6-7-2016

Habitat for Humanity Apartment Complex Redesign

Megan August
Santa Clara Univeristy

Molly Bencomo
Santa Clara Univeristy

Ashley Waite
Santa Clara Univeristy

SANTA CLARA UNIVERSITY

Department of Civil Engineering

I HEREBY RECOMMEND THAT THE THESIS PREPARED
UNDER MY SUPERVISION BY

Megan August, Molly Bencomo, Ashley Waite

ENTITLED

HABITAT FOR HUMANITY APARTMENT COMPLEX REDESIGN

BE ACCEPTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF

BACHELOR OF SCIENCE
IN
CIVIL ENGINEERING

Tonya Wilson 6/6/2016

Advisor Date

6/7/2016

Chairman of Department Date

HABITAT FOR HUMANITY APARTMENT COMPLEX REDESIGN

By

Megan August, Molly Bencomo, and Ashley Waite

SENIOR DESIGN PROJECT REPORT

Submitted to
the Department of Civil Engineering

of

SANTA CLARA UNIVERSITY

in Partial Fulfillment of the Requirements
for the degree of
Bachelor of Science Degree in Civil Engineering

Santa Clara, California

Spring 2016

ACKNOWLEDGEMENTS

Dr. Tonya Nilsson, Project Advisor

Dr. Sukamander Singh, Geotechnical Consultant

Professor Tracy Abbott, Lateral Consultant

Professor Humza Chowdry, Foundation and BIM Consultant

Professor Jacquelyn Hendricks, Thesis and Presentation Advisor

Hamid Taeb, Habitat for Humanity EBSV

Michele Choi, Habitat for Humanity EBSV

Jim Cilker, Pine Cone Lumber

Curtis Caton, Pyatok Architects

Dylan Versteeg, Pyatok Architects

Ramin Golesorkhi, Treadwell & Rollo

HABITAT FOR HUMANITY APARTMENT COMPLEX REDESIGN

Megan August, Molly Bencomo, and Ashley Waite

Department of Civil Engineering
Santa Clara University, Spring 2016

ABSTRACT

This project consists of the redesign of a three-story apartment complex for Habitat for Humanity that will be constructed in Walnut Creek, CA in 2017. A project in Fremont, CA served as the basis for the design. However, the height of the complex in Fremont exceeded the Walnut Creek Building Code height limitations, making the redesign of this timber structure necessary. The challenge was to reduce the structural space between stories to 9.5 inches in order to achieve comfortable interior clearances and meet the City of Walnut Creek's height restriction. The structural components for Building Type A in the Las Juntas Way Apartment Complex were designed. Initially, a sawn lumber design was completed. However, this design did meet the target structural depth. Therefore, a design using TJI-joists was completed. This alternative met the target structural depth. From there, a lateral force resisting system with connection details and a mat foundation were designed. A cost analysis confirmed that the TJI-joist design was a cost-effective alternative. For sustainability, a Green Point Rating Checklist was completed. Lastly, a three-dimensional model was created using Revit, a four-dimensional Building Information Modeling technology. All structural drawings and calculations were submitted to Habitat for Humanity for use in the final design.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Chapter 1: Introduction

Habitat for Humanity, a nonprofit organization devoted to building decent and affordable housing, was designing an apartment complex for Walnut Creek, CA. This design was based on a complex with a similar layout being constructed in Fremont, CA. The overall height of the Fremont complex is 33 feet. Walnut Creek's building codes, however, required similar structures to be below 29 feet. Habitat for Humanity created a design that had interior clearances below 8 feet, however Habitat strongly desired 8-foot interior clearances. The goal of this project was to shorten the height of the building to meet Walnut Creek's strict building codes while providing comfortable ceiling heights and living space for the residents of the structure. A cost analysis was performed to assess the feasibility of the design for Habitat for Humanity. Safety, constructability, and sustainability were considered throughout the design in order to have a positive social and environmental impact on the community.

1.1 Background

Habitat for Humanity is a nonprofit organization with the belief that every person is entitled to a safe and affordable place to live. It is the only international organization that provides affordable housing "for sale" rather than "for rent," meaning that they give people an opportunity to own a home rather than renting one. Their goal is to simply set people up for success. To do this, families must go through a selection process. After being selected, they then become a "Partner Family," emphasizing Habitat's devotion to working with the family toward successful home ownership. Habitat does not require Partner Families to provide a down payment; instead, these families are asked to volunteer 500 hours constructing Habitat projects. This makes the homes much more affordable and makes families feel responsible for creating their new living environment (Habitat.org).

This project was located in California’s Bay Area, where land is scarce and prices are high. Habitat for Humanity’s decision to build a new complex in Walnut Creek, CA was primarily due to limited land availability in this region. The development will be an apartment complex in order to provide more housing units per acre. With single family homes, Habitat can provide approximately five to six units per acre, whereas an apartment complex allows nearly 26 units per acre. This project was Habitat’s second affordable housing apartment complex in the East Bay. Figure 1 shows the exact location of the project, as provided on the first page of the plans provided by Habitat.

