 W/E SECTION THROUGH LIVING ROOM
SCALE: 1/4" = 1'-0"




3 W/E SECTION THROUGH ENTRY
SCALE: 1/4" = 1'-0"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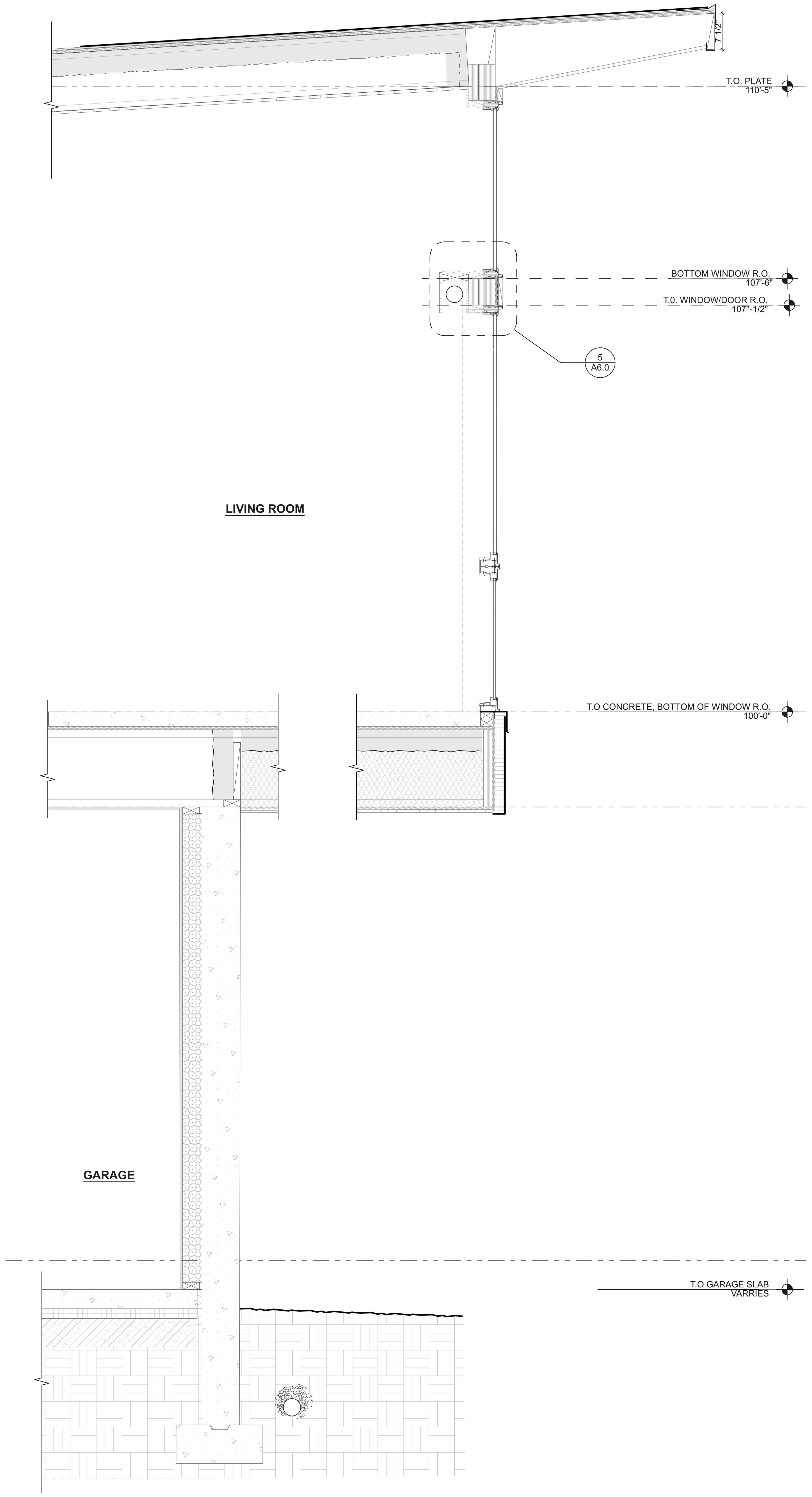
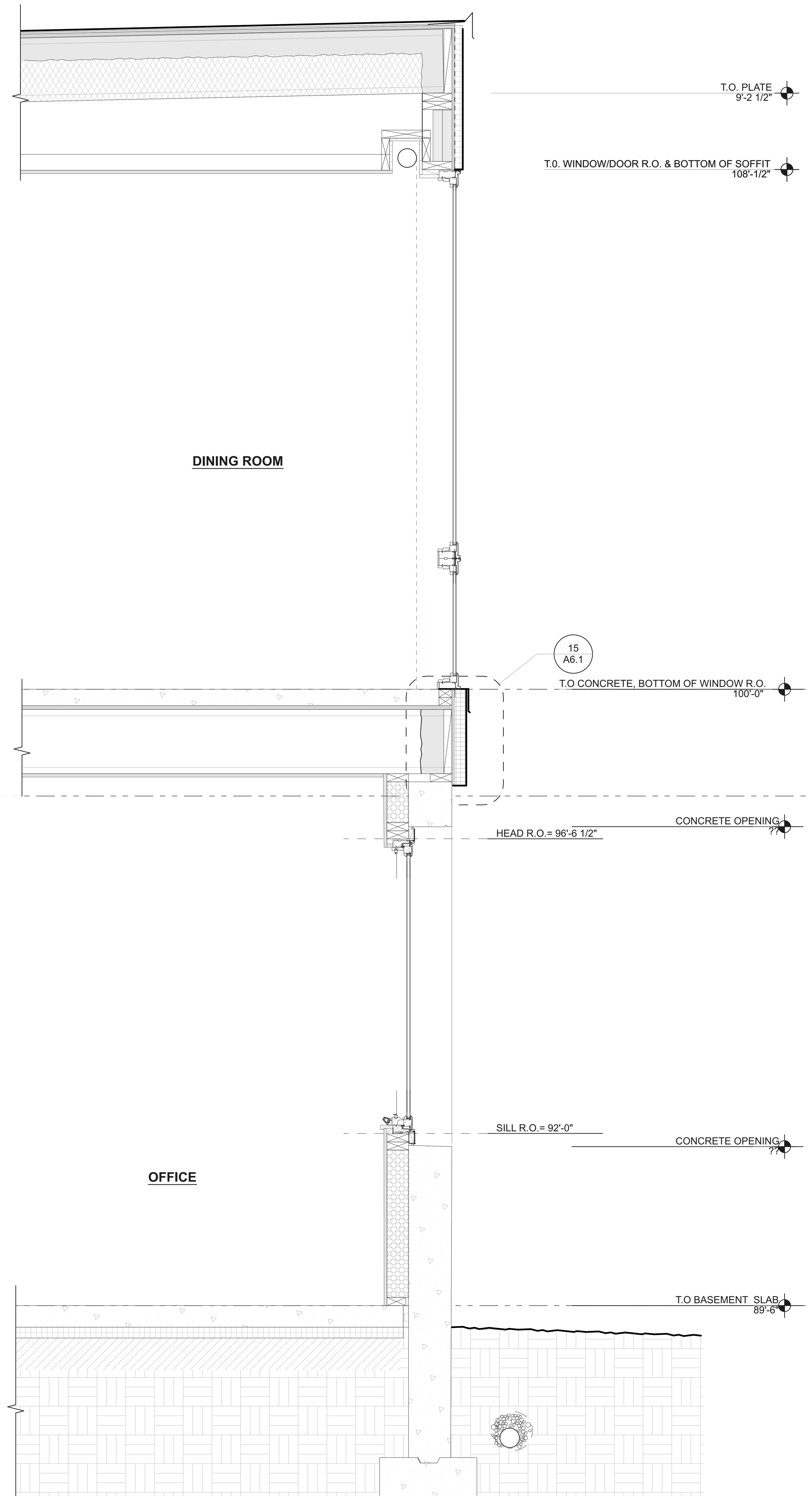
Section

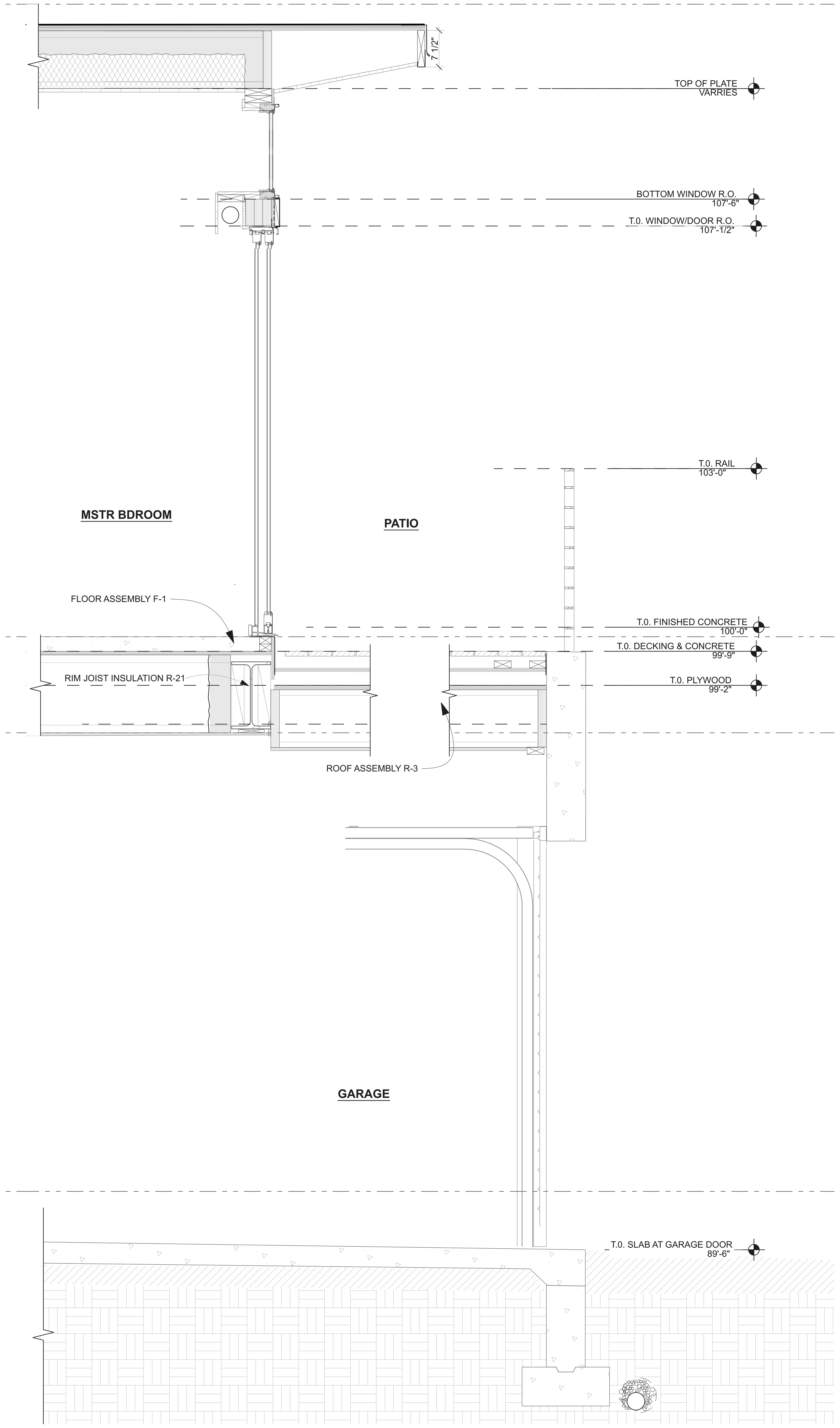
A4.0




1 SECTION AT LIVING ROOM
SCALE: 3/4" = 1'-0"




2 SECTION AT MASTER BEDROOM
SCALE: 3/4" = 1'-0"




3 SECTION AT DECK
SCALE: 3/4" = 1'-0"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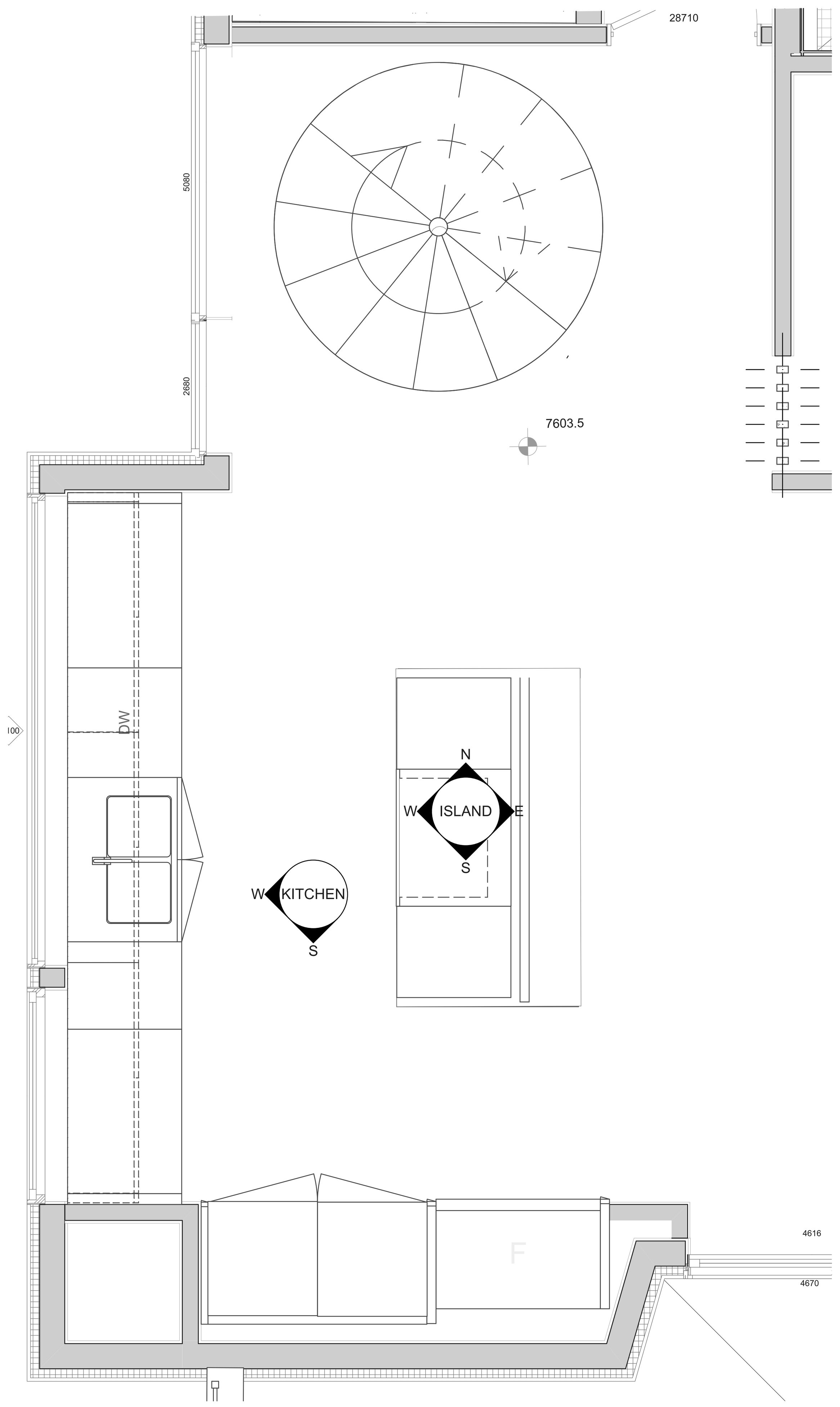
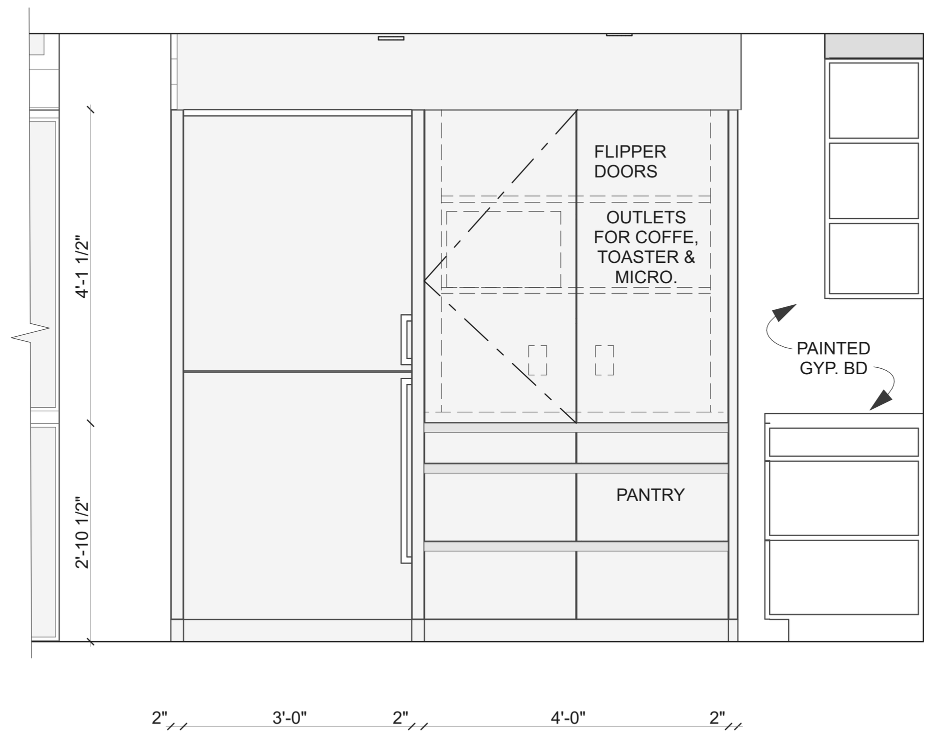
Section

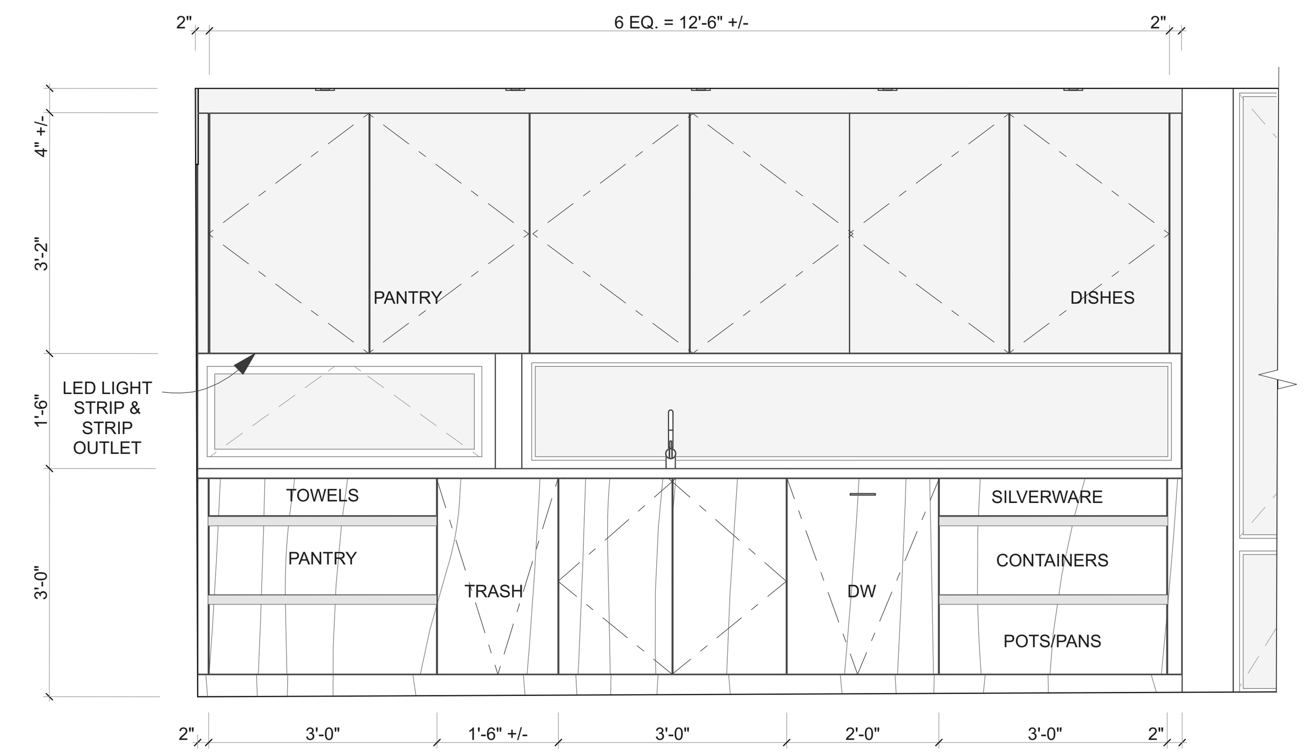
A5.0



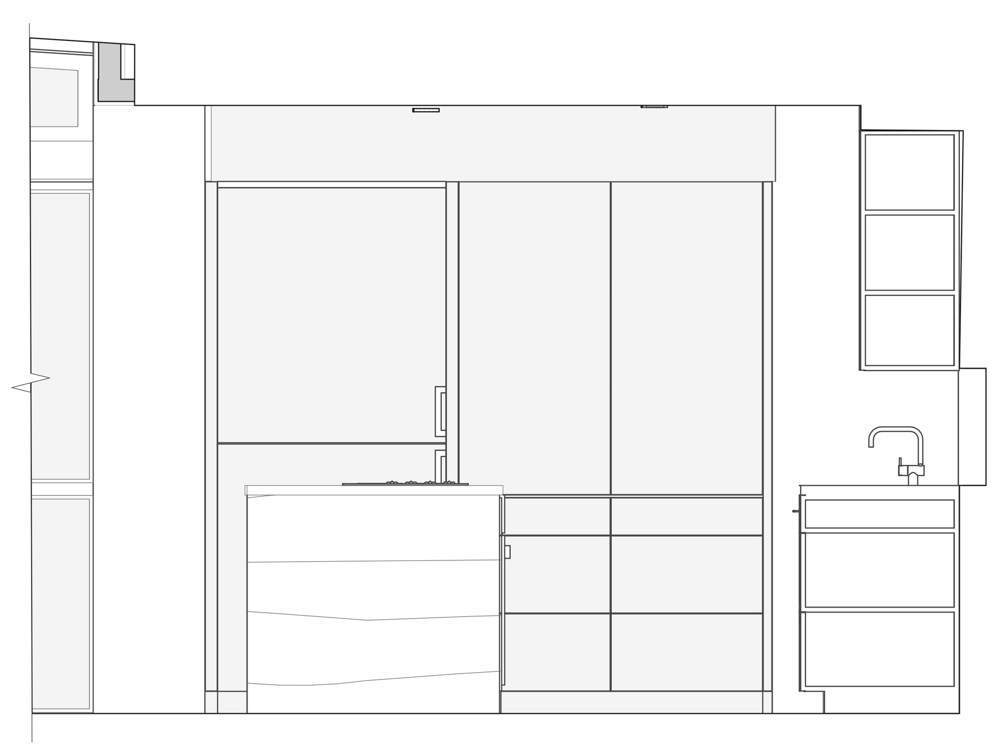

1 KITCHEN
SCALE: 1/2" = 1'-0"



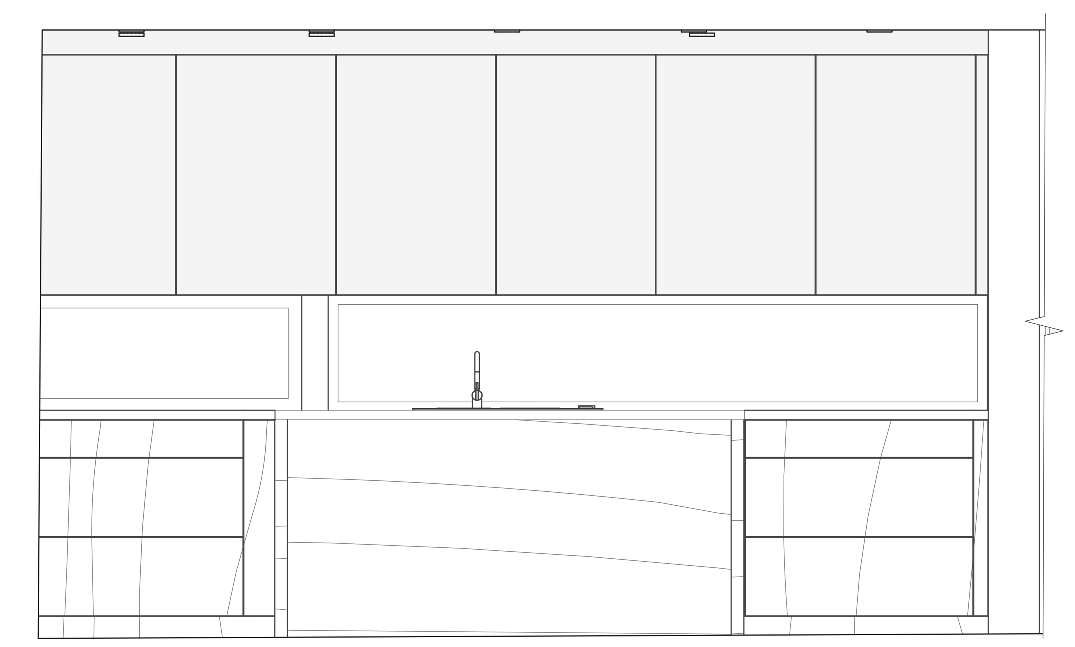

2 KITCHEN LOOKIN SOUTH
SCALE: 1/2" = 1'-0"




3 KITCHEN LOOKING WEST
SCALE: 1/2" = 1'-0"

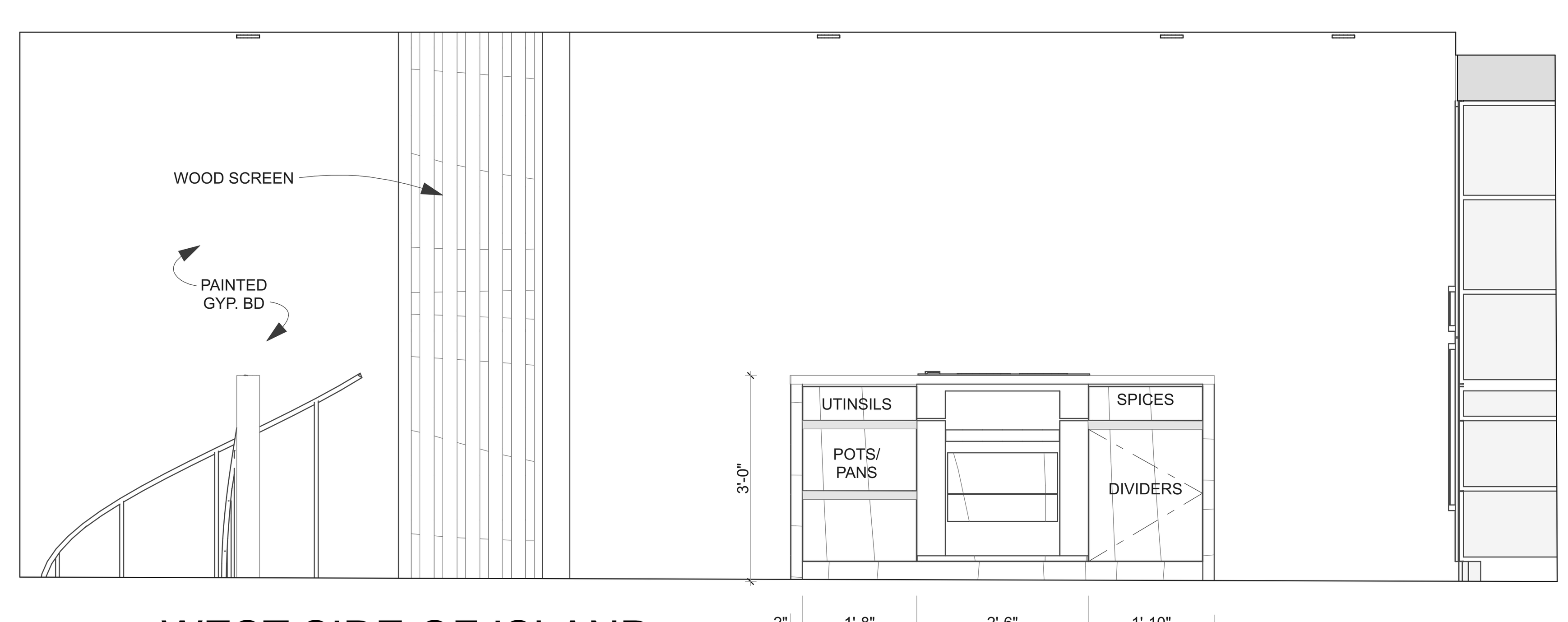


7 NORTH SIDE OF ISLAND
SCALE: 1/2" = 1'-0"



6 EAST SIDE OF ISLAND
SCALE: 1/2" = 1'-0"

4 SOUTH SIDE OF ISLAND
SCALE: 1/2" = 1'-0"




5 WEST SIDE OF ISLAND
SCALE: 1/2" = 1'-0"

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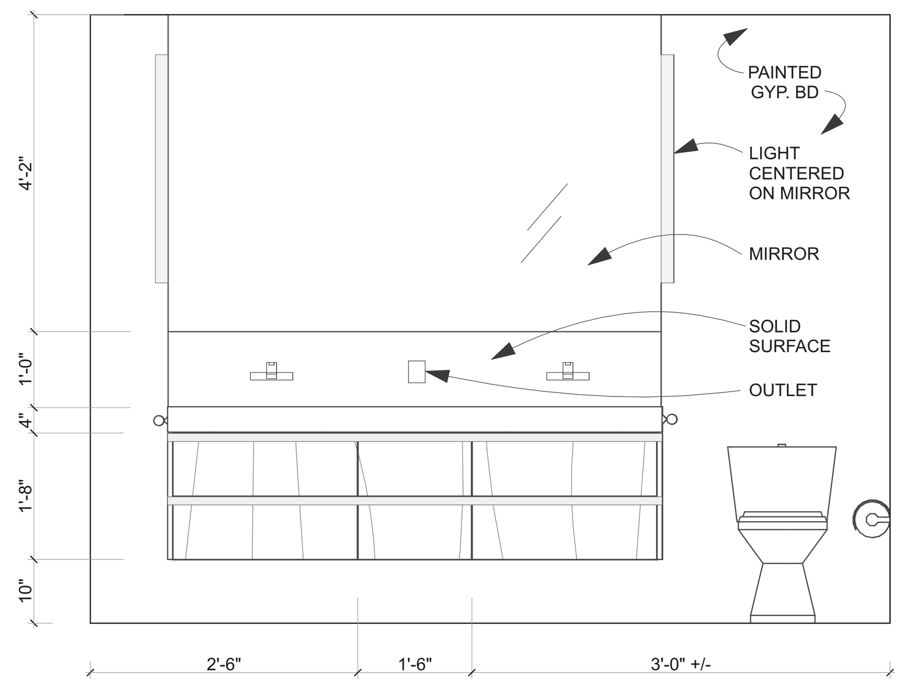
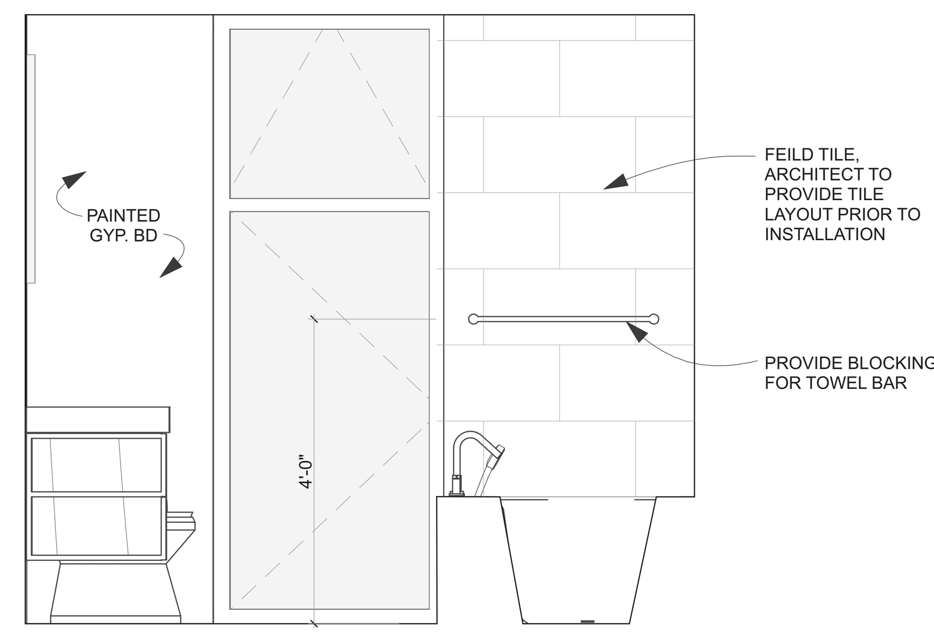
KITCHEN

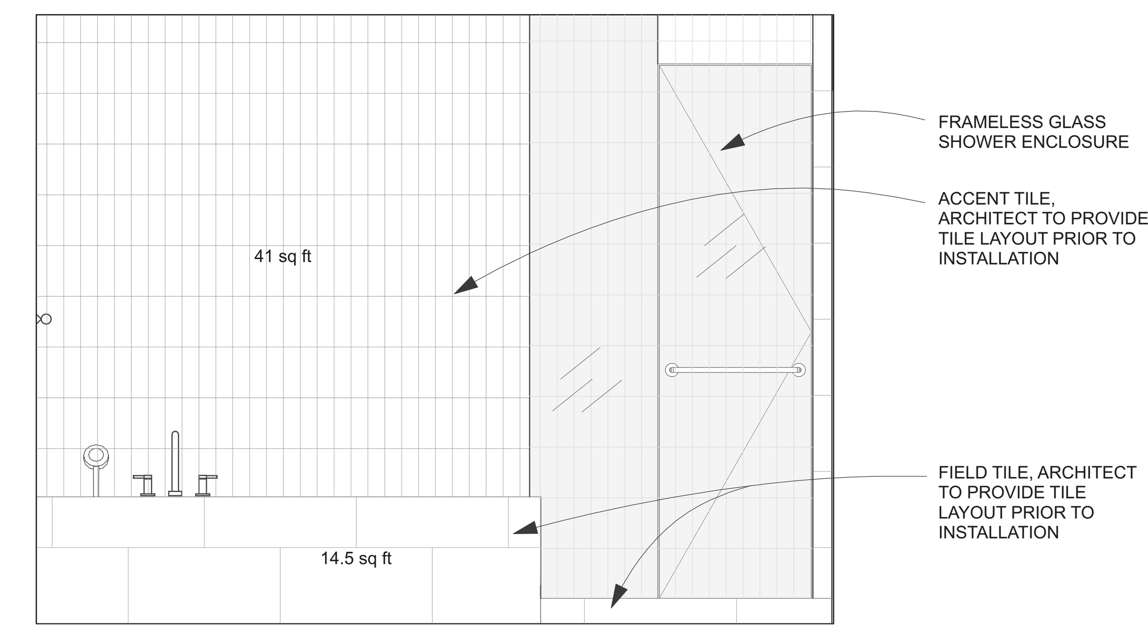
A7.0




2 MASTER BATHROOM NORTH
SCALE: 1/2" = 1'-0"




3 MASTER BATHROOM EAST
SCALE: 1/2" = 1'-0"




4 MASTER BATHROOM SOUTH
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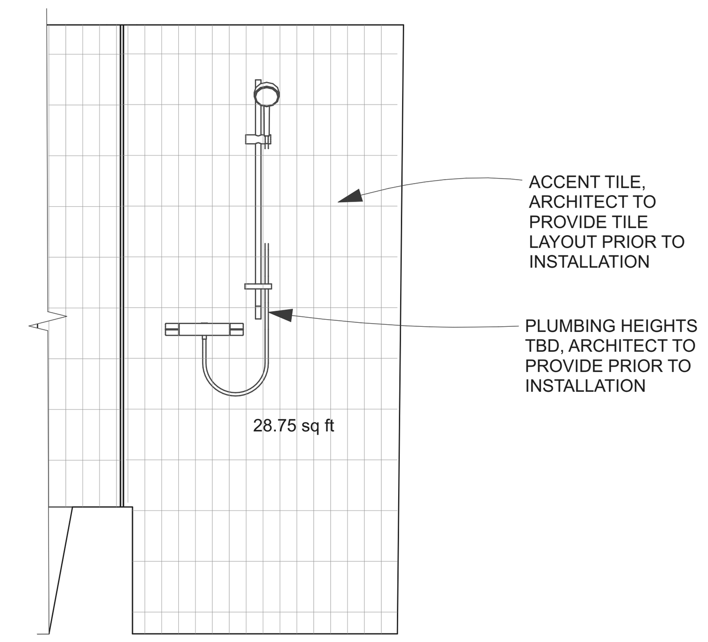
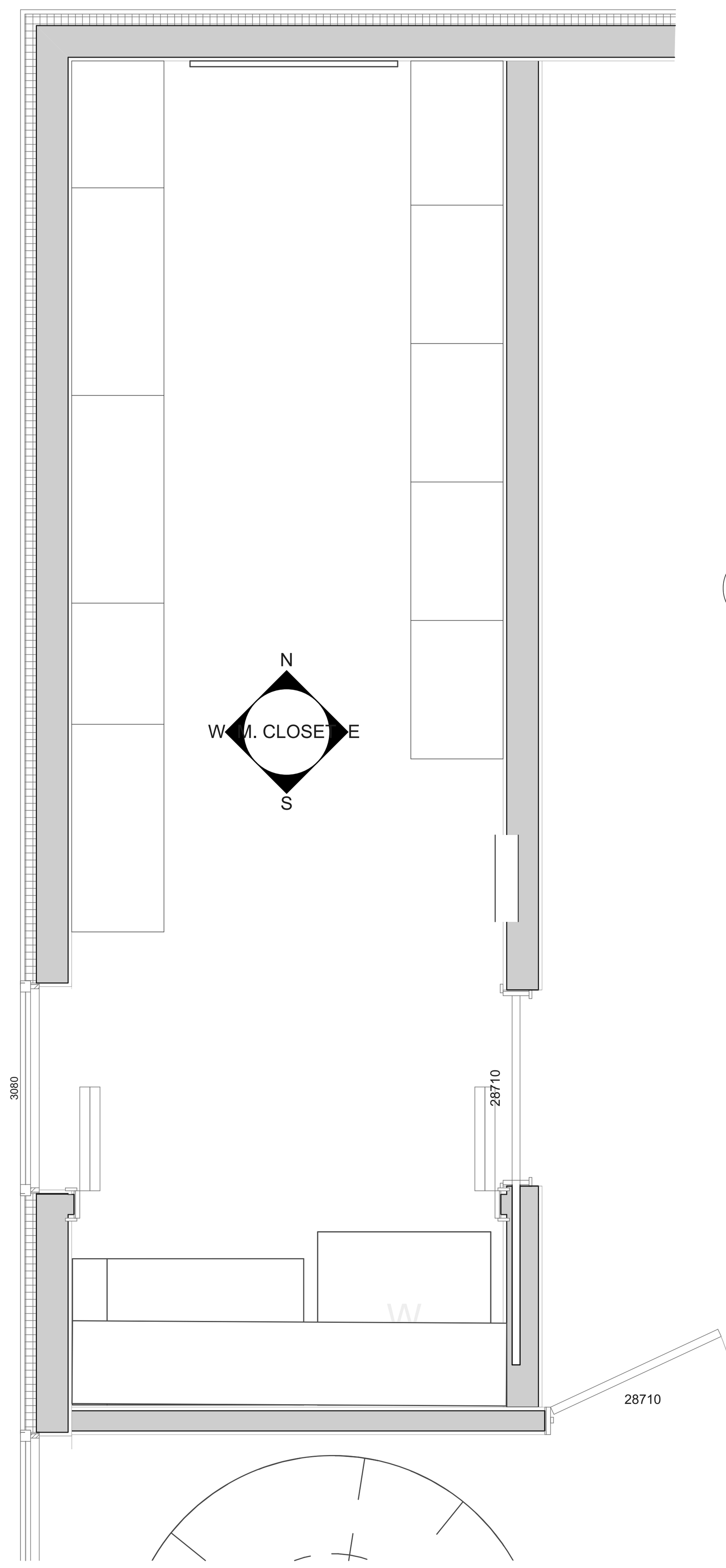
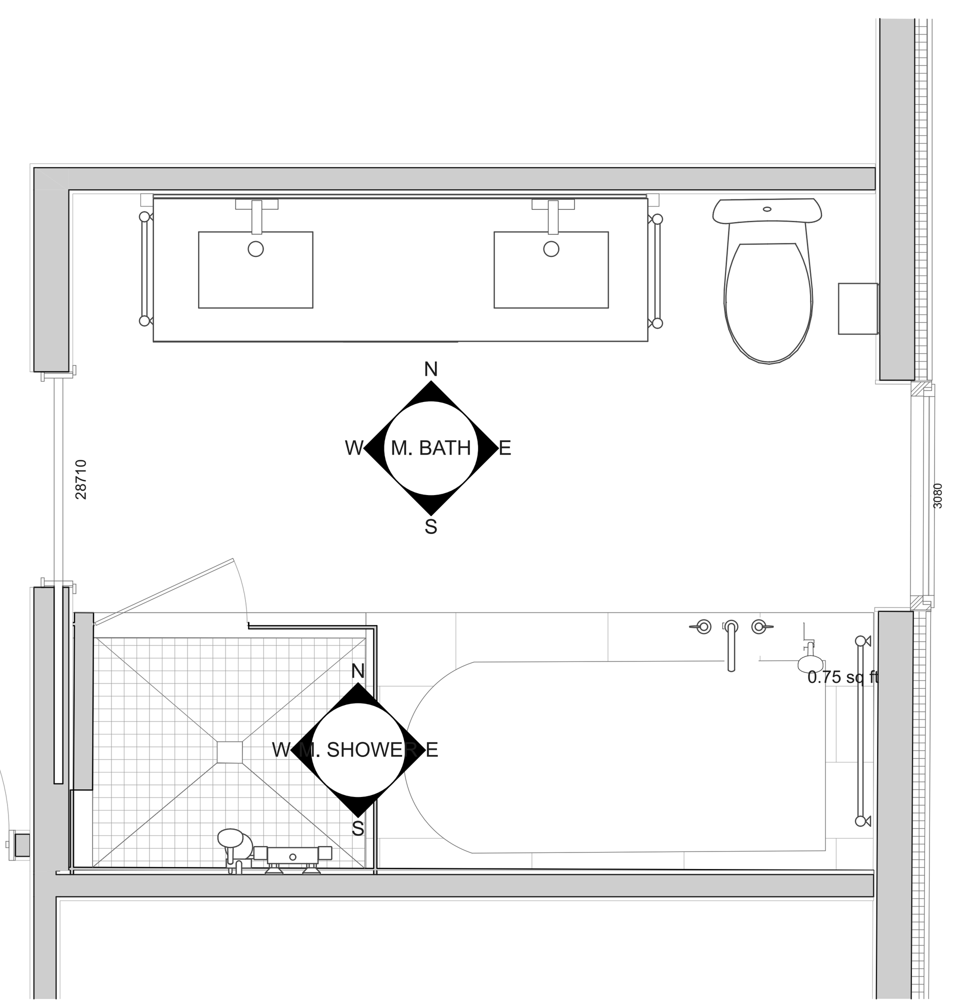