Figure 1. Project location - 1250 Las Juntas Way Walnut Creek, CA 94597

This project provides a solution to the growing affordable housing issue in the United States, which allowed the project to have an impact on a community beyond Santa Clara University. Walnut Creek is known to have a competitive housing market, as with many cities in the Bay Area. Therefore, low-income families have greater difficulty affording homes that can comfortably accommodate their families. The entire Las Juntas Way Apartment Complex will allow approximately 52 families to have decent homes, providing a strong foundation for a comfortable lifestyle. Located near the Pleasant Hill Bay Area Rapid Transit (BART) station, this complex gives residents sustainable and accessible public transportation alternatives. Figure 2 highlights the layout of the apartment complex. The letters “A, B, and C” signify the three different types of floor plans within the complex. This work focused only on Building Type A (“flat” style first floor with the second and third floors combining to make townhouses) because at the time when the project began, Building Type A was the only layout with accurate AutoCAD architectural drawings.

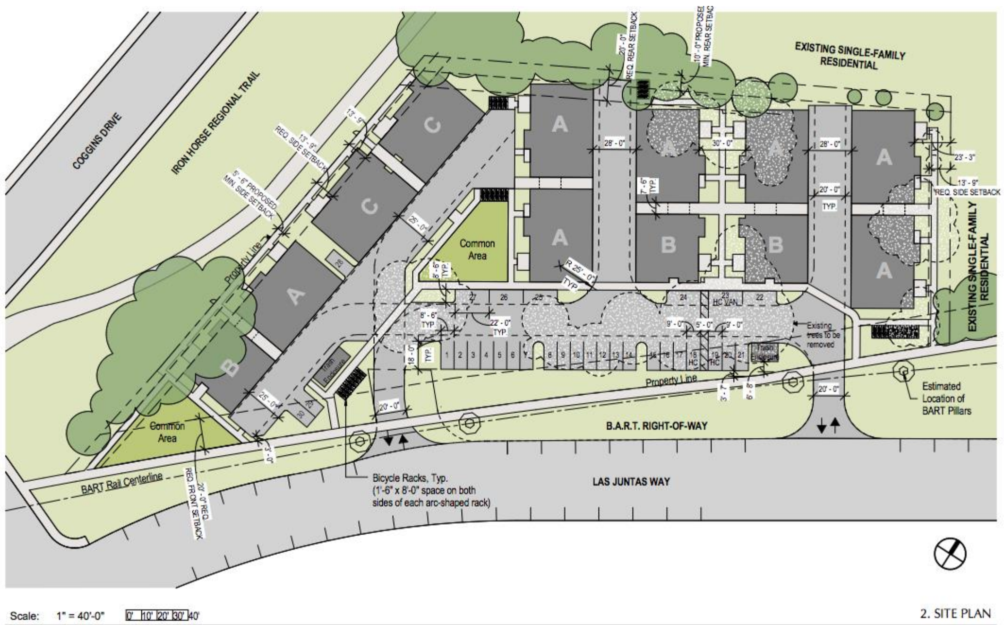


Figure 2. General building layout of the apartment complex

1.2 Proposed Solution

Prior to meeting with Habitat for Humanity, a few solutions were contemplated to solve the building height issue. Table 1 shows the initial conceptualized solutions, highlighting the chosen solution.

Table 1. Initial conceptualized solutions

Design Alternative	Advantages	Disadvantages
1. Condense the Complex to Two-Stories	Allows for greater ceiling height and more space for each unit	Fewer housing units able to be constructed and, thus, fewer homes for families
2. Lower the First Level to Below Ground	Keeps the three stories; Only need to redesign foundation	Drainage issues
3. Reduce the Amount of Space Needed for Structural Members	Maintaining the three stories maximizes the number of people who can live there	Increased cost; Constructability; Complete structural redesign

The initial meeting with Habitat for Humanity took place in their Oakland office in order to discuss the project in more detail and to select the best design alternative. After Solution 3 (highlighted above) was chosen, alternatives to comply with Walnut Creek's height restrictions were discussed. These options are outlined in Table 2.

Table 2. In-depth analysis of proposed solution 3

Alternatives	Advantages	Disadvantages
Glulams	Can have a smaller member with high strength	More expensive alternative and habitat has limited funds
New Roof Design	Eliminates the need for more small beam members	The requirement states that 75% of the roof area of the building should be at minimum of 3:12
More Beams, Smaller Members	Allows for more vertical space if members aren't as bulky	Harder to construct (more detailed), More labor, Longer to construct

This project analyzed these alternatives to provide Habitat for Humanity with a solution that was both cost effective and easily constructible by volunteer labor.

1.3 Scope of Work

The scope of work for the redesign of Habitat for Humanity's apartment complex was as follows:

Task 1. Analysis of Plans: Review architectural drawings for the Walnut Creek Las Juntas Way project provided by Habitat for Humanity for the layout of Building Type A

Task 2. Site Investigation: Visit property location to familiarize ourselves with the surrounding area and any possible constraints

Task 3. Gravity Design: Determine all member sizes for all floors of Building Type A to withstand gravity loads (using sawn lumber and TJI-joists)

Task 4. Lateral and Connection Design: Design lateral force resisting system to withstand seismic and wind loads, as well as detail connections for load transfer to the foundation

Task 5. Foundation Design: Create a foundation plan that will effectively support the building

Task 6. Cost Estimation: Analyze the cost difference between sawn lumber members and TJI-joists

Task 7. Revit Model & Construction Drawings: Use AutoCAD and Revit to create structural drawings, details, and a structural 3D model of the building

Task 8. Environmental Impact: Use the GreenPoint Rating System to analyze the impact the building will have on the environment

Task 9. Implementation Plan: Present all information to Habitat for Humanity so they can consider the solution in their final design for Building Type A

Chapter 2: Design Criteria and Standards

The project required the use of several different structural codes. These range from the California Building Code to the very specific Walnut Creek Building Code, which contained design criteria that directly applied to the building height restriction, acting as the basis of the project. All of the designs adhered to the 2013 California Building Code.

2.1 Walnut Creek Building Code

The Walnut Creek Building Code's main constraint was the specified maximum building height. Chapter 10, D(9) stated that "the maximum building height for multi-family development shall be 30 feet unless otherwise specified in the zoning map. The maximum height for single family development shall be 25 feet." The zoning map, as shown in Figure 3, indicated that the Las Juntas Way Apartment Complex was located in a 25-foot zone. However, there was an exception. Chapter 2 stated that for a structure to be 29 feet high, 75 percent of the roof must be at a 3:12 pitch. Therefore, a 29-foot maximum height was used for the whole project.

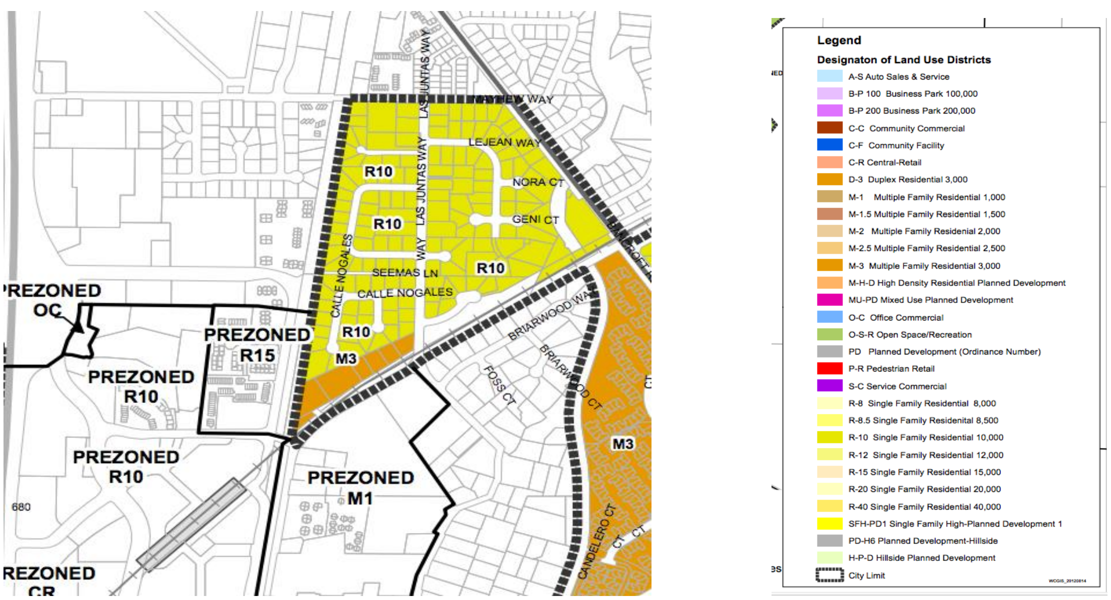


Figure 3. Walnut Creek Zoning Map

2.2 Prescriptive Design Codes

The project team adhered to the following prescriptive codes:

- *NDS (2012 edition):* These manuals were used to size wood members according to code including beams, columns, and shear walls.
- *Simpson Strong-Tie Wood Construction Connections Catalogs (2015-16 Edition):* These catalogs contain design loads and specifications for common member connections in wood construction. These design loads allowed for the selection of Simpson metal plate connectors, which were specified in the final plans.
- *Minimum Design Loads for Building and Other Structures (ASCE/SEI 7-10):* This specification provided guidance for the entirety of the lateral design.
- *2013 California Building Code:* This code provided minimum regulations and provisions for building design. Chapter 23 on wood construction was especially useful and served as a reference for minimum design standards and requirements.
- *Weyerhaeuser Beams, Headers, and Columns Guide:* This guide aided in sizing Trus Joist, TimberStrand LSL, Microllam LVL, and Parallam LSL members.