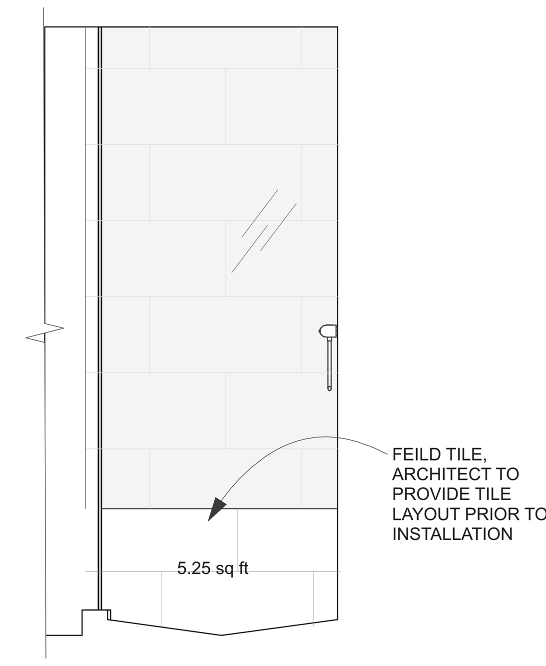

5 SHOWER SOUTH
SCALE: 1/2" = 1'-0"



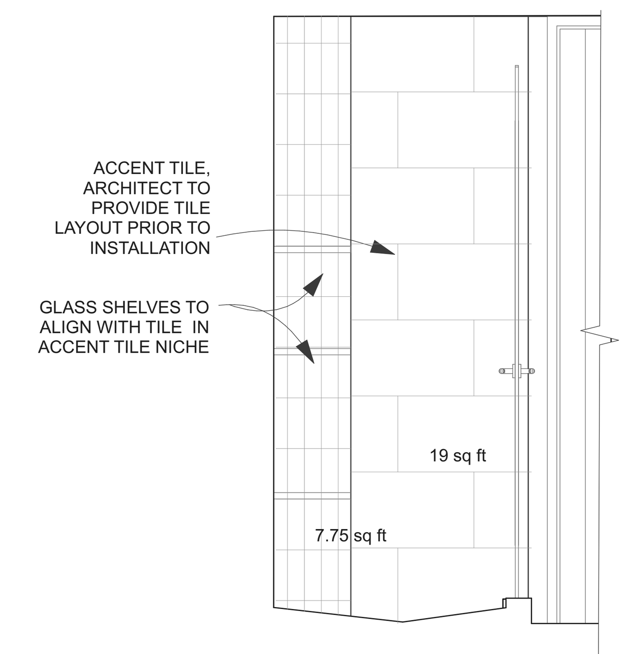



1 MASTER BATHROOM & CLOSET
SCALE: 1/2" = 1'-0"

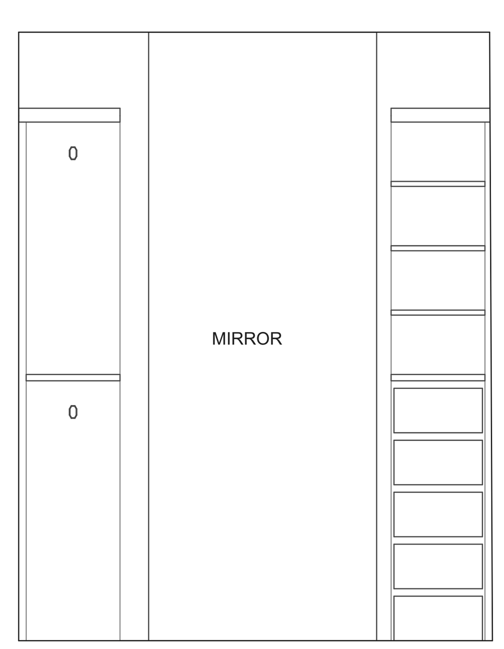

6 MASTER BAHTROOM WEST
SCALE: 1/2" = 1'-0"



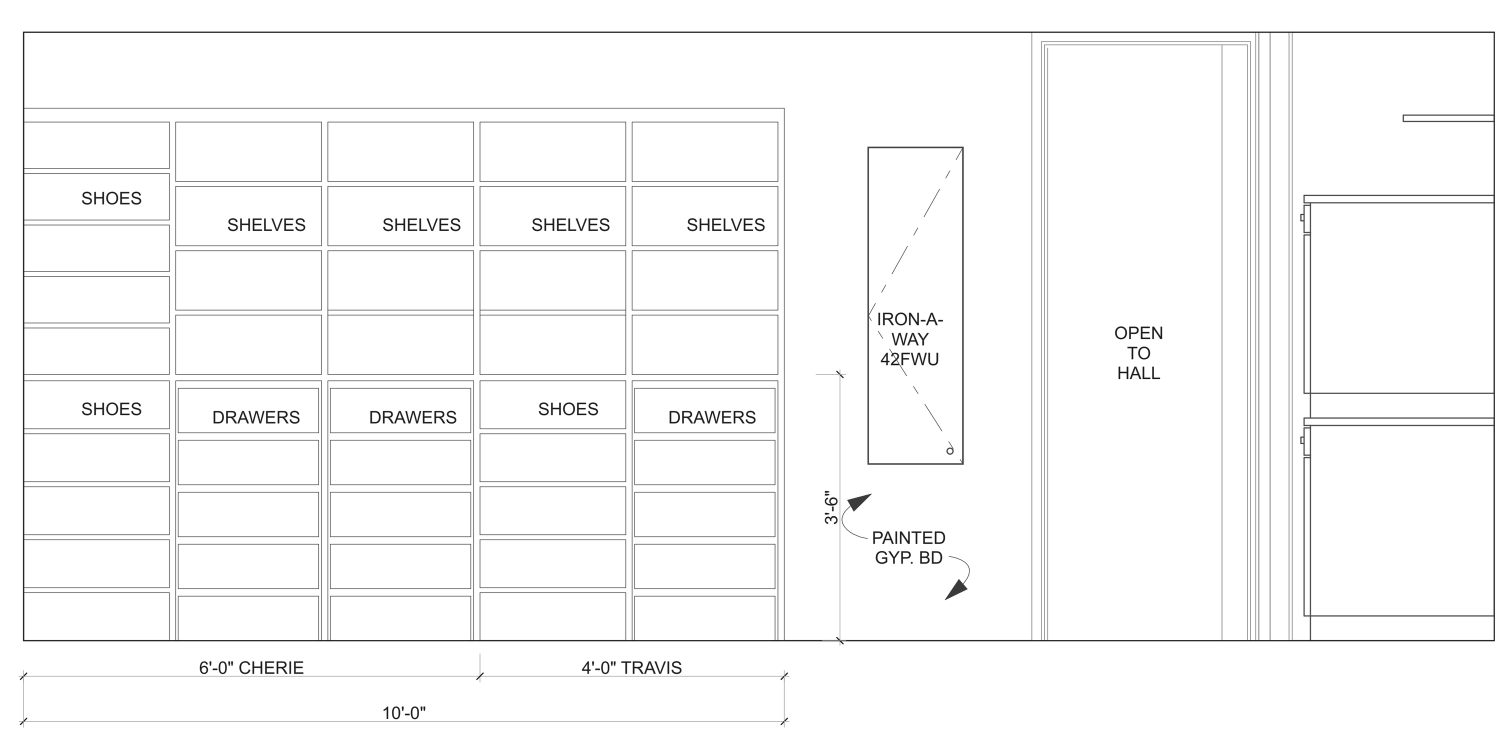

7 SHOWER EAST
SCALE: 1/2" = 1'-0"



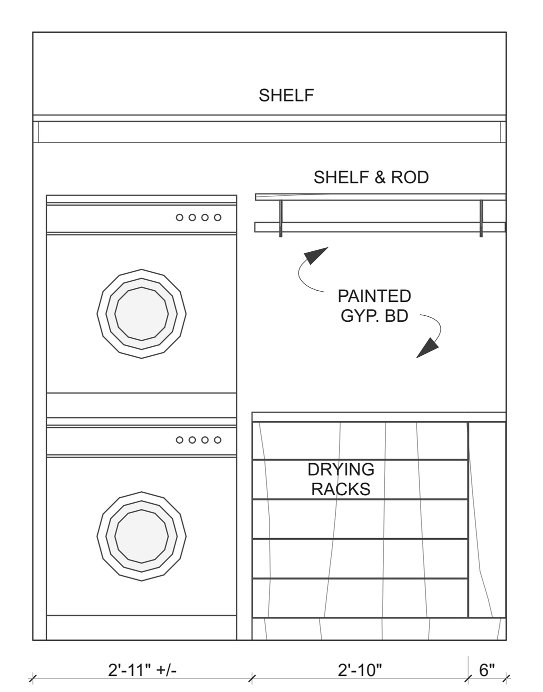

9 SHOWER WEST
SCALE: 1/2" = 1'-0"



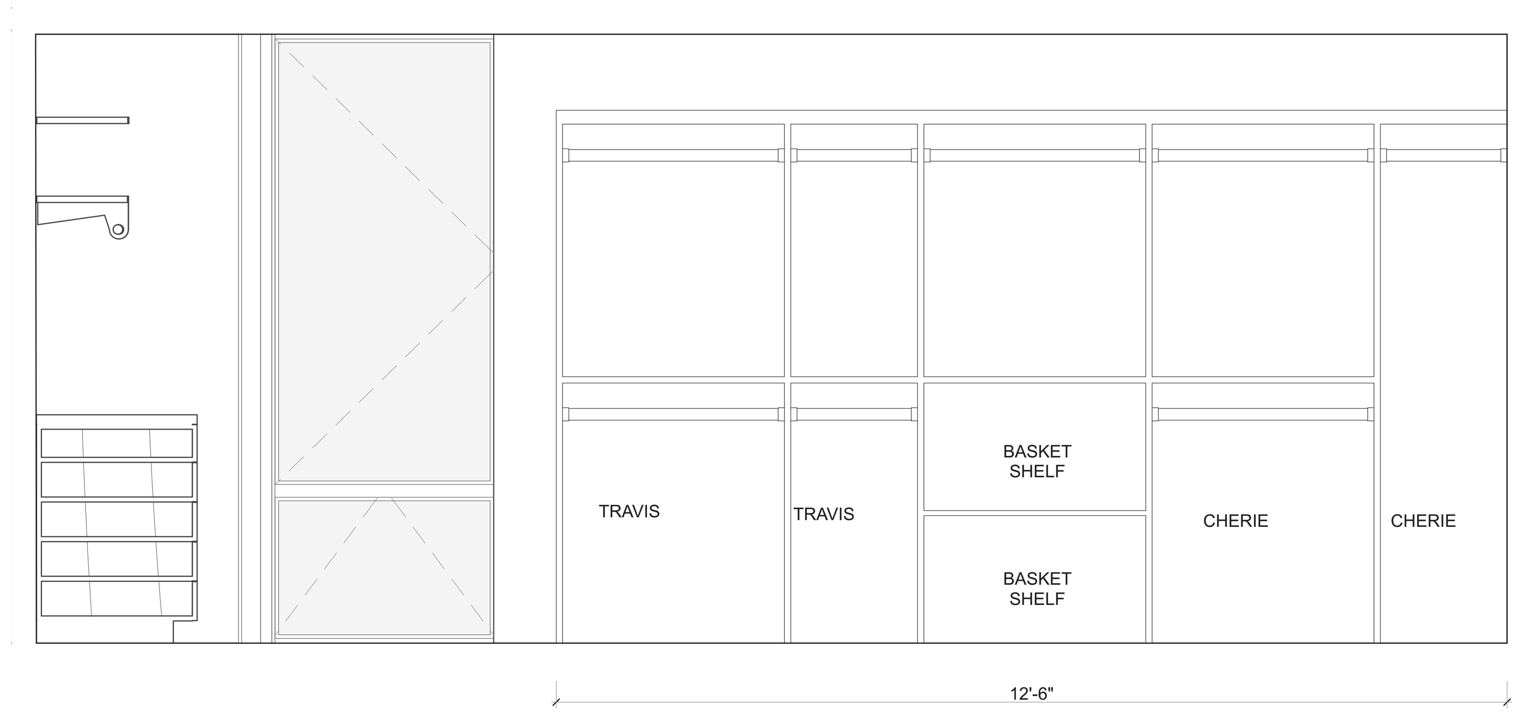

11 CLOSET EAST
SCALE: 1/2" = 1'-0"




10 CLOSET NORTH
SCALE: 1/2" = 1'-0"




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




13 CLOSET WEST
SCALE: 1/2" = 1'-0"

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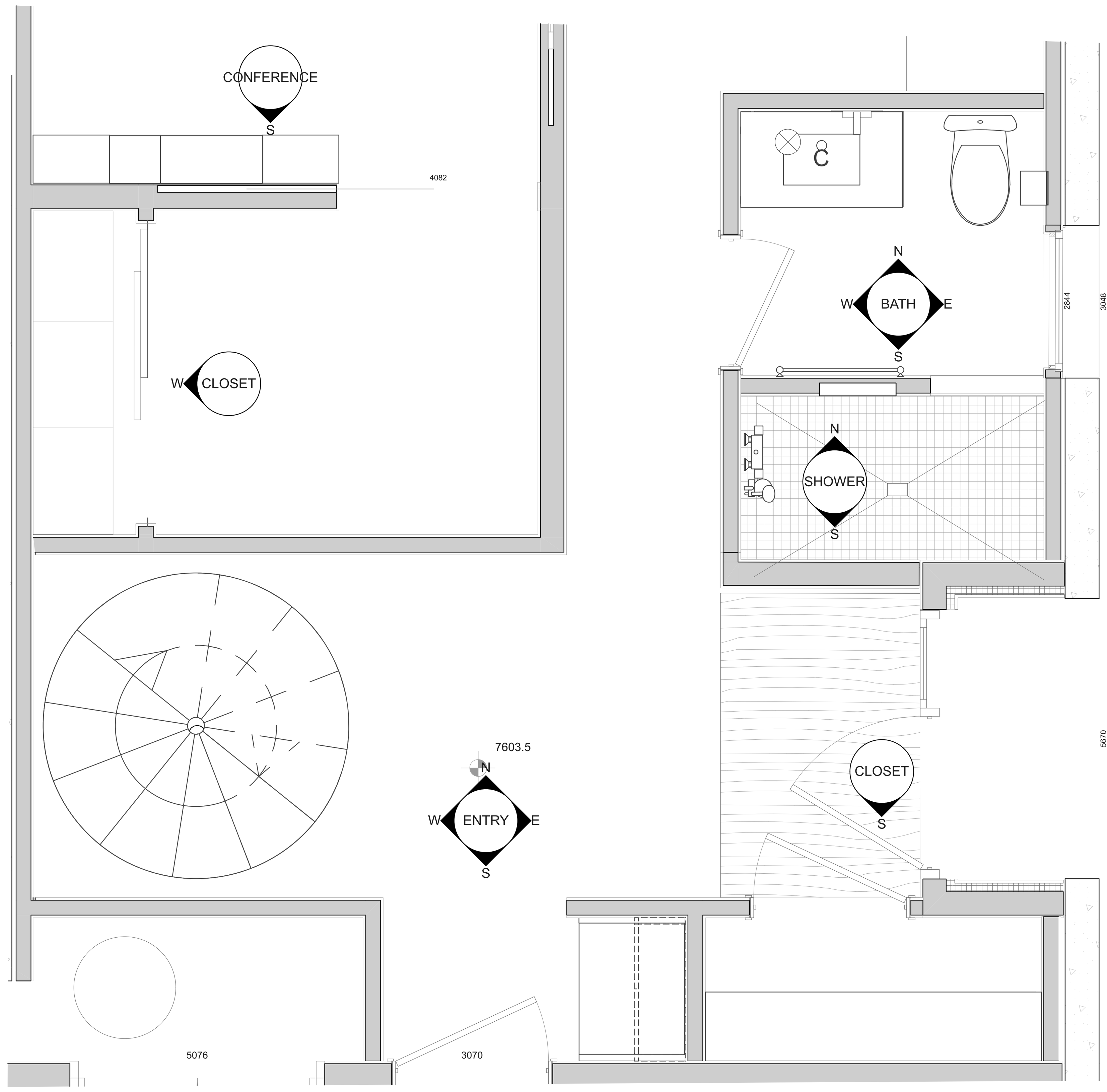
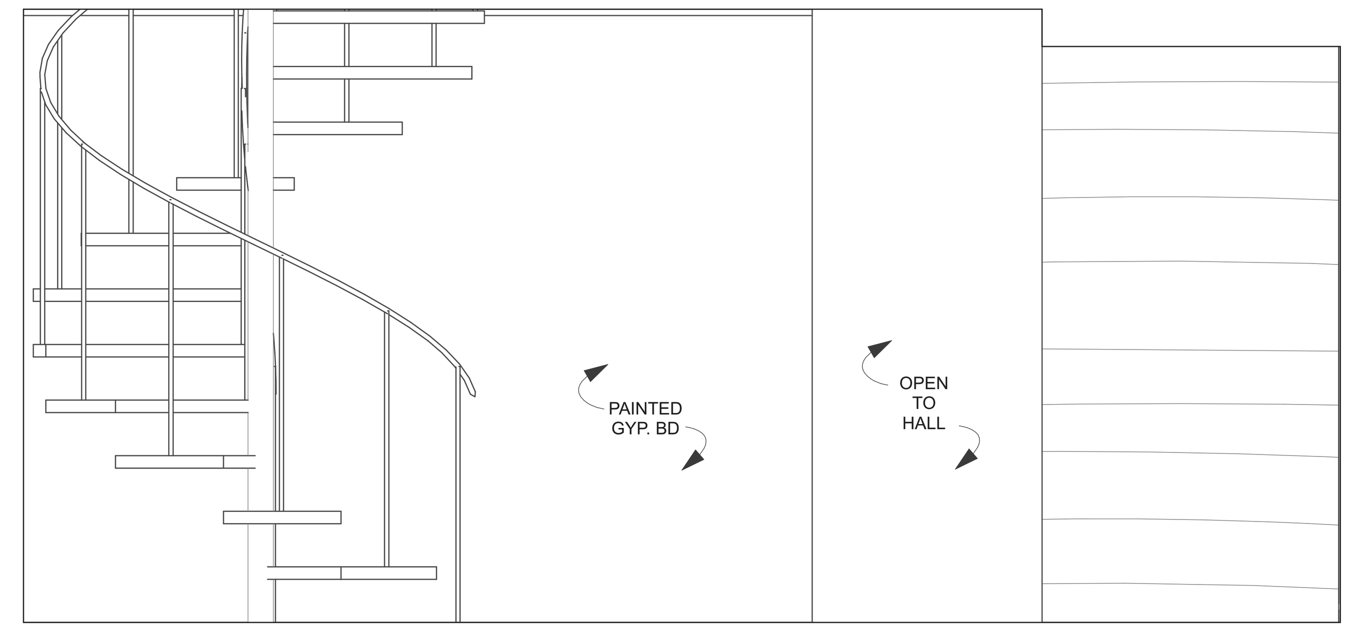
MASTER BATH, CLOSET AND LAUNDRY

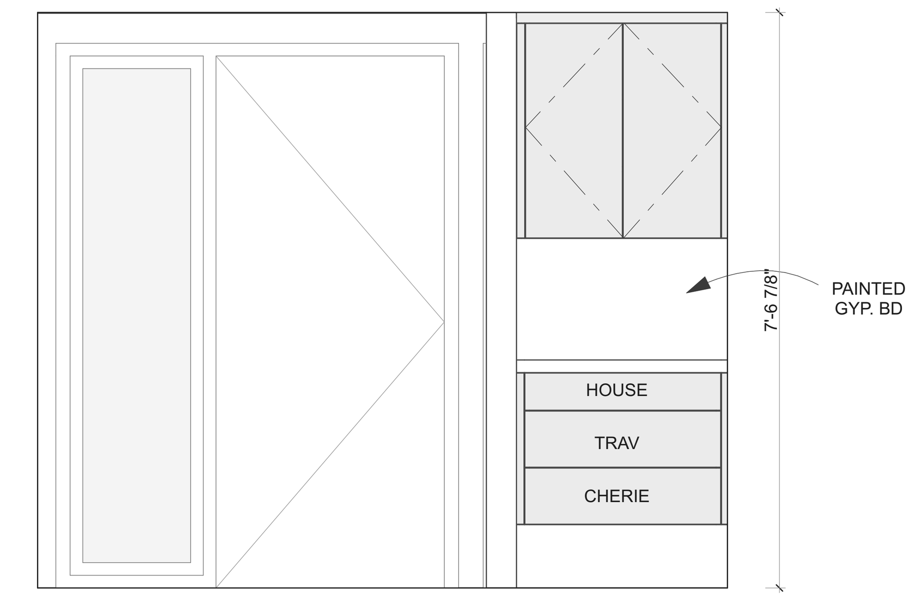
A7.1



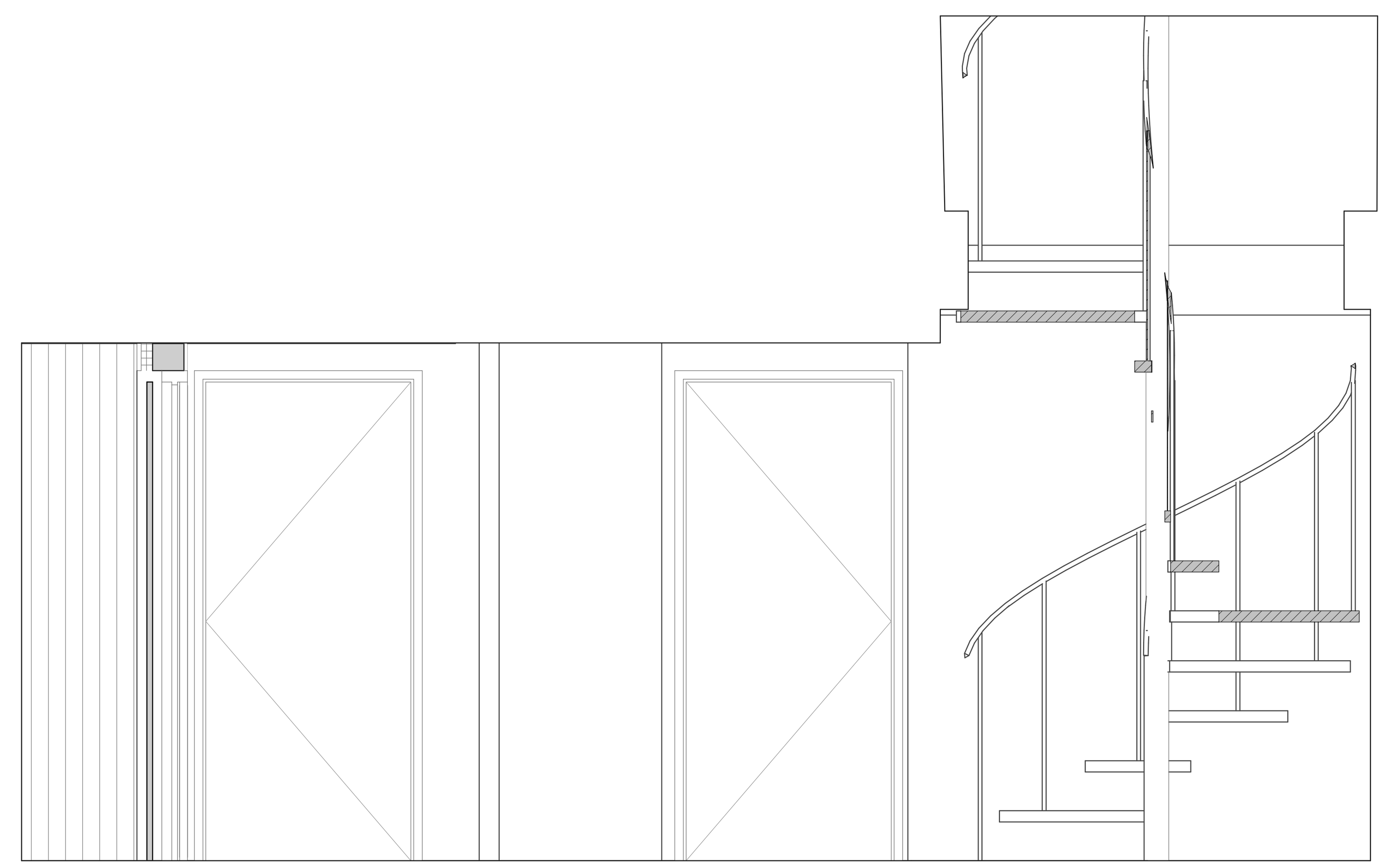

1 BASEMENT
SCALE: 1/2" = 1'-0"



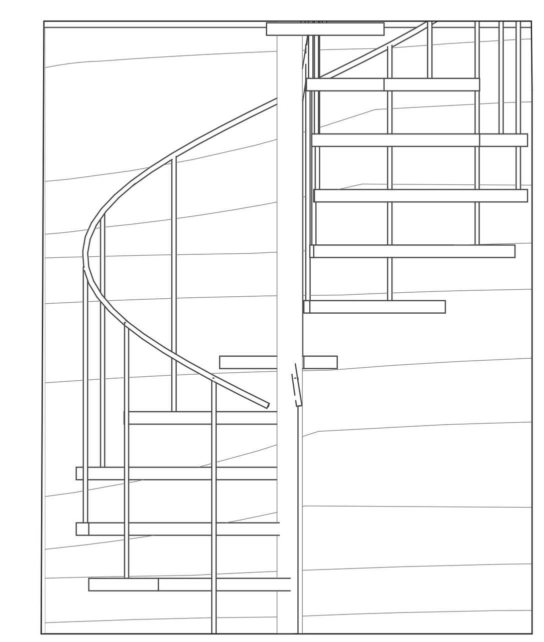

2 ENTRY NORTH
SCALE: 1/2" = 1'-0"



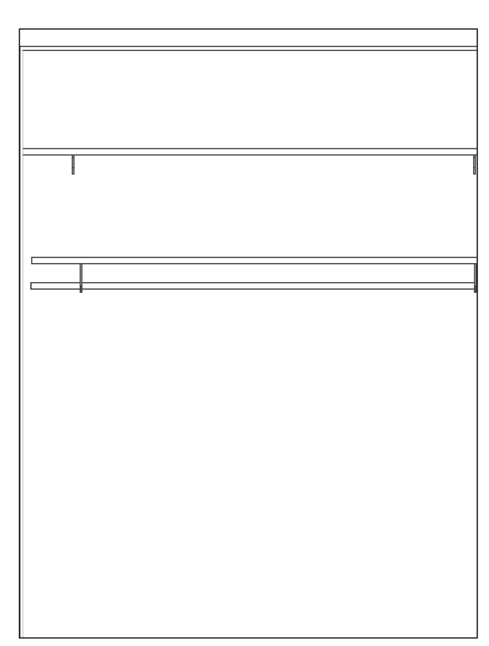

3 ENTRY EAST
SCALE: 1/2" = 1'-0"



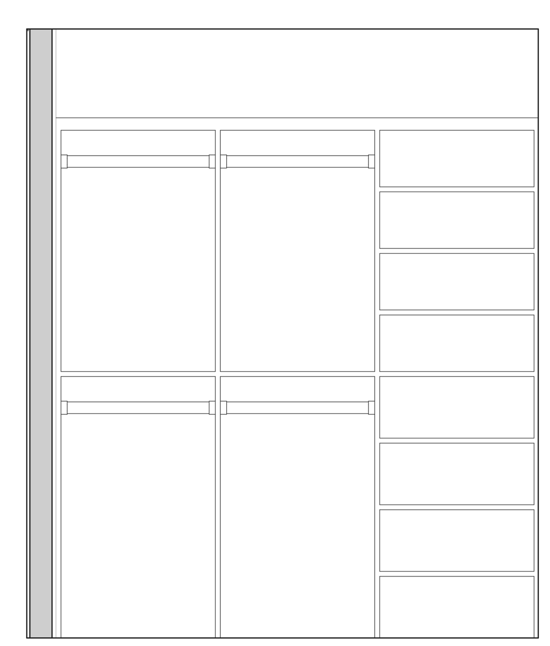
4 ENTRY SOUTH
SCALE: 1/2" = 1'-0"



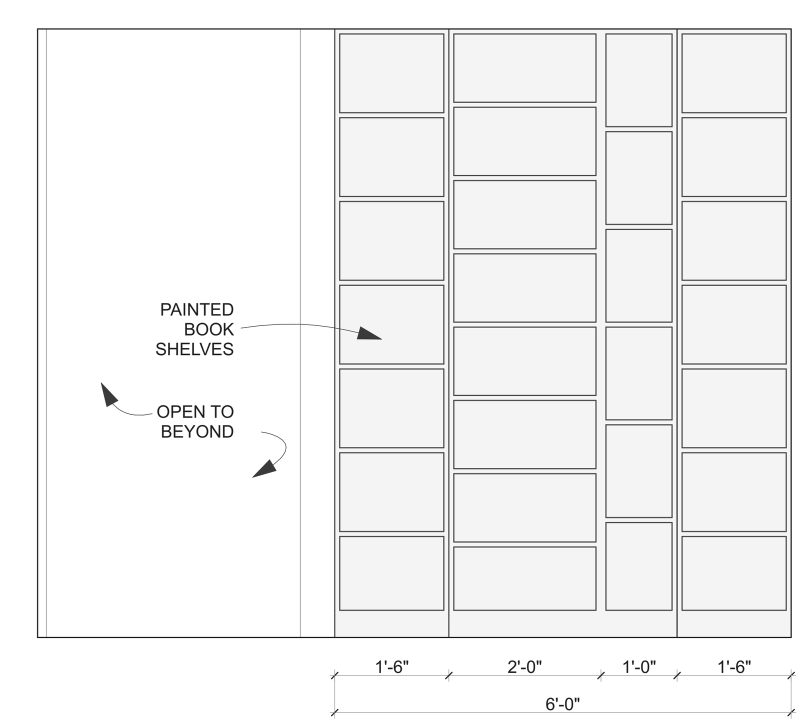
5 ENTRY WEST
SCALE: 1/2" = 1'-0"



6 ENTRY CLOSET
SCALE: 1/2" = 1'-0"



7 EXERCISE NOOK CLOSET
SCALE: 1/2" = 1'-0"




8 BOOKCASE
SCALE: 1/2" = 1'-0"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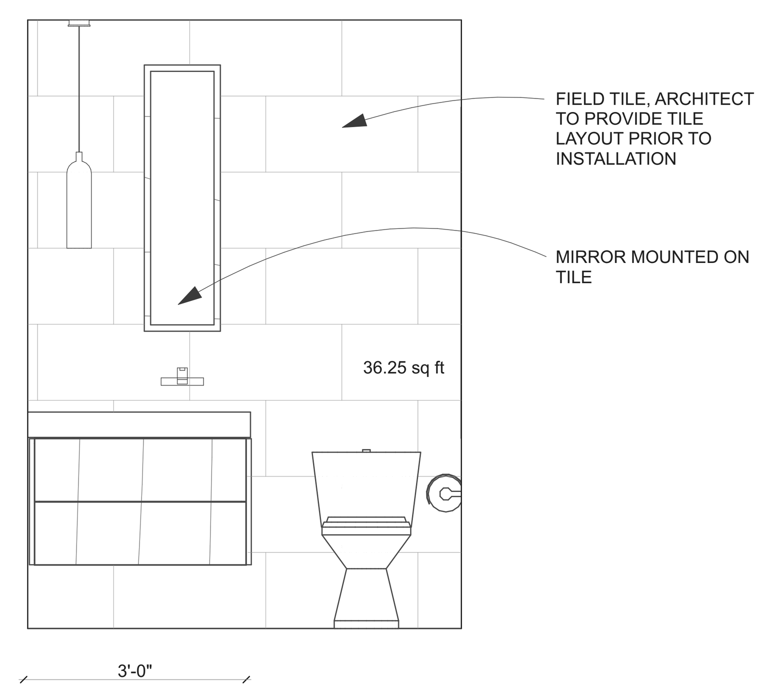
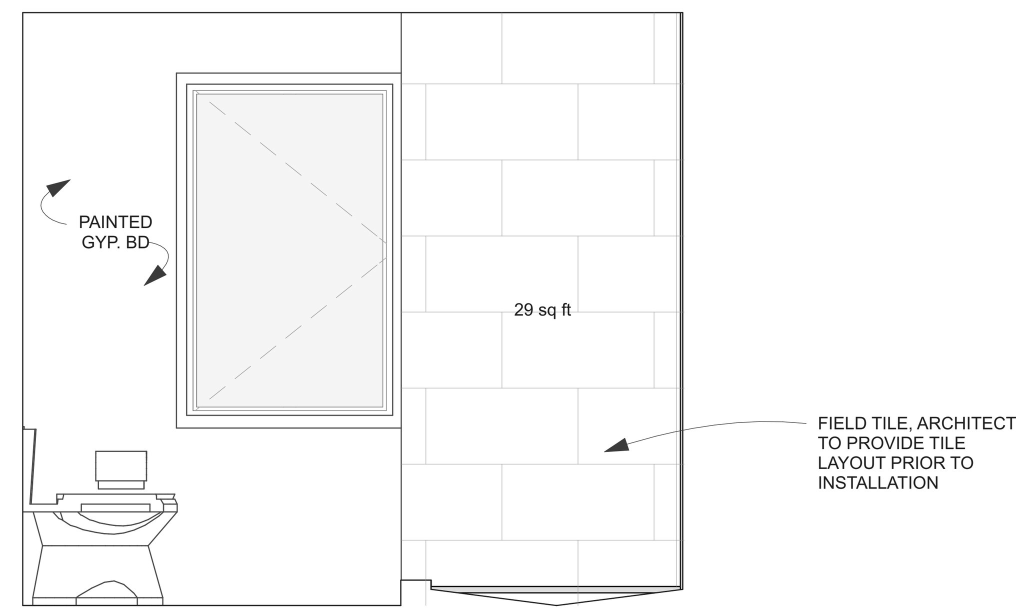
ENTRY, CLOSETS, AND GUEST ROOM BUILT IN