Chapter 3: Non-Technical Considerations

While the structural design met the standards stated in the design codes listed in Chapter 2, other design criteria were considered in the structural design for Habitat for Humanity's needs.

3.1 Economic and Political

Walnut Creek is a more affluent city in California. According to the United States Census Bureau, the per capita income in the year 2013 was $51,314 in Walnut Creek, compared to $29,527 for all of California. Though the housing cost for participants in the Habitat for Humanity program is subsidized, it was a concern that it may be difficult for the residents to afford the cost of living in Walnut Creek because the cost of everyday amenities is likely to be higher.

Another concern that was taken into account was the cost of the project's construction. Though Habitat for Humanity has the funding to implement this project, its cost needed to be reasonable. For example, if parallams were selected in the design, the cost of the project would potentially increase because parallams cost more than sawn lumber beams.

3.2 Health and Safety

This structure is going to be built by volunteers. Therefore, safety was a key consideration in the design. The risk of injury increases when more structural members are used. An overly complex design was avoided.

3.3 Environmental

This apartment complex was located within walking distance from the Pleasant Hill BART station and various bus stations. Therefore, public transportation was accessible and could be used as a sustainable alternative. Habitat for Humanity also used an environmentally-friendly system called the GreenPoint Rating system to ensure their structure was sustainably constructed.

3.4 Ethical

This project fulfilled a community need. Walnut Creek has limited affordable housing, allowing Habitat for Humanity to provide such housing for people to live comfortably in a highly desired area. Additionally, these homes will be built by volunteers. Habitat incorporates community service into every structure they build.

Chapter 4: Central Commons Complex

The Las Juntas Way Apartment Complex was modeled after the Central Commons Complex being constructed in Fremont, CA, which is expected to be completed by the end of 2016. Habitat for Humanity provided a complete set of plans for the Fremont complex to use as reference for the Las Juntas Way design. The plans of the Central Commons were analyzed in order to provide an understanding of Habitat's previous work and feasibility of the different components of the redesign.

4.1 Existing Gravity System

The Central Commons Complex did not have the same height restrictions as the Las Juntas Way Complex. As a result, they used larger beams because they were not limited by the member depth. Some commonly used beam sizes were 3 ½" X 11 ⅞" and 1 ½" X 11 ⅞". This allowed for fewer beams and posts on each floor, as well as a structural depth of nearly one foot. The posts were designed and placed so that they could carry the load down from each floor directly to the foundation. TJI 210 Joists were used throughout the project to span across beams at 24 inches o.c., affirming that Habitat for Humanity was willing to use TJI-joists in design.

4.2 Existing Lateral System

The basic lateral force resisting system was made up of light-framed (wood) walls sheathed with wood structural panels rated for shear resistance. Typical plywood sheathing was placed on most walls throughout the structure. Each shear wall was designed to withstand the shear forces (given in pounds per foot) imposed by wind and earthquake loads. The nailing schedule for each type of shear wall was given on each level's respective structural floor plan.

A large portion of space on the first floor of each building served as one- or two-car garages. The large openings necessary for the garage doors made the structure a soft-story building. With limited wall space on this face of the building, typical plywood panels could not be used to resist lateral forces. Thus, prefabricated Simpson Steel Strong Walls were placed between garage doors.

4.3 Existing Foundation

A 12 inch thick mat slab was used as the foundation for the Central Commons Complex. The main steel reinforcement used was rebar size #5 placed at 12 inches o.c. At exterior and interior wall locations, additional reinforcement was used. Three #6 bars were specified under the North & South external walls while four #6 bars were required for the East & West ones. The interior walls required two #5 bars. Along the interior walls, #3 rebar ties were used at 18 inches o.c. Figure 4 show the foundation details for Building 1 of the Central Commons (which resembled Building Type A of the Las Juntas Way Complex).