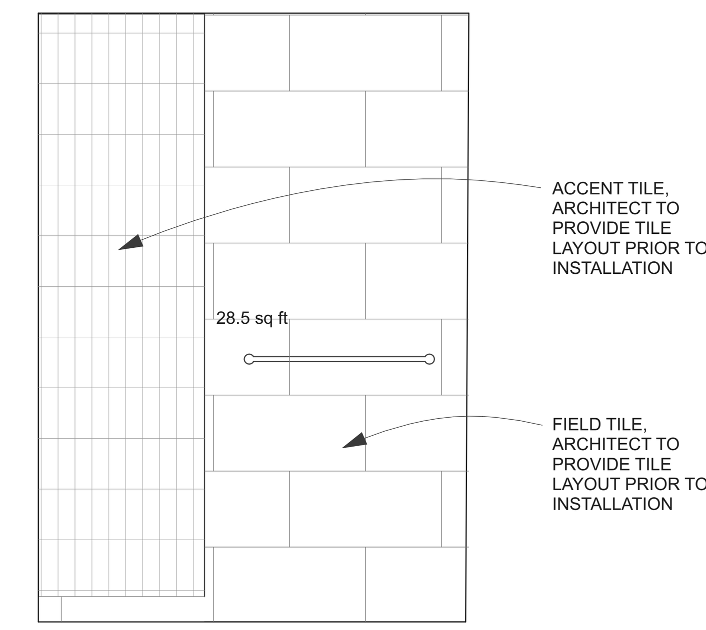
A7.2



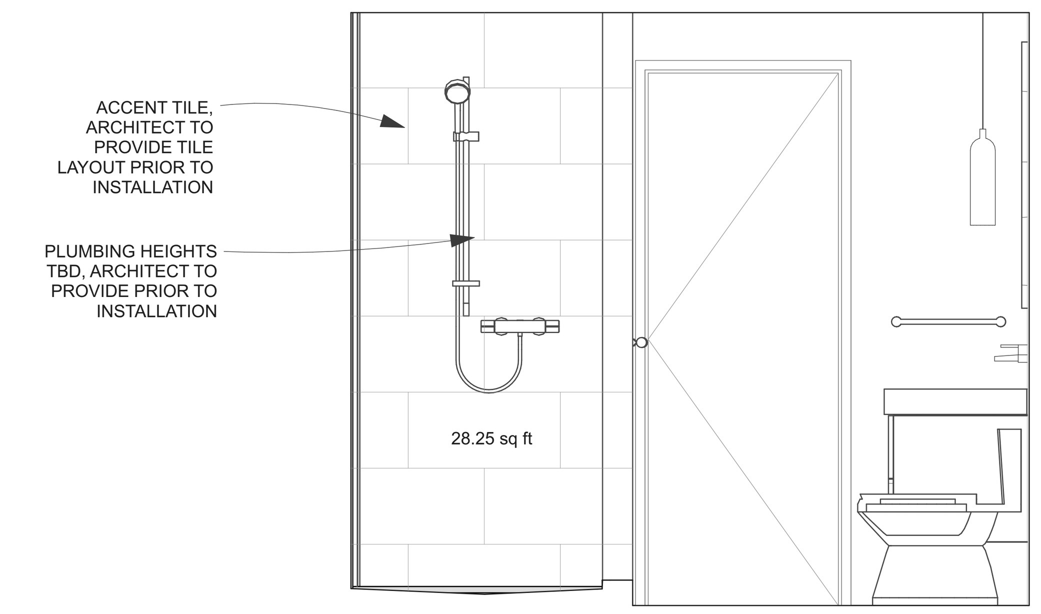

1 BATH NORTH
SCALE: 1/2" = 1'-0"



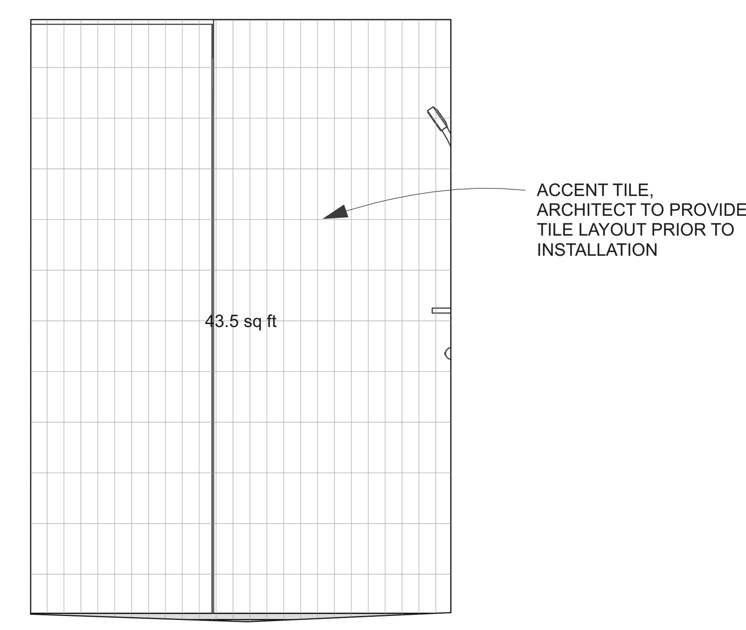

2 BATH EAST
SCALE: 1/2" = 1'-0"



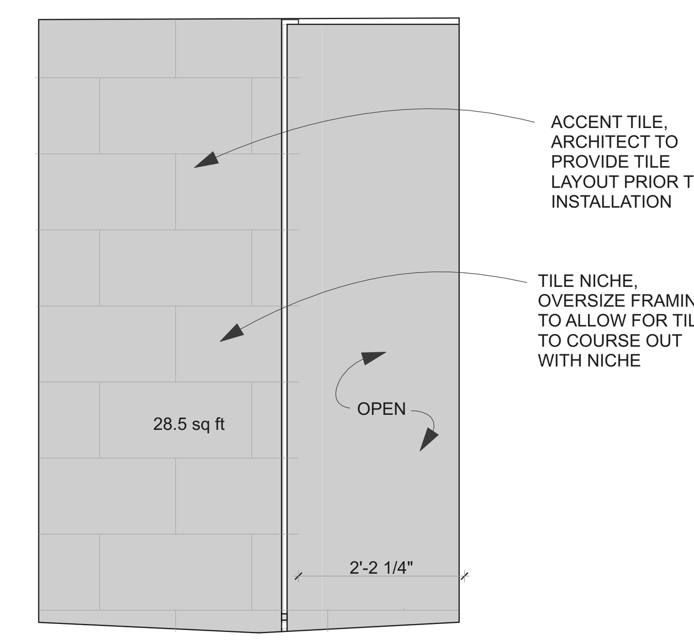

3 BATH SOUTH
SCALE: 1/2" = 1'-0"



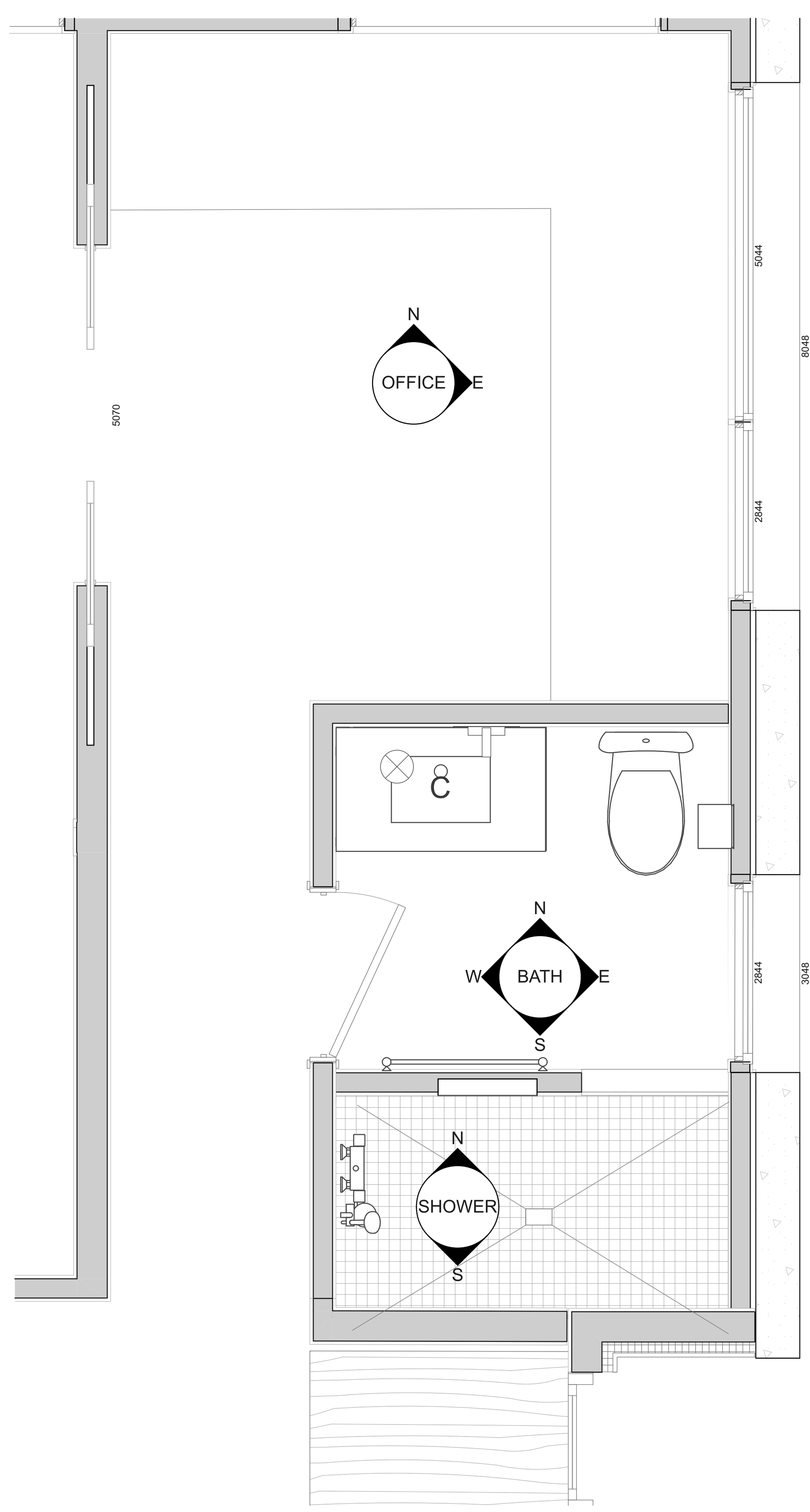

4 BATH WEST
SCALE: 1/2" = 1'-0"



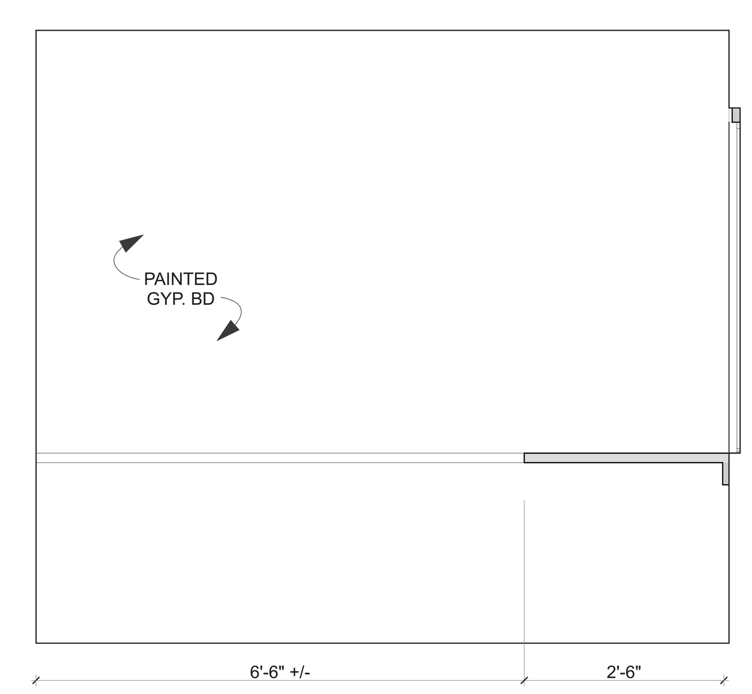

5 SHOWER SOUTH
SCALE: 1/2" = 1'-0"



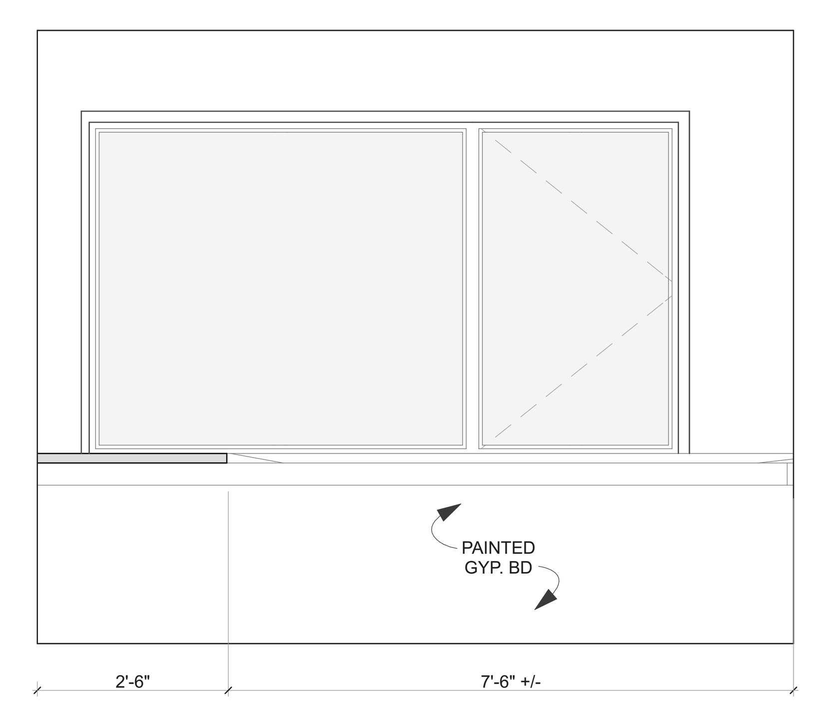

6 SHOWER NORTH
SCALE: 1/2" = 1'-0"




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




8 OFFICE NORTH
SCALE: 1/2" = 1'-0"




7 OFFICE EAST
SCALE: 1/2" = 1'-0"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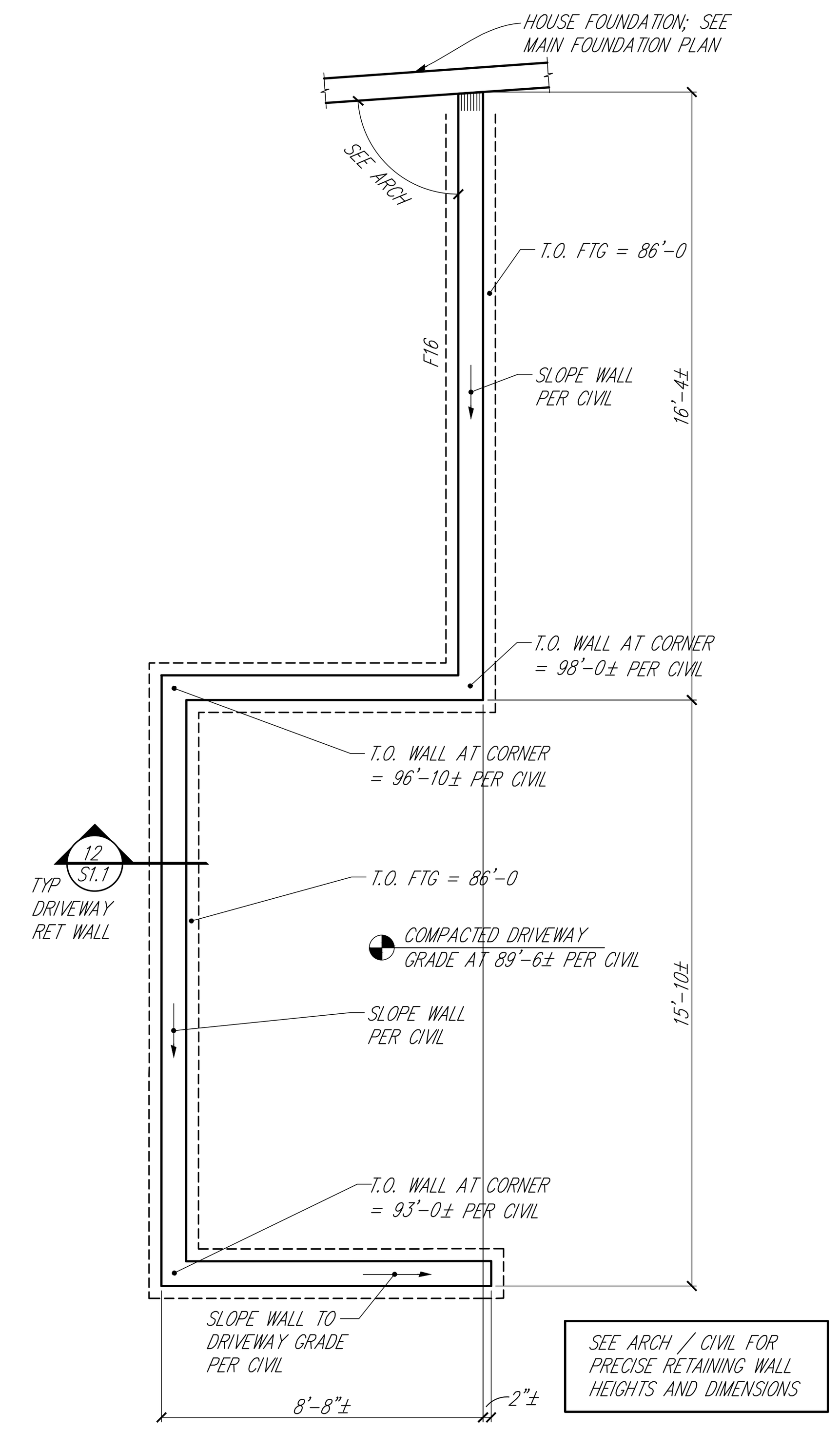
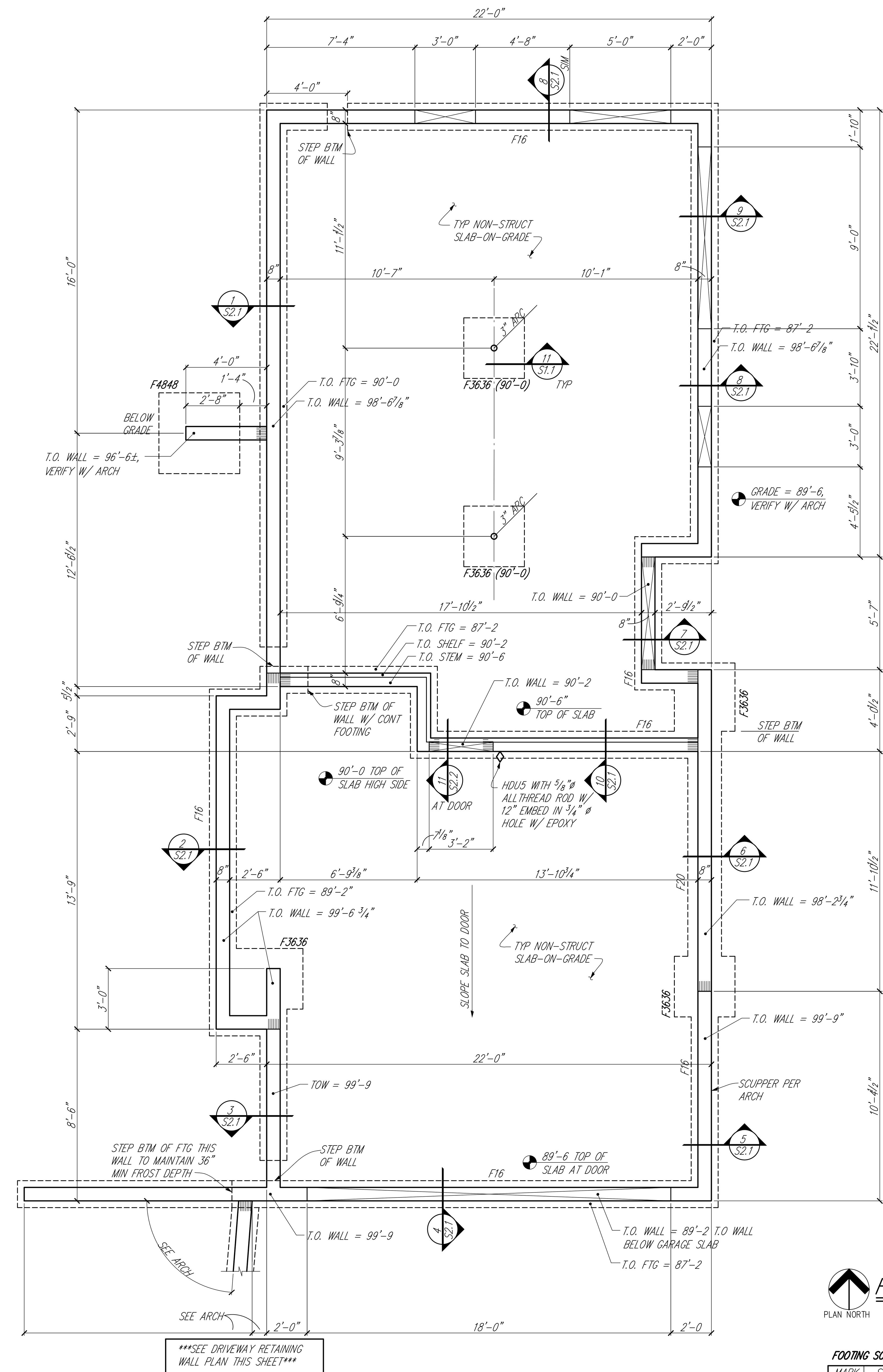
BATH& OFFICE

A7.3




PLAN NORTH **DRIVEWAY RET WALL PLAN**
1/4"=1'-0

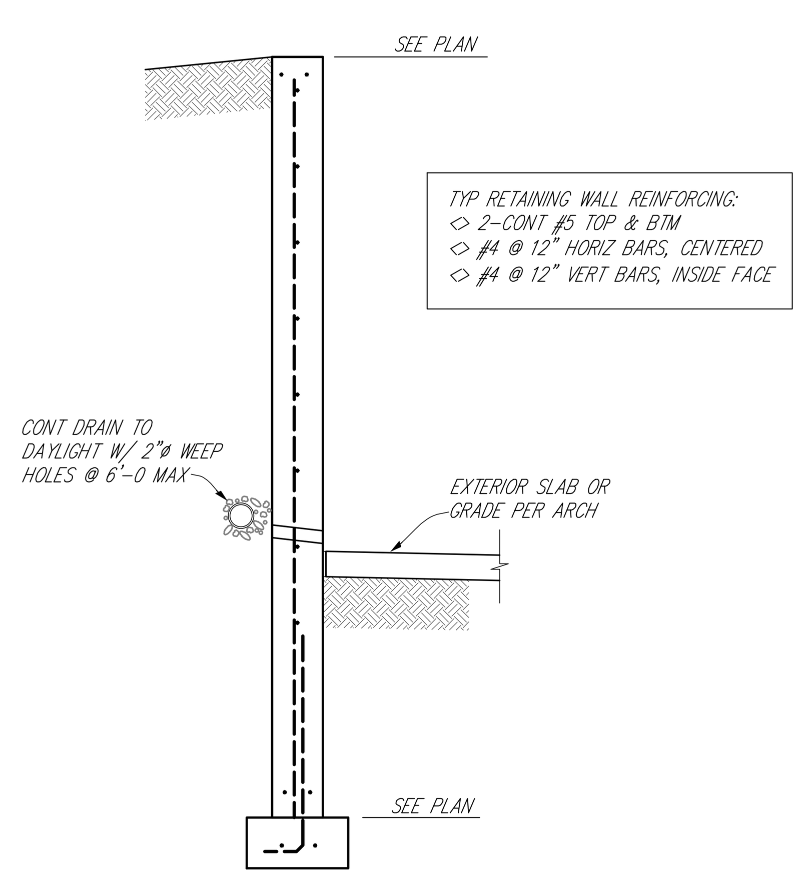



***SEE DRIVEWAY RETAINING WALL PLAN THIS SHEET***

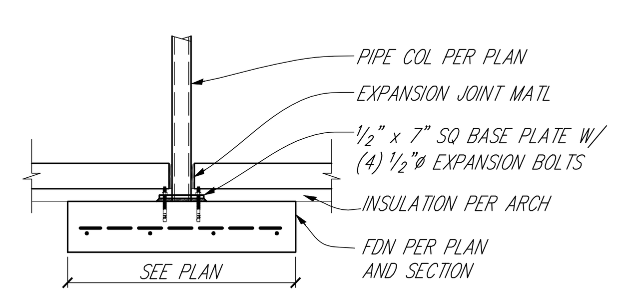
PLAN NORTH **FOUNDATION PLAN**
1/4"=1'-0

**FOOTING SCHEDULE**

| MARK | SIZE | REINFORCING |
|---|---|---|
| F16 | 8"x1'-4" x CONT | 2'-8 / 8" #4 DOWELS @ 24"<br>2-#5 CONT MID-DEPTH |
| F20 | 8"x1'-8" x CONT | 2'-8 / 8" #4 DOWELS @ 24"<br>2-#5 CONT MID-DEPTH |
| F3636 | 10"x3'-0" SQUARE | 3-#4 EA WAY, 3" CLR BTM OF FOOTING |
| F4848 | 12"x4'-0" SQUARE | 4-#4 EA WAY, 3" CLR BTM OF FOOTING |




DETAIL 12/S1.1 1/2"=1'-0



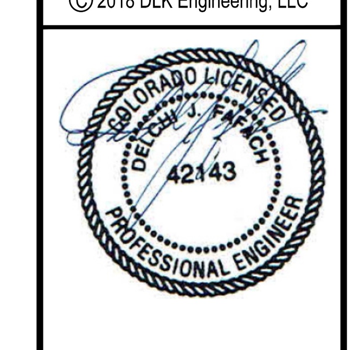

DETAIL 11/S1.1 1/2"=1'-0

DLK
DLK ENGINEERING, LLC
STRUCTURAL ENGINEERING CONSULTING
1300 PLAZA CT NORTH
LAFAYETTE, CO 80026
www.DLKENG.com
LAFAYETTE: 720-696-0355
LOVELAND: 970-699-5310
INFO@DLKENG.COM

# BLUE MOUNTAIN
## 9020 BRUMM TRAIL
GOLDEN, CO 80403

| | |
|---|---|
| Goff | DLK JOB # |
| 10.11.2019 | DATE |
| BY: DLK | |
| REVSIONS: | |
| No. | Description |






SHEET NO.
S1.1

## GENERAL STRUCTURAL NOTES

DESIGN LIVE LOADS:

Design loads are per the 2015 International Residential Code (IRC / the Code) unless noted otherwise.

- Risk category II (from ASCE 7 Table 1–1)
- Floors 40 psf
- Sleeping Rooms 30 psf
- Exterior Decks 40 psf
- Ground Snow, $P_g$ 68 psf
- Roof Snow, $P=0.7C_eC_tIP_g$ 48 psf
- Wind speed ($V_{asd}$, 3 second gust) 100 mph, Exposure C
- Wind speed ($V_{ult}$) 129 mph, Exposure C

SOILS AND FOUNDATION

- Soils Report: Project No. 2255 by Kordziel Engineering in 07/22/2019
- The soils report is hereby referenced, and all recommendations and precautions contained in that report shall be adhered to by the Owner and Contractor except where otherwise specifically noted.

CONCRETE AND REINFORCEMENT:

- Structural slabs shall have 4000 psi compressive strength at 28 days ($f'_c$). Other concrete shall have 3500 psi $f'_c$. All cement shall be Type I/II.
- Place rebar 3" clear of soil and 1 ½" clear of forms except as noted. Splice bars 50 diameters (18" for #3, 24" for #4, 32" for #5). Add (2) #5 or (3) #4 bars around openings with 32" straight extensions at corners of opening.
- Place concrete continuously without horizontal cold joints.
- Concrete shall conform to applicable provisions of ACI 301 and 318. All rebar shall be ASTM A615 grade 60 fabricated and placed per ACI Manual of Standard Practice (ACI 315) and Welded Wire Fabric (WWF) shall be ASTM A185. Keep reinforcement clean and free of dirt, oil, and scale.
- Unless noted otherwise, anchors fastened to concrete with epoxy shall have a hole 1/8" larger in diameter than the anchor, installed per manufacturer's instructions, and shall be either Simpson "SET" or Hilti HIT HY 150 / HIT–ICE.

STRUCTURAL STEEL:

- Steel material shall be as follows unless specifically noted otherwise:
  - * Wide–flange beams.: ASTM A992
  - * Bolts and anchors ASTM A307 or A36, except as noted
  - * Standard pipe columns: ASTM A 53, Grade B, 35 ksi.
- All structural steel shall be fabricated and erected per the current edition of AISC Steel Construction Manual.
- Welding shall be by qualified welders. Use E70XX electrodes and 3/16" fillet welds unless noted otherwise.
- Adjustable caps NOT allowed on columns UNO on plans.
- Non–shrink grout beneath column base and beam bearing plates shall be non–metallic with minimum compressive strength of 5,000 psi.
- STEEL BEAMS:
  - * All beams shall have full depth web stiffeners both sides at steel columns above and below.
  - * At flush steel beams which receive top mounted hangers, rip 2x nailer to exact beam width plus 3/8" and attach to top flange with construction adhesive and 5/32" diameter powder actuated drive pins @ 24" or 1/2" diameter machine bolts @ 32", staggered. Plate shall overhang beam flange (at least 1/8" but not more than 1/4") on both sides to prevent hangers from contacting steel beam. Set joists in hangers with adhesive.
  - * At dropped steel beams bearing on built–up studs, bear beams on stud end grain. Install 2x6 vertical blocking between beam flanges and nail king studs thereto with at least (6) 16d nails each side unless noted otherwise.
  - * All beams shall be braced against rotation at points of bearing. At beam pockets in concrete, grout beam bearing solid around shims.

WOOD FRAMING:

- All framing and details not specifically specified shall comply with the prescriptive (non–engineered) requirements of the Code.
- Nominal 2x and 3x lumber shall be Douglas Fir #2. Optionally, 2x4 & 2x6 members may be #2 Hem–Fir except as noted.
- Timbers (nominal 4x and wider) shall be Douglas Fir No. 1, $F_b$=1,350 psi, E=1,600,000 psi.
- Laminated Veneer Lumber (LVL): Manufactured 1–3/4" width with $F_b$=2,600 psi, E=2,000,000 psi, $F_v$=285 psi.
- LSL studs and wall plates shall be "Timberstrand" by Weyerhaeuser. Sill plates and other LSL in contact with concrete shall be "StrandGuard" by Weyerhaeuser. All LSL material, including StrandGaurd, is only for dry use and shall not be in contact with soil.
- Floor sheathing shall be T&G Sturd–I–Floor (23/32" min) with 24" oc APA rating. Lay panels perpendicular to framing members and stagger joints with at least 2–spans per panel. Glue and nail with 10d ring–shank nails @ 6" along edges & @ 12" in fields.
- Exterior walls shall be 2x6 @ 16" with 7/16" minimum sheathing with 24/16 APA rating. Block unsupported edges and nail sheathing to all studs, plates, and nails with 8d nails @ 6" along edges & @ 12" in fields. Note additional requirements at shear walls where shown on plan.
- Pitched roof sheathing shall be 15/32" minimum with 32/16 APA rating. Lay panels perpendicular to framing members and stagger joints with at least 2–spans per panel. Glue and nail with 8d ring–shank nails @ 6" along edges & @ 12" in fields.
- "Flat roof" sheathing shall be 19/32" minimum with 40/20 APA rating. Lay panels perpendicular to framing members and stagger joints with at least 2–spans per panel. Glue and nail with 8d ring–shank nails @ 6" along edges & @ 12" in fields.
- Anchor all roof rafters, joists, and trusses to beams and walls at bearing points with H2.5A, doubled within 4'–0" of corners at hips.
- Anchor all roof girders (including girder trusses) at bearing points with double ST18 or double HTS20.
- All wood posts and columns shall be supported with posts of equal size at all walls below and with squash blocking in all platform levels to transfer load to foundation.
- All I–joist floors shall be exact product shown on plan with continuous LSL rim joist around edge of floor except as noted. Roll–block between all joists over bearing where there is no rim.
- At all double top plate breaks at junction of new addition and existing walls: Install (1) MSTC28 strap centered on plate break with (18) 16d sinkers each side.

WOOD FRAMING HARDWARE AND FASTENERS:

- Metal connectors shall be by Simpson Strong Tie and installed with nailing to achieve maximum rated capacity unless noted otherwise. Note that heavy duty and skewed hangers may require special order. Connectors in contact with treated wood shall be galvanized or stainless steel.
- FASTENERS:
  - * Framing nails in 2x lumber shall be 12d common nails (0.131" diameter x 3 ¼" long) unless noted otherwise. These nails are commonly referred to as "short sixteens" or "16d gun nails". Nails called out as "16d" on plan shall be 12d common nails except as noted below or on plan:
  - * "16d common nails" refer to 0.162" diameter x 3 ½" long. NO SUBSTITUTIONS.
  - * "16d sinker nails" refer to 0.148" diameter x 3 ¼". NO SUBSTITUTIONS.
  - * Framing connector designations refer to products by Simpson Strong–Tie Company, Inc and shall be installed as required to develop MAX fastener capacity shown in current catalog. 16d sinkers may be substituted for 16d common nails in hangers except as noted on plan.
  - * Nails in roof, wall, and floor sheathing, as well as nails designated as "8d" nails on plan, shall be 8d ring shank gun nails (0.113" diameter x 2 ½" long) unless noted otherwise. Nail all sheathing with 8d @ 6"/12" minimum unless noted otherwise.

USE OF PLANS, OBSERVATIONS, INSPECTIONS, AND SHOP DRAWINGS

- Field verify (FV or VIF) all existing (EX or EXIST) construction and dimensions noted on plans prior to construction and notify DLK Engineering and Architect of any discrepancies immediately.
- Supplier of structural components (such as rebar and structural steel) and performance–specified components (such as prefabricated floor joist systems and components supported by primary structure) shall submit shop and erection drawings for architect and engineer review. Allow five working days for review.
- Observations of foundation reinforcing, framing, etc required by the Owner, lender, insurer, building department or any other party will be accomplished by the engineer at the Owner's expense. Notify DLK at least 24–hour in advance.
- Contractor is responsible for complying with all applicable Special Inspections requirements of the Code. Special Inspections and Testing shall be performed by a qualified Special Inspector, retained by the Owner, in accordance with the applicable sections of IBC Chapter 17.
- These plans illustrate the completed structure with all elements in their final positions, properly supported and braced. The Contractor, in the proper sequence, shall provide proper shoring and bracing as may be required to achieve the final completed structure.
- These plans have been engineered for construction at the specific building site shown and shall not be used at any other site without specific review by DLK Engineering.

### TYP WOOD FRAMING MEMBER CONNECTION SCHEDULE

U.N.O. ON PLANS, CONNECT WOOD FRAMING MEMBERS AS FOLLOWS:

| MEMBER/CONDITION: | TYP CONNECTION, UNO: |
|---|---|
| SAWN LUMBER JOISTS | LUS–SERIES HANGER OF MAX HANGER HEIGHT, TO MATCH MEMBER |
| FLOOR I–JOISTS (TJIs) | IUS–SERIES HANGERS TO MATCH MEMBER SIZE W/ 10d x 1 1/2" NAILS |
| SLOPED ROOF RAFTERS: SAWN OR ENGR'D LUMBER | LSSU–SERIES HANGERS TO MATCH RAFTER DEPTH AT BEAMS & LEDGERS; |
| LVL BEAMS / JOISTS | HU– OR HUC–SERIES HANGERS OF MAX HEIGHT, TO MATCH MEMBER |
| ALL ROOF JOISTS/RAFTERS: | ADD H2.5A TIES AT ALL BEARINGs; H8 TIES AT I–JOIST JOISTS/RAFTERS |

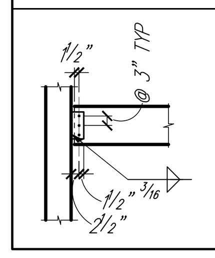
### HEAVY HANGER NAILING NOTE

FRAMING CONNECTOR DESIGNATIONS REFER TO PRODUCTS BY SIMPSON STRONG–TIE COMPANY, INC AND SHALL BE INSTALLED AS REQUIRED TO DEVELOP MAX FASTENER CAPACITY SHOWN IN CURRENT CATALOG. SEE CURRENT SIMPSON CATALOG OR "INSTALLER'S POCKET GUIDE" FOR REQUIRED NAILING. NOTE THAT HEAVY HANGERS REQUIRE 16D COMMON NAILS. "SINKERS", 12D COMMON NAILS, AND SHORT "HANGER NAILS" ARE NOT ACCEPTABLE UNLESS SPECIFICALLY NOTED ON PLAN.

### TYP STEEL FRAMING MEMBER CONNECTION SCHEDULE

U.N.O. ON PLANS, CONNECT STEEL FRAMING MEMBERS WITH STANDARD SINGLE–PLATE "CONVENTIONAL CONFIGURATION" BOLTED–WELDED CONNECTIONS PER THE AISC STEEL MANUAL, 13TH ED., AS FOLLOWS:

| SUPPORTED BM: | TYP CONNECTION (SEE NOTES BELOW): | Rn/Ω |
|---|---|---|
| W12, W14 | PL 1/4"x8 1/2" W/ (3) 3/4"Ø A325 BOLTS | 25.6 |
| W16, W18 | PL 1/4"x11 1/2" W/ (4) 3/4"Ø A325 BOLTS | 34.8 |




NOTES:

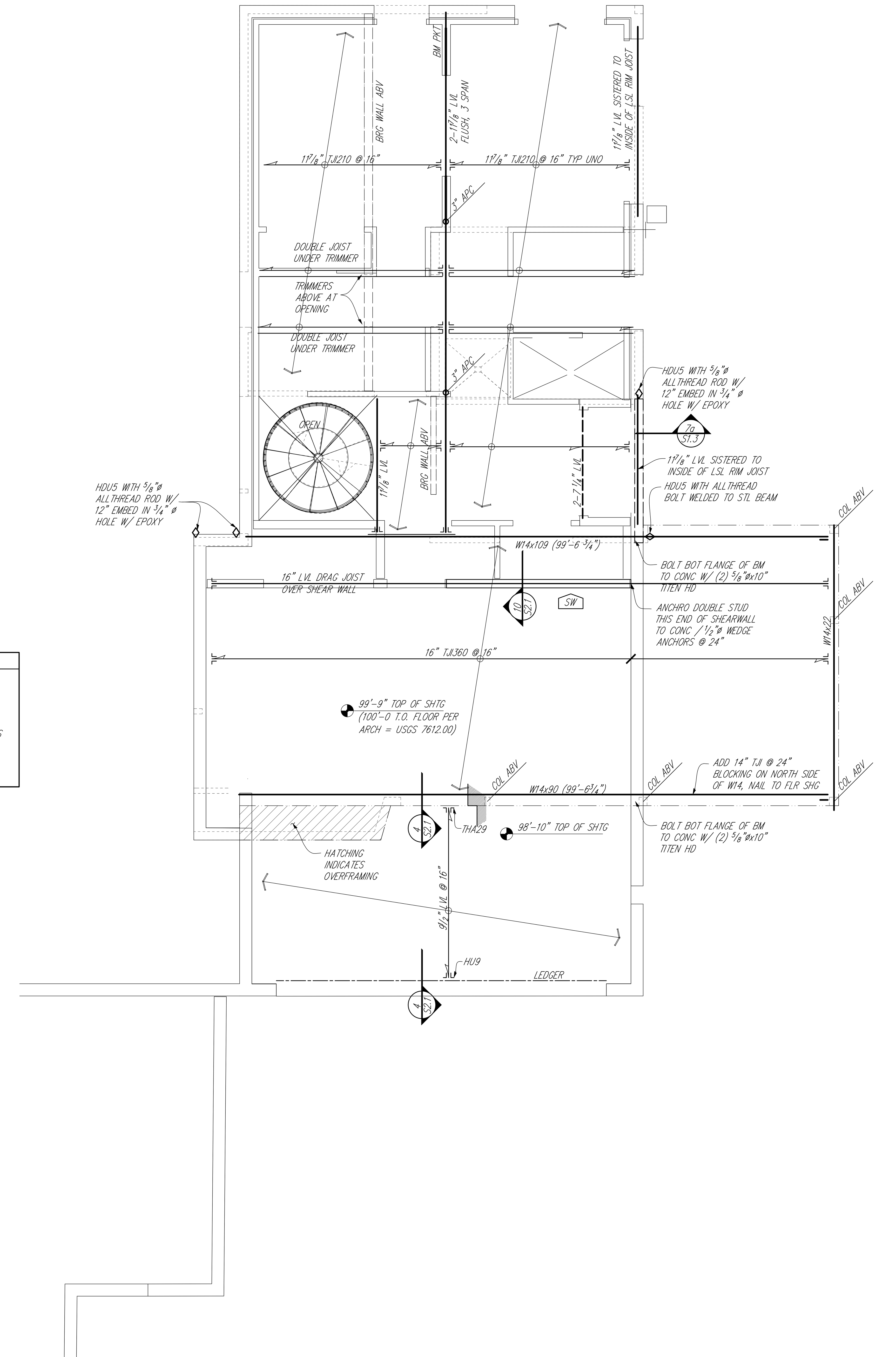
- ALL BOLTS HIGH–STRENGTH GR A325
- BEAM WEB SHALL BE 1/4" THICK, MIN
- COPE SUPPORTED BEAM FOR FIT WHERE NEEDED, BUT NOT INSIDE PLATE AREA. (ROUND ALL INSIDE CORNERS OF COPING)

### COLUMN SCHEDULE

- 3" APC – 3" PIPE STD WITH 2" MAX ADJUSTABLE CAP RATED FOR 21,000 LB WORKING LOAD.

NOTES:

- FIELD–WELD ALL COLs TOP & BTM TO BASE PLATES AND / OR BEAMS W/ 1/4" FILLET ALL AROUND (NO END PLs ON COLUMNS UNO).
- AT ALL BASEMENT COL's UNO: BASE PL SHALL BE EMBED PL OF SIZE SHOWN W/ (4) 1/2"x8" HAS AT ALIGNED WITH COLUMN CORNERS.




MAIN FLOOR FRAMING PLAN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LOVELAND: 970-699-5310
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BLUE MOUNTAIN
9020 BRUMM TRAIL
GOLDEN, CO 80403

| | |
|---|---|
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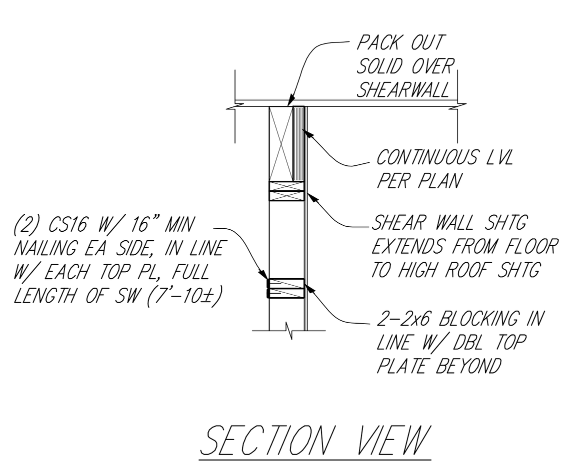
| 10.11.2019 | DATE |
| BY: DLK | |
| REVISIONS: | |
| No. | Description |

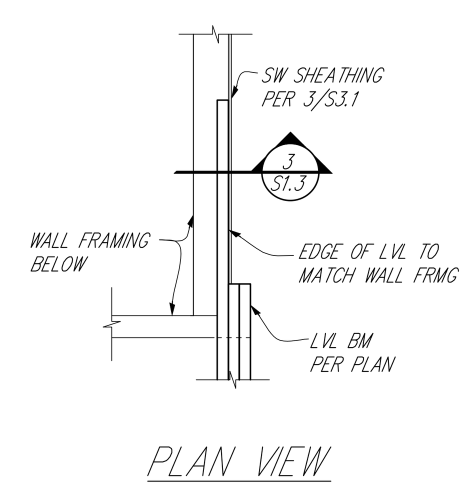


COLORADO LICENSED PROFESSIONAL ENGINEER 42143

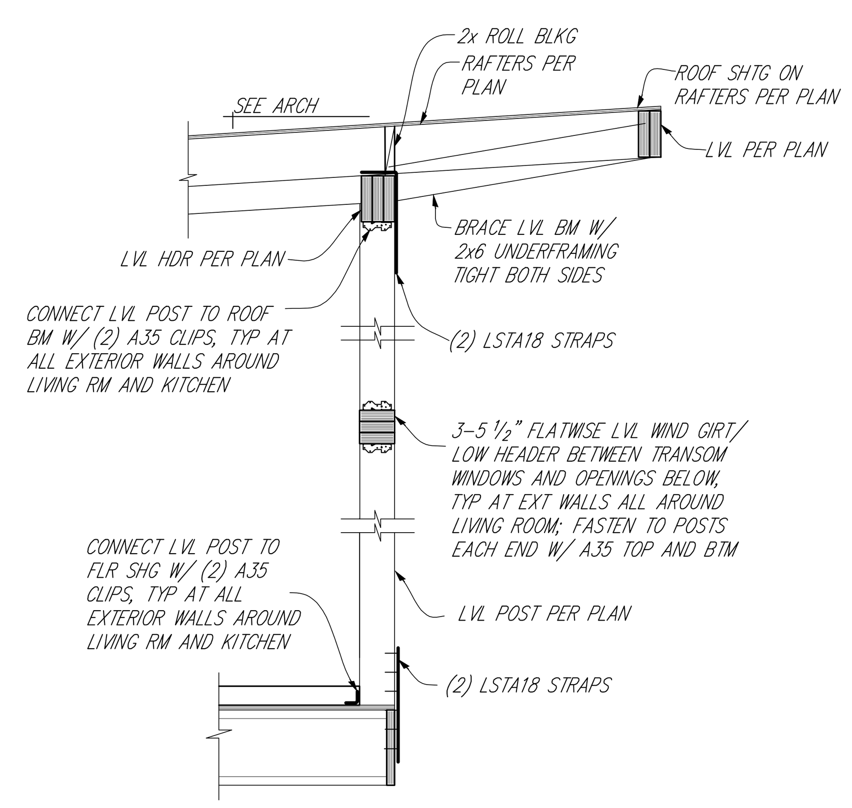
SHEET NO.
S1.2



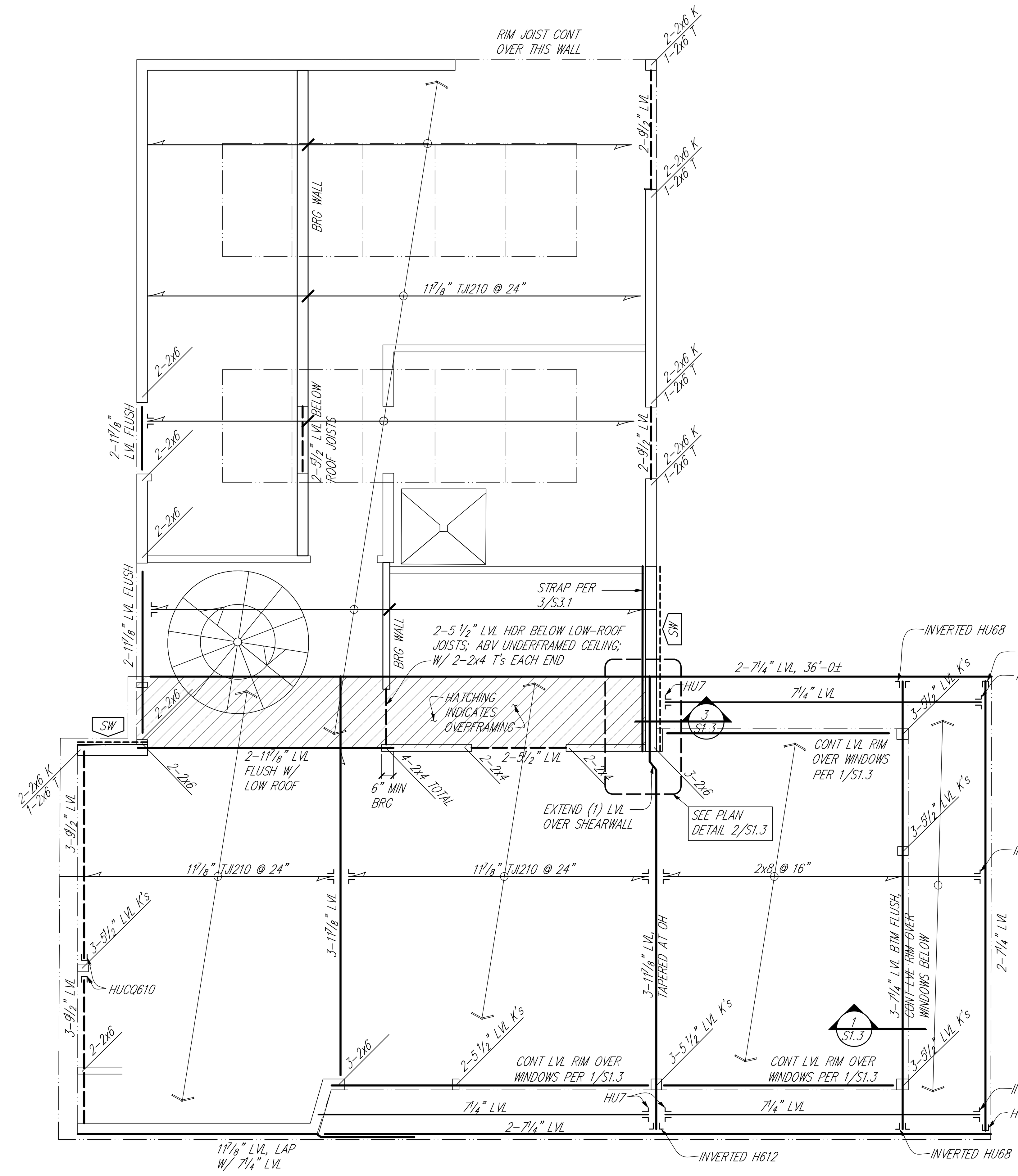

DETAIL 3/S1.3 1/2"=1'-0




DETAIL 2/S1.3 1/2"=1'-0




DETAIL 1/S1.3 1/2"=1'-0




SHEAR WALLS NOTED THUS THIS SHEET: SW WHETHER INTERIOR OR EXTERIOR WALLS, SHALL BE FRAMED & SHEATHED PER TYPICAL EXTERIOR WALLS WITH 8d NAILS @ 2" ALONG EDGES & 12" IN FIELDS

PLAN NORTH

ROOF FRAMING PLAN 1/4"=1'-0

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# BLUE MOUNTAIN
9020 BRUMM TRAIL
GOLDEN, CO 80403

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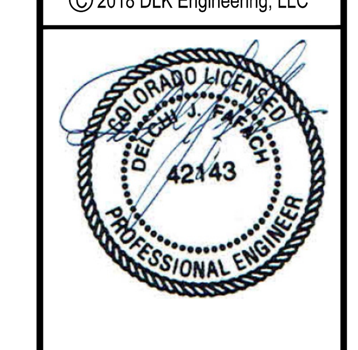
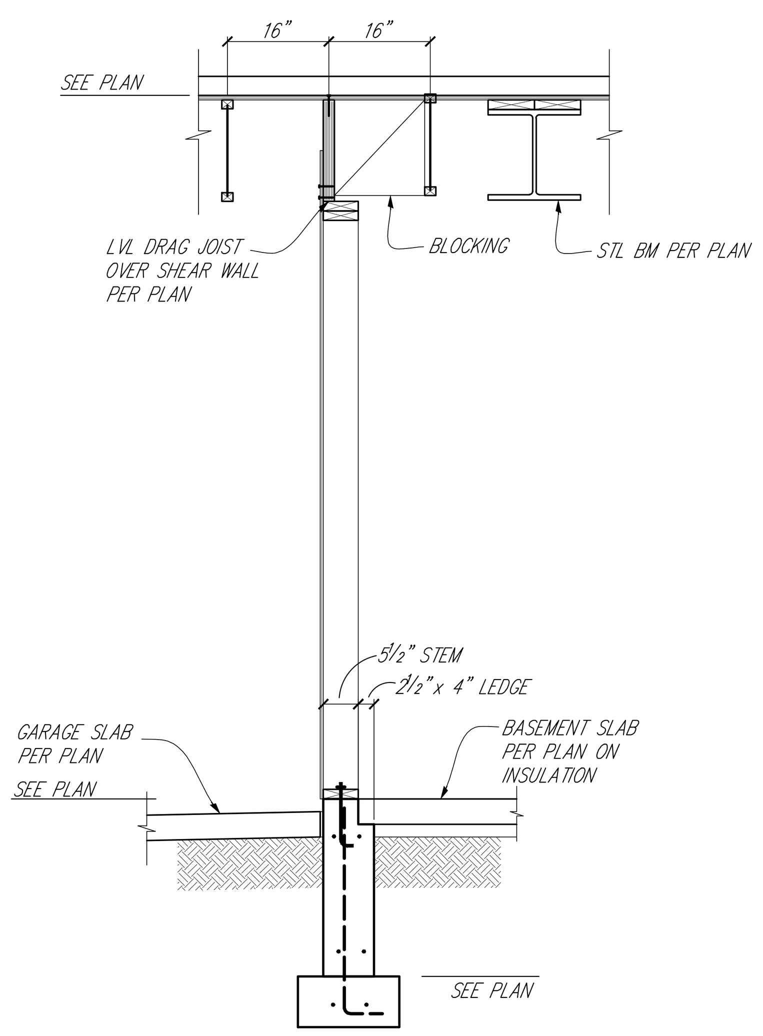
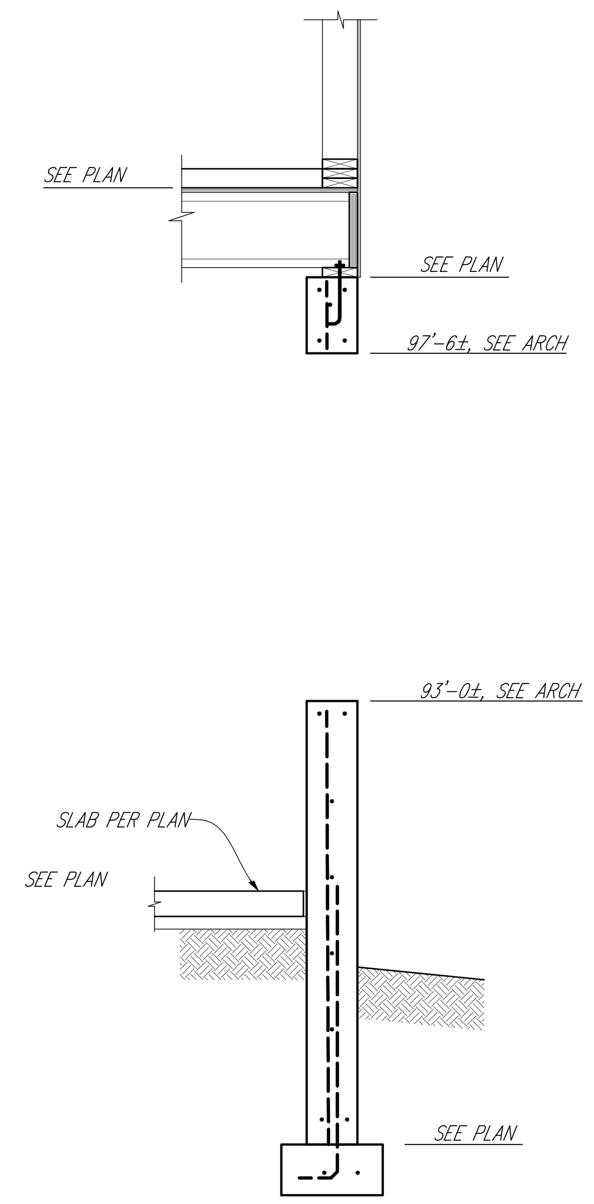


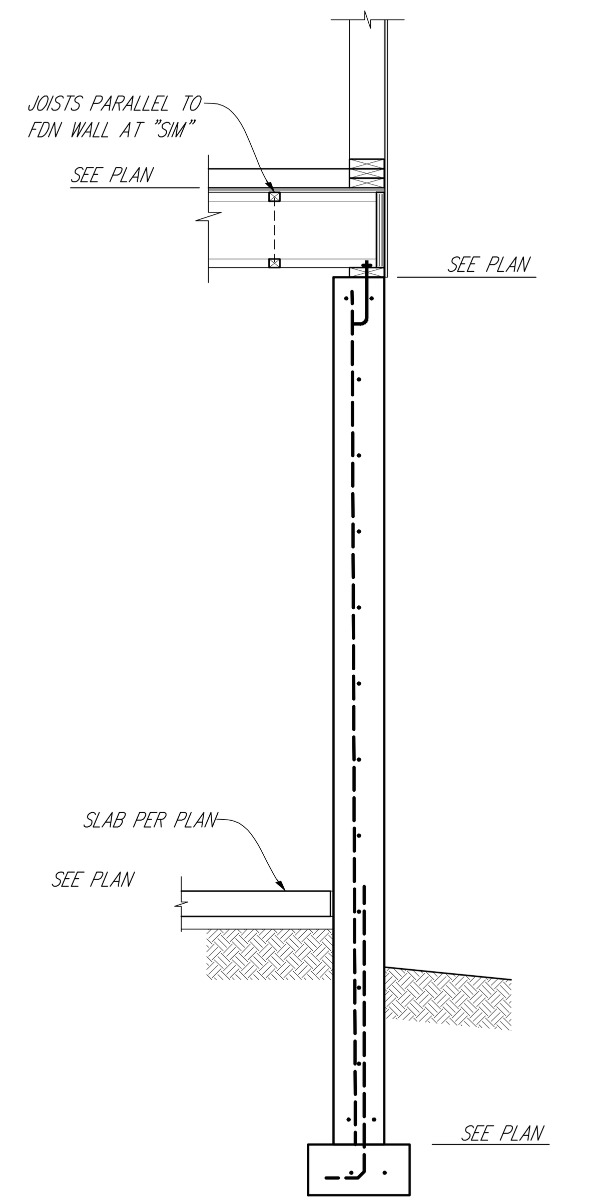

SHEET NO.
S1.3



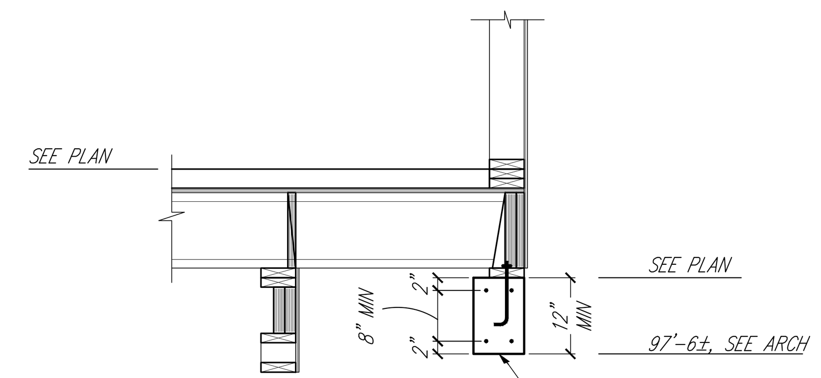

DETAIL 10/S2.1 1/2"=1'-0



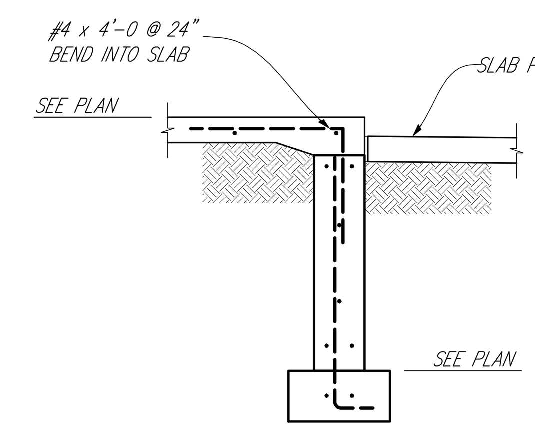

DETAIL 9/S2.1 1/2"=1'-0



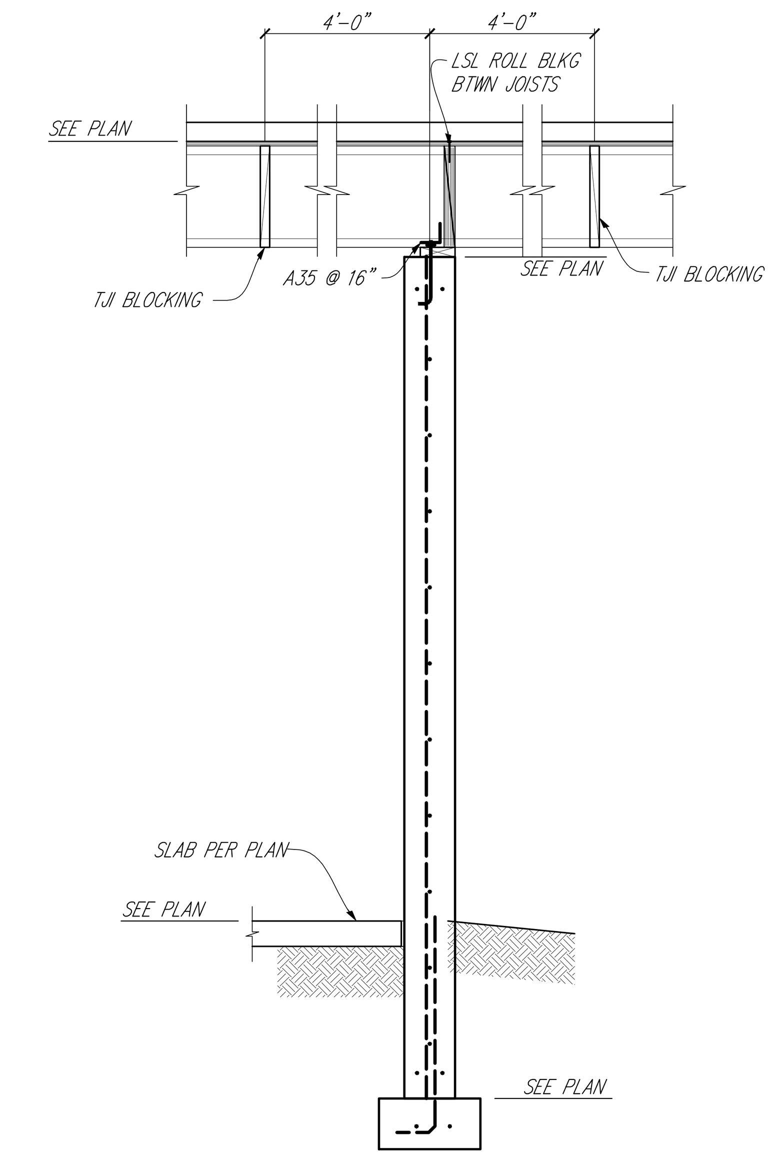

DETAIL 8/S2.1 1/2"=1'-0



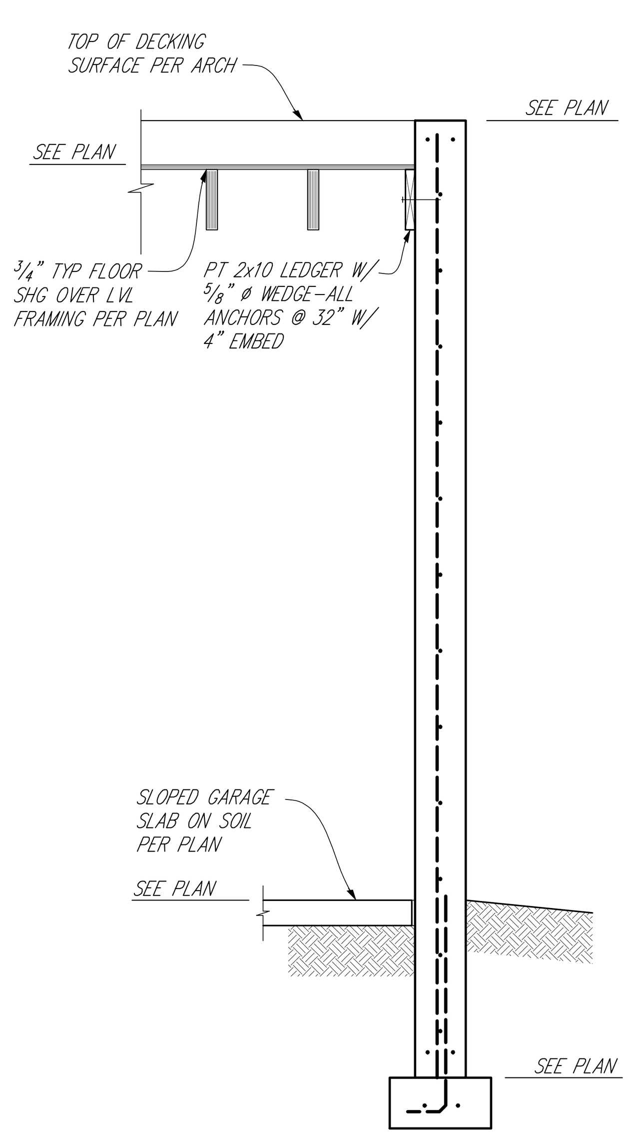

DETAIL 7a/S2.1 1/2"=1'-0



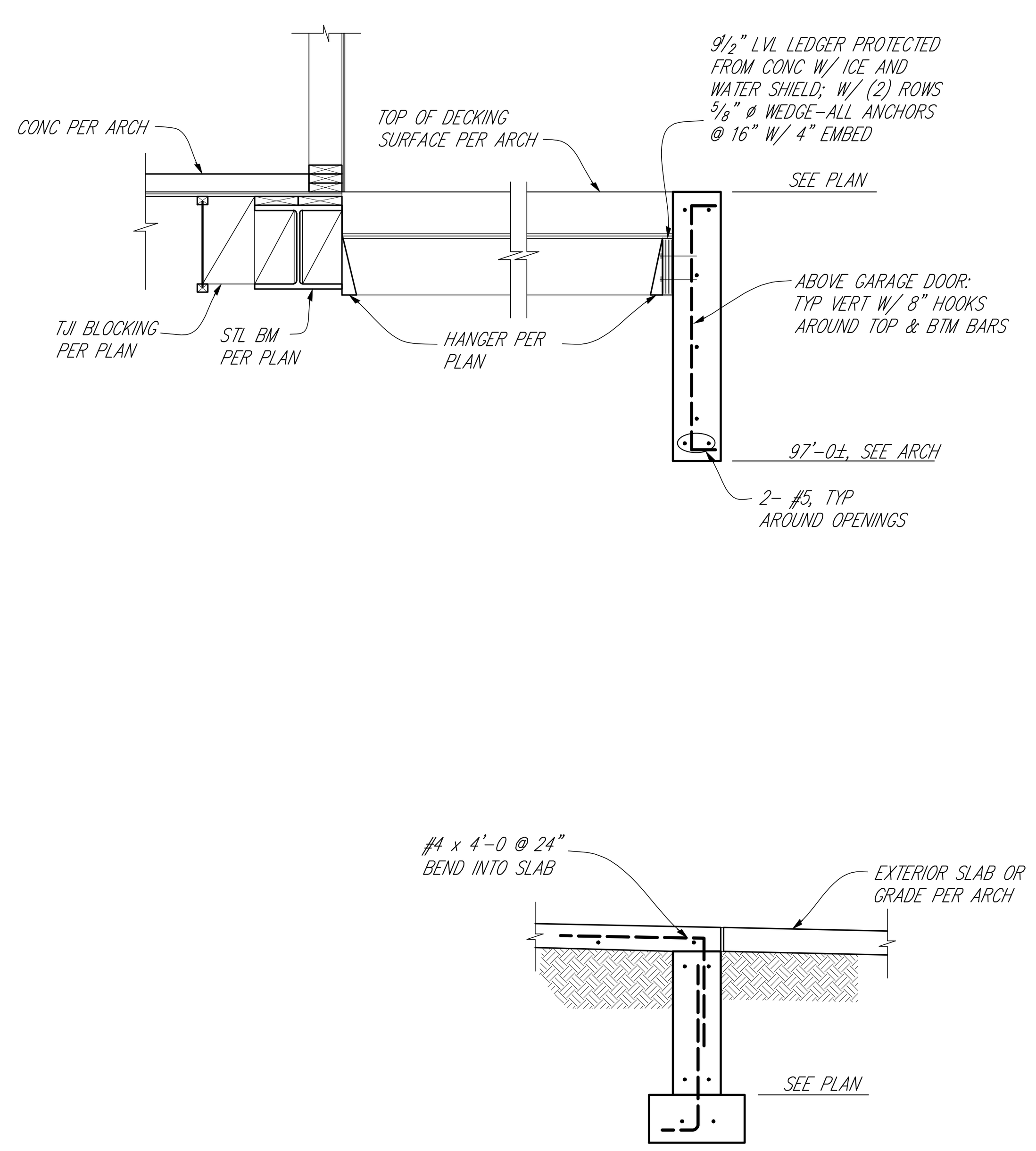

DETAIL 7/S2.1 1/2"=1'-0



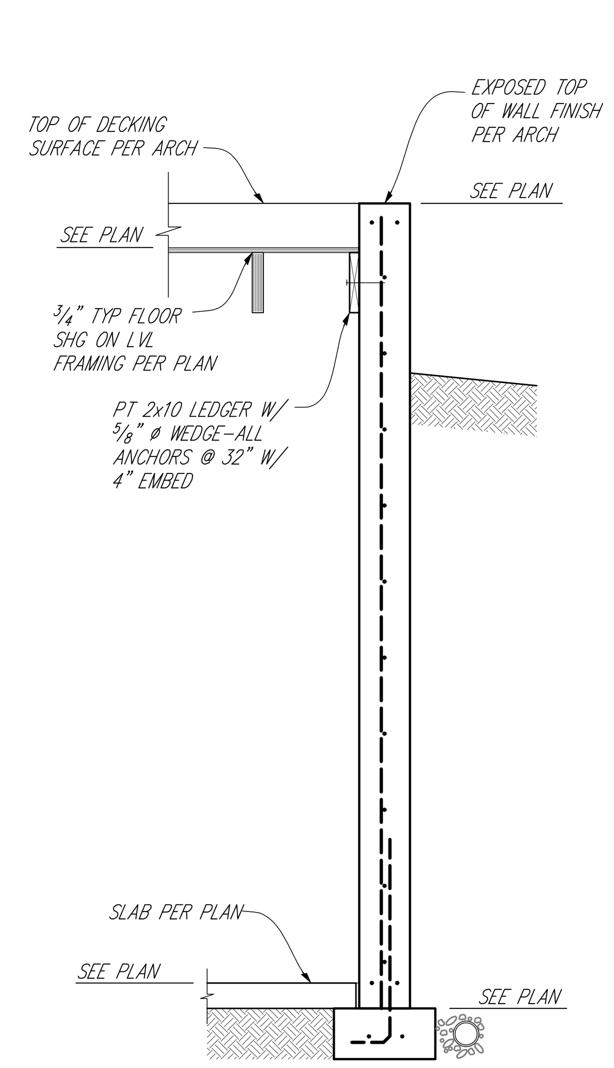

DETAIL 6/S2.1 1/2"=1'-0



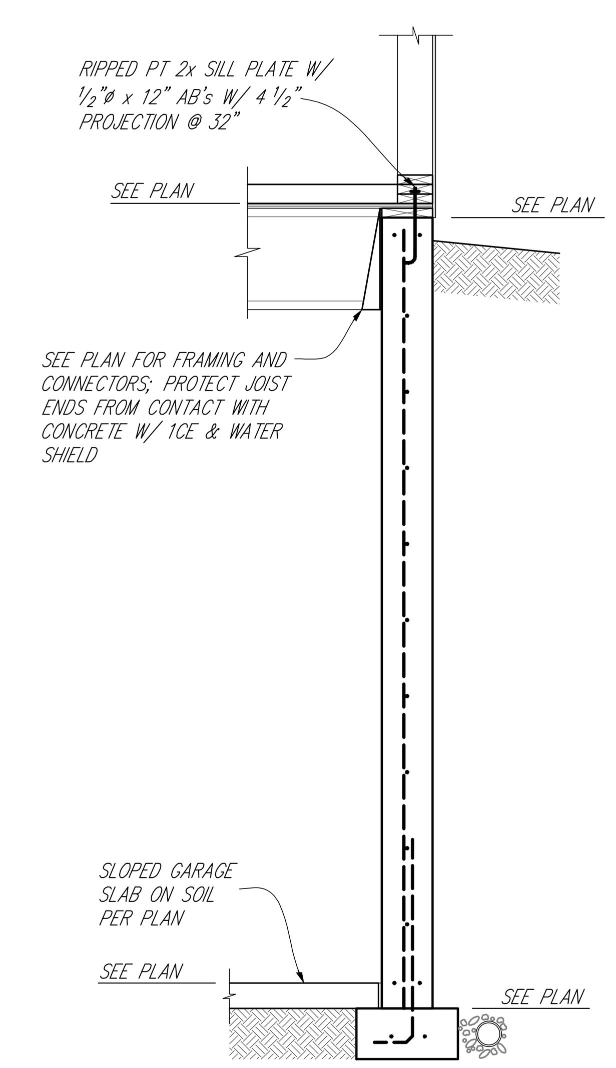

DETAIL 5/S2.1 1/2"=1'-0



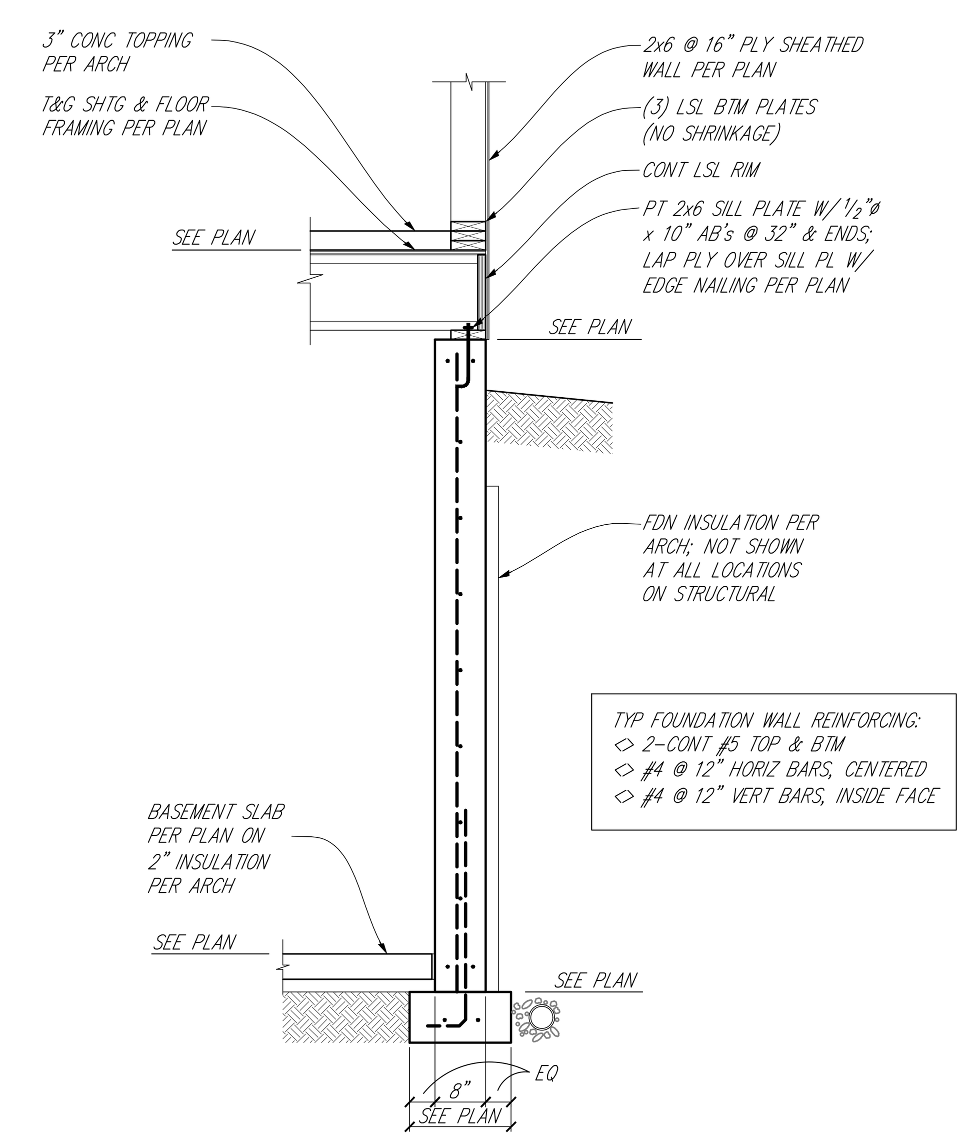

DETAIL 4/S2.1 1/2"=1'-0




DETAIL 3/S2.1 1/2"=1'-0




DETAIL 2/S2.1 1/2"=1'-0




DETAIL 1/S2.1 1/2"=1'-0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BLUE MOUNTAIN
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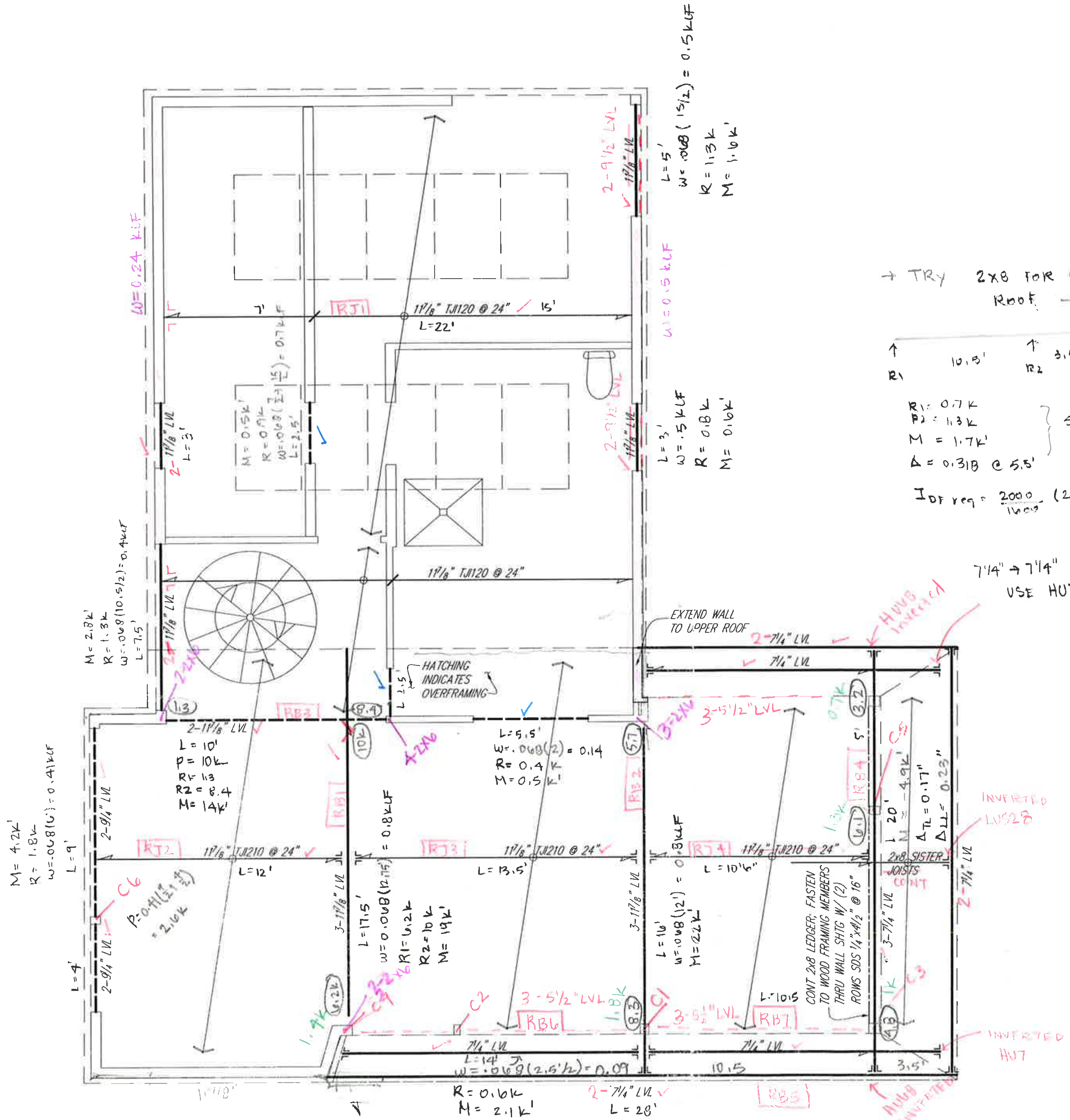
COLORADO LICENSED PROFESSIONAL ENGINEER 42143

SHEET NO.
S2.1

HEADERS SHOWN THUS THIS SHEET: ———— SHALL BE 2-5½" LVL WITH 2x6 KING (K) AND 2x6 TRIMMER (T) EACH END EXCEPT AS NOTED; DOUBLE TRIMMERS & KING STUDS AT OPENINGS WIDER THAN 5'-0 UNO.

# ROOF FRAMING CALCS

GOFF RESIDENCE
DLK ENG MKG
7/3/19
SCALE 3/16" = 1'0"




→ TRY 2x8 FOR CANTILEVER ROOF → RJ4

R1 10.5' R2 3.5'

R1 = 0.7k
R2 = 1.3k
M = 1.7k'
Δ = 0.318 @ 5.5'

Forte: 5½" LVL @16"
I = 24.26

$I_{DF\,req} = \frac{2000}{1600}(24.26) = 30.3\,in^4$ → 2x8 @ 16"

7¼" → 7¼"
USE HU7 INVERTED

LOADS

| | | |
|---|---|---|
| 20 | D | |
| 48 | S | |
| 68 | | TL |

UPLIFT: W − 0.6D = 15psf

Ratio: $\frac{W-0.6D}{D+S} = \frac{15}{68} = 22\%$

Worst col Load = C1 = 8.3
.22(8.3) = 1.8k

USE (2) LSTA18 STRAPS AT TOP + BOT ALL COL
Simpson p.173

2-5½" LVL
Vmax = 4.2k
Mmax = 4.4k'

WIND: RB6

(0.7) 18psf (5' TW) = 63plf

63 plf, 13'

R = 0.42k
M = 1.3k'

$\Delta_{S1\,240} = \frac{ML}{8} = 2.2\,in^4$

$\Delta_{LVL\,240} = 31.3\,in^4$

LOADED EDGE WISE 3-5½" LVL EDGE

$I = \frac{bh^3}{12} = \frac{5.25"(1.75"\times 3)^3}{12} = 63.3\,in^4 > I_{req}$ ✓ ok

RB7 w = 63plf (See RB6)
R = 0.33k
M = 1.1k'
$\Delta_{S1} = 1.13$ → $\Delta_{LVL} = 16.5\,in^4$ → USE 2-5½" LVL

## ROOF FRAMING PLAN

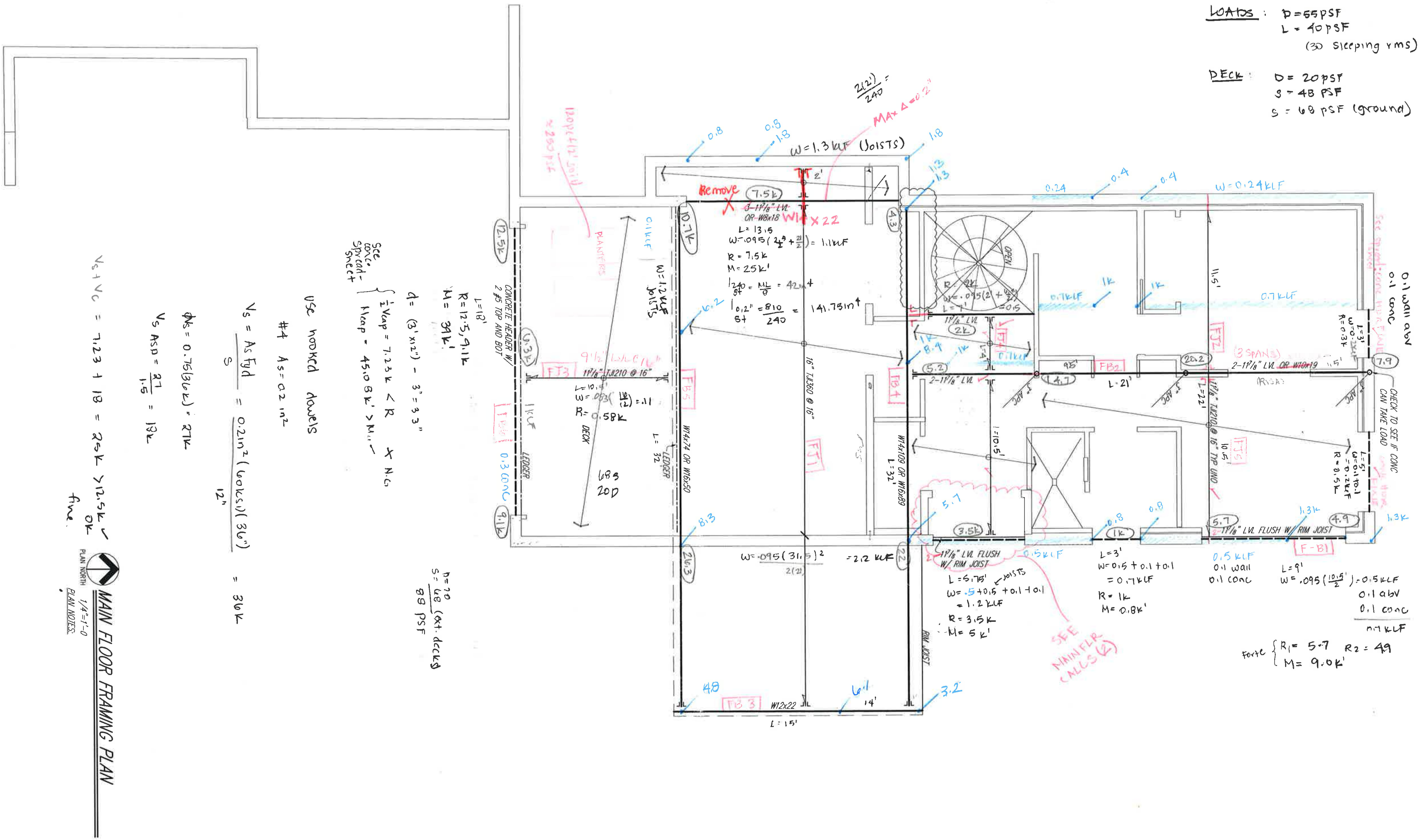
PLAN NORTH

GOFF RESIDENCE
DLK ENG MKG
7/16/19

MAIN FLOOR CALCS

LOADS: D = 55 PSF
L = 40 PSF
(30 sleeping rms)

DECK: D = 20 PSF
S = 48 PSF
S = 68 PSF (ground)



GOFF RESIDENCE
DLK ENG MKG
7/30/19
SCALE: 3/16" = 1'-0"

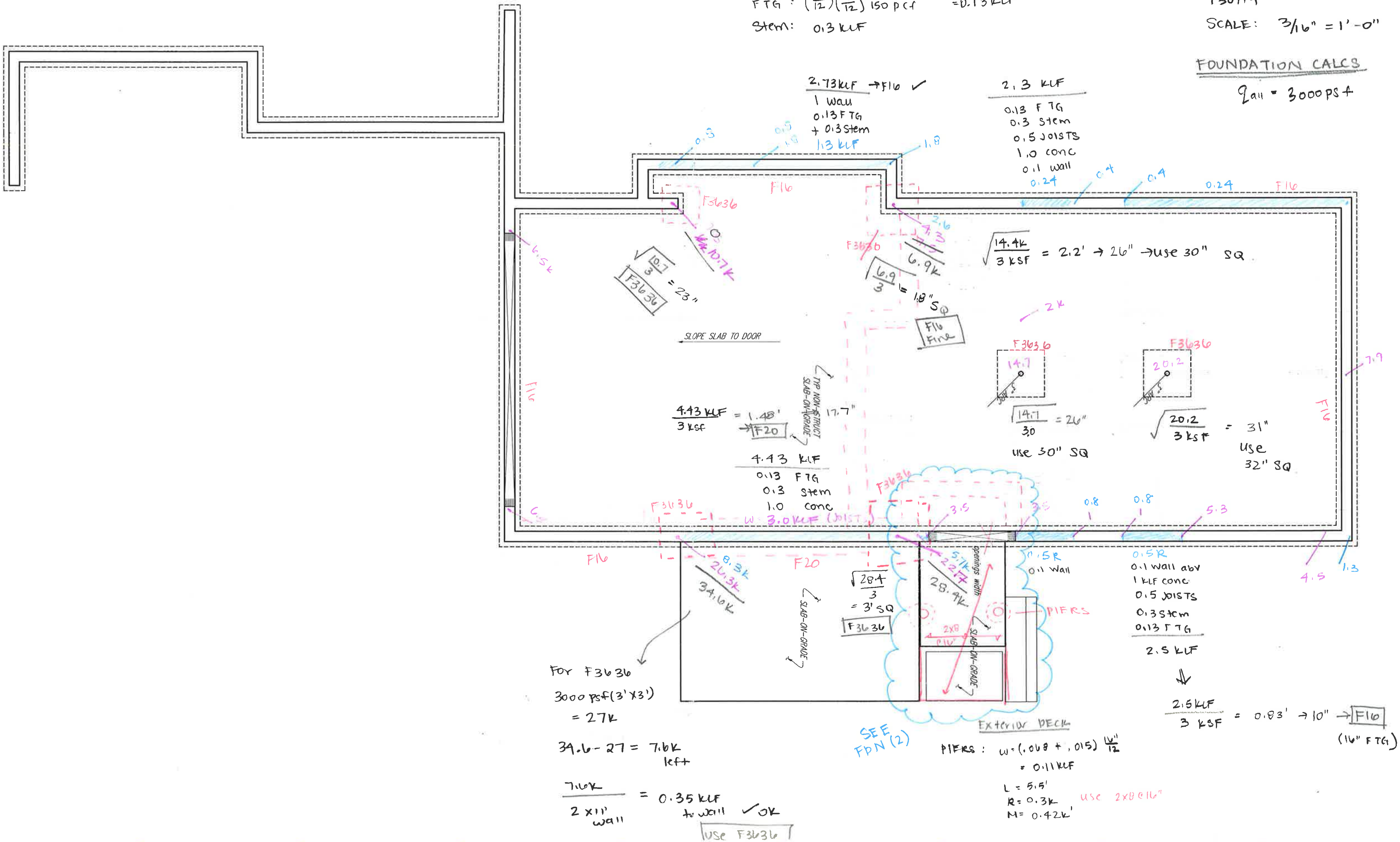
## FOUNDATION CALCS

$q_{all}$ = 3000 psf

wall: $\frac{8"}{12"}$ (150 pcf)(10' tall) = 1.0 KLF

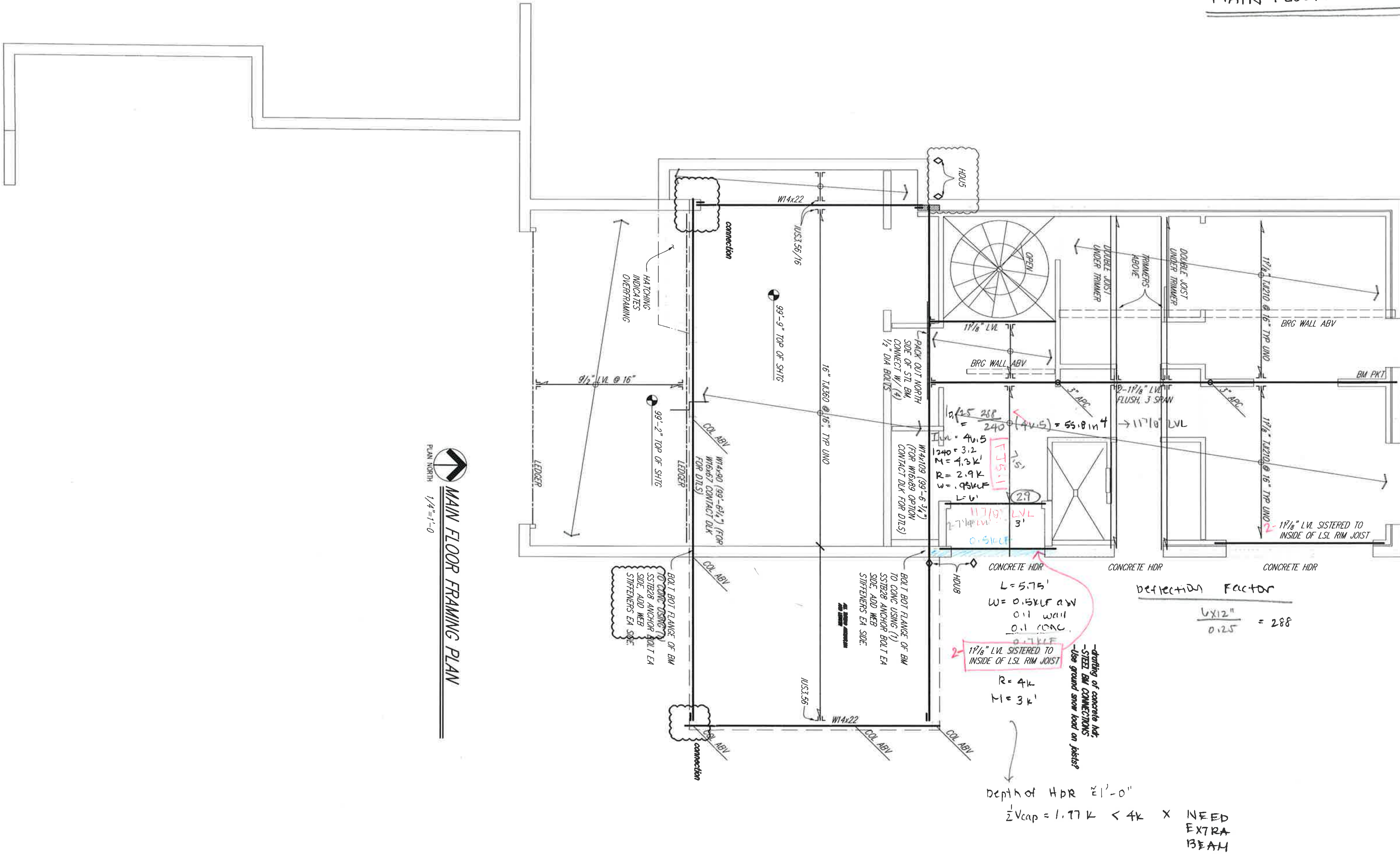
FTG: $\left(\frac{8"}{12}\right)\left(\frac{16"}{12}\right)$ 150 pcf = 0.13 KLF

Stem: 0.3 KLF



BEAM CHECK

MAIN FLOOR CALCS (2)

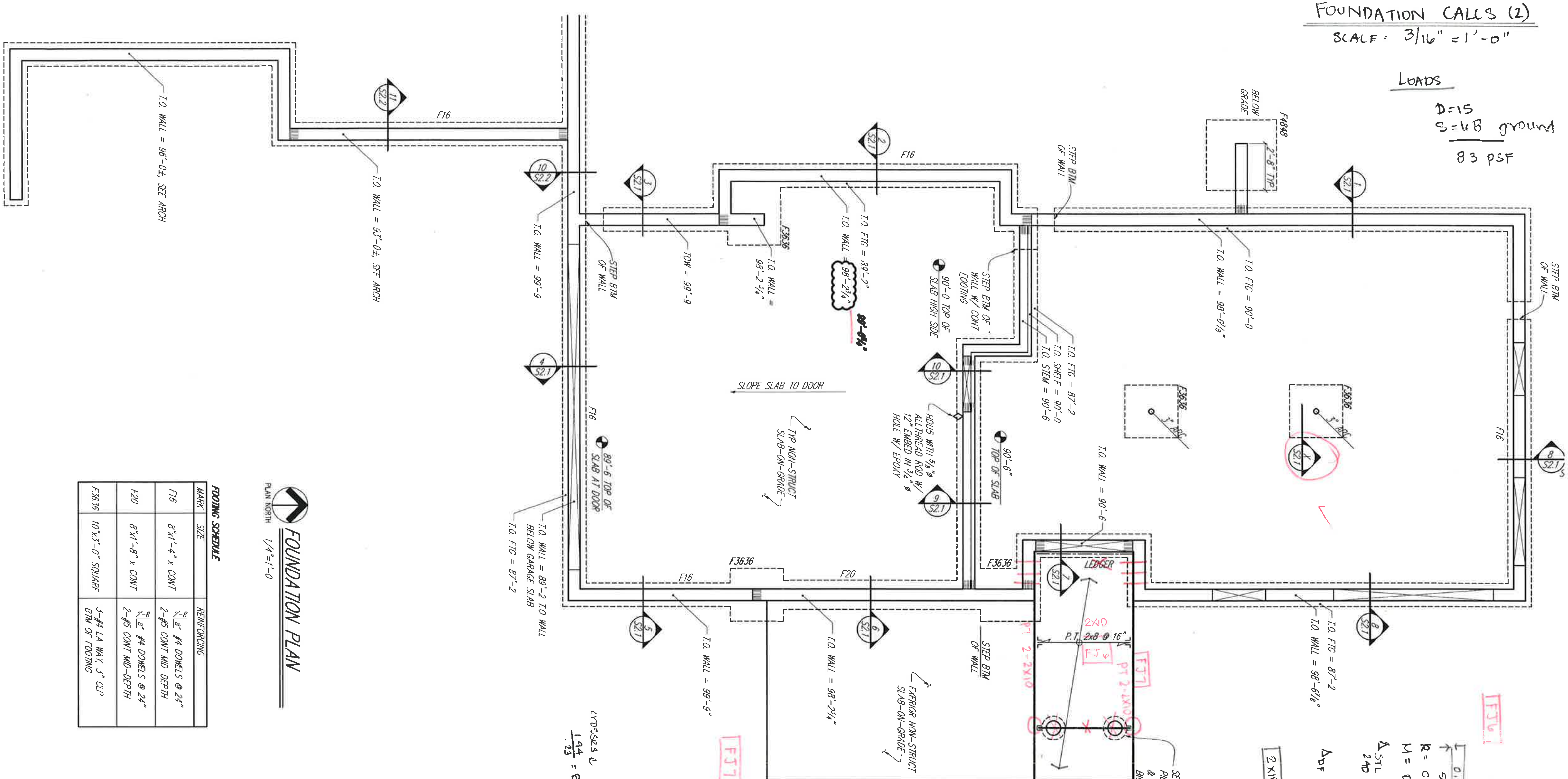


# FOUNDATION CALCS (2)

SCALE: 3/16" = 1'-0"

## LOADS

D = 15
S = 68 ground
83 PSF




**FOOTING SCHEDULE**

| MARK | SIZE | REINFORCING |
|---|---|---|
| F16 | 8"x1'-4" x CONT | 2'-8 \| 8" #4 DOWELS @ 24"<br>2-#5 CONT MID-DEPTH |
| F20 | 8"x1'-8" x CONT | 2'-8 \| 8" #4 DOWELS @ 24"<br>2-#5 CONT MID-DEPTH |
| F3636 | 10"x3'-0" SQUARE | 3-#4 EA WAY, 3" CLR BTM OF FOOTING |

**FJ6**

JOISTS @ 16"

0.11 klf, 5'6"

R = 0.3k

M = 0.42k'

$\Delta_{STL} = \frac{L}{240} = \frac{ML}{8} = \frac{0.24k' * 5.5'}{8} = 0.165 \text{ in}^4$

$\Delta_{DF} = 0.165 * \frac{29000}{1600} = 3 \text{ in}^4$

2X10 ok ✓

BOLT DESIGN FOR (2) PT 2X10

V = 1k

USE (3) 5/8" EXPANSION BOLTS

**FJ7**

EXTERIOR DECK #1

0.23 klf, 10', 3', R1, R2

R1 = 1.0k

R2 = 1.9k

crosses @ $\frac{1.94}{.23} = 8.3'$

$M = \frac{1}{2}(1.0k)(8.3') = 4k'$

USE 2-2X10

GOFF RESIDENCE
DLK ENG MKG
7/9/19
SCALE : 3/16" = 1'-0"

**LATERAL CALCULATIONS – ROOF**

WALLS = 11.5 PSF
ROOF = 0 PSF

**DIAPHRAGM CHECK:**

cant diaphragm
$\frac{2}{3}(19.5) = 13' \approx 14'$
ok cant. diaphragm fine

3' R1 22' R2 14' 19.5'

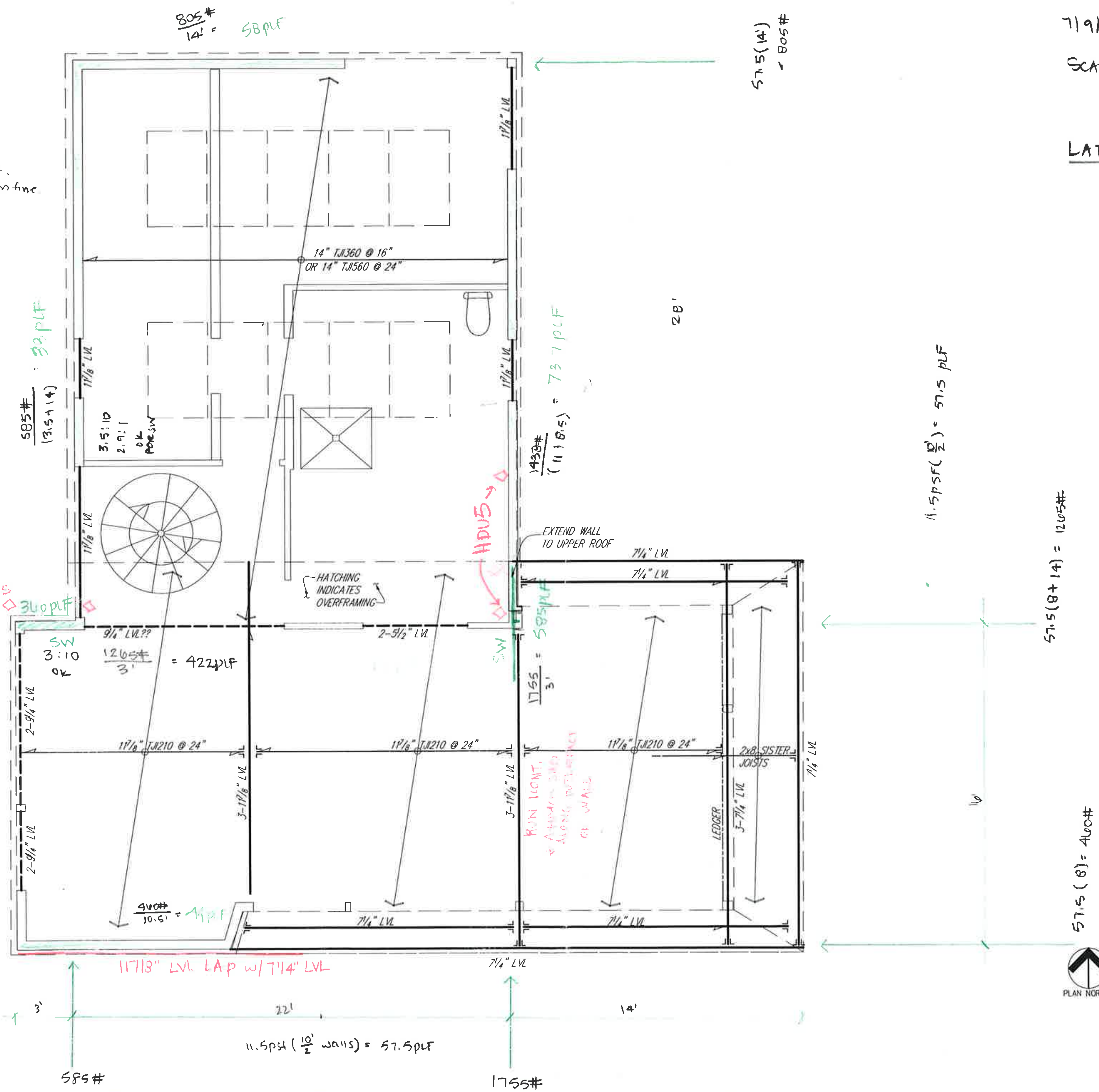
DIAPHRAGM 2: $R_2$: $\frac{1438\#}{19.5'}$ = 74 plf
R1 = ok

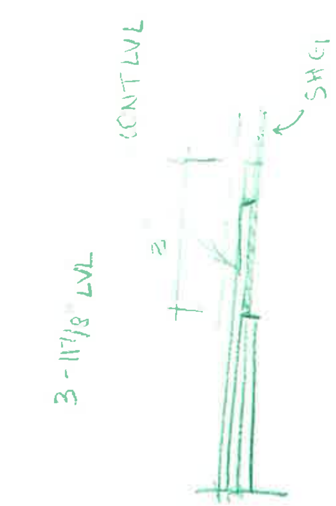
DLK STANDARD:
15/32" SHG 8d @ 6" EN, 12" FN
3x FRMG : $V_{ALL}$ = $\frac{800 plf}{2}$
= 400 plf > 74 plf

**SHEAR WALL HOLD-DOWN**

1755# → 7.5'
10' 4"
1.67k 1.67k
USE HDU5 Tall = 5.6k > 1.67 ✓ ok
Simpson p. 46

1265# → 3'
10'
4.2k 4.2k < Tall = 5.6k ✓ ok
USE HDU5 w/ 5/8" A.B.