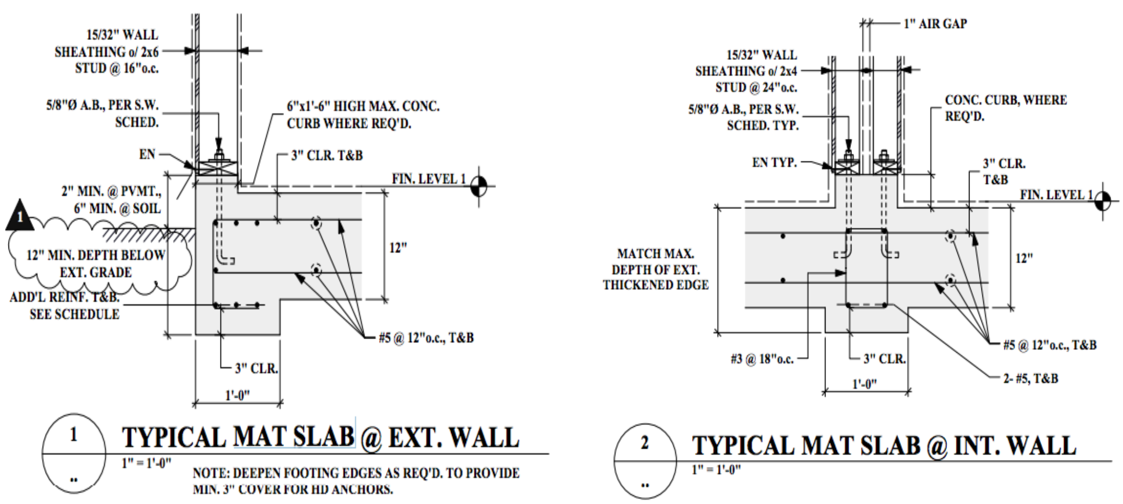


Figure 4. Interior and exterior wall mat slab details

Chapter 5: Design of Las Juntas Complex

The Walnut Creek Building Code required a complete structural redesign for the Las Juntas Way Complex. This included the design of gravity and lateral systems, connections, and the foundation. The roof was not included in this redesign because the truss system was designed and constructed by a third party engineer.

5.1 Field Visit

In order to become familiar with the area surrounding the project, the team conducted a site visit to Walnut Creek. While there, a few observations were made. First, the terrain was relatively flat. This meant that excavation would be simplified and that the topography would allow for an Exposure B category for wind design. The second observation made was that the site was located in a residential area surrounded by both single and multi-family homes. This was also further confirmation of the Exposure B category.

The most significant observation made at the site dealt with the Pleasant Hill BART Station nearby. A passing BART train caused a drastic increase in noise level, which would have an impact on those residing in the structure. This observation inspired the team to consider sound insulation in the final suggestions given to Habitat for Humanity.

5.2 Architectural Floor Plans

The architectural drawings for the Las Juntas Complex were compiled by Pyatok Architects, who shared the AutoCAD digital files with the project team. Initially, the scope of the project included the structural design of three building types in the complex. However, Pyatok communicated that the dimensions for Building Types B and C were incorrect and would not be updated until later in the year. This prompted a revision of the project scope. Narrowing the project scope to focus solely on Building Type A allowed for a more comprehensive design, as well as a more thorough cost analysis of two design alternatives.

5.3 Gravity Design

5.3.1 Sawn Lumber Design

Initially, the team created a design using sawn lumber members because sawn lumber is less expensive and commonly used in residential construction. Throughout the design process, it was incredibly difficult to find load paths down to each floor. The open concept architectural layout made it challenging to find walls that aligned and allowed for continuous load transfer from the roof all the way down to the foundation, requiring beams to pick up discontinuous post loads. Due to the high loads, most of the beams designed were an engineered lumber, such as glulam or parallam beams. This was because the beams often had to span long distances because there were no walls to pick up the load. Thus, an engineered lumber was required due to its ability to hold higher loads. This increased the material cost for this design. See Table 3 for a list of beams used in the sawn lumber design.

Another challenge the team faced involved the garages on the first floor. A load path from the second and third floors carried down and landed directly in the middle of each garage. To disperse this load, the team wanted to place a column in the middle of the space so a beam would not need to span the full 20-foot garage width. However, Habitat for Humanity did not want a post in the middle of each garage, so the resulting beam that was designed was a twenty-foot-long parallam beam that was sixteen inches in depth. Clearly, 16 inches exceeded the team’s 9.5 inch target depth. Additionally, this beam's high weight would have been difficult for volunteer builders to lift and install. As constructability and the health and safety of the volunteers were of the utmost concern, it was concluded that this design would not be acceptable. The team explored other design options and ended up creating an entirely new design using TJI-joists. Figure 5 below shows the first, second, and third floor layouts overlapping each other to highlight the open concept architectural layout and the difficulty in finding load paths. Additionally, the problem area in the garages on the first floor are shown by the red circles, showing where the team wanted to place a post to break the 20-foot-long span.

Table 3. List of beams used in the sawn lumber design

Member Size	**Quantity**
4 x 10	10
6 x 10	5
GLU 3.125 x 9	3
GLU 3.5 x 9	1
GLU 5.5 x 9	3
PSL 3.5 x 9.25	1
PSL 3.5 x 9.5	2
PSL 5.25 x 9.25	1
PSL 5.25 x 9.5	2
PSL 7 x 9.5	2