SOUTH SIDE REACTION LINES

60 PLF
3' ↑ 22' ↑ 14'
R1 R2

$R_2 = \frac{60(36')(18') - 60(3)(1.5)}{22}$

$R_2$ = 1755 #, R1 = 585 #

ROOF FRAMING PLAN
PLAN NORTH

GOFF RESIDENCE
DLK ENG MKG
7/19/11

SCALE 3/16" = 1'-0"

LATERAL CALCS – MAIN FLR
WALLS = 11.5 PSF

DIAPHRAGM CHECK

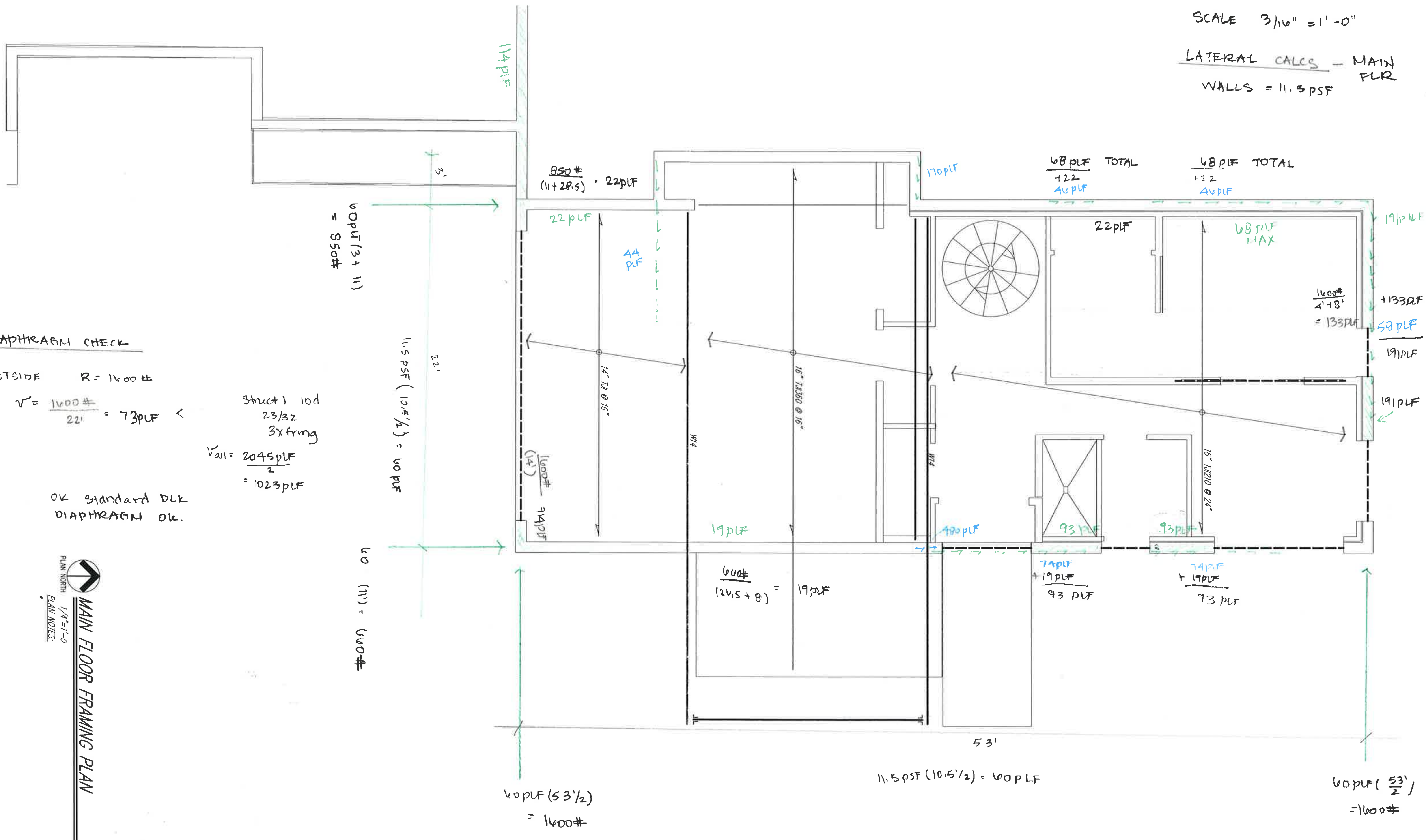
EASTSIDE R = 1600 #

$v = \frac{1600\#}{22'} = 73 plf <$

Struct 1 10d
23/32
3x frmg

$V_{all} = \frac{2045 plf}{2} = 1023 plf$

OK standard DLK DIAPHRAGM OK.



WIND LOADING

# TABLE R301.2(1) - CLIMATIC AND GEOGRAPHIC DESIGN CRITERIA

| Ground and Roof Snow Load | Wind Design* | | Seismic Design Category | Subject To Damage From | | | Winter Design Temp | Ice Barrier Underlayment Required | Flood Hazards | Air Freezing Index | Mean Annual Temp |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Speed (mph) | Topo-graphic Effects | | Weather-ing | Frost line depth | Termite | | | | | |
| Varies See Table | 129 mph** $V^{ult}$ Exp. ~~B~~ C | Yes | "B" | Severe | 36" | Slight to Moderate | 1° F | Yes | Varies | 532 | 50.5° F |

**Manual J Design Criteria**

| Elevation | Latitude | Winter Heating 99% Dry Bulb | Summer Cooling 1% Dry Bulb | Altitude Correction Factor | Indoor Design Temperature | Design Temperature Cooling | Heating Temperature Difference |
|---|---|---|---|---|---|---|---|
| Below 7400 ft. | 39° North | -7 | 95 | Varies | 72° | 75° | 79° |
| Above 7400 ft. | 39°North | -11 | 90 | Varies | 72° | 75° | 83° |
| Cooling Temperature Difference | Wind Velocity Heating | Wind Velocity Cooling | Coincident Wet Bulb | Daily Range | Winter Humidity | Summer Humidity | – |
| 20° | 15 mph | 7.5 mph | 59 | High (H) | 50% | 50% | – |
| 15° | 15 mph | 7.5 mph | 59 | High (H) | 50% | 50% | – |

* Rocky Mountain Metropolitan Airport area between Simms St. and Wadsworth Blvd. and north of 108th Ave. shall be 155 mph $V^{ult}$ Exposure C (approx. 120 mph three second gust Exposure C)

** Approximately Equivalent to 100 mph $V^{asd}$ (three second gust) Exposure B (see Table R301.2.1.3 for conversion)

$V_{ASD}$ = 100 PSF

Address Wizard

SNOW LOADING

**Results of Search!**

* NEARBY RESIDENCE

| | |
|---|---|
| Address (Address Number, or ADNO) | 25221 WESTRIDGE RD ( 188451 ) |
| Address Post Office and Zip | GOLDEN, CO 80403 |
| **Parcel Data for this Address** | |
| *Want property or tax information?* | PROPERTY DATA TAX DATA |
| **Physical Data for this Address** | |
| *Want to see a map?* | ONLINE MAP |
| PLSS Township, Range, Section Quarter-Section | T 2 S, R 71 W, Section 24, Quarter-Section: SE |
| Longitude, Latitude (Decimal Degrees) | 105.28343° W, 39.85922° N |
| Longitude, Latitude (DMS) | 105° 17' 0" W, 39° 51' 33" N |
| X, Y (SPCS, CO Cent Zone, NAD83, Feet) | 3060800, 1737925 |
| Elevation (USGS 10-meter DEM, Feet)<br>Snow Load Factor (Roof)<br>Snow Load Factor (Ground) | 7491<br>46.9 $S_r$ = 48 psF<br>67.1 $S_g$ = 68 psF |
| **Political Data for this Address** | |
| SE JeffCo Local Improvement District? | No |
| Municipal Status | UNINCORPORATED |
| City Precinct and Ward | *Not applicable* |
| County Precinct | 7202730211 |
| Assessor | Scot Kersgaard |
| Clerk and Recorder | George Stern |
| Commissioner Residing in (District) | Libby Szabo (District 1) |
| Commissioners | Lesley Dahlkenper,<br>Libby Szabo,<br>Casey Tighe |
| Coroner | Annette Cannon |
| District Attorney | Pete Weir |
| Sheriff | Jeff Shrader |
| Treasurer | Gerald 'Jerry' DiTullio |
| State House Representative (District) | Brianna Titone (District 27) |
| State Senate Representative (District) | Jessie Danielson (District 20) |
| U.S. House Representative (District) | Ed Perlmutter (District 7) |
| U.S. Senators | Michael F. Bennet,<br>Cory Gardner |




Gateway to the Rockies

DLK
DLK ENGINEERING, LLC

PROJECT: GOFF RESIDENCE JOB NO: GOFF BY: MKG DATE: 7/2/19

## LOAD TAKEOFF

**ROOF:**

| | | |
|---|---|---|
| 3/4" PLY | 3 psf × 3/4" | = 2.3 |
| METAL DECK | | = 2.5 |
| INSULATION | 1/2 (6") | = 3.0 |
| 1/2" GYP | 5.0 (1/2") | = 2.5 |
| JOISTS | | ≈ 3.0 |
| BMS | | ≈ 2.0 |
| SOLAR PANELS/MISC | | = 4.7 |
| | | 20 PSF DEAD |
| | | 48 PSF SNOW |

**FLOOR:**

| | | |
|---|---|---|
| CONCRETE | 150 pcf (3"/12) | = 37.5 |
| 3/4" PLY | 3 psf (3/4") | = 2.3 |
| 1/2" GYP | 5.0 psf (1/2) | = 2.5 |
| INSULATION | 1/2 (6") | = 3.0 psf |
| JOISTS | | = 3.0 psf |
| BMS | | = 3.0 psf |
| MISC | | = 3.7 psf |
| | | 55 psf DEAD |

(ASCE 7-16 T4.3-1) → 40 psf LIVE LOAD
( " " ) → (30 psf SLEEPING RMS)

**DECK**

NO CONC TOPPING → USE 20 psf = D
68 psf = S (ground)

SHEET NO:

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FORTE WEB

CALC PACKAGE REPORT

Goff

| Roof | | | |
|---|---|---|---|
| **Member Name** | **Results** | **Current Solution** | **Comments** |
| RJ1 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 24" OC | |
| RJ2 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 24" OC | |
| RJ3 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 24" OC | |
| RJ4 | Passed | 2 piece(s) 1 3/4" x 5 1/2" 2.0E Microllam® LVL @ 24" OC | |
| RB1 | Passed | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | |
| RB2 | Passed | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | |
| RB3 | Failed | 2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | Support 2 failed reaction check due to insufficient bearing capacity. → OK. Designed for. |
| RB4 | Passed | 3 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL | |
| RB5 | Passed | 1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL | |
| Roof: Flush Beam | Passed | 2 piece(s) 1 3/4" x 5 1/2" 2.0E Microllam® LVL | |
| **Main Floor** | | | |
| **Member Name** | **Results** | **Current Solution** | **Comments** |
| F-J1 | Failed | 1 piece(s) 16" TJI® 560 @ 16" OC | Right overhang exceeds the maximum length of 7' for this product. → Supported @ end by steel |
| F-J2 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 16" OC | |
| F-J3 | Failed | 1 piece(s) 1 3/4" x 9 1/2" 2.0E Microllam® LVL @ 16" OC | Support 1 failed reaction check due to insufficient bearing capacity. → on conc |
| F-J4 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 16" OC | |
| F-J5 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 16" OC | |
| F-J5.1 | Passed | 1 piece(s) 11 7/8" TJI® 210 @ 16" OC | |
| F-B1 | Passed | 2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | |
| F-B2 | Failed | 2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | Multiple Failures/Errors → Reactions fine |
| F-B3 | Failed | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | Support 2 failed reaction check due to insufficient bearing capacity. → STL BM |
| F-B4 | Failed | 3 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL | Multiple Failures/Errors → STL BM |
| F-B5 | Failed | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | Multiple Failures/Errors → STL BM |
| F-B6 | Failed | 3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL | Multiple Failures/Errors → Conc. HDR |

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 8:26:24 PM UTC

# FORTE WEB

**MEMBER REPORT** **FAILED**

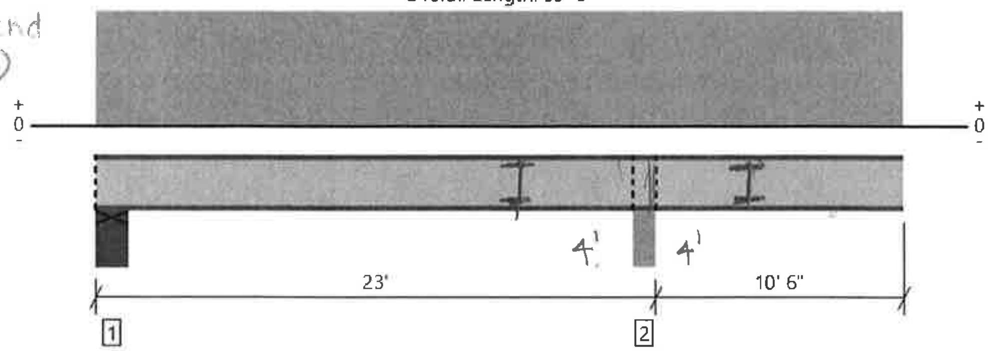
Main Floor, F-J1

**1 piece(s) 16" TJI® 560 @ 16" OC**

Right overhang exceeds the maximum length of 7' for this product.

→ can model w/ support @ end (see below)

→ JOIST STIFFNESS CHECK




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3093 @ 22' 9 1/4" | 3455 (5.25") | Passed (90%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Shear (lbs) | 1599 @ 22' 6 1/2" | 2710 | Passed (59%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Moment (Ft-lbs) | -7291 @ 22' 9 1/4" | 9694 | Passed (75%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Live Load Defl. (in) | 0.444 @ 33' 6" | 0.715 | Passed (2L/580) | -- | 1.0 D + 1.0 L (Alt Spans) |
| Total Load Defl. (in) | 0.613 @ 33' 6" | 0.715 | Passed (2L/420) | -- | 1.0 D + 1.0 L (Alt Spans) |
| TJ-Pro™ Rating | 51 | 40 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/360).
- Overhang deflection criteria: LL (2L/360) and TL (2L/360).
- Input live load span ratio deflection limit is below building code minimum value of L/360. This minimum value was used for design.
- Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 8" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' 8" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

EI one joist 16" TJI560 = 1250 x10⁶ in²/lbs
x10 joists over wall = 12500 x10⁶ in²

EI: W14x109
I = 1240 in⁴
E = 29,000,000 lb/in²

EI = 1240 x 29x10⁶ = 36000 x10⁶ lb in²

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 8.00" | 1.84" | 666 | 623/-138 | 1289/-138 | Blocking |
| 2 - Beam - SPF | 5.50" | 5.50" | 3.86" | 1791 | 1302 | 3093 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 33' 6" | 16" | 55.0 | 40.0 | Default Load |

## Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

$\frac{\text{Joists}}{\text{Steel}} = \frac{12,500}{2(36000)} = 0.17 \approx \frac{1}{6}$

→ Steel is ≈ 5/6 stronger than TJI's. can model w/ support @ end.

→ No blk needed.
Steel BMS @ 4' from support @ cant end.

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
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8/2/2019 8:32:07 PM UTC
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2
File Name: Goff

DLK ENGINEERING, LLC

Job No. Goff | Date: 7/2/19 | By: MKG

Project: Goff Blue Mountain Residence | Sheet of

## ASCE7-10 Envelope Procedure: MWFRS Pressures for Low Rise, Enclosed Building

| Building Geometry: | | Other Input | | | Limitations: | | |
|---|---|---|---|---|---|---|---|
| Length (Parallel to ridge) | 53 ft | $V_{ASD\ 3\text{-}sec}$ | 100 mph | | No Hills: | Kzt: | 1 |
| Width (Perpendicular to ridge) | 26 ft | Exposure | c | B, C, D? | Buildings Only: | Kd: | 0.85 |
| Mean Roof Height, h | 20 ft | Risk Category | II | | Rigid Struct: | G: | 0.85 |
| Parapet Height (at TOW): | 0 ft | Elevation: | 7490 | | Enclosed: | GCpi +/- | 0.18 |
| Roof Slope: 0.75 /12 = | 3.6 deg | Elevation Factor = | 0.80 | | Low Rise Building, h < 60 ft | | |
| | | | | | Calc Importance Factor | | 1.00 |
| | | $V_{ult}$ | 129 mph | | | $q_p$ = | **14.8** |

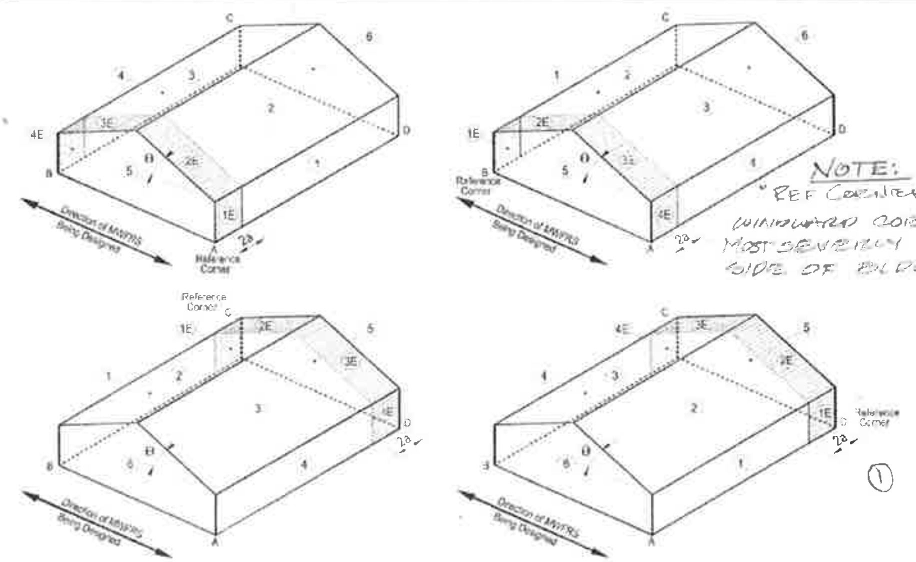
| From Table 26.9-1 | | Kh = | 0.9019 |
|---|---|---|---|
| alpha = | 9.5 | $q_h$ = | **15.7 psf** |
| zg = | 900 | Kp = | 0.8489 |

| NET Parapet Forces: | $p_p$, psf | GCpn |
|---|---|---|
| **Windward Wall:** | **22.2** | 1.5 |
| **Leeward Wall:** | **-14.8** | -1.0 |

*NOTE: Torsional LCs not req'd for 2-story max light framed bldgs*

**Design Pressures on Building Surfaces (psf):** SIGNS: Pos. = push toward bulding; Neg. = pull away from buildiing

| 2a = 6 ft | 1 | 2 | 3 | 4 | 5 | 6 | 1E | 2E | 3E | 4E |
|---|---|---|---|---|---|---|---|---|---|---|
| $p_{design}$ with internal suction: | 9.1 | -8.0 | -3.0 | -1.7 | -4.2 | -4.2 | 12.4 | -14.0 | -5.5 | -3.9 |
| $p_{design}$ with internal pressure: | 3.5 | -13.7 | -8.6 | -7.4 | -9.9 | -9.9 | 6.8 | -19.6 | -11.2 | -9.6 |



NOTE: "REF CORNER" = WINDWARD CORNER ON MOST SEVERELY LOADED SIDE OF BLDG.

Transverse Direction

**Net Vert Projected Pressures:**

| | | |
|---|---|---|
| Walls: | 1 - 4 = | 10.8 psf |
| | 1E-4E = | 16.3 psf |
| | difference: | 5.5 psf |
| Roof: | 2 - 3 = | -5.0 psf |
| | 2E-3E = | -8.5 psf |
| | difference: | -3.5 psf |
| Net 1 - Parapet: | | 37.0 psf |

*(Note: negative roof values should not be used to reduce base shear.)*

**Notes & Calculations:**

① WALLS: 10.8 (47/53) + 16.3 (6/53) = 11.4 PSF

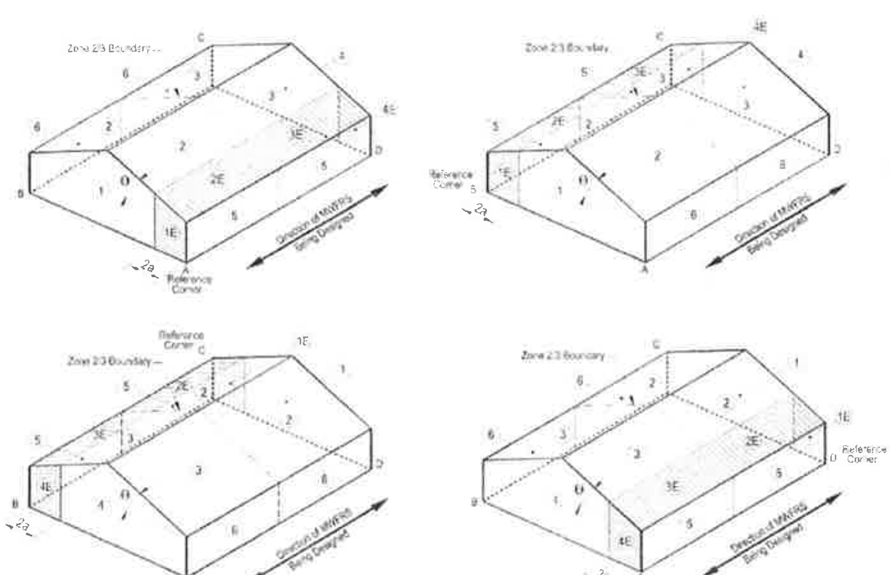
ROOF: Neg pressure

OR

② WALLS 10 PSF, ROOF 10 PSF } min 27.1.5

① controls.

USE walls = 11.5 PSF, roof = 0 PSF



Longitudinal Direction

WIND SPREADSHEET → ENVELOPE PROCEDURE

Step 1: Risk Category : II (ASCE 7-16 T.1.5-1)

Step 2: Basic wind speed: $V_{ult}$ = 129 mph (JeffCO website)

$V_{ASD} = \sqrt{0.6}\, V_{ult}$ (IBC 2012 EQ 16-33)

$= \sqrt{0.6}\,(129)$

$= 100$ mph

Step 3: wind Load Parameters

$K_d = 0.85$ (BLD MFRS) (ASCE 7-16 T 26.6-1)

Exposure C ( " 26.7.3 )

$K_{zt} = 1.0$ (no hills) ( " 26.8.2 )

"elevation" factor → $K_e$ : 7490ft > 6000ft

$K_e = e^{-0.0000362(7490)}$

$= 0.80$ (T 26.9-1 Ftnote 2)

G : 0.85 (ridgid bld) ( 26.11.1 )

Enclosed: ±0.18 (GPi) ( T26.13-1)

Step 4: $K_h$ : h=20' → 0.9

Step 5: $q_h = 0.00256 K_h K_{zt} K_d K_e V^2$

$= 0.00256(0.9)(1.0)(0.85)(0.80)(100\text{mph})^2$

$q_h$ = 15.7 psf

$p_p$: for parapets (Not applicable)

Find p: $p = q_h(GC_{pf} - GC_{pi})$ ASCE 7-16 p. 313

$GC_{pf}$ = factors in Figure 28.3-1)

Loading Surf 1: $p_1 = 15.7(0.40 + 0.18) = 9.1$

$= 15.7\,(0.40 - 0.18) = 3.5$

2: $p_2 = 15.7(-0.69 + 0.18) = -8.0$

$= 15.7(-.69 - .18) = -13.7$

⋮

2E $p_{2E} = 15.7(-1.07 + 0.18) = -14.0$

$= 15.7(-1.07 - 0.18) = -19.6$

⋮

continue process



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NET PROJECTED PRESSURES:

Walls: 1-4: $p_1 + p_4 = 9.1 - (-1.7) = 10.8$ psf
1E-4E: $p_{1E} - p_{4E} = 12.4 - (-3.9) = 16.3$ psf

Roof: 2-3: $P_2 - P_3 = -8.0 - (-3.0) = -5.0$ psf
2E-3E: $P_{2E} - P_{3E} = -19.6 - (-11.2) = -8.5$ psf

gives an average for wall + roof design

conservative: use 0 for roof because suction helps relieve roof load.

PARAPET: NOT APPLICABLE

DESIGN FOR WALL AND ROOF LOADS ABOVE, BUT CHECK CODE MIN

27.1.5 WALLS: $\frac{16 \text{ psf}}{1.6} = 10$ psf

ROOF: $\frac{8 \text{ psf}}{1.6} = 5$ psf

↗ ASD CONVERSION

→ THIS BLD HAS A FLAT ROOF. USE TABULATED VALUES

→ FIND WALL DESIGN LOAD

FIND DIST FOR 1E-4E = 2a

$$2a = 2 * \min \begin{cases} 0.10(w) = 0.10(26) = 2.6 \\ 0.4(h) = 0.4(20) = 4 \\ 3' \quad\quad 3' \text{ min} \end{cases}$$

← controls

$2a = 3(2) = 6$ ft

→ RATIO THE WALLS AND END REGIONS ACCORDING TO DIMENSIONS. SEE WIND SPREADSHEET FOR CALCS



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DLK
DLK ENGINEERING, LLC

Job No. Goff | Date: 7/2/19 | By: MKG

Project: Goff Blue Mountain Residence | Sheet | of

## Comp & Cladding Pressures for Low Rise, Enclosed WALLS

**Building Geometry:**

| | | |
|---|---|---|
| Length (Parallel to ridge) | 53 | ft |
| Width (Perpendicular to ridge) | 26 | ft |
| Mean Roof Height, h | 20 | ft |
| Parapet Height (at TOW): | 0 | ft |
| Roof Slope: 0.75 /12 = | 3.6 | deg |

**Other Input**

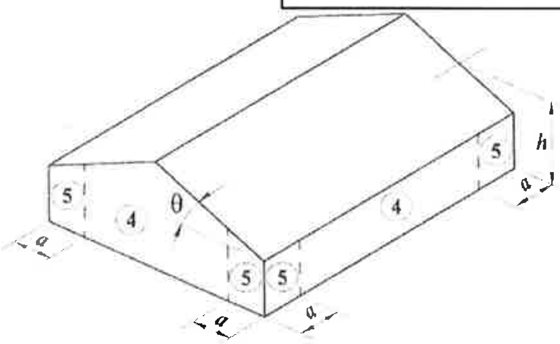
| | | |
|---|---|---|
| V (3-sec gust) | 100 | mph |
| Exposure | c | B, C, D? |
| Risk Category | II | |
| Elevation: | 7490 | ft |
| Elevation Factor = | 0.80 | |

**Limitations:**

| | | |
|---|---|---|
| No Hills: | Kzt: | 1 |
| Buildings Only: | Kd: | 0.85 |
| Rigid Struct: | G: | 0.85 |
| Enclosed: | GCpi +/- | 0.18 |
| Low Rise Building, h < 60 ft | | |
| Importance Factor | | 1.00 |

| From Table 26.9-1 | | | |
|---|---|---|---|
| alpha = | 9.5 | Kh = | 0.9019 |
| zg = | 900 | $q_h$ = | **15.7 psf** |

a = 3 ft




Calculating GCp: $GCp(A) = y_0 + c*\log(A)$

Where: A = area(sq ft); $y_0$ and $c$ as follows:

| | index | Zones | y1 | y2 | x2 | c | $y_o$ |
|---|---|---|---|---|---|---|---|
| neg | 1 | 4 | -1.1 | -0.8 | 500 | 0.1766 | -1.2766 |
| neg | 2 | 5 | -1.4 | -0.8 | 500 | 0.3532 | -1.7532 |
| pos | 3 | 4,5 | 1 | 0.7 | 500 | -0.1766 | 1.1766 |

**Negative Pressures**

ZONE 4 — 1

| A, ft$^2$ | GCp | P, psf |
|---|---|---|
| 10 | -1.10 | **-20.1** |
| 20 | -1.05 | **-19.3** |
| 50 | -0.98 | **-18.2** |
| 100 | -0.92 | **-17.3** |
| 200 | -0.87 | **-16.5** |
| 500 | -0.80 | **-15.4** |

ZONE 5 — 2

| A, ft$^2$ | GCp | P, psf |
|---|---|---|
| 10 | -1.40 | **-24.8** |
| 20 | -1.29 | **-23.1** |
| 50 | -1.15 | **-20.9** |
| 100 | -1.05 | **-19.3** |
| 200 | -0.94 | **-17.6** |
| 500 | -0.80 | **-15.4** |

**Positive Pressures**

ZONES 4 & 5 — 3

| A, ft$^2$ | GCp | P, psf |
|---|---|---|
| 10 | 1.00 | **18.5** |
| 20 | 0.95 | **17.7** |
| 50 | 0.88 | **16.6** |
| 100 | 0.82 | **15.8** |
| 200 | 0.77 | **14.9** |
| 500 | 0.70 | **13.8** |

UPPER FLOOR – SOUTH SIDE WINDOWS

C1: $A = (10.5' \text{ tall})\left(\frac{8.5}{2} + \frac{10.5}{2}\right) = 100 ft^2$ → USE −17.3 PSF

C2: $A = 10.5'\left(\frac{8.5}{2} + \frac{4.75}{2}\right) = 70 ft^2$ → USE −18.2 PSF

C3: $A = 10.5\left(\frac{10.5}{2}\right) = 50 ft^2$ → USE −18.2 PSF

C4: $A = 10.5(4.75/2) = 25 ft^2$ → USE −19.3 PSF

RB6: $A = (13' \text{ long})\left(\frac{3}{2} + \frac{7}{2}\right) = 78 ft^2$ → USE −18 PSF

C5: $A = 10.5(10/2 + 5/2) = 78 ft^2$ → USE −18 PSF

WEST SIDE → C6: $A = 10.5(4/2 + 9/2) = 68 ft^2$ → USE −18 PSF

Roof - C1                3 - 5 1/2" LVL

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C1

***Axial Compression:***

| | | | |
|---|---|---|---|
| P = | **8.30** | k | |
| $L_e$ = | **10.5** | effective length, ft | |
| depth = | **5.25** | in | |
| width = | **5.25** | in | |
| $F_c$ = | 2510 | psi | HF#2 |
| $C_F$ = | 1.00 | | 6x6 |
| c = | 0.90 | | |
| E = | 2,000,000 | psi | |
| $E_{min}'$ = | 965,710 | psi | |

| | | |
|---|---|---|
| Axial Load = | 8300 | lb |
| $l_e$ = | 126.0 | in |
| Area = | 27.5625 | in² |
| $F_c^*$ = | 4016 | psi |
| l/d = | 24.0 | |
| $F_{cE}$ = | 1378 | psi |
| Cp = | 0.33 | |
| $F'_c$ = | *1314* | *psi* |
| $f_c$ = | *301* | *psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL #1 | (6) 2x8 DF |
|---|---|---|---|---|---|---|
| $F_c$ = | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| $C_F$ = | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| c = | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| E = | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| $E_{min}'$ = | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |
| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
| $F_b$ = | 675 | 850 | 900 | 900 | 2600 | 1000 |
| $C_D$ = | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| $C_r$ = | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| $C_F$ = | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| $C_M$ = | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | **17.3** | psf |
| Tributary Width = | **9.50** | ft |
| $w_{lateral}$ = | **164.4** | plf |
| length = | 10.5 | ft |
| A = | 27.56 | in² |
| Sx = | 24.12 | in³ |
| Ix = | 63.31 | in⁴ |
| **$V_{max}$= R1 =R2 =** | **863** | **lb** |
| **$M_{max}$ =** | **2265** | **ft-lb** |
| $f_{bx}$ = | 1127 | psi |

Bending allowable stress

| | | |
|---|---|---|
| $F'_{bx}$ = | **4160** | **psi** |
| $F_b$ = | 2600 | psi |
| $C_D$ = | 1.60 | |
| $C_r$ = | 1.00 | |
| $C_F$ = | 1.00 | |
| $C_M$ = | 1.00 | |

***Bending Deflection Check***

| | | | |
|---|---|---|---|
| Deflection criteria ---> | L / | 240 | |
| Allowable Deflection = | 0.53 | in | |
| Actual Deflection = | 0.35 | in | **OK** |
| 70% Actual Deflection = | 0.25 | in | **OK for wind** ✓ |

***Combined Stresses***
$F_{cEx}$ = 1378 psi
(Same as $F_{cE}$ because of full lateral support.)

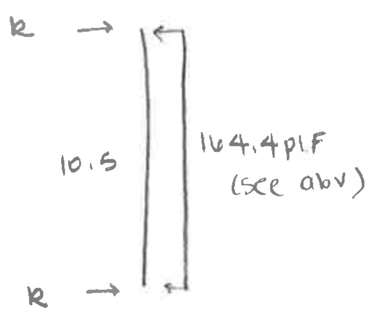
$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1-f_c/F_{cEx})} = \mathbf{0.399 < 1.0}$$

| | AXIAL | | BENDING |
|---|---|---|---|
| = | 0.052503 | + | 0.3466522 |

***Bearing Check***

| | | |
|---|---|---|
| $f_{c,perp}$ = | **301** | **psi** |
| $F'_{c,perp,HF}$ = | 0.405 | psi |

FIND SHEAR : CLIP DESIGN        (worst case lateral load) clips will work for all




R : 864# = V

A35 Clip (Simpson p. 190)

Floor : 2(595#) = 1190 #> 864 = $V_u$ ✓ OK

USE (2) A35 Clips @ Base and ROOF

Simpson Wood Construction Connectors    p. 190

Subject ______

Project # ______
By ______
8/2/2019
Sheet# ______

Roof – C2    2- 5 1/2" LVL

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C2

***Axial Compression:***

| | | |
|---|---|---|
| P = | **0.00** | k |
| $L_e$ = | **10.5** | effective length, ft |
| depth = | **5.50** | in |
| width = | **3.50** | in |
| $F_c$ = | 2510 | psi LVL |
| $C_F$ = | 1.00 | |
| c = | 0.90 | |
| E = | 2,000,000 | psi |
| $E_{min}'$ = | 965,710 | psi |

| | | |
|---|---|---|
| Axial Load = | 0 | lb |
| $l_e$ = | 126.0 | in |
| Area = | 19.25 | $in^2$ |
| $F_c^*$ = | 4016 | psi |
| l/d = | 22.9 | |
| $F_{cE}$ = | 1513 | psi |
| Cp = | 0.36 | |
| $F'_c$ = | *1433* | *psi* |
| $f_c$ = | *0* | *psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL | (6) 2x8 DF #1 |
|---|---|---|---|---|---|---|
| $F_c$ = | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| $C_F$ = | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| c = | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| E = | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| $E_{min}'$ = | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | **18.2** | psf |
| Tributary Width = | **6.60** | ft |
| $w_{lateral}$ = | **120.1** | plf |
| length = | 10.5 | ft |
| A = | 19.25 | $in^2$ |
| Sx = | 17.65 | $in^3$ |
| Ix = | 48.53 | $in^4$ |
| **$V_{max}$= R1 =R2 =** | **631** | **lb** |
| **$M_{max}$ =** | **1655** | **ft-lb** |
| $f_{bx}$ = | 1126 | psi |

| Bending allowable stress | | |
|---|---|---|
| $F'_{bx}$ = | **4160** | psi |
| $F_b$ = | 2600 | psi |
| $C_D$ = | 1.60 | |
| $C_r$ = | 1.00 | |
| $C_F$ = | 1.00 | |
| $C_M$ = | 1.00 | |

| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
|---|---|---|---|---|---|---|
| $F_b$ = | 675 | 850 | 900 | 900 | 2600 | 1000 |
| $C_D$ = | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| $C_r$ = | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| $C_F$ = | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| $C_M$ = | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending Deflection Check***

| | | |
|---|---|---|
| Deflection criteria ---> | L / | 240 |
| Allowable Deflection = | 0.53 | in |
| Actual Deflection = | 0.34 | in **OK** |
| 70% Actual Deflection = | 0.24 | in **OK for wind** |

***Combined Stresses***

$F_{cEx}$ = 1513 psi
(Same as $F_{cE}$ because of full lateral support.)

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1-f_c/F_{cEx})} = \mathbf{0.271} < \mathbf{1.0}$$

***Bearing Check***

| | | |
|---|---|---|
| $f_{c,perp}$ = | **0** | psi |
| $F'_{c\ perp,\ HF}$ = | 0.405 | psi |

| | AXIAL | BENDING |
|---|---|---|
| = | 0 + | 0.2706136 |

Subject

Project # ______
By ______
8/6/2019
Sheet# ______

Roof - C3

2/3 - 5 1/2" LVL

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C3

***Axial Compression:***

| | | |
|---|---|---|
| P = | **4.80** k | |
| $L_e$ = | **10.5** effective length, ft | |
| depth = | **5.50** in | |
| width = | **3.50** in | |
| $F_c$ = | 2510 psi | LVL |
| $C_F$ = | 1.00 | |
| c = | 0.90 | |
| E = | 2,000,000 psi | |
| $E_{min}'$ = | 965,710 psi | |

| | |
|---|---|
| Axial Load = | 4800 lb |
| $l_e$ = | 126.0 in |
| Area = | 19.25 $in^2$ |
| $F_c^*$ = | 4016 psi |
| l/d = | 22.9 |
| $F_{cE}$ = | 1513 psi |
| Cp = | 0.36 |
| $F'_c$ = | *1433 psi* |
| $f_c$ = | *249 psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL #1 | (6) 2x8 DF |
|---|---|---|---|---|---|---|
| **$F_c$ =** | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| **$C_F$ =** | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| **c =** | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| **E =** | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| **$E_{min}'$ =** | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |

| Bending allowable stress | |
|---|---|
| $F'_{bx}$ = | **4160** psi |
| $F_b$ = | 2600 psi |
| $C_D$ = | 1.60 |
| $C_r$ = | 1.00 |
| $C_F$ = | 1.00 |
| $C_M$ = | 1.00 |

| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
|---|---|---|---|---|---|---|
| **$F_b$ =** | 675 | 850 | 900 | 900 | 2600 | 1000 |
| **$C_D$ =** | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| **$C_r$ =** | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| **$C_F$ =** | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| **$C_M$ =** | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | | **18.2** psf |
| Tributary Width = | | **5.25** ft |
| $W_{lateral}$ = | | **95.6** plf |
| length = | | 10.5 ft |
| A = | 19.25 $in^2$ | |
| Sx = | 17.65 $in^3$ | |
| Ix = | 48.53 $in^4$ | |
| **$V_{max}$= R1 =R2 =** | | **502 lb** |
| **$M_{max}$ =** | | **1317 ft-lb** |
| $f_{bx}$ = | | 895 psi |

***Bending Deflection Check***

| | | |
|---|---|---|
| Deflection criteria ---> | L / | 240 |
| Allowable Deflection = | | 0.53 in |
| Actual Deflection = | | 0.27 in **OK** |
| 70% Actual Deflection = | | 0.19 in **OK for wind** |

✓

***Combined Stresses***

$F_{cEx}$ = 1513 psi
(Same as $F_{cE}$ because of full lateral support.)

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1 - f_c/F_{cEx})} = \mathbf{0.288 < 1.0}$$

= AXIAL 0.030277 + BENDING 0.2577533

***Bearing Check***

| | |
|---|---|
| $f_{c,\ perp}$ = | **249** psi |
| $F'_{c,perp,\ HF}$ = | 0.405 psi |

→ Increase to triple ble loaded in two directions
(@ corner of cant. living room)

Subject ____________________

Project # ______
By ______
8/2/2019
Sheet# ______

Roof - C4

USE 3 - 2x6

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C4

***Axial Compression:***

| | | |
|---|---|---|
| P = | **6.20** | k |
| $L_e$ = | **10.5** | effective length, ft |
| depth = | **5.50** | in |
| width = | **4.50** | in |
| | **4.50** | |
| $F_c$ = | 1300 | psi HF#2 |
| $C_F$ = | 1.00 | ~~6x6~~ |
| c = | 0.80 | |
| E = | 1,300,000 | psi |
| $E_{min}$' = | 470,000 | psi |

4x4   5x5

| | | |
|---|---|---|
| Axial Load = | 6200 | lb |
| $l_e$ = | 126.0 | in |
| Area = | 24.75 | $in^2$ |
| $F_c$* = | 2080 | psi |
| l/d = | 22.9 | |
| $F_{cE}$ = | 736 | psi |
| Cp = | 0.32 | |
| *F'c* = | *672* | *psi* |
| *fc* = | *251* | *psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL #1 | (6) 2x8 DF |
|---|---|---|---|---|---|---|
| **$F_c$ =** | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| **$C_F$ =** | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| **c =** | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| **E =** | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| **$E_{min}$' =** | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | **19.3** | psf |
| Tributary Width = | **2.50** | ft |
| $w_{lateral}$ = | **48.3** | plf |
| length = | 10.5 | ft |
| A = | 24.75 | $in^2$ |
| Sx = | 22.69 | $in^3$ |
| Ix = | 62.39 | $in^4$ |
| **$V_{max}$= R1 =R2 =** | **253** | **lb** |
| **$M_{max}$ =** | **665** | **ft-lb** |
| $f_{bx}$ = | 352 | psi |

Bending allowable stress

| | | |
|---|---|---|
| $F'_{bx}$ = | **1768** | psi |
| $F_b$ = | 850 | psi |
| $C_D$ = | 1.60 | |
| $C_r$ = | 1.00 | |
| $C_F$ = | 1.30 | |
| $C_M$ = | 1.00 | |

| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
|---|---|---|---|---|---|---|
| **$F_b$ =** | 675 | 850 | 900 | 900 | 2600 | 1000 |
| **$C_D$ =** | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| **$C_r$ =** | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| **$C_F$ =** | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| **$C_M$ =** | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending Deflection Check***

| | | |
|---|---|---|
| Deflection criteria ---> | L / | 240 |
| Allowable Deflection = | 0.53 | in |
| Actual Deflection = | 0.16 | in **OK** |
| 70% Actual Deflection = | 0.11 | in **OK for wind** |

***Combined Stresses***

$F_{cEx}$ = 736 psi
(Same as $F_{cE}$ because of full lateral support.)

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1-f_c/F_{cEx})} = \mathbf{0.441} < 1.0$$

= AXIAL 0.138967 + BENDING 0.301545

***Bearing Check***

| | | |
|---|---|---|
| $f_{c,perp}$ = | **251** | psi |
| $F'_{c\ perp,\ HF}$ = | 0.405 | psi |

Subject ______________

Project # ______
By ______
8/2/2019
Sheet# ______

Roof - C5

2/3 - 5 1/2" LVL

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C5

***Axial Compression:***

| | | |
|---|---|---|
| P = | **6.10** k | |
| $L_e$ = | **10.5** effective length, ft | |
| depth = | **5.50** in | |
| width = | **3.50** in | |
| $F_c$ = | 2510 psi | HF#2 |
| $C_F$ = | 1.00 | 6x6 |
| c = | 0.90 | |
| E = | 2,000,000 psi | |
| $E_{min}'$ = | 965,710 psi | |

| | |
|---|---|
| Axial Load = | 6100 lb |
| $l_e$ = | 126.0 in |
| Area = | 19.25 $in^2$ |
| $F_c^*$ = | 4016 psi |
| l/d = | 22.9 |
| $F_{cE}$ = | 1513 psi |
| Cp = | 0.36 |
| $F'_c$ = | *1433 psi* |
| $f_c$ = | *317 psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL | (6) 2x8 DF #1 |
|---|---|---|---|---|---|---|
| $F_c$ = | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| $C_F$ = | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| c = | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| E = | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| $E_{min}'$ = | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | | **18.2** psf |
| Tributary Width = | | **8.00** ft |
| $w_{lateral}$ = | | **145.6** plf |
| length = | | 10.5 ft |
| A = | 19.25 $in^2$ | |
| Sx = | 17.65 $in^3$ | |
| Ix = | 48.53 $in^4$ | |
| **$V_{max}$= R1 =R2 =** | | **764 lb** |
| **$M_{max}$ =** | | **2007 ft-lb** |
| $f_{bx}$ = | | 1365 psi |

| Bending allowable stress | |
|---|---|
| $F'_{bx}$ = | **4160 psi** |
| $F_b$ = | 2600 psi |
| $C_D$ = | 1.60 |
| $C_r$ = | 1.00 |
| $C_F$ = | 1.00 |
| $C_M$ = | 1.00 |

| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
|---|---|---|---|---|---|---|
| $F_b$ = | 675 | 850 | 900 | 900 | 2600 | 1000 |
| $C_D$ = | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| $C_r$ = | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| $C_F$ = | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| $C_M$ = | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending Deflection Check***

| | | |
|---|---|---|
| Deflection criteria ---> | L / 240 | |
| Allowable Deflection = | 0.53 in | |
| Actual Deflection = | 0.41 in | **OK** |
| 70% Actual Deflection = | 0.29 in | **OK for wind** |

increase to 3 - 5 1/2" LVL

***Combined Stresses***

$F_{cEx}$ = 1513 psi
(Same as $F_{cE}$ because of full lateral support.)

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1-f_c/F_{cEx})} = \mathbf{0.464} < \mathbf{1.0}$$

AXIAL = 0.046698 + BENDING 0.4149513

***Bearing Check***

| | |
|---|---|
| $f_{c,perp}$ = | **317** psi |
| $F'_{c\ perp,\ HF}$ = | 0.405 psi |

Subject ____________

Project # ______
By ______
8/2/2019
Sheet# ______

Roof - C6

3- 5 1/2" LVL

**Combined Axial & Bending Stress Analysis**
Updated 9/9/13 to NDS 2005

for member C6

***Axial Compression:***

| | | | |
|---|---|---|---|
| P = | **2.62** | k | |
| $L_e$ = | **10.5** | effective length, ft | |
| depth = | **5.50** | in | |
| width = | **3.50** | in | |
| $F_c$ = | 2510 | psi | HF#2 |
| $C_F$ = | 1.00 | | 6x6 |
| c = | 0.90 | | |
| E = | 2,000,000 | psi | |
| $E_{min}'$ = | 965,710 | psi | |

| | | |
|---|---|---|
| Axial Load = | 2620 | lb |
| $l_e$ = | 126.0 | in |
| Area = | 19.25 | $in^2$ |
| $F_c^*$ = | 4016 | psi |
| l/d = | 22.9 | |
| $F_{cE}$ = | 1513 | psi |
| Cp = | 0.36 | |
| *F'c* = | *1433* | *psi* |
| *fc* = | *136* | *psi* |

Example Axial Inputs

| | 2x6 HF Stud @16' | 2x6 HF #2 @16" | 2x6 DF #2 @16" | 2x4 DF #2 @16" | 5 1/2" LVL #1 | (6) 2x8 DF |
|---|---|---|---|---|---|---|
| $F_c$ = | 800 | 1300 | 1350 | 1350 | 2510 | 1500 |
| $C_F$ = | 1 | 1.1 | 1.1 | 1.15 | 1 | 1.05 |
| c = | 0.8 | 0.8 | 0.8 | 0.8 | 0.9 | 0.8 |
| E = | 1200000 | 1300000 | 1600000 | 1600000 | 2000000 | 1700000 |
| $E_{min}'$ = | 440000 | 470000 | 580000 | 580000 | 965710 | 620000 |

***Bending***

| | | |
|---|---|---|
| lateral load, psf = | **18.0** | psf |
| Tributary Width = | **7.00** | ft |
| $w_{lateral}$ = | **126.0** | plf |
| length = | 10.5 | ft |
| A = | 19.25 | $in^2$ |
| Sx = | 17.65 | $in^3$ |
| Ix = | 48.53 | $in^4$ |
| **$V_{max}$ = R1 = R2 =** | **662** | **lb** |
| **$M_{max}$ =** | **1736** | **ft-lb** |
| $f_{bx}$ = | 1181 | psi |

Bending allowable stress

| | | |
|---|---|---|
| $F'_{bx}$ = | **4160** | psi |
| $F_b$ = | 2600 | psi |
| $C_D$ = | 1.60 | |
| $C_r$ = | 1.00 | |
| $C_F$ = | 1.00 | |
| $C_M$ = | 1.00 | |

| | Bending: | Bending: | Bending: | Bending: | Bending: | Bending: |
|---|---|---|---|---|---|---|
| $F_b$ = | 675 | 850 | 900 | 900 | 2600 | 1000 |
| $C_D$ = | 1.6 | 1.6 | 1.6 | 1.6 | 1.6 | 1.15 |
| $C_r$ = | 1.15 | 1.15 | 1.15 | 1.15 | 1 | 1.15 |
| $C_F$ = | 1 | 1.3 | 1.3 | 1.5 | 1 | 1.2 |
| $C_M$ = | 1 | 1 | 1 | 1 | 1 | 1 |

***Bending Deflection Check***

| | | | |
|---|---|---|---|
| Deflection criteria ---> | L / | 240 | |
| Allowable Deflection = | | 0.53 | in |
| Actual Deflection = | | 0.36 | in **OK** |
| 70% Actual Deflection = | | 0.25 | in **OK for wind** |

0.53
0.26
0.18
← Increase to 3- 5 1/2" LVL to lower deflection.

***Combined Stresses***

$F_{cEx}$ = 1513 psi
(Same as $F_{cE}$ because of full lateral support.)

$$\left(\frac{f_c}{F'_c}\right)^2 + \frac{f_{bx}}{F'_{bx}(1 - f_c/F_{cEx})} = \boxed{0.321 < 1.0}$$

= AXIAL 0.009021 + BENDING 0.3119293

0.288

***Bearing Check***

| | | |
|---|---|---|
| $f_{c,perp}$ = | **136** | psi |
| $F'_{c,perp,HF}$ = | 0.405 | psi |

Subject: ____________

Project # ______
By ______
8/2/2019
Sheet# ______

DLK
DLK ENGINEERING, LLC

UPLIFT

Job No. Goff | Date: 7/2/19 | By: MKG

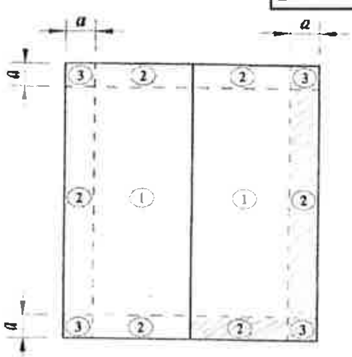
Project: Goff Blue Mountain Residence | Sheet | of

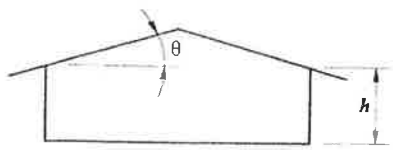
**Comp & Cladding Pressures for Low Rise, Enclosed FLAT/GABLE ROOFS < 7°**

| **Building Geometry:** | | | **Other Input** | | | **Limitations:** | | |
|---|---|---|---|---|---|---|---|---|
| Length (Parallel to ridge) | 53 | ft | V (3-sec gust) | 100 | mph | No Hills: | Kzt: | 1 |
| Width (Perpendicular to ridge) | 26 | ft | Exposure | c | B, C, D? | Buildings Only: | Kd: | 0.85 |
| Mean Roof Height, h | 20 | ft | Risk Category | II | | Rigid Struct: | G: | 0.85 |
| Parapet Height (at TOW): | 0 | ft | Elevation: | 7490 | ft | Enclosed: | GCpi +/- | 0.18 |
| Roof Slope: 0.75 /12 = | 3.6 | deg | Elevation Factor = | | 0.80 | Low Rise Building, h < 60 ft | | |
| | | | | | | Importance Factor | | 1.00 |

| From Table 26.9-1 | | | |
|---|---|---|---|
| alpha = | 9.5 | Kh = | 0.90189 |
| zg = | 900 | $q_h$ = | **15.7 psf** |

a = 3 ft




| **ROOF** | | | | | |
|---|---|---|---|---|---|
| Calculating GCp: GCp(A) = $y_0$ + c*log(A) | | | | | |
| Where: A = area(sq ft); $y_0$ and $c$ as follows: | | | | | |
| index Zones | y1 | y2 | x2 | c | $y_0$ |
| 1 1 | -1 | -0.9 | 100 | 0.1 | -1.1 |
| 2 2 | -1.8 | -1.1 | 100 | 0.7 | -2.5 |
| 3 3 | -2.8 | -1.1 | 100 | 1.7 | -4.5 |
| 4 ALL | 0.3 | 0.2 | 100 | -0.1 | 0.4 |

| **OVERHANG** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Calculating GCp: GCp(A) = $y_0$ + c*log(A) | | | | | | | |
| Where: A = area(sq ft); $y_0$ and $c$ as follows: | | | | | | | |
| Zones | y1 | y2 | y3 | x2 | x3 | c1 | $y_{o1}$ |
| 1 & 2 | -1.7 | -1.6 | -1.1 | 100 | 500 | 0.1 | -1.8 |
| 3 | -2.8 | -0.8 | -0.8 | 100 | 500 | 2 | -4.8 |

**ROOF**

**Negative Pressures**

| ZONE 1 | | 1 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | -1.00 | **-18.5** |
| 20 | -0.97 | **-18.1** |
| 50 | -0.93 | **-17.4** |
| 100 | -0.90 | **-17.0** |

| ZONE 2 | | 2 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | -1.80 | **-31.1** |
| 20 | -1.59 | **-27.8** |
| 50 | -1.31 | **-23.4** |
| 100 | -1.10 | **-20.1** |

| ZONE 3 | | 3 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | -2.80 | **-46.8** |
| 20 | -2.29 | **-38.8** |
| 50 | -1.61 | **-28.1** |
| 100 | -1.10 | **-20.1** |

(handwritten: "80" bracketing the 50 and 100 rows of Zone 2 and Zone 3)

**Positive Pressures**

| ALL ZONES | | 4 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | 0.30 | **7.5** |
| 20 | 0.27 | **7.1** |
| 50 | 0.23 | **6.4** |
| 100 | 0.20 | **6.0** |

**OVERHANG**

**Negative Pressures**

| ZONES 1 & 2 | | 1 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | -1.70 | **-26.7** |
| 20 | -1.67 | **-26.2** |
| 50 | -1.63 | **-25.6** |
| 100 | -1.60 | **-25.1** |
| 200 | -1.38 | **-21.8** |
| 500 | -1.10 | **-17.3** |

| ZONE 3 | | 2 |
|---|---|---|
| A, ft² | GCp | **P, psf** |
| 10 | -2.80 | **-44.0** |
| 20 | -2.20 | **-34.5** |
| 50 | -1.40 | **-22.0** |
| 100 | -0.80 | **-12.6** |

ROOF

column: C1 $A = \left(\frac{16'}{2}\right)\left(\frac{22}{2}\right) = 88 ft^2$
(worstly loaded)

$(20+28)/2 = 24$ psf

use 24psf uplift

W - 0.6D

= 24psf - 0.6(15psf) = 15 psf

*see roof frmg plans for connection calcs (straps)

## ROOF CONNECTIONS

(1) RJ4 to RB4

Hanger for 2x8 @ 16" → LUS28 INVERTED

Simpson Catalog 2019-2020 p. 104

$P_{all,snow}$ = 1.26 K > $P_{uplift}$ = 0.32 K

1.26 (0.64) = 0.8 K > 0.32 K ✓

(2) RB4 to EDGE OF ROOF

3-7¼" LVL → HU68 INVERTED

Simpson p. 148

$P_{all,snow}$ = 1.68 k > $P_{uplift}$ ✓ ok

= 1.68 (0.64)
= 1.07 k

(3) cantelиever roof

7¼" LVL to 2-7¼" LVL → HU7 INVERTED

Simpson p. 144

$P_{all,S}$ = 2.015 K
= 2.0 (0.64)
= 1.28 K > Pup ✓ ok

(4) RIM to RB5

2-7¼" LVL to 2-7¼" LVL → HUSC48 *concealed Flanges "c"

Simpson p. 146

$P_{all,snow}$ = 1.815 K

= 1.815 (0.64) = 1.2 K > $P_{down}$ ✓ ok

(5) RB2 to RB5

3 - 11⅞" LVL to 2-7¼" LVL → HU12 INVERTED

Simpson p. 149

$P_{all,S}$ = 3.695 K



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☐ LOVELAND, CO OFFICE: 441 E 4th STREET #103 LOVELAND, CO 80537 PHONE: (970) 699-5310 Loveland@DLKEng.com

DLK
DLK ENGINEERING, LLC

PROJECT: Goff JOB NO: Goff BY: MKG DATE: 08/6/19

Connections - SHEAR WALL STRAP

SW = 585 pLF TRY CS16 strap, 2 ea plate

$P_{all}$ = 1.705 K (Tension)

Simpson wood constr. connectors p. 175

585 pLF (3') = 1755# ≈ 1705 (2) = 3410# ✓ OK

place 1 strap on each TOP PLATE OF LOW ROOF

**(2) CS16 w/ 16" min nailing ea side**

HANGER CONNECTIONS:

(6) HDR TO C6 ON ROOF - KITCHEN WINDOWS

$R_{max}$ = 1.8 K 3 - 9 1/2" LVL

Simpson catalog p. 149

**HUCQ610** $P_{all\ snow}$ = 4,680#

4680 (0.64) = 3000# > $R_{max}$ ✓

(7) 7 1/4" LVL TO RB2 ON SOUTH SIDE

**HU7** $P_{all\ snow}$ = 2,015# (0.64)

= 1.28 K > $P_{up}$ ✓ OK

SHEET NO:

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DLK
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PROJECT: Goff JOB NO: Goff BY: MKG DATE: 9/5/19

Connections

EXTERIOR DECK

(8) FJ3 → FB6 9 1/2" LVL TO LEDGER

HU9 $P_{all,snow}$ = 3020#(0.64)

Simpson P.145

= 1.9 k > $P_{down}$ = 1.0(12/16)
= 0.8 klf ✓ok

(9) FJ3 → FB5 9 1/2" LVL TO STEEL PACKED BM

Simpson P.

THA29 $P_{all,snow}$ = 1.750k(0.64)
= 1.12 k > 1.2(12"/16")
= 0.9 klf ✓ok

FLOOR BEAM

(10) 11 7/8" LVL TO FB4

Simpson P.144

HU11 $P_{all,FLR}$ = 3275 #(0.64)
= 2096 # > 2 k ✓ok

Ledger To Wall Design

(11) Transverse direction PT 2x10 Ledger

5/8" ϕ wedge-all anchor 2 1/4" embed @32"

Simpson anchoring and fastening for concrete and masonry C-A-2016 p. 167

$P_{all}$ = # > $P_{load}$
load in other direction, Design fine

3, 5/S2.1

SHEET NO:

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DLK
DLK ENGINEERING, LLC

PROJECT: Goff JOB NO: Goff BY: MKG DATE: 9/5/19

## Connections

(12) longitudinal Direction 9 1/2" LVL Ledger

Simpson anchor + fasten p. 167

5/8" ϕ Wedge all anchor
2 1/4" embed

$P_{all}$ = 1130 #

5/S2.1

$\frac{1130\#}{1200 KLF} \times 12" = 11.3"$ required

place | (2) rows of 5/8" wedge all @16" o.c. |

## Hold-downs

HD5B w/ 5/8" Bolt

Simpson p. 46 wood constr. connectors

P = 5645#

* See lateral design for checks

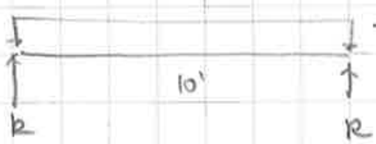
SHEET NO:

# ROOF - Lateral Member Design

Below RB4

$A_{smallest} = (5' \text{ long})(7\frac{1}{2} + 3\frac{1}{2}) = 25 \text{ ft}^2$ → USE −19.3 psf

FOR 10' span:




$-19.3(0.7)(5' \text{ tw}) = 67.6 \text{ plf}$

$\frac{10 \times 12}{0.25} = 480$

$R = 0.34k$

$M = 0.845k'$

$\frac{\Delta}{240} = \frac{ML}{8} = 1 \text{ in}^4$

$\frac{\Delta_{LVL}}{240} = 15.3 \text{ in}^4$

$\frac{\Delta_{LVL}}{480} = 30.6 \text{ in}^4$ → **USE 3 - 5½" LVL FLATWISE**

$I = \frac{1}{12}(5.25")^3(5.5)$

$= 66.3 \text{ in}^4$ ✓ OK

## KITCHEN WINDOWS - WEST SIDE OF HOUSE

USE W = 20 psf


$W = 20\text{psf}(0.7)(4\frac{1}{2} + 2\frac{1}{2}) = 42 \text{ plf}$ (tw wall)

$\frac{9 \times 12}{.25} = 432$

$R = 0.2k$

$M = 0.43k'$

$\frac{\Delta}{240} = \frac{ML}{8} = 0.48 \text{ in}^4$

$\frac{\Delta_{LVL}}{432} = 12.5 \text{ in}^4$ → **3 - 9½" LVL**

*loaded flat wise

$I = \frac{1}{12}(1.75)^3(9.5")$

$= 11.45 \text{ in}^4$ ✓ OK

SHEET NO:

| DLK ENGINEERING, LLC | Project: | Goff | Date: | 07/12/19 | Job No: | JOB NO |
|---|---|---|---|---|---|---|
| | Client: | Cherie with Goff | By: | MKG | Sheet | of |

**Reinforced Concrete Beam Analysis:**

| | |
|---|---|
| f'c, ksi | 3 |
| fy, ksi | 60 |
| $\beta_1$ | 0.85 |
| $\rho_{MIN}$ | 0.003333 |
| $\rho_{tens\ cntrlld}$ | 0.013547 |
| $\rho_{MAX}$ | 0.01547 |
| $\rho_{cmp\ cntrlld}$ | 0.021675 |

| LoadFact | 1.5 |
|---|---|

| Bar Size | Area |
|---|---|
| 3 | 0.11 |
| 4 | 0.2 |
| 5 | 0.31 |
| 6 | 0.44 |
| 7 | 0.6 |
| 8 | 0.79 |
| 9 | 1 |
| 10 | 1.27 |
| 11 | 1.56 |
| 14 | 2.25 |
| 18 | 4 |

| | | | | | | LFRD | | ASD | |
|---|---|---|---|---|---|---|---|---|---|
| Mark # | b, in | d, in | qty | bar # | As, $in^2$ | $\phi$Mn, k' | 0.5$\phi$Vc, k | $M_{CAP}$, k' | $^1/_2V_{C,CAP}$ k |
| | 8 | 33 | 2 | 5 | 0.620 | 67.62 | 10.84 | **45.08** | **7.23** |
| | 8 | 9 | 2 | 5 | 0.620 | 22.57 | 2.96 | **15.04** | **1.97** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
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| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |
| | 8 | 36 | 2 | 4 | 0.400 | 48.00 | 11.83 | **32.00** | **7.89** |

GARAGE HDR

MAIN FLR HDR CHECKS

DLK
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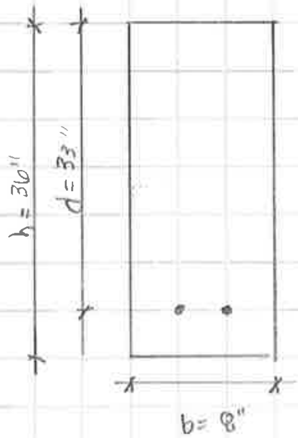
PROJECT: REINFORCED CONC BEAM SPREADSHEET EXAMPLE CALC | JOB NO: GOFF | BY: MKG | DATE: 9/5/19

$f'c = 3000$ psi (DLK STANDARD)

$fy = 60$ ksi

$\beta 1 = 0.85$ $f'c = 3$ ksi $< 4$ksi




REBAR: 2#5

$As = 2(0.31 in^2) = 0.62 in^2$

$\phi Mn = \phi As f_y (d - \frac{a}{2})$

$a = \frac{\beta 1 \; As \; Fy}{0.85 f'c \; \beta 1 b} = \frac{0.62 in^2 (60 ksi)}{0.85(3 ksi)(8")} = 1.82"$

$\phi Vc = \phi 2 \lambda \sqrt{f'c} \, bwd$

$= 0.75(2)(1.0)\sqrt{3000 psi}(8")(33")$

$= 21.7 K$

$0.5 \phi Vc = 10.84$ K ✓ matches spreadsheet

USED SO DONT HAVE TO CHECK REINFORCEMENT.

LOADS ARE IN ASD. CONVERT LRFD → ASD

Load Factor = 1.5

$ASD = \frac{1}{1.5}(0.5 \phi Vc) =$ **7.23K** ✓ Same

SHEET NO:

DLK ENGINEERING, LLC

| | | | | | |
|---|---|---|---|---|---|
| Project: | Goff | Date: | 07/30/19 | Job No: | |
| Client: | Goff Residene | By: | mkg | Sheet | of |

**Input:**

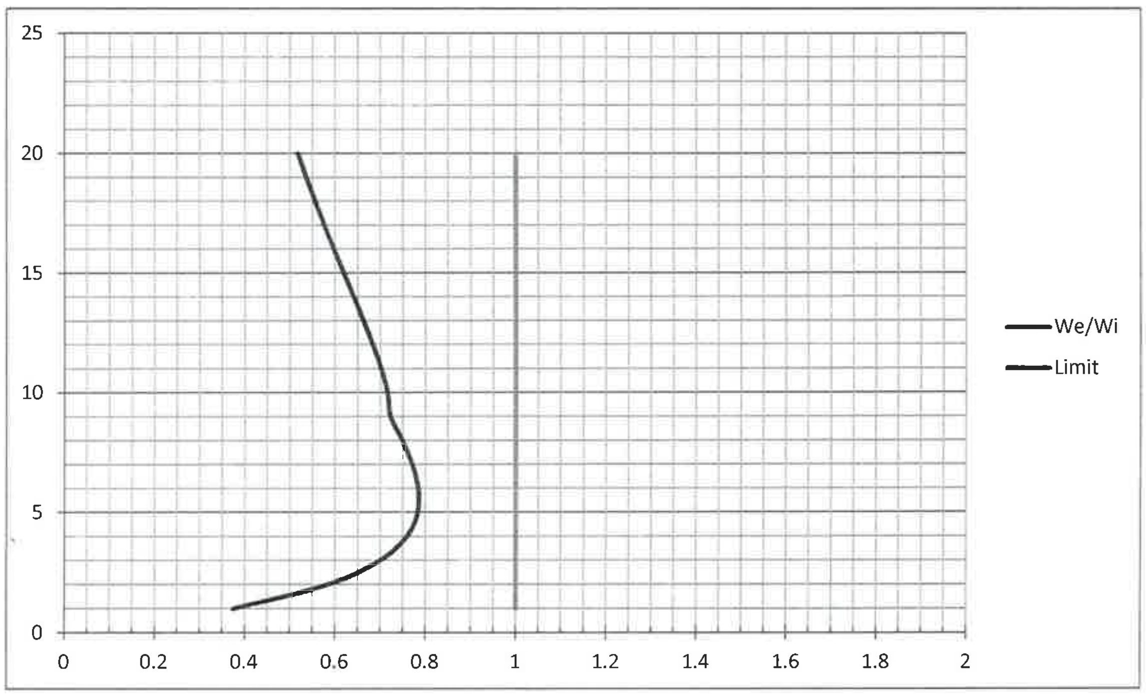
| | | |
|---|---|---|
| b, ft | 16.5 | Width of Wall |
| a, ft | 9 | Height of wall and retainage |
| gamma, kcf | 0.045 | Equiv fluid pressure of soil |

static Earth pressure → soils Report.

**Wall Strengths**

| my | | | | my | | | | mx | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Horiz bar strength at corner: | | | | Horiz bar strength in field | | | | Vert bar strength in field | | | |
| f'c | 3.5 | ksi | | f'c | 3.5 | ksi | | f'c | 3.5 | ksi | |
| fy | 60 | ksi | | fy | 60 | ksi | | fy | 60 | ksi | |
| d | 4 | in | | d | 4 | in | | d | 4.5 | in | |
| t | 8 | in | | t | 8 | in | | t | 8 | in | |
| Use # | 4 | 12 | in | Use # | 4 | 12 | in | Use # | 4 | 12 | in |
| Max spacing | | 18 | in | Max spacing | | 18 | in | Max spacing | | 18 | in |
| As provided | | 0.20 | in2/ft | As provided | | 0.20 | in2/ft | As provided | | 0.20 | in2/ft |
| As min | | 0.19 | in2/ft | As min | | 0.19 | in2/ft | As min | | 0.12 | in2/ft |
| **ϕmn** | | **3.45** | **k-ft/ ft** | **ϕmn** | | **3.45** | **k-ft/ ft** | **ϕmn** | | **3.90** | **k-ft/ ft** |
| ***0.75ϕmn*** | | ***2.59*** | ***k-ft/ ft*** | ***0.75ϕmn*** | | ***2.59*** | ***k-ft/ ft*** | ***0.75ϕmn*** | | ***2.92*** | ***k-ft/ ft*** |
| | Min As OK | | | | Min As OK | | | | Min As OK | | |

| | h, ft | We/Wi | Max Value |
|---|---|---|---|
| ok | 1 | 0.375034 | 1 |
| ok | 2 | 0.584393 | 1 |
| ok | 3 | 0.700018 | 1 |
| ok | 4 | 0.759072 | 1 |
| ok | 5 | 0.782691 | 1 |
| ok | 6 | 0.783783 | 1 |
| ok | 7 | 0.770676 | 1 |
| ok | 8 | 0.748984 | 1 |
| ok | 9 | 0.72263 | 1 |
| ok | 10 | 0.715844 | 1 |
| ok | 11 | 0.701782 | 1 |
| ok | 12 | 0.683419 | 1 |
| ok | 13 | 0.662717 | 1 |
| ok | 14 | 0.640953 | 1 |
| ok | 15 | 0.618949 | 1 |
| ok | 16 | 0.597225 | 1 |
| ok | 17 | 0.576099 | 1 |
| ok | 18 | 0.555758 | 1 |
| ok | 19 | 0.5363 | 1 |
| ok | 20 | 0.517769 | 1 |




*Other wall L = 29.5'

add the back → span is now ≈ 15'

WALL REINF. IS FINE

#4 @ 12" ea way

Basement Walls - Yield Line Analysis EX calcs

Input: length of wall, width, height, EFP (soils report)

Spacing of reinforcement (#4 @ 12" ea way)

Checking: $\frac{We}{Wi} < 1.0$ We = external work
Wi = internal work

* If internal work is greater than external work, the wall will not move. It will have enough reinforcement to withstand the loads

checking $\frac{We}{Wi}$ @ 1' strips from bottom of wall

Plot is showing the ratio @ each foot.

For our wall $\frac{We}{Wi} < 1$ for all heights. The reinf. is enough to withstand the loads

SHEET NO:

DLK
DLK ENGINEERING, LLC

PROJECT: Goff JOB NO: Goff BY: MKG DATE: 8/6/19

# CONCRETE WALL HEIGHTS

## THROUGH MASTER: 11 7/8" FLOOR JOISTS

| | |
|---|---|
| 99' 9" | TOP OF SHG |
| - 3/4" | SHG |
| - 11 7/8" | JOISTS |
| - 1 1/2" | PLATE |
| 98' 6 7/8" | |

## THROUGH LIVING ROOM = EAST SIDE

| | |
|---|---|
| 99' 9" | TOP OF SHG |
| - 3/4" | SHG |
| - 16" | JOISTS |
| - 1 1/2" | PLATE |
| 98' 2 3/4" | |

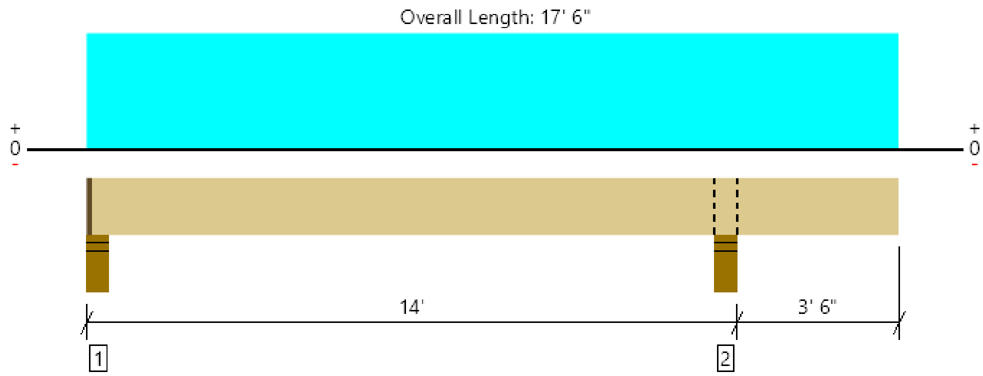
## = WEST SIDE

| | |
|---|---|
| 99' 8" | |
| - 3/4" | SHG |
| - 1 1/2" | PLATE |
| 99' 5 3/4" | |

SHEET NO:

☐ LAFAYETTE, CO OFFICE: 1300 PLAZA COURT N LAFAYETTE, CO 80026 PHONE: (720) 696-0355 Lafayette@DLKEng.com
☐ LOVELAND, CO OFFICE: 441 E 4th STREET #103 LOVELAND, CO 80537 PHONE: (970) 699-5310 Loveland@DLKEng.com

Roof, RB1
3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 10146 @ 13' 9 1/4" | 12275 (5.50") | Passed (83%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5568 @ 12' 6 5/8" | 13622 | Passed (41%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 18832 @ 6' 8 9/16" | 30788 | Passed (61%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Live Load Defl. (in) | 0.318 @ 6' 11 1/2" | 0.448 | Passed (L/508) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.446 @ 6' 11 1/8" | 0.672 | Passed (L/362) | -- | 1.0 D + 1.0 S (Alt Spans) |

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 15' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 17' 5" o/c unless detailed otherwise.

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.25/12

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 5.50" | 4.25" | 2.74" | 1862 | 4348 | 6210 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 5.50" | 5.50" | 4.55" | 3128 | 7018 | 10146 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 17' 6" | N/A | 18.2 | -- | |
| 1 - Uniform (PLF) | 0 to 17' 6" (Back) | N/A | 126.0 | 302.0 | Linked from: RJ2, Support 2 |
| 2 - Uniform (PLF) | 0 to 17' 6" (Front) | N/A | 141.0 | 338.0 | Linked from: RJ3, Support 1 |

## Weyerhaeuser Notes



The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser    SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

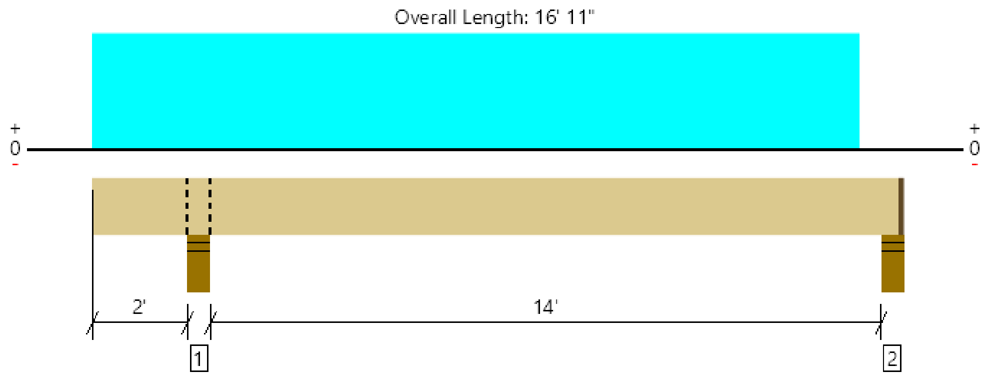
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB2

3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 8120 @ 2' 2 3/4" | 12272 (5.50") | Passed (66%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5194 @ 3' 5 3/8" | 13622 | Passed (38%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 21104 @ 9' 6 1/16" | 30788 | Passed (69%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Live Load Defl. (in) | 0.400 @ 9' 5 3/16" | 0.478 | Passed (L/430) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.571 @ 9' 5 5/16" | 0.718 | Passed (L/302) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240). Upward deflection on left cantilever exceeds overhang deflection criteria.
- Top Edge Bracing (Lu): Top compression edge must be braced at 12' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 16' 10" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 5.50" | 5.50" | 3.64" | 2470 | 5650 | 8120 | Blocking |
| 2 - Stud wall - SPF | 5.50" | 4.25" | 2.48" | 1675 | 3850 | 5525 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 16' 9 3/4" | N/A | 18.2 | -- | |
| 1 - Uniform (PLF) | 0 to 16' (Front) | N/A | 99.0 | 252.5 | Linked from: RJ4, Support 1 |
| 2 - Uniform (PLF) | 0 to 16' (Back) | N/A | 141.0 | 338.0 | Linked from: RJ3, Support 2 |

## Weyerhaeuser Notes



Weyerhaeuser SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 4:33:19 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

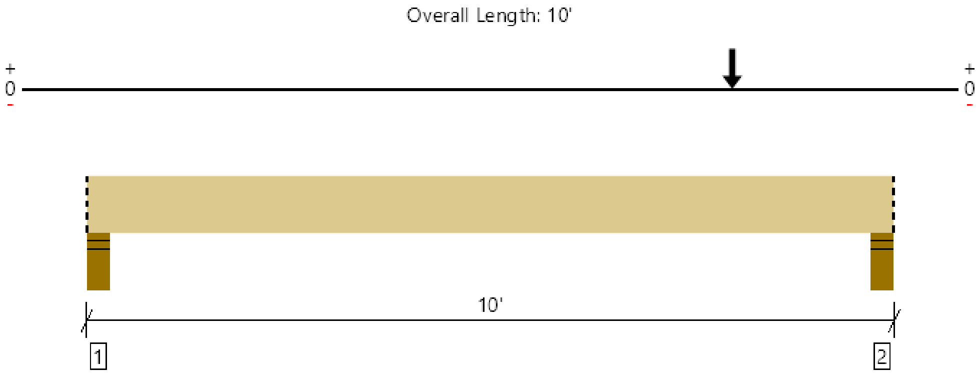
MEMBER REPORT

FAILED

Roof, RB3

2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Support 2 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 8395 @ 9' 8" | 8181 (5.50") | Failed (103%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 8377 @ 8' 6 5/8" | 9081 | Passed (92%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 13968 @ 8' | 20525 | Passed (68%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.128 @ 5' 7" | 0.311 | Passed (L/873) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.188 @ 5' 6 7/8" | 0.467 | Passed (L/596) | -- | 1.0 D + 1.0 S (All Spans) |

System : Roof
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 9' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 10' o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 5.50" | 5.50" | 1.50" | 619 | 1253 | 1872 | Blocking |
| 2 - Stud wall - SPF | 5.50" | 5.50" | 5.64" | 2630 | 5765 | 8395 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 10' | N/A | 12.1 | -- | |
| 1 - Point (lb) | 8' (Top) | N/A | 3128 | 7018 | Linked from: RB1, Support 2 |

## Weyerhaeuser Notes



Weyerhaeuser SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

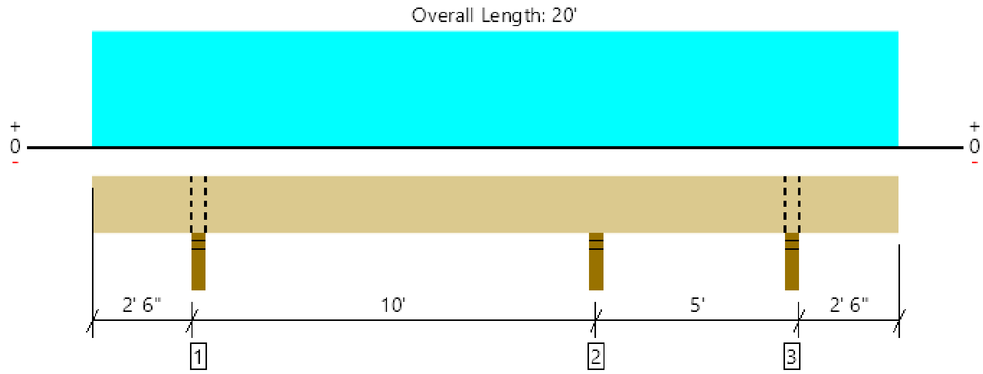
FORTE WEB

MEMBER REPORT

PASSED

Roof, RB4

3 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 6057 @ 12' 6" | 7809 (3.50") | Passed (78%) | -- | 1.0 D + 1.0 S (Adj Spans) |
| Shear (lbs) | 3164 @ 11' 9" | 8317 | Passed (38%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) |
| Moment (Ft-lbs) | -5299 @ 12' 6" | 12273 | Passed (43%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) |
| Live Load Defl. (in) | 0.178 @ 7' 3 3/16" | 0.328 | Passed (L/664) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.246 @ 7' 3 3/8" | 0.493 | Passed (L/481) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 20' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 20' o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 2.15" | 1462 | 3341 | 4803 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 2.71" | 1739 | 4318 | 6057 | None |
| 3 - Stud wall - SPF | 3.50" | 3.50" | 1.50" | 871 | 2364 | 3235 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 20' | N/A | 11.1 | -- | |
| 1 - Uniform (PLF) | 0 to 20' (Back) | N/A | 192.5 | 462.0 | Linked from: RJ4, Support 2 |

## Weyerhaeuser Notes



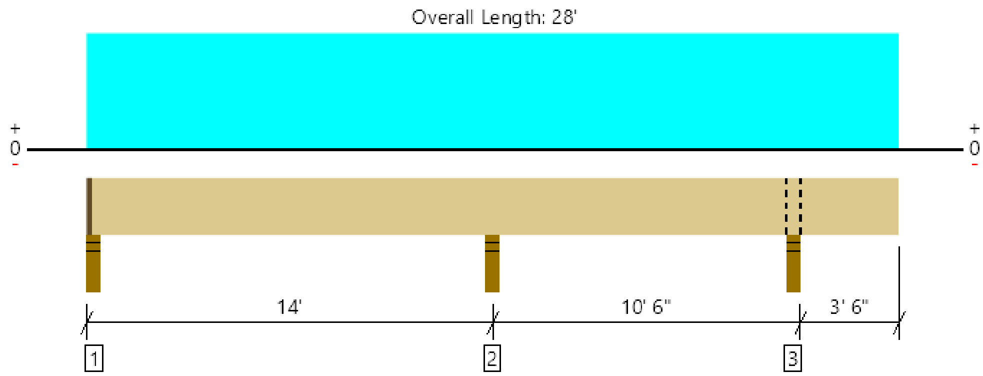
| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

MEMBER REPORT

**PASSED**

Roof, RB5

1 piece(s) 1 3/4" x 7 1/4" 2.0E Microllam® LVL




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1060 @ 14' | 2603 (3.50") | Passed (41%) | -- | 1.0 D + 1.0 S (Adj Spans) |
| Shear (lbs) | 538 @ 13' 3" | 2772 | Passed (19%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) |
| Moment (Ft-lbs) | -1324 @ 14' | 4091 | Passed (32%) | 1.15 | 1.0 D + 1.0 S (Adj Spans) |
| Live Load Defl. (in) | 0.233 @ 6' 6 3/4" | 0.461 | Passed (L/713) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.336 @ 6' 6 3/16" | 0.692 | Passed (L/495) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Roof
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 26' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 23' 7" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 1.50" | 137 | 288 | 425 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 1.50" | 343 | 717 | 1060 | None |
| 3 - Stud wall - SPF | 3.50" | 3.50" | 1.50" | 183 | 403 | 586 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 28' | N/A | 3.7 | -- | |
| 1 - Uniform (PSF) | 0 to 28' (Front) | 1' | 20.0 | 48.0 | |

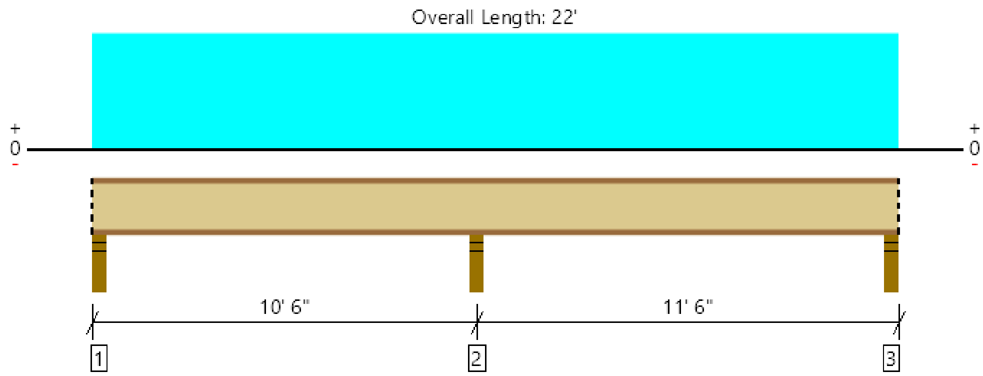
## Weyerhaeuser Notes



| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

Roof, RJ1

1 piece(s) 11 7/8" TJI® 210 @ 24" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1838 @ 10' 6" | 2467 (3.50") | Passed (75%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 848 @ 10' 7 3/4" | 1903 | Passed (45%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | -1993 @ 10' 6" | 4364 | Passed (46%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.091 @ 16' 7 13/16" | 0.376 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.124 @ 16' 8 5/8" | 0.565 | Passed (L/999+) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 3" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 3" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 157 | 416 | 573 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 3.50" | 541 | 1297 | 1838 | None |
| 3 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 182 | 464 | 646 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 22' | 24" | 20.0 | 48.0 | Default Load |