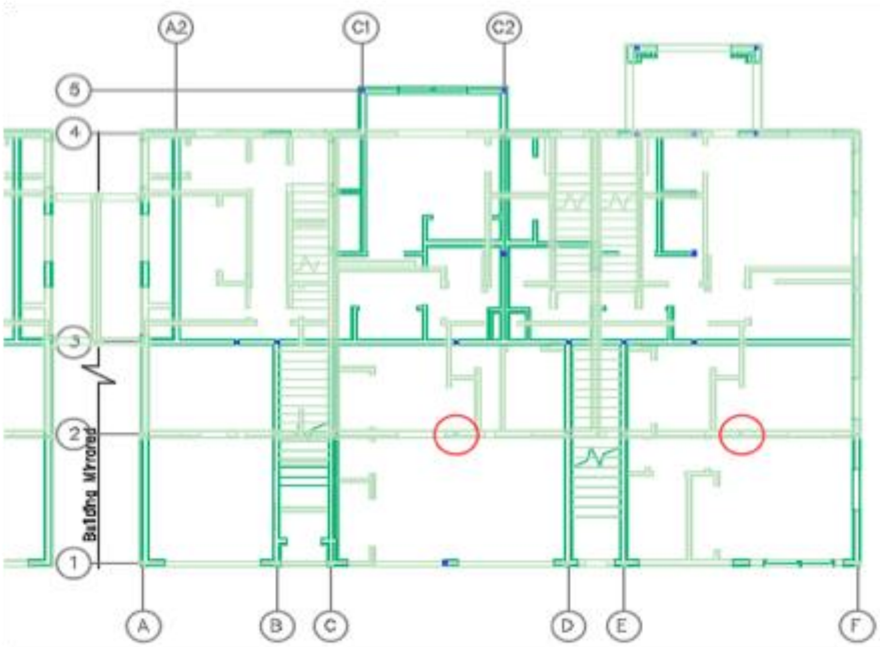


Figure 5. Overlap of first, second, and third floor layouts

5.3.2 TJI Joist Design

The second design alternative used TJI-joists, an engineered lumber, which are stronger and more capable of spanning longer distances. Load paths were easier to find because fewer beams and columns were necessary to meet the required load, as the joists could span across room lengths, where sawn lumber joists could not. Also, the point loads in the garages were no longer an issue because the TJI-joists could span the entire garage in comparison to the sawn lumber design.

Ultimately, the TJI-joists used throughout the design were the TJI 230 joists at 12 inches o.c. with a 9.5 inch depth and a 3.33 kip-ft moment capacity. While this capacity was not needed throughout the entire design, the team decided to select a uniform size for constructability. In some areas, TJI 210 joists would have been sufficient, but after consulting with Pine Cone Lumber, it was discovered that TJI 230 joists were ordered in bulk and would therefore be less expensive for our design. Based on these conclusions, all further aspects of the design were completed using the TJI alternative. See Appendix O for construction drawings of layouts of TJI joist design. Table 4 shows the beams used in the TJI-joist design. Though engineered lumber was still used, fewer of them were needed in this design in comparison to the sawn lumber design.

Table 4. List of beams used in the TJI design

Member Size	**Quantity**
4 x 10	7
GLU 3.125 x 9	3
GLU 5.5 x 9	1
PSL 5.25 x 9.5	2

5.4 Lateral Design

Once the gravity design was completed, lateral forces were considered. Both seismic and wind forces were taken into account for the structure's lateral force resisting system.

5.4.1 Determination of Seismic Forces

Because the Las Juntas Way Apartment Complex is in California, an earthquake-prone area, seismic loads need to be taken into consideration for lateral design. Seismic forces were determined via the Equivalent Lateral Force Method using factors from ASCE 7-10. A base shear of 18.1 kips was calculated. Factors that were used are outlined in Table 5.

Table 5. Factors used in the determination of seismic forces

Seismic Design Category	D
Sds	1.21g
Sd1	0.63g
Importance Factor	1.00
R	6.50
Ta	0.22 sec
Base Shear	18.1kips

5.4.2 Determination of Wind Forces

Because the structure was constructed of timber, and therefore lightweight construction, it was assumed that a wind load would govern the lateral design. Using factors from ASCE 7-10, total shear forces in both the North-South and East-West directions were calculated. Factors that were used are outlined in Table 6.

The 24.6 kips load in the East-West direction controlled the lateral design. While the 18.1 kips seismic load governed in the North-South direction, 24.6 kips was used to design a conservative lateral force resisting system.

Table 6. Factors used in the determination of wind forces

Exposure Category	B
Wind Speed	110 mph
Kzt	1.00
Importance Factor	1.00
G	0.85
Cp	0.80
Total Shear (N-S)	24.6 kips
Total Shear (E-W)	11.3 kips

5.4.3 Design of Lateral Force Resisting System

The lateral force resisting system was designed to withstand the governing 24.6 kips load. Plywood shear walls with a 15/32 inch thickness were used throughout the structure with 10d nails at 6 inches o.c. First floor shear walls are shown in Figure 6 and are denoted using triangles. More detailed placement of these shear walls, as well as a legend of different nailing patterns, can be found in the structural drawings attached in Appendix O.

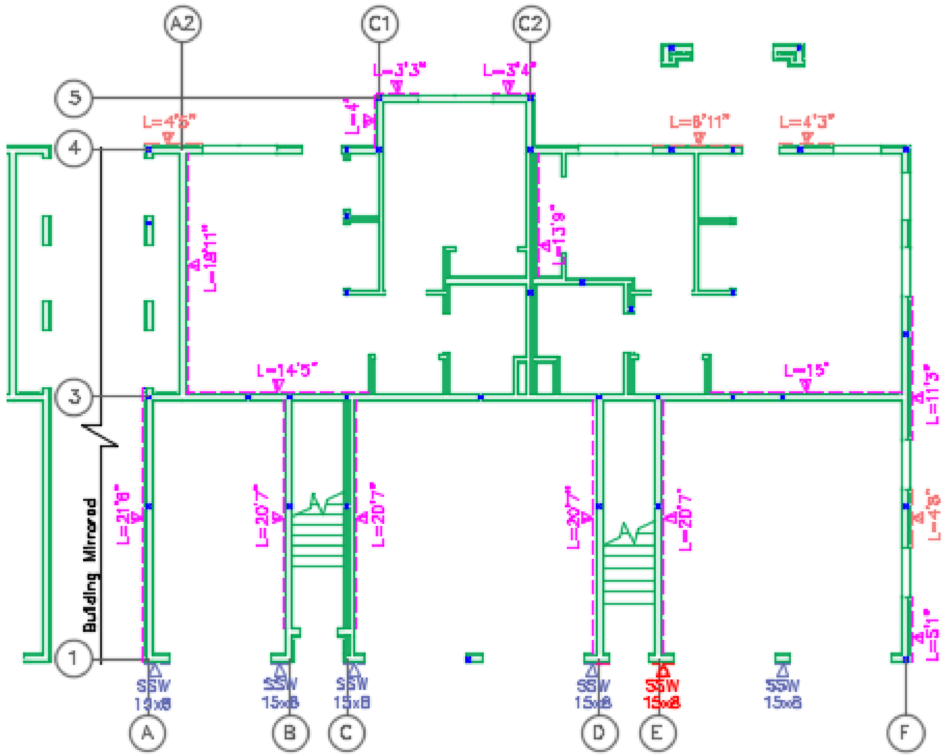


Figure 6. Shear wall layout for the first floor

Shear walls covered the vast majority of the walls on each floor. While this amount was not necessary to meet the structure's shear capacity, the sheathing was placed in this fashion in order to provide a more constructible design, allowing for finishes, such as drywall, to be more easily attached during construction.

On the first floor, Steel Simpson Strong Walls were used in the garage area, instead of the basic plywood shear walls used everywhere else. The large openings for the garage doors created a soft-story condition. Because soft-story structures are more susceptible to lateral forces, this area needed to be more heavily reinforced. Additionally, the walls between garage door openings were not wide enough to meet the code minimum 2:1 height-to-width ratio for shear walls. This also validated the use of Steel Simpson Strong Walls in this area.

5.4.4 Connection Details

Details were designed for the lateral force resisting system. The first detail, shown in Figure 7, shows load transfer between two columns. A top column is connected to a floor joist through a base plate and called-out sill plate nailing. The forces are then transferred from the floor joist to the column below through a double top plate and Simpson A35 clips. These A35 clips, as well as HDU holdowns and other lateral connectors were used throughout the system to drag forces down towards the foundation.

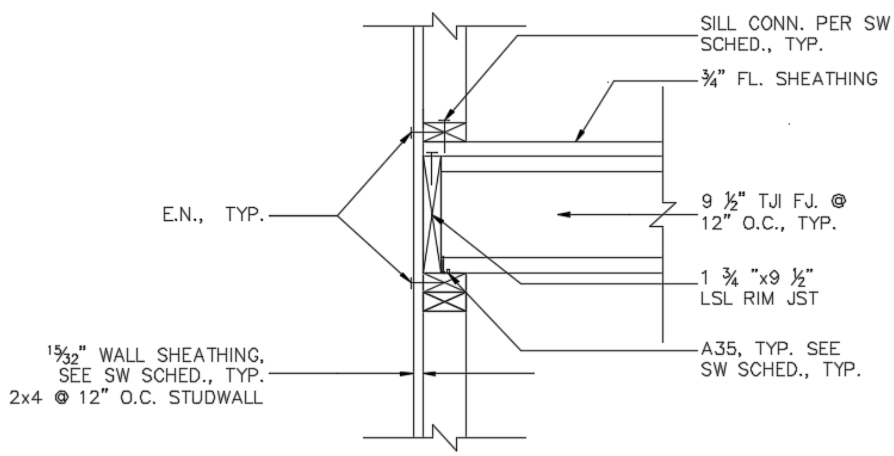


Figure 7. Load transfer between two columns

Figure 8 shows a connection at the base of the structure. HDU holdowns were used to prevent overturning on each floor. Anchor bolts with a 5/8 inch diameter at a code minimum of 48 inches o.c. were used on the first floor to connect walls and posts to the concrete foundation.