## Weyerhaeuser Notes



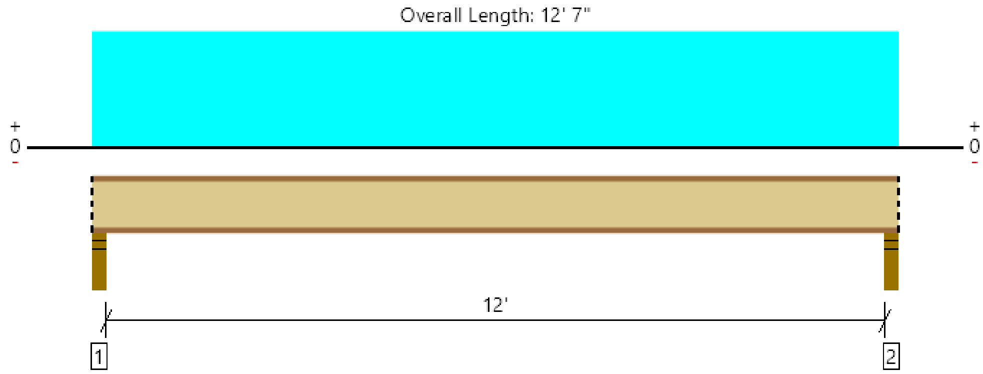
| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

MEMBER REPORT

PASSED

Roof, RJ2

1 piece(s) 11 7/8" TJI® 210 @ 24" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 856 @ 2 1/2" | 1679 (3.50") | Passed (51%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 816 @ 3 1/2" | 1903 | Passed (43%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 2517 @ 6' 3 1/2" | 4364 | Passed (58%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.182 @ 6' 3 1/2" | 0.406 | Passed (L/801) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.258 @ 6' 3 1/2" | 0.608 | Passed (L/566) | -- | 1.0 D + 1.0 S (All Spans) |

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.25/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 4' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 12' 7" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 252 | 604 | 856 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 252 | 604 | 856 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 12' 7" | 24" | 20.0 | 48.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

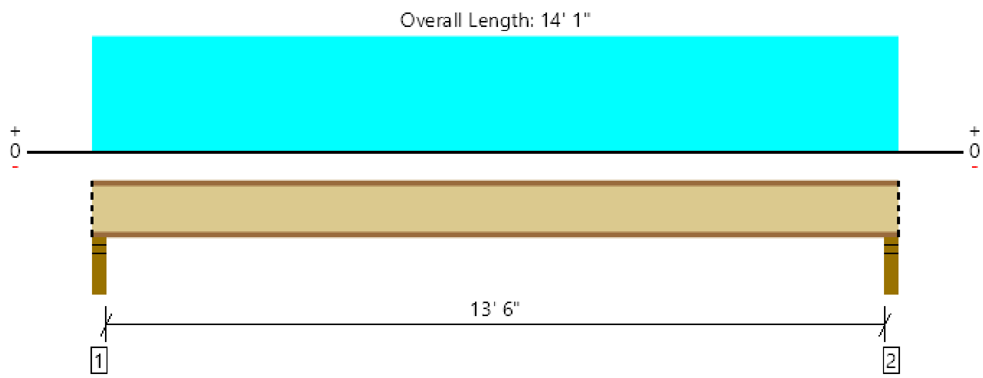
FORTE WEB

MEMBER REPORT

PASSED

Roof, RJ3

1 piece(s) 11 7/8" TJI® 210 @ 24" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 958 @ 2 1/2" | 1679 (3.50") | Passed (57%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 918 @ 3 1/2" | 1903 | Passed (48%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 3175 @ 7' 1/2" | 4364 | Passed (73%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.280 @ 7' 1/2" | 0.456 | Passed (L/587) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.396 @ 7' 1/2" | 0.683 | Passed (L/414) | -- | 1.0 D + 1.0 S (All Spans) |

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.25/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 4' 1" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 14' 1" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 282 | 676 | 958 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 1.75" | 282 | 676 | 958 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 14' 1" | 24" | 20.0 | 48.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

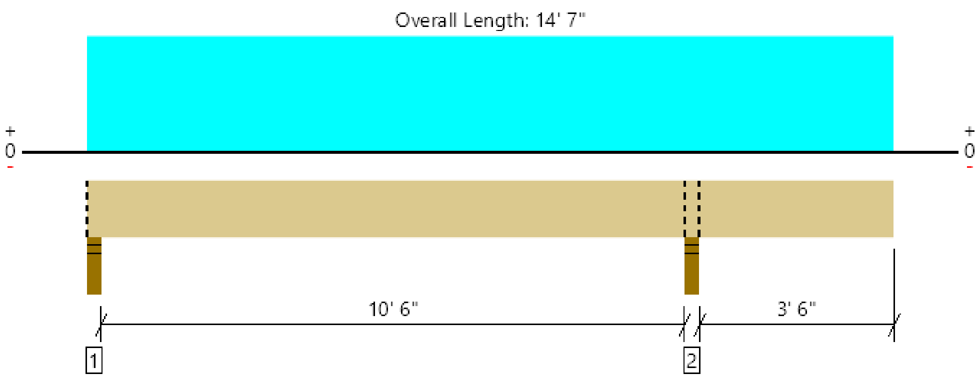
FORTE WEB

MEMBER REPORT

PASSED

Roof, RJ4

2 piece(s) 1 3/4" x 5 1/2" 2.0E Microllam® LVL @ 24" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1310 @ 10' 11 1/4" | 5207 (3.50") | Passed (25%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 732 @ 10' 4" | 4206 | Passed (17%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 1676 @ 5' 2 1/16" | 5084 | Passed (33%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Live Load Defl. (in) | 0.263 @ 5' 5 7/16" | 0.358 | Passed (L/490) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 0.355 @ 5' 4 15/16" | 0.537 | Passed (L/363) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.25/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 14' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 14' 7" o/c unless detailed otherwise.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 1.50" | 198 | 505 | 703 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 1.50" | 385 | 924 | 1309 | Blocking |

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Snow (1.15) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 14' 7" | 24" | 20.0 | 48.0 | Default Load |

| Member Notes |
|---|
| Conversion to 2X8 Joists |

## Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

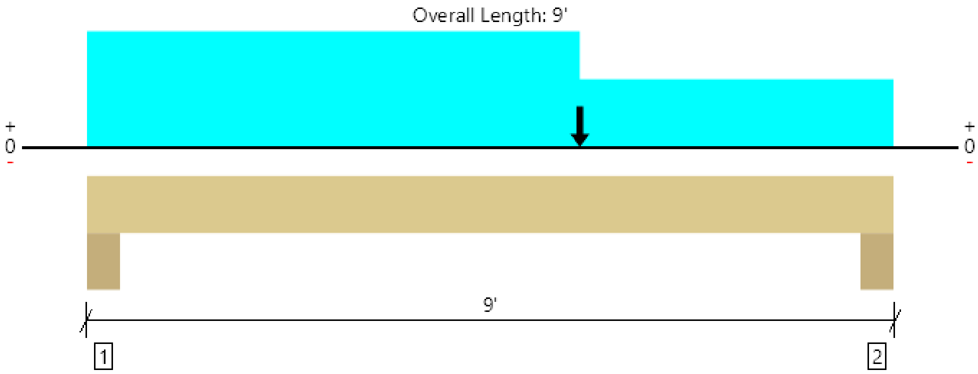
8/6/2019 4:31:31 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

Main Floor, F-B1

2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 4991 @ 6 1/2" | 21000 (8.00") | Passed (24%) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs) | 3217 @ 1' 7 7/8" | 9081 | Passed (35%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Moment (Ft-lbs) | 9084 @ 4' 7 15/16" | 20525 | Passed (44%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Live Load Defl. (in) | 0.053 @ 4' 6" | 0.198 | Passed (L/999+) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.129 @ 4' 6" | 0.396 | Passed (L/739) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 9' o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 9' o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Trimmer - DF | 8.00" | 8.00" | 1.90" | 2989 | 945 | 1725 | 5659 | None |
| 2 - Trimmer - DF | 8.00" | 8.00" | 1.63" | 2726 | 945 | 1118 | 4789 | None |

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 9' | N/A | 12.1 | -- | -- | |
| 1 - Point (lb) | 5' 6" | N/A | 382 | - | 918 | HDR Above |
| 2 - Uniform (PLF) | 0 to 5' 6" | N/A | 150.0 | - | 350.0 | Joists Above |
| 3 - Uniform (PLF) | 0 to 9' | N/A | 200.0 | - | - | Wall abv and concrete weight |
| 4 - Uniform (PLF) | 0 to 9' | N/A | 288.8 | 210.0 | - | Linked from: F-J5, Support 2 |

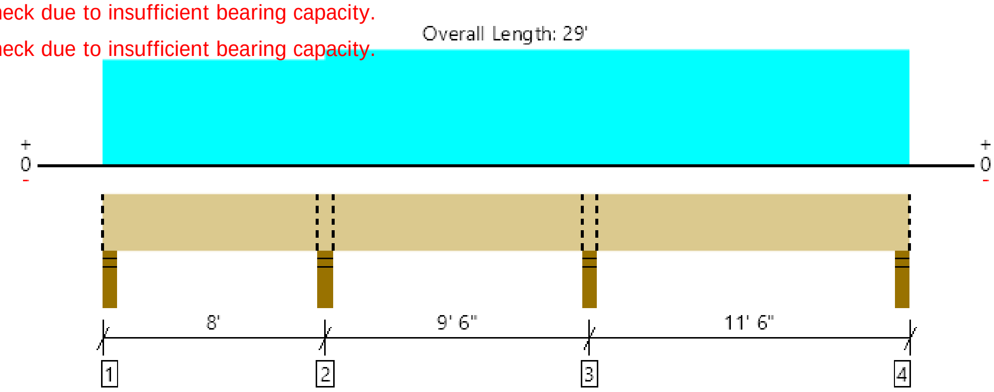


| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

# Main Floor, F-B2

## 2 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Support 2 failed reaction check due to insufficient bearing capacity.
Support 3 failed reaction check due to insufficient bearing capacity.
Support 4 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 17567 @ 17' 6" | 5206 (3.50") | Failed (337%) | -- | 1.0 D + 0.75 L + 0.75 S (Adj Spans) |
| Shear (lbs) | 8024 @ 18' 7 5/8" | 9081 | Passed (88%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (Adj Spans) |
| Moment (Ft-lbs) | -18138 @ 17' 6" | 20525 | Passed (88%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (Adj Spans) |
| Live Load Defl. (in) | 0.185 @ 23' 6 7/16" | 0.283 | Passed (L/737) | -- | 1.0 D + 0.75 L + 0.75 S (Alt Spans) |
| Total Load Defl. (in) | 0.379 @ 23' 7 3/4" | 0.567 | Passed (L/358) | -- | 1.0 D + 0.75 L + 0.75 S (Alt Spans) |

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 11" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 5' 6" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 3.50" | 2.99" | 2062 | 1192/-286 | 1999 | 5253/-286 | Blocking |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 8.43" | 6217 | 3841 | 4598 | 14656 | Blocking |
| 3 - Stud wall - SPF | 3.50" | 3.50" | 11.81" | 9638 | 5601 | 4971 | 20210 | Blocking |
| 4 - Stud wall - SPF | 3.50" | 3.50" | 4.62" | 3707 | 2228/-155 | 1989 | 7924/-155 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 0 to 29' | N/A | 12.1 | -- | -- | |
| 1 - Uniform (PLF) | 0 to 29' (Front) | N/A | 288.8 | 210.0 | - | Linked from: F-J5, Support 1 |
| 2 - Uniform (PLF) | 0 to 8' (Back) | N/A | 340.5 | 80.3 | 553.5 | Linked from: F-J4, Support 2 |
| 3 - Uniform (PLF) | 8' to 29' (Back) | N/A | 484.5 | 230.3 | 402.8 | Linked from: F-J2, Support 2 |

## Weyerhaeuser Notes



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| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

FORTE WEB

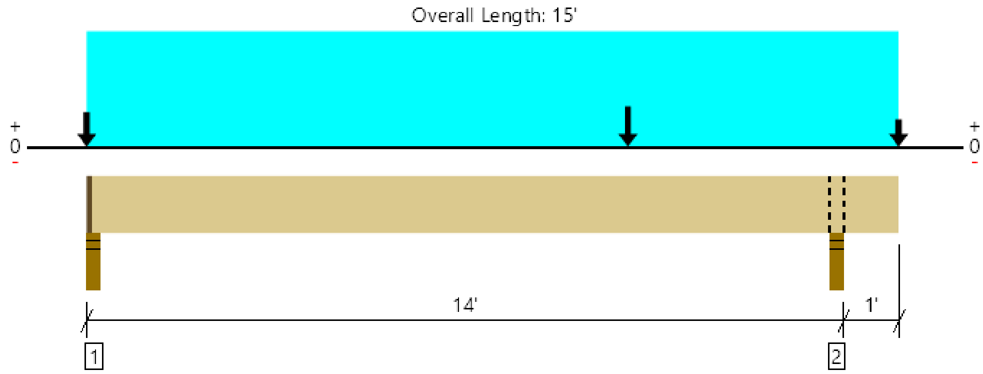
MEMBER REPORT

FAILED

Main Floor, F-B3

3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Support 2 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 9727 @ 13' 10 1/4" | 7809 (3.50") | Failed (125%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 5962 @ 12' 8 5/8" | 13622 | Passed (44%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 19381 @ 10' | 30788 | Passed (63%) | 1.15 | 1.0 D + 1.0 S (Alt Spans) |
| Live Load Defl. (in) | 0.222 @ 7' 5 11/16" | 0.342 | Passed (L/741) | -- | 1.0 D + 0.75 L + 0.75 S (Alt Spans) |
| Total Load Defl. (in) | 0.431 @ 7' 4 5/16" | 0.684 | Passed (L/382) | -- | 1.0 D + 0.75 L + 0.75 S (Alt Spans) |

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 14' 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 14' 11" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 1.64" | 3497 | 1094 | 4458 | 9049 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 4.36" | 4063 | 1254 | 5664 | 10981 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 15' | N/A | 18.2 | -- | -- | |
| 1 - Uniform (PSF) | 0 to 15' (Back) | 3' 10 13/16" | 55.0 | 40.0 | - | Default Load |
| 2 - Point (lb) | 15' (Top) | N/A | 871 | - | 2364 | Linked from: RB4, Support 3 |
| 3 - Point (lb) | 10' (Top) | N/A | 1739 | - | 4318 | Linked from: RB4, Support 2 |
| 4 - Point (lb) | 0 (Top) | N/A | 1462 | - | 3341 | Linked from: RB4, Support 1 |

## Member Notes

Convert to Steel by changing I.

## Weyerhaeuser Notes



| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 7:39:20 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

FORTE WEB

MEMBER REPORT

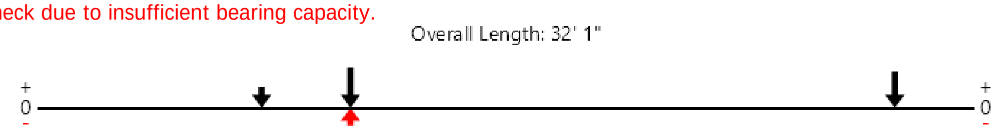
**FAILED**

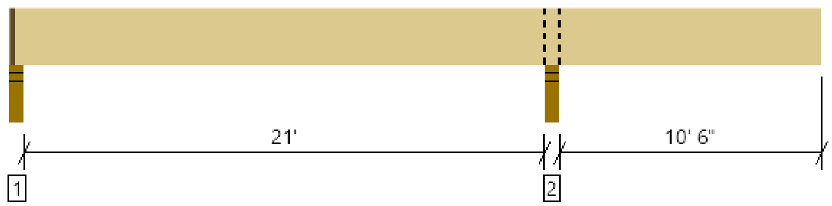
Main Floor, F-B4

3 piece(s) 1 3/4" x 16" 2.0E Microllam® LVL

Right overhang exceeds the maximum length of 7' for this product.

Support 2 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) [Group] |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 21481 @ 21' 5 1/4" | 7809 (3.50") | Failed (275%) | -- | 1.0 D + 1.0 S (All Spans) [1] |
| Shear (lbs) | 11456 @ 19' 11 1/2" | 18354 | Passed (62%) | 1.15 | 1.0 D + 1.0 S (All Spans) [1] |
| Moment (Ft-lbs) | -99266 @ 21' 5 1/4" | 40254 | Failed (247%) | 1.15 | 1.0 D + 1.0 S (All Spans) [1] |
| Live Load Defl. (in) | 2.565 @ 32' 1" | 0.532 | Failed (2L/100) | -- | 1.0 D + 1.0 S (Alt Spans) [1] |
| Total Load Defl. (in) | 4.030 @ 32' 1" | 1.065 | Failed (2L/64) | -- | 1.0 D + 1.0 S (Alt Spans) [1] |

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6" o/c unless detailed otherwise.
- Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 2.29" | 1769 | 1232/-593 | 3215/-402 | 6216/-995 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 9.63" | 9222 | 2649 | 12259 | 24130 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 32' 1" | N/A | 24.5 | -- | -- | |
| 1 - Point (lb) | 6' 6" (Front) | N/A | 1158 | 842 | - | |
| 2 - Point (lb) | 10' (Front) | N/A | 294 | - | 706 | |
| 3 - Point (lb) | 10' (Top) | N/A | 2630 | - | 5765 | Linked from: RB3, Support 2 |
| 4 - Point (lb) | 10' (Back) | N/A | 2062 | 1192/-286 | 1999 | Linked from: F-B2, Support 1 |
| 5 - Point (lb) | 31' 6" (Top) | N/A | 4063 | 1254 | 5664 | Linked from: F-B3, Support 2 |

## Member Notes

Design done in Risa as well for Steel

## Weyerhaeuser Notes



| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 8:00:44 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
| --- | --- |
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

Main Floor, F-B5

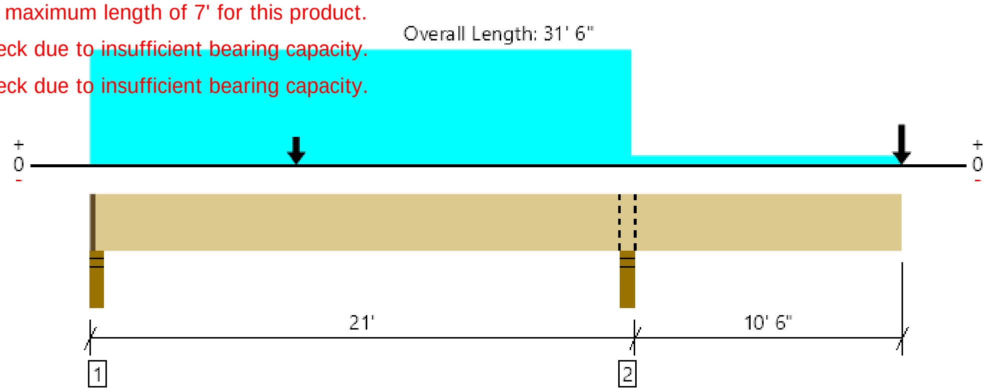
3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Right cantilever length exceeds 1/3 member length or 1/2 back span length.

Right overhang exceeds the maximum length of 7' for this product.

Support 1 failed reaction check due to insufficient bearing capacity.

Support 2 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 27519 @ 20' 10 1/4" | 7809 (3.50") | Failed (352%) | -- | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 16977 @ 19' 8 5/8" | 13622 | Failed (125%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Moment (Ft-lbs) | -91395 @ 20' 10 1/4" | 23091 | Failed (396%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 4.853 @ 31' 6" | 0.532 | Failed (2L/52) | -- | 1.0 D + 1.0 S (Alt Spans) |
| Total Load Defl. (in) | 6.631 @ 31' 6" | 1.065 | Failed (2L/38) | -- | 1.0 D + 1.0 S (Alt Spans) |

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/480) and TL (2L/240). Upward deflection on right cantilever exceeds overhang deflection criteria.
- Top Edge Bracing (Lu): Top compression edge must be braced at 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 6" o/c unless detailed otherwise.
- Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.
- Upward deflection on right cantilever exceeds 0.4".

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 5.54" | 6856 | 2207/-541 | 5307 | 14370/-541 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 3.50" | 12.33" | 15375 | 3860 | 12143 | 31378 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 31' 6" | N/A | 18.2 | -- | -- | |
| 1 - Uniform (PLF) | 0 to 31' 6" (Top) | N/A | 100.0 | - | - | |
| 2 - Point (lb) | 8' (Top) | N/A | 1862 | - | 4348 | Linked from: RB1, Support 1 |
| 3 - Uniform (PLF) | 0 to 21' (Front) | N/A | 626.3 | 210.0 | 357.0 | Linked from: F-J3, Support 2 |
| 4 - Point (lb) | 31' 6" (Front) | N/A | 3497 | 1094 | 4458 | Linked from: F-B3, Support 1 |

## Member Notes

Reactions conservative because using planter weight on deck joists full length. See Risa for more exact calcs

## Weyerhaeuser Notes



| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

| ForteWEB Software Operator | Job Notes |
| --- | --- |
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

FORTE WEB

MEMBER REPORT

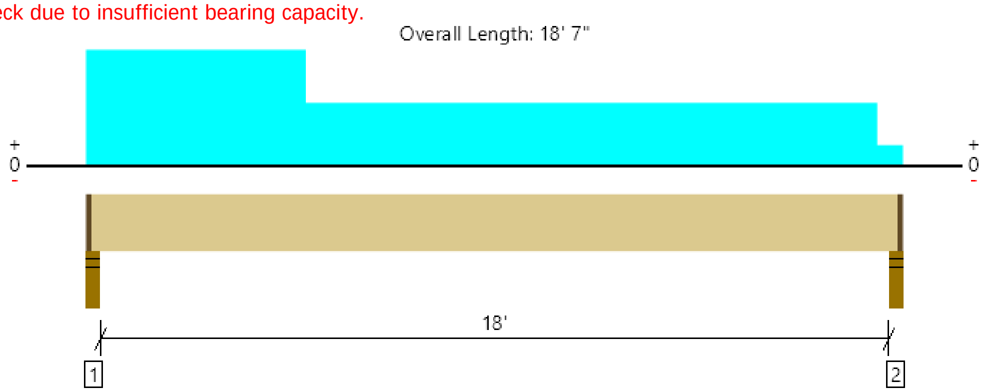
FAILED

Main Floor, F-B6

3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL

Support 1 failed reaction check due to insufficient bearing capacity.

Support 2 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 10967 @ 2" | 5020 (2.25") | Failed (218%) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs) | 9054 @ 1' 3 3/8" | 13622 | Passed (66%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Moment (Ft-lbs) | 39057 @ 8' 7 15/16" | 30788 | Failed (127%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Live Load Defl. (in) | 0.756 @ 9' 3 7/16" | 0.456 | Failed (L/290) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 1.691 @ 9' 1 5/8" | 0.913 | Failed (L/129) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 18' 5" o/c unless detailed otherwise.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 4.92" | 7185 | 1950 | 3315 | 12450 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 2.25" | 3.51" | 4154 | 1830 | 3111 | 9095 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Vertical Loads | Location (Side) | Tributary Width | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 0 - Self Weight (PLF) | 1 1/4" to 18' 5 3/4" | N/A | 18.2 | -- | -- | |
| 1 - Uniform (PSF) | 5' to 18' (Front) | 5' 3" | 15.0 | 40.0 | 68.0 | Default Load |
| 2 - Uniform (PLF) | 0 to 5' (Back) | N/A | 881.3 | 210.0 | 357.0 | Linked from: F-J3, Support 1 |
| 3 - Uniform (PLF) | 0 to 18' 7" (Front) | N/A | 300.0 | - | - | |

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/1/2019 8:49:27 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

FORTE WEB

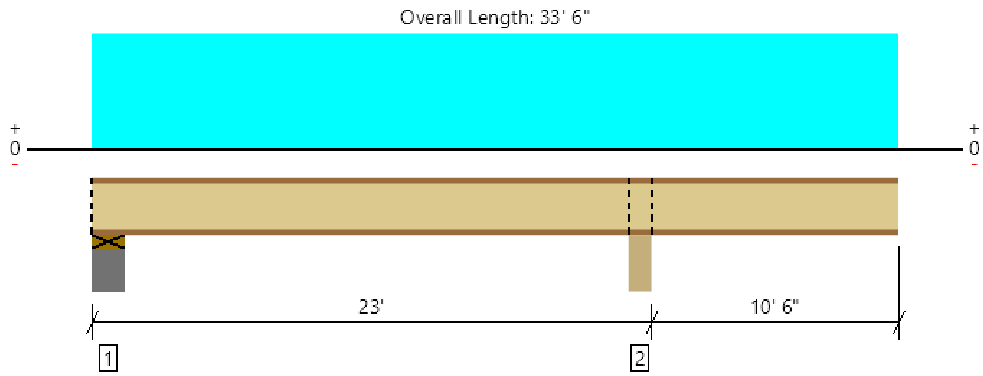
MEMBER REPORT

FAILED

Main Floor, F-J1

1 piece(s) 16" TJI® 560 @ 16" OC

Right overhang exceeds the maximum length of 7' for this product.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 3093 @ 22' 9 1/4" | 3455 (5.25") | Passed (90%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Shear (lbs) | 1599 @ 22' 6 1/2" | 2710 | Passed (59%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Moment (Ft-lbs) | -7291 @ 22' 9 1/4" | 9694 | Passed (75%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Live Load Defl. (in) | 0.444 @ 33' 6" | 0.715 | Passed (2L/580) | -- | 1.0 D + 1.0 L (Alt Spans) |
| Total Load Defl. (in) | 0.613 @ 33' 6" | 0.715 | Passed (2L/420) | -- | 1.0 D + 1.0 L (Alt Spans) |
| TJ-Pro™ Rating | 51 | 40 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/360).
- Overhang deflection criteria: LL (2L/360) and TL (2L/360).
- Input live load span ratio deflection limit is below building code minimum value of L/360. This minimum value was used for design.
- Moment capacity over cantilever support 2 has been reduced by 25% to lessen the effects of buckling.
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 8" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 7' 8" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 8.00" | 1.84" | 666 | 623/-138 | 1289/-138 | Blocking |
| 2 - Beam - SPF | 5.50" | 5.50" | 3.86" | 1791 | 1302 | 3093 | Blocking |

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 33' 6" | 16" | 55.0 | 40.0 | Default Load |

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 8:11:22 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

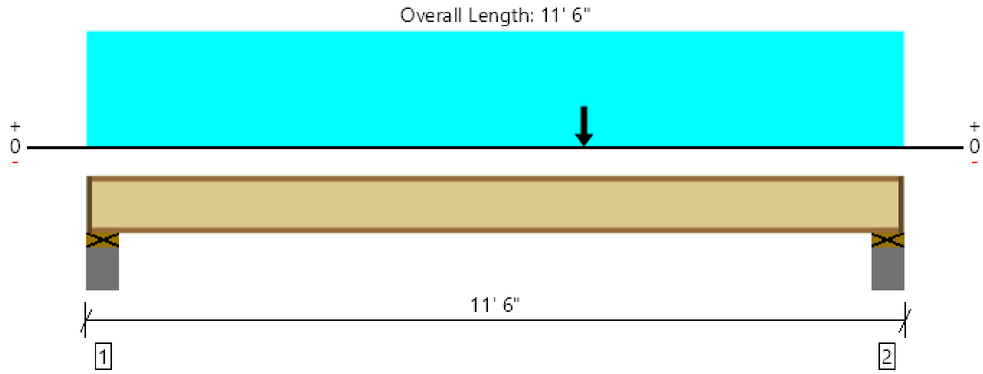
FORTE WEB

MEMBER REPORT

PASSED

Main Floor, F-J2

1 piece(s) 11 7/8" TJI® 210 @ 16" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1267 @ 10' 11" | 1679 (3.50") | Passed (75%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs) | 1203 @ 10' 10" | 1903 | Passed (63%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Moment (Ft-lbs) | 3902 @ 7' | 4364 | Passed (89%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.121 @ 5' 11 5/8" | 0.258 | Passed (L/999+) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.234 @ 5' 11 1/8" | 0.517 | Passed (L/529) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| TJ-Pro™ Rating | 62 | 44 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 3' 7" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 11' 4" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 6.75" | 1.75" | 558 | 307 | 328 | 1193 | 1 1/4" Rim Board |
| 2 - Plate on concrete - SPF | 8.00" | 6.75" | 2.12" | 646 | 307 | 537 | 1490 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Vertical Loads | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 11' 6" | 16" | 55.0 | 40.0 | - | Default Load |
| 2 - Point (PLF) | 7' | 16" | 270.5 | - | 648.5 | Linked from: RJ1, Support 2 |

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser   SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
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| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/6/2019 7:30:55 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

FORTE WEB

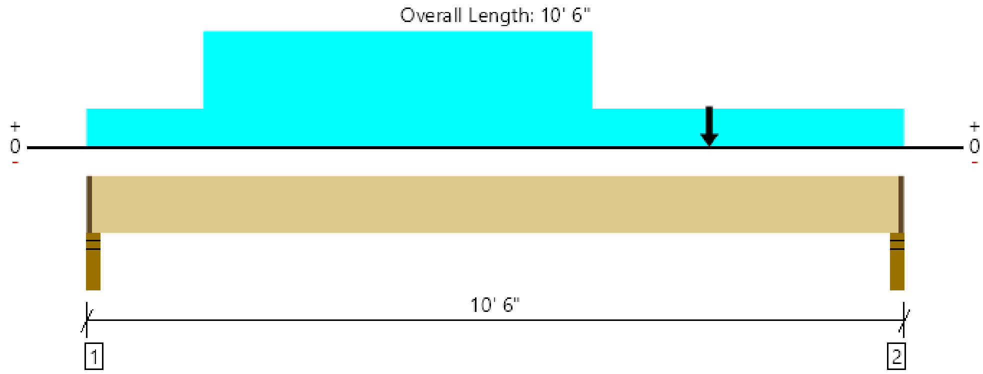
MEMBER REPORT

**FAILED**

Main Floor, F-J3

1 piece(s) 1 3/4" x 9 1/2" 2.0E Microllam® LVL @ 16" OC

Support 1 failed reaction check due to insufficient bearing capacity.




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1729 @ 2 1/2" | 1673 (2.25") | Failed (103%) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Shear (lbs) | 1604 @ 1' 1" | 3633 | Passed (44%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Moment (Ft-lbs) | 4714 @ 4' 10 5/16" | 7041 | Passed (67%) | 1.15 | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Live Load Defl. (in) | 0.098 @ 5' 3" | 0.252 | Passed (L/999+) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| Total Load Defl. (in) | 0.328 @ 5' 1 11/16" | 0.504 | Passed (L/369) | -- | 1.0 D + 0.75 L + 0.75 S (All Spans) |
| TJ-Pro™ Rating | 66 | 44 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 7' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 10' 4" o/c unless detailed otherwise.
- A 4% increase in the moment capacity has been added to account for repetitive member usage.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 1/2" Gypsum ceiling.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Stud wall - SPF | 3.50" | 2.25" | 2.32" | 1175 | 280 | 476 | 1931 | 1 1/4" Rim Board |
| 2 - Stud wall - SPF | 3.50" | 2.25" | 1.87" | 835 | 280 | 476 | 1591 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Vertical Loads | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 10' 6" | 16" | 15.0 | 40.0 | 68.0 | Default Load |
| 2 - Point (PLF) | 8' | 16" | 100.0 | - | - | |
| 3 - Uniform (PSF) | 1' 6" to 6' 6" | 16" | 250.0 | - | - | |

## Member Notes

Additional Loads:
Planters: (120 pcf soil * 2') = 250 psf
Wall Above = 100 plf

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Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

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|---|---|
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8/6/2019 7:56:14 PM UTC

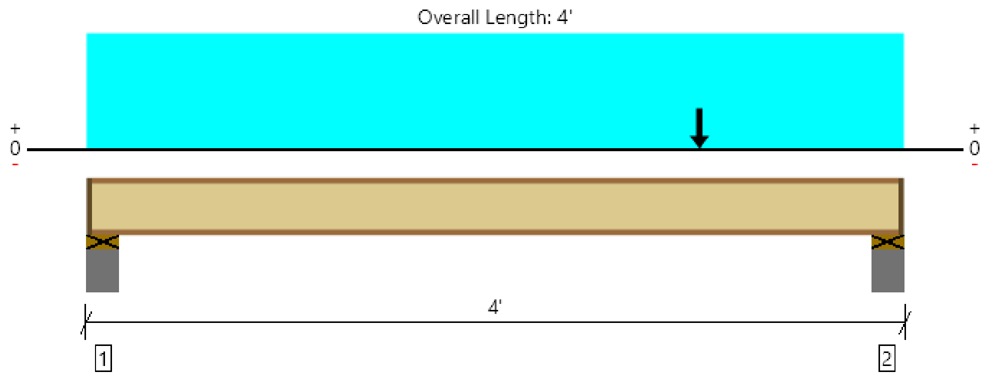
ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

PASSED

Main Floor, F-J4

1 piece(s) 11 7/8" TJI® 210 @ 16" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 1184 @ 3' 5" | 1679 (3.50") | Passed (71%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Shear (lbs) | 1143 @ 3' 4" | 1903 | Passed (60%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Moment (Ft-lbs) | 472 @ 3' | 4364 | Passed (11%) | 1.15 | 1.0 D + 1.0 S (All Spans) |
| Live Load Defl. (in) | 0.006 @ 3' | 0.071 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| Total Load Defl. (in) | 0.009 @ 3' | 0.142 | Passed (L/999+) | -- | 1.0 D + 1.0 S (All Spans) |
| TJ-Pro™ Rating | 74 | 44 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 3' 10" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 3' 10" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | | Accessories |
|---|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Snow | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 6.75" | 1.75" | 200 | 107 | 127 | 434 | 1 1/4" Rim Board |
| 2 - Plate on concrete - SPF | 8.00" | 6.75" | 1.85" | 454 | 107 | 738 | 1299 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Vertical Loads | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Snow (1.15) | Comments |
|---|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 4' | 16" | 55.0 | 40.0 | - | Default Load |
| 2 - Point (PLF) | 3' | 16" | 270.5 | - | 648.5 | Linked from: RJ1, Support 2 |

## Weyerhaeuser Notes



Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

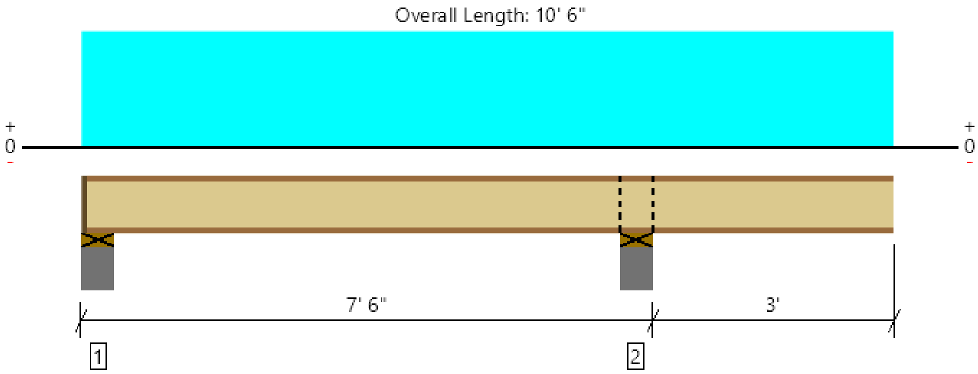
| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

MEMBER REPORT

**PASSED**

Main Floor, F-J5.1

1 piece(s) 11 7/8" TJI® 210 @ 16" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 946 @ 7' 2" | 2565 (5.25") | Passed (37%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Shear (lbs) | 445 @ 6' 10" | 1821 | Passed (24%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Moment (Ft-lbs) | -704 @ 7' 2" | 3795 | Passed (19%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Live Load Defl. (in) | 0.019 @ 10' 6" | 0.200 | Passed (2L/999+) | -- | 1.0 D + 1.0 L (Alt Spans) |
| Total Load Defl. (in) | 0.031 @ 10' 6" | 0.333 | Passed (2L/999+) | -- | 1.0 D + 1.0 L (Alt Spans) |
| TJ-Pro™ Rating | 69 | 44 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Overhang deflection criteria: LL (2L/0.2") and TL (2L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 8' 8" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 8' 8" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 6.75" | 1.75" | 222 | 207/-39 | 429/-39 | 1 1/4" Rim Board |
| 2 - Plate on concrete - SPF | 8.00" | 8.00" | 3.50" | 548 | 398 | 946 | Blocking |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 10' 6" | 16" | 55.0 | 40.0 | Default Load |

## Weyerhaeuser Notes



| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

8/1/2019 7:41:14 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

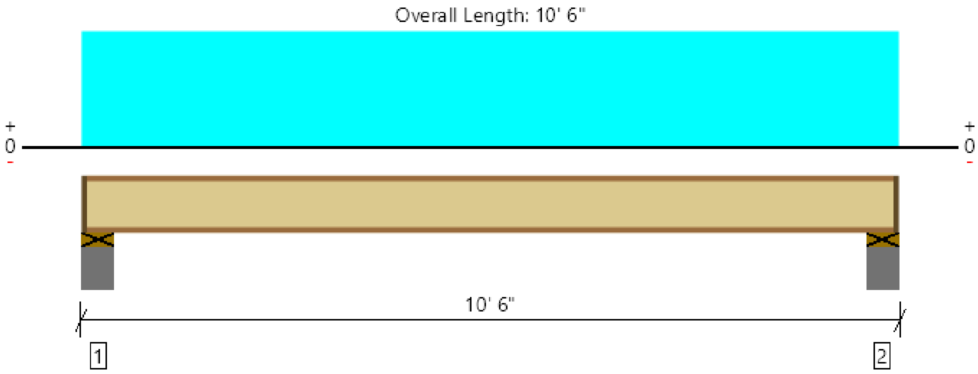
FORTE WEB

MEMBER REPORT

PASSED

Main Floor, F-J5

1 piece(s) 11 7/8" TJI® 210 @ 16" OC




All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

| Design Results | Actual @ Location | Allowed | Result | LDF | Load: Combination (Pattern) |
|---|---|---|---|---|---|
| Member Reaction (lbs) | 652 @ 7" | 1460 (3.50") | Passed (45%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Shear (lbs) | 581 @ 8" | 1655 | Passed (35%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Moment (Ft-lbs) | 1379 @ 5' 3" | 3795 | Passed (36%) | 1.00 | 1.0 D + 1.0 L (All Spans) |
| Live Load Defl. (in) | 0.034 @ 5' 3" | 0.233 | Passed (L/999+) | -- | 1.0 D + 1.0 L (All Spans) |
| Total Load Defl. (in) | 0.081 @ 5' 3" | 0.467 | Passed (L/999+) | -- | 1.0 D + 1.0 L (All Spans) |
| TJ-Pro™ Rating | 64 | 44 | Passed | -- | -- |

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Top Edge Bracing (Lu): Top compression edge must be braced at 6' 4" o/c unless detailed otherwise.
- Bottom Edge Bracing (Lu): Bottom compression edge must be braced at 10' 4" o/c unless detailed otherwise.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

| Supports | Bearing Length | | | Loads to Supports (lbs) | | | Accessories |
|---|---|---|---|---|---|---|---|
| | Total | Available | Required | Dead | Floor Live | Total | |
| 1 - Plate on concrete - SPF | 8.00" | 6.75" | 1.75" | 385 | 280 | 665 | 1 1/4" Rim Board |
| 2 - Plate on concrete - SPF | 8.00" | 6.75" | 1.75" | 385 | 280 | 665 | 1 1/4" Rim Board |

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

| Vertical Load | Location (Side) | Spacing | Dead (0.90) | Floor Live (1.00) | Comments |
|---|---|---|---|---|---|
| 1 - Uniform (PSF) | 0 to 10' 6" | 16" | 55.0 | 40.0 | Default Load |

## Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

Weyerhaeuser

SUSTAINABLE FORESTRY INITIATIVE

| ForteWEB Software Operator | Job Notes |
|---|---|
| Marin Govett<br>DLK Engineering<br>(720) 917-5758<br>marin@dlkeng.com | |

7/30/2019 2:17:33 PM UTC

ForteWEB v2.1, Engine: V7.3.2.309, Data: V7.2.0.2

File Name: Goff

KORDZIEL ENGINEERING, INC.

www.kordzielengineering.com P.O. Box 16267 Golden, CO 80402-6005 phone 303-216-1919 fax 303-216-9292

July 22, 2019

Cherie Goff
3265 Foundry Place, #101
Boulder, CO 80301

Subject: Subsurface Investigation and Geotechnical Recommendations
Proposed Residence, 9020 Brumm Trail
Tract 42, Part of the SE/4, Section 24, T2S, R71W, 6th P.M.
Jefferson County, Colorado
Project No. 2255

Ms. Goff,

As requested, Kordziel Engineering, Inc. investigated subsurface conditions at the site. From the information obtained, we are providing geotechnical foundation design recommendations.

Site Conditions: The site is located in a rural-mountain area in Jefferson County, Colorado. A site plan is presented in Appendix A. The ground slopes down steeply east in the area of the proposed residence. There is a sparse cover of trees and a moderate cover of native grasses at the site.

Proposed Construction: A single family residence is proposed at the site. We understand the structure will consist of concrete and wood frame construction. Structural loads will generally be light, consistent with the proposed construction. Site grading will be minimal as needed.

Subsurface Conditions: Subsurface conditions were investigated by observing road cuts adjacent to the site and rock outcroppings in the area of the proposed residence. Subsurface conditions consist of 0 to 0.5 feet of topsoil, underlain to a depth of 1 to 2 feet by silty sand and gravel, underlain by hard gneiss bedrock with granitic intrusions. The soil and bedrock observed at the site has little to no swell potential based on our experience in the area and the bulk soil sample obtained from the road cut. A gradation analysis of the soil sample is presented on Figure 2.

Recommendations: The native bedrock observed at the site is suitable for support of a spread footing foundation system. Footings should be designed for a maximum allowable soil bearing pressure of 3000 pounds per square foot (PSF). The bearing capacity should be confirmed by Kordziel Engineering once the building excavation is completed. Footings should rest on undisturbed bedrock. Undisturbed bedrock should be exposed in the footing excavations. Blasting is possible as an excavation method. Bedrock loosened by blasting or the excavation process should be removed prior to placing footings.

Foundation walls should be reinforced to span isolated loose zones. Reinforcing adequate to span an unsupported length of 10 feet is recommended. Minimum 16-inch wide continuous

spread footings and 24-inch square isolated columns should be used. Exterior footings should be protected from frost action. Three feet of earth cover as frost protection is recommended.

**Kordziel Engineering, Inc. must be contacted to confirm soil and/or bedrock in the footing excavations is suitable for support of the proposed structures.**

Floor Slabs: The bedrock and soils (except topsoil) at the site is suitable for support of slab-on-grade construction, with a low risk of slab movement. Where fill is required, the excavated, weathered bedrock may be used provided it is processed to a soil like consistency, or imported structural fill. Sub-slab fill (and fill beneath exterior flatwork) should be compacted to a minimum of 95 percent of the standard Proctor maximum dry density as determined by ASTM D698. Slabs should be separated from exterior walls with a flexible joint, which allows the slab to move freely.

Site Grading: The ground surface should be graded to provide positive drainage away from the structure in all directions. A minimum slope of 12 inches in the first 10 feet from the structure is recommended. Any settlement of backfill should be immediately filled and positive drainage should be re-established away from the structure. Downspouts should discharge beyond the limits of backfill. Good surface drainage should be incorporated into the design of the proposed structure. For planning purposes, maximum cut slopes may excavated at 0.75:1 (horizontal:vertical) and maximum fill slopes should be anticipated at 1.5:1 (horizontal:vertical) for the onsite granular materials. The granular materials observed at the site should provide adequate support for slab-on-ground construction.

Lateral Loads and Subsurface Drainage: Below grade walls must be designed for lateral loads. For "active" conditions, an equivalent fluid pressure of 35 pounds per cubic foot (PCF) should be used for backfill consisting of processed bedrock as previously described. For "at rest" conditions, an equivalent fluid pressure of 45 PCF is recommended. A passive earth pressure of 300 PCF may be utilized and for retaining walls and a coefficient of friction for sliding of 0.5 should be used. These loads do not include hydrostatic loads or surcharge loads such as sloping backfill or vehicles. An exterior drain should be installed at the below grade perimeter of all residence foundations to reduce the risk for water migrating into the basement and the development of hydrostatic pressures. An exterior foundation drain detail is presented on Figure 1. The exterior drain should lead to a gravity discharge or to a sump where water can be removed by pumping.

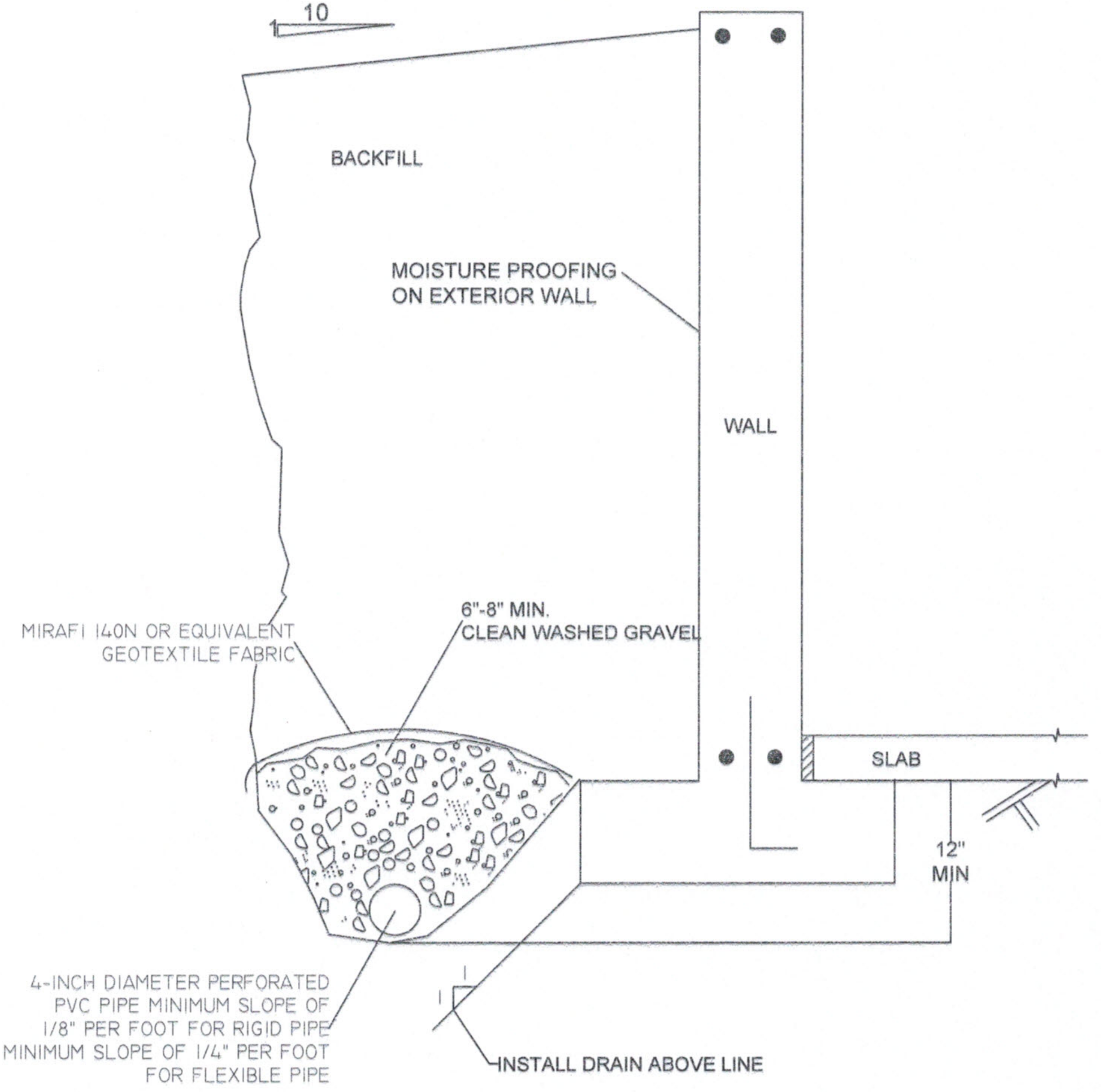
The recommendations contained herein must be confirmed during construction by having a representative of our office observe the open foundation excavations and foundation drains.

If there are questions or if we can be of further service, please call.

Kordziel Engineering, Inc.

COLORADO LICENSED
JOSEPH C. KORDZIEL
29994
7-22-19
PROFESSIONAL ENGINEER

Joseph C. Kordziel, P.E.
Principal
ecopy sent




NOTES:

1. DRAIN PIPE SHOULD LEAD TO SUMP OR POSITIVE GRAVITY DISCHARGE.
2. COVER GRAVEL COMPLETELY WITH GEOTEXTILE IN SANDY OR SILTY SOILS.
3. BOTTOM OF DRAIN SHOULD BE A MINIMUM OF 12 INCHES BELOW TOP OF SLAB AT HIGH POINT.
4. GRAVEL SPECIFICATIONS: CLEAN WASHED GRAVEL, 100% PASSING 1.5", 60-100% RETAINED #4, <3% PASSING #200

KORDZIEL ENGINEERING, INC.

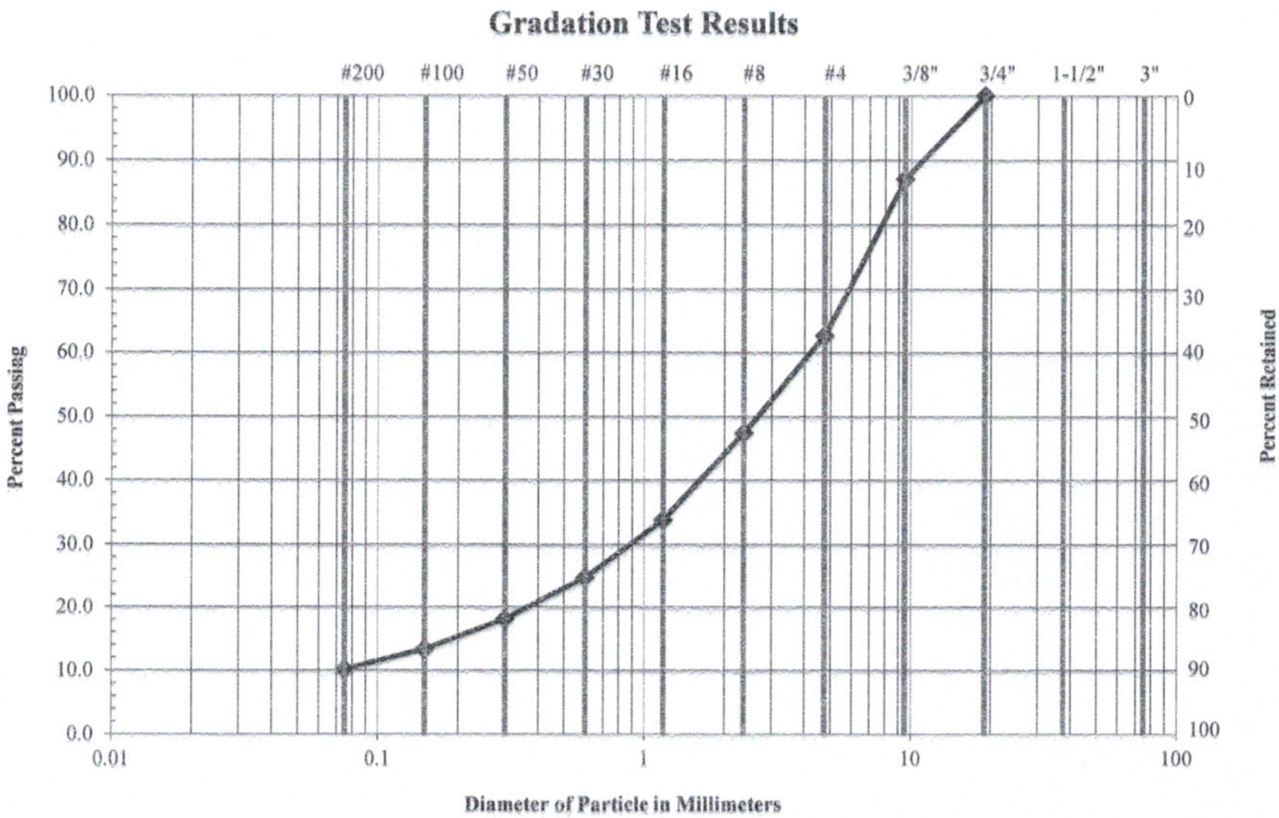
SCALE: NTS
DATE: 7-22-19
REV. DATE:
DES. BY: JCK
DRAWN BY: JCK

TYPICAL EXTERIOR WALL DRAIN

PROJECT NO. 2255

FIGURE 1

## KORDZIEL ENGINEERING, INC.




DESCRIPTION: Sand, gravelly, silty

| | | | |
|---|---|---|---|
| GRAVEL | 37% | HOLE / SAMPLE | Road Cut |
| SAND | 53% | DEPTH | Bulk |
| FINES | 10% | LIQUID LIMIT | |
| MOISTURE | 6.8% | PLASTICITY INDEX | |
| | | DRY DENSITY (pcf) | N/A |

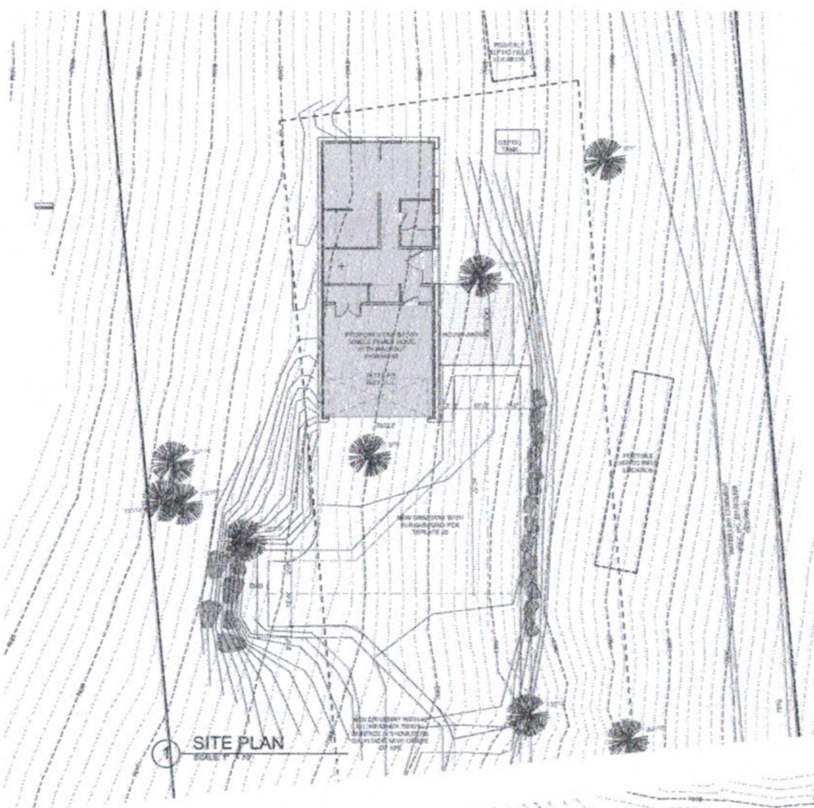
DATE: 7/22/2019

NAME: 9020 Brumm Trail

PROJECT NO.: 2255

FIGURE 2

# APPENDIX A







HMH ARCHITECTURE +
INTERIORS

1701 15TH STREET
BOULDER CO 80302
303.444.8488
303.413.0305

HMHAI.COM


# BLUE MOUNTAIN PRELIMINARY

#Contact Address1
#Contact City, #Contact Country

DATE: 4/17/19

DRAWN BY: INITIALS
CHECKED BY: INITIALS
PROJECT #: 0

SITE PLAN

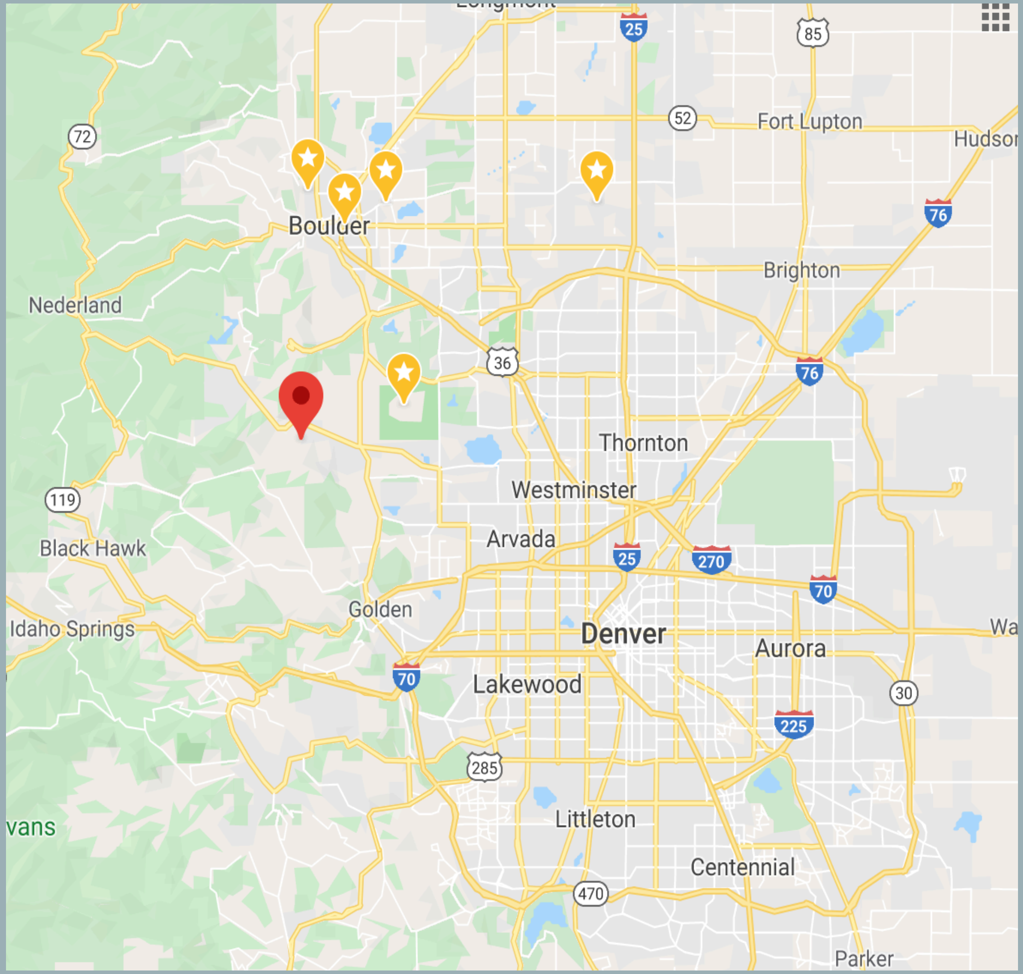
G1.1

# BLUE MOUNTAIN RESIDENCE

MARIN GOVETT

# LOCATION

VIEW TOWARDS DENVER



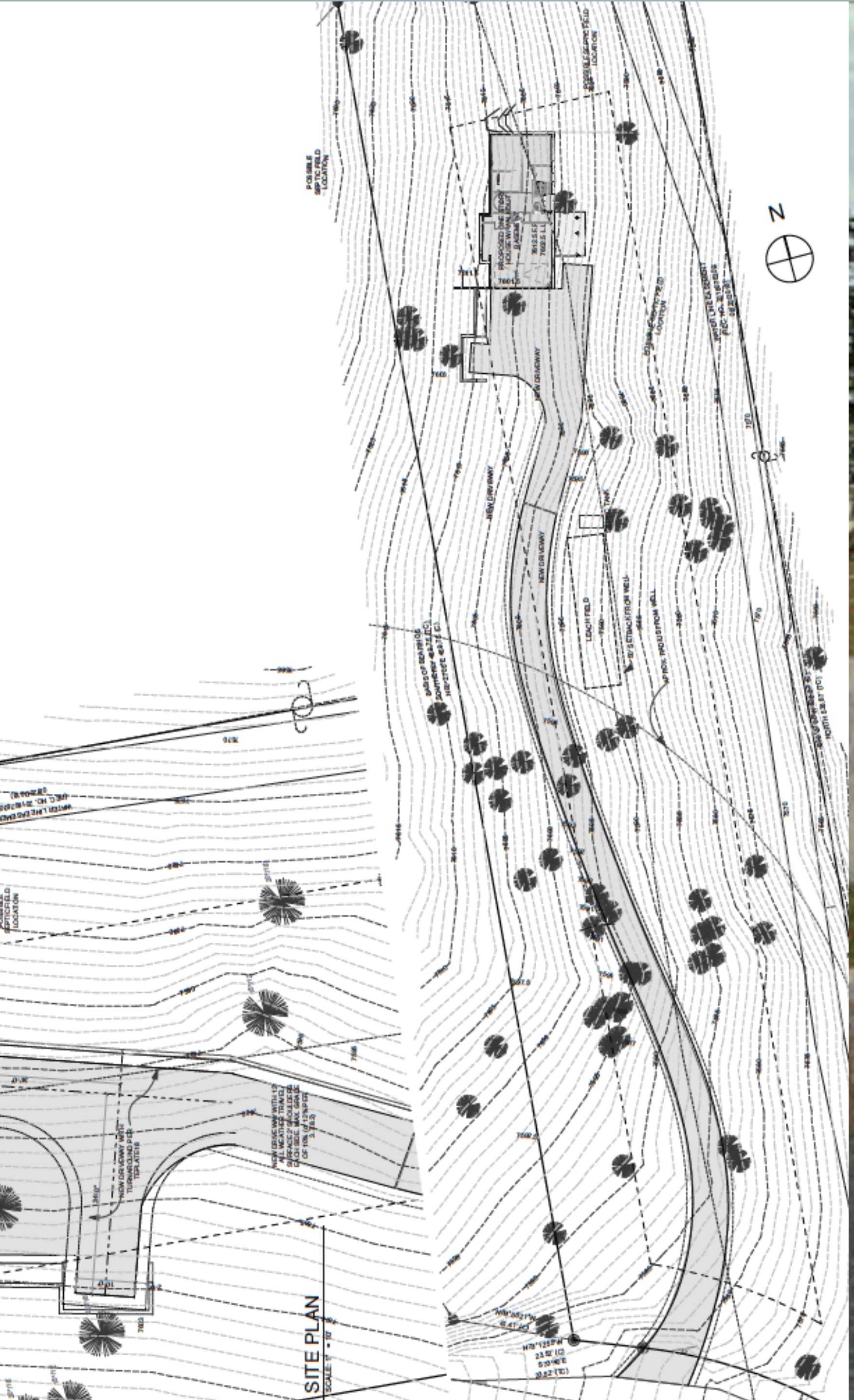

GOLDEN, COLORADO

# SITE

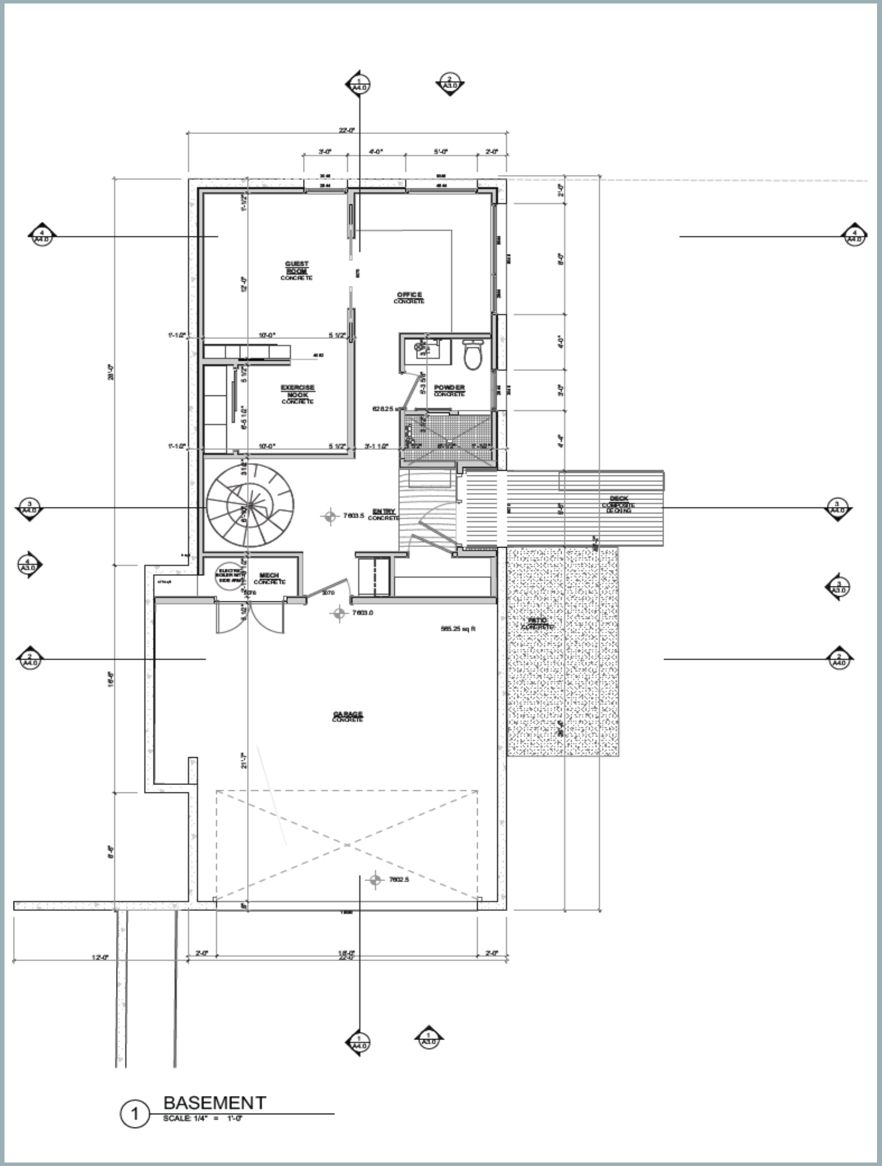
VIEW TOWARDS ROAD

VIEW TO THE WEST

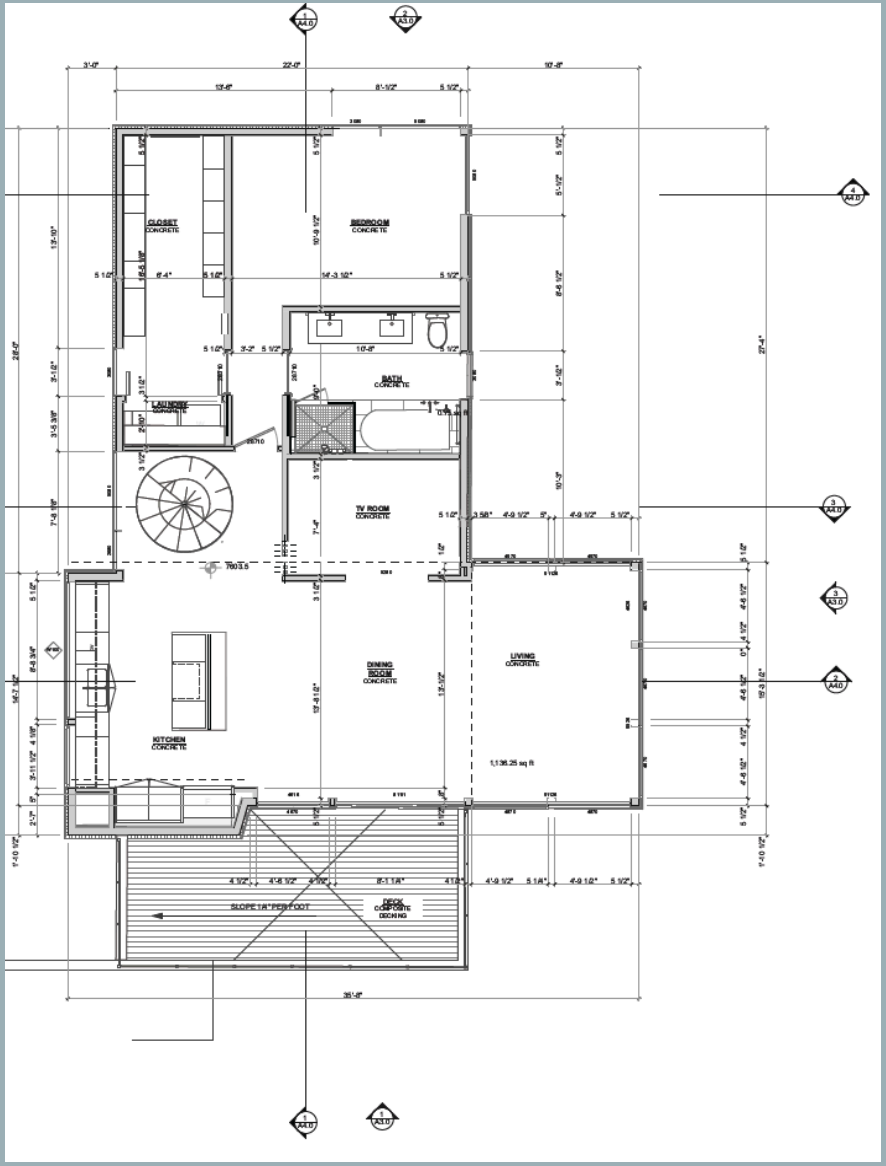
# PROJECT DESCRIPTION




# PLANS




BASEMENT PLAN

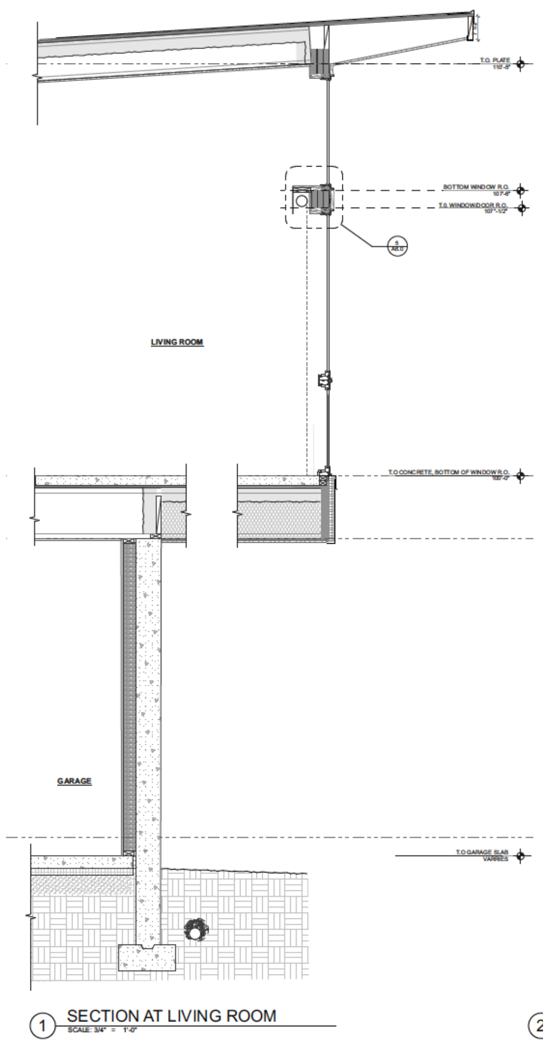


FIRST FLOOR PLAN

**Gravity System:**
- Wood
- Steel
- Concrete

**Lateral System:**
- Wood Shear Walls

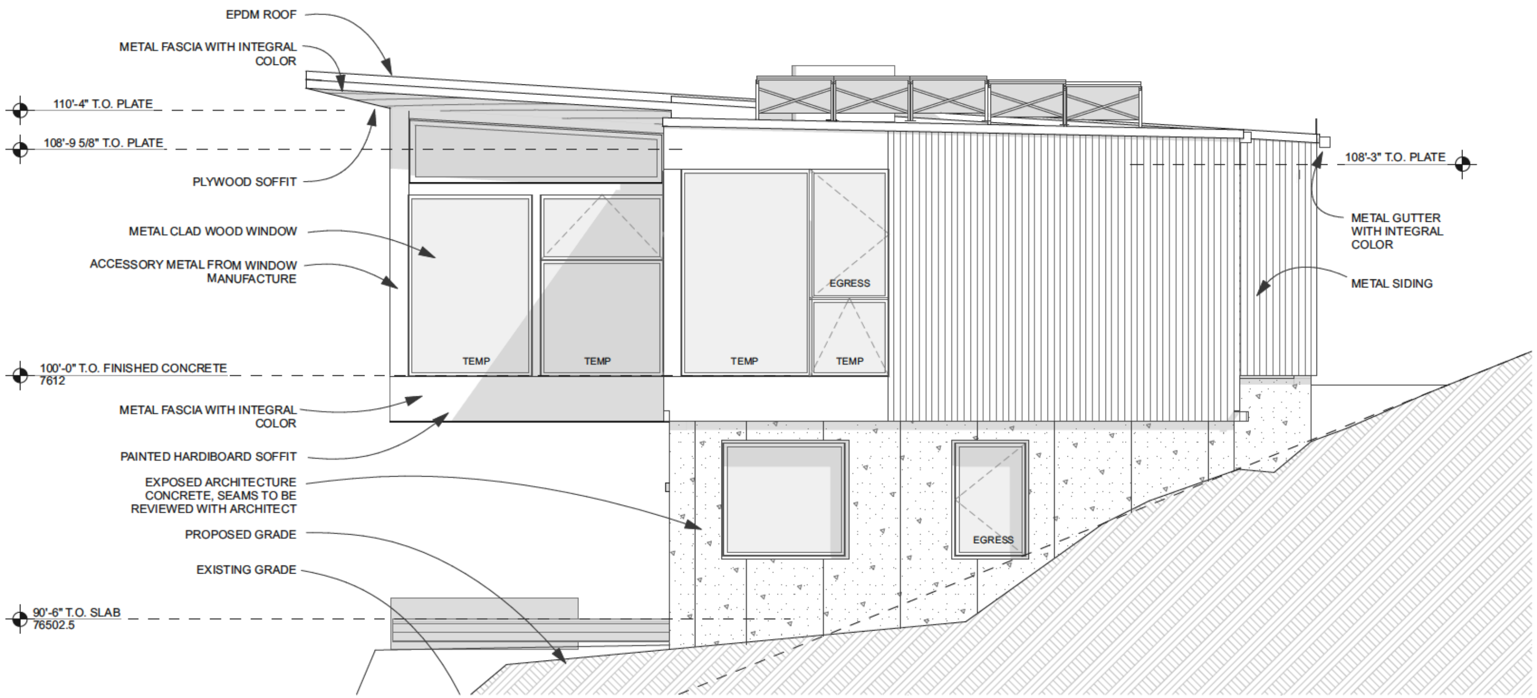
# ARCHITECTURAL SECTION





SECTION AT LIVING ROOM

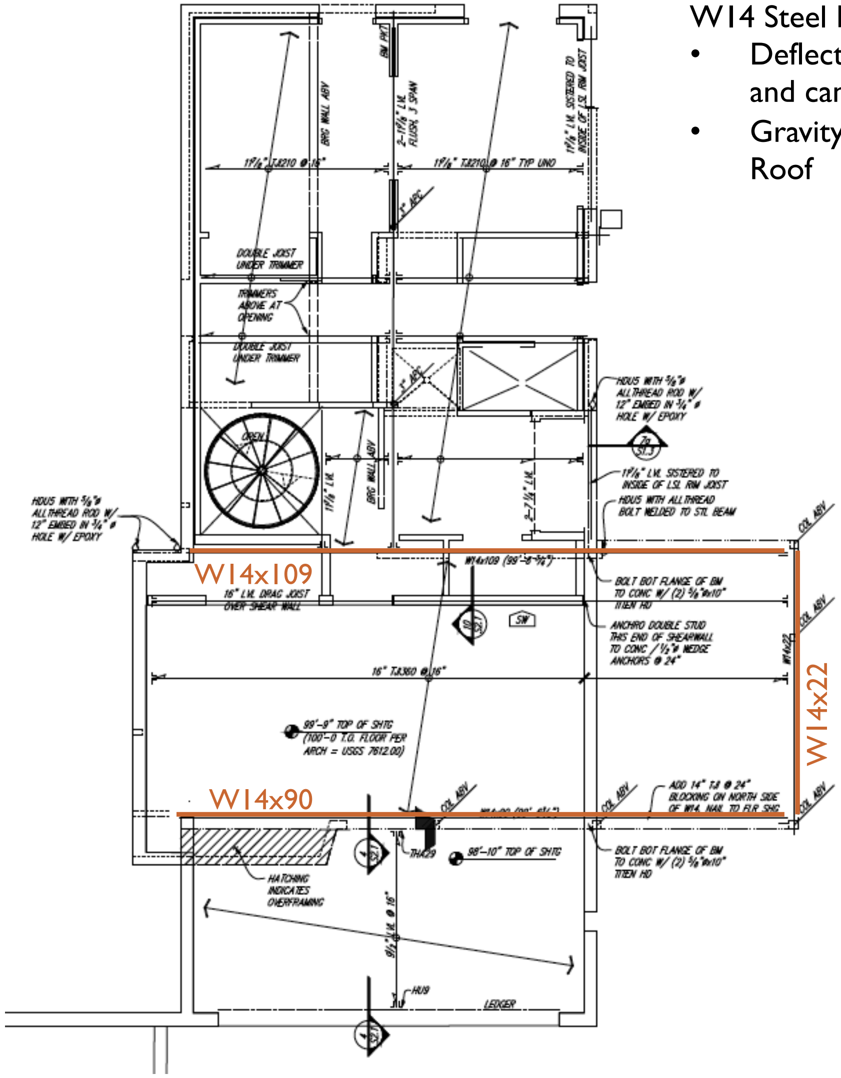
EAST ELEVATION




2 NORTH ELEVATION
SCALE: 1/4" = 1'-0"

# LIVING ROOM DESIGN

# STRUCTURAL CANTELIEVER DESIGN

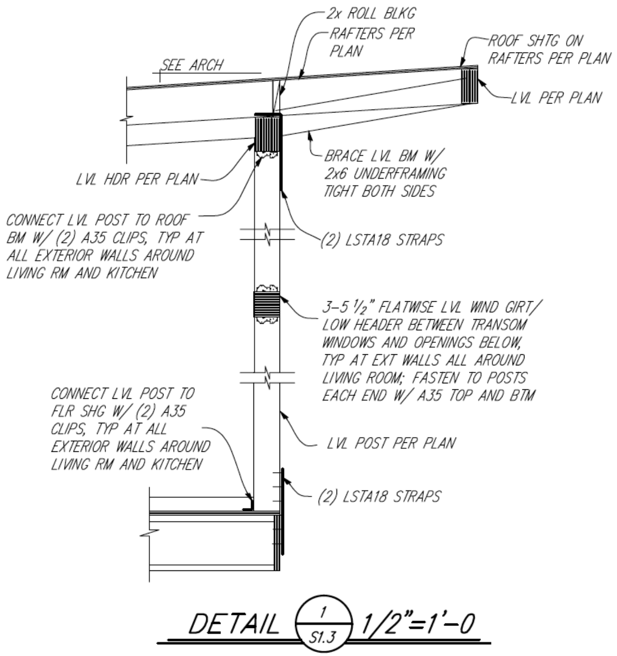



MAIN FLOOR FRAMING PLAN

W14 Steel Beams

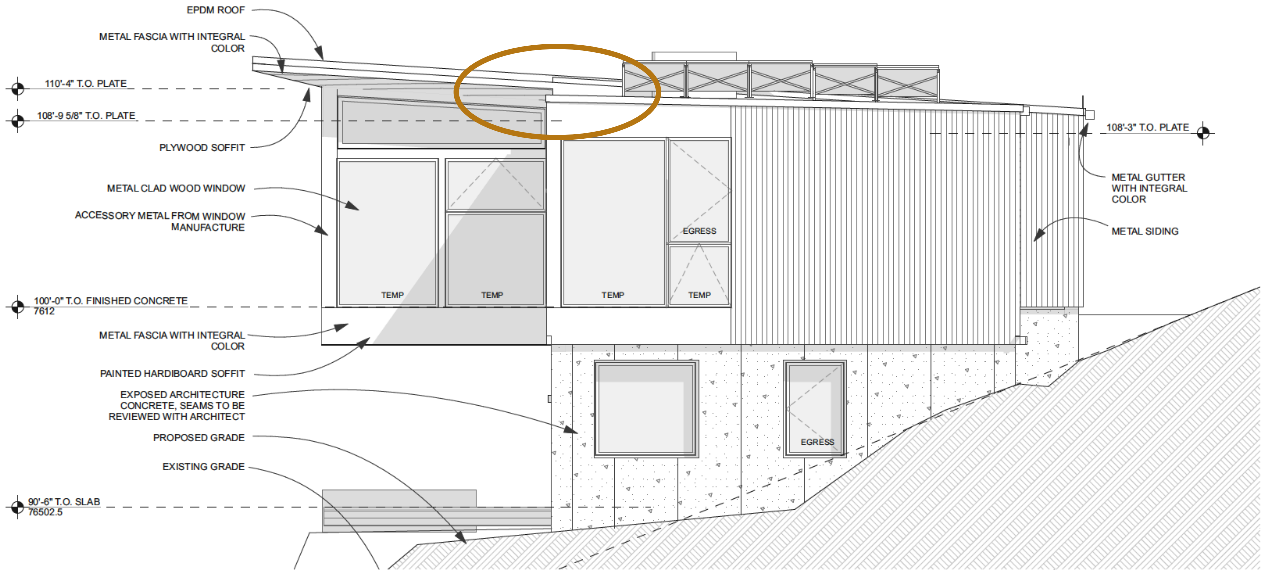
- Deflection at mid span and cantilever
- Gravity Loads from Roof

# LIVING ROOM WINDOW DESIGN

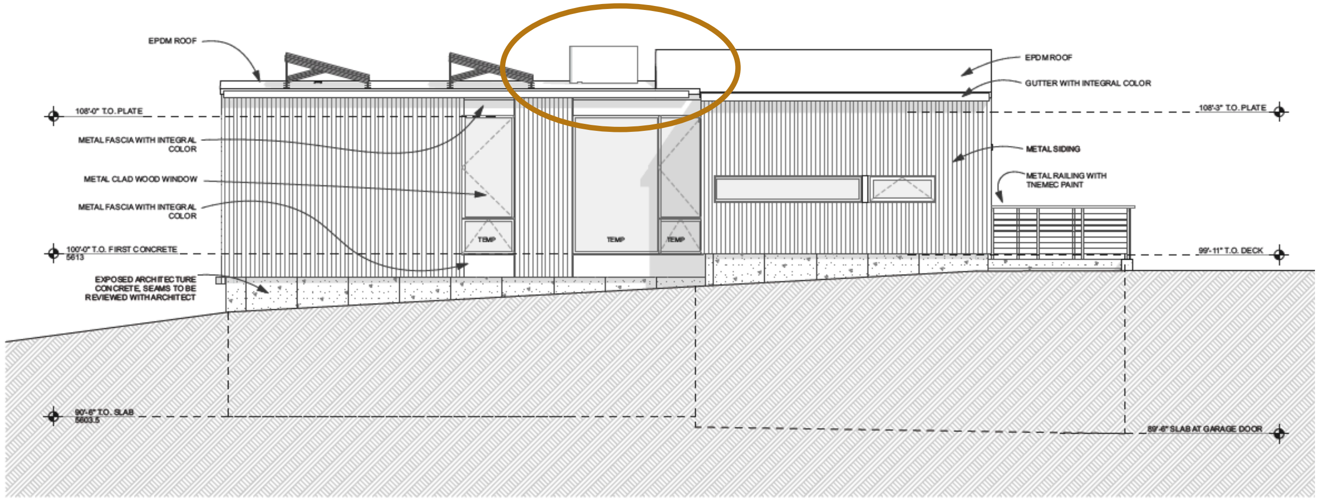



STRUCTURAL DETAIL AT LIVING ROOM

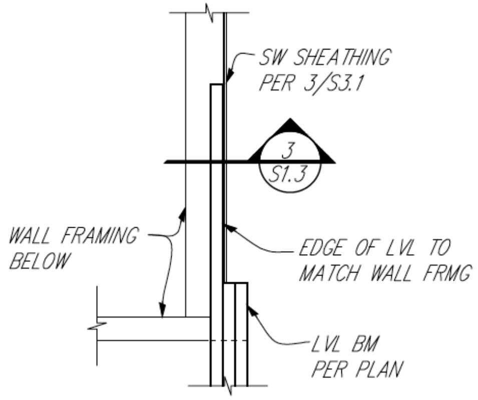
# ROOF DIAPHRAGM DESIGN




2 NORTH ELEVATION
SCALE: 1/4" = 1'-0"

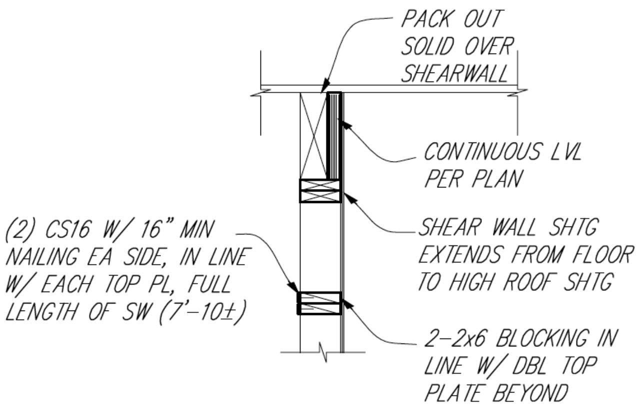



4 WEST ELEVATION
SCALE: 1/4" = 1'-0"



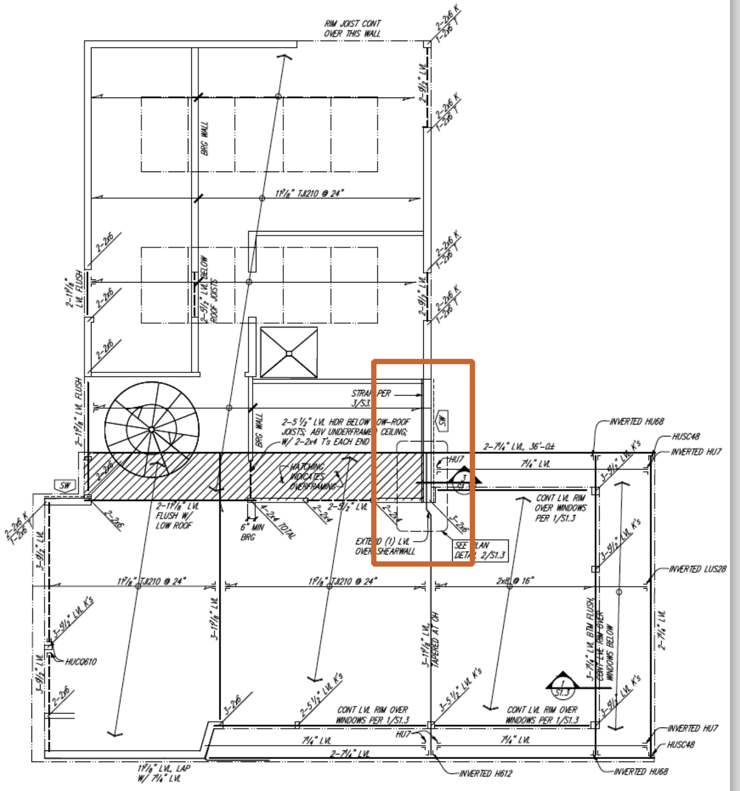

PLAN VIEW

DETAIL 2/S1.3 1/2"=1'-0




SECTION VIEW

DETAIL 3/S1.3 1/2"=1'-0




SHEAR WALLS NOTED THUS THIS SHEET:: SW
WHETHER INTERIOR OR EXTERIOR WALLS, SHALL BE
FRAMED & SHEATHED PER TYPICAL EXTERIOR WALLS
WITH 8d NAILS @ 2" ALONG EDGES & 12" IN FIELDS

PLAN NORTH

ROOF FRAMING PLAN

1/4"=1'-0

HMH ARCHITECTURE + INTERIORS

DLK

COTTONWOOD CUSTOM BUILDERS, INC

# DESIGN TEAMS

THANK YOU!

## APPENDIX F: WORKS CITED


American Concrete Institute (ACI 318-95): Code Requirements for Structural Concrete

Blue Mountain Watershed. “Blue Mountain Watershed Trust.” *Blue Mountain Watershed Trust*, 2018, watershedtrust.ca/.

International Building Code: 2018 Edition, ICC IBC-2018

Jefferson County. “Jefferson County, CO: Official Website.” *Jefferson County, CO | Official Website*, www.jeffco.us/.

Manual of Steel Construction: Fifteenth Edition, American Institute of Steel Construction (AISC) 2016

Minimum Design Loads for Buildings and Other Structures: ASCE Standard ASCE/SEI 7- 16, American Society of Civil Engineers

National Design Specification for Wood Construction: 2018 Edition, American Wood Council

NDS Supplement: Design Values for Wood Construction: 2018 Edition, American Wood Council

Special Design Provisions for Wind and Seismic: 2015 Edition, American Wood Council