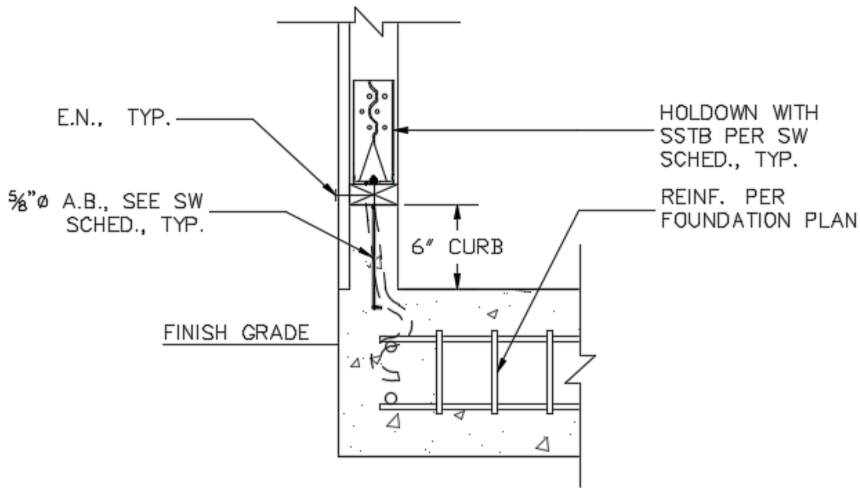


Figure 8. Connection at the base of the structure

A more detailed view of these details and the lateral force resisting system can be found in Appendix O.

5.5 Foundation Design

To complete the foundation design, the team used a geotechnical report to determine the type of soil on which the Las Juntas Way project would be built. From there, the allowable bearing capacity of the soil was calculated. Initially, a square footing design was created because it is the most economical foundation design. Due to several issues, discussed below, the square footing design was impractical and led to a mat slab foundation design. Refer to Appendix O for foundation construction drawings.

5.5.1 Geotechnical Report

A geotechnical report for the site was requested from Habitat for Humanity. Unfortunately, it was too early in the design process, and one had yet to be completed. As a feasible alternative, the geotechnical firm that completed the soils report for the Pleasant Hill BART station was contacted to potentially share their report. Because the BART station was in close proximity to the site, it was assumed that this information would be sufficient for the foundation design. Treadwell and Rollo, the geotechnical firm who worked on the Pleasant Hill BART station, graciously provided their soils report, which is partially shown in Appendix K.

5.5.2 Allowable Bearing Capacity

With the boring sample data, a soils profile was created to determine the allowable bearing capacity of the soil. Below the project site, there were two different clay layers and one layer of sand. Figure 9 shows the soil profile and soil properties for the site.

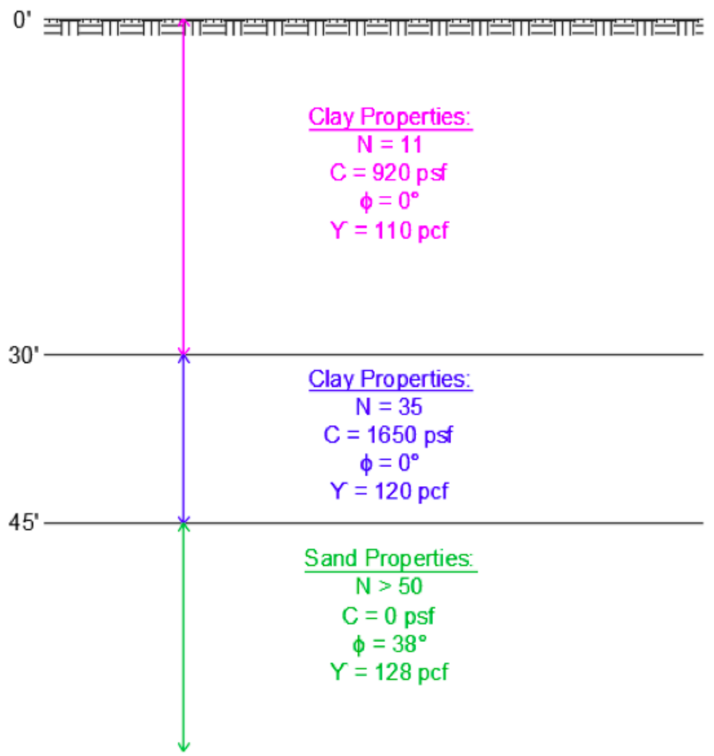


Figure 9. Las Juntas Way soil profile

Since the water table was not identified in the report, it was assumed to be very deep in the calculations. The team used a 20.1 kips maximum column load to find the foundation's depth of impact to be 6.5 feet below surface. Therefore, for all calculations, the first clay layer's properties were used. The team used Terzaghi's method and a factor of safety of 3 (to be conservative) to find the allowable bearing capacity of the clay. The allowable bearing capacity of the first soil layer was 2.38 ksf.

5.5.3 Square Footing Design

Square footings were designed first because they are the most economical foundation design. The largest footing needed was 3.5 feet x 3.5 feet while the smallest was 1.5 feet x 1.5 feet. The red squares in Figure 10 indicate the layout of square footings for the structure. Many of the footings were too close together. Additionally, varying loads throughout the building caused high differential settlement. Settlement was a main concern because clay is an expansive soil. Expansive soils, in general, make foundation designs challenging because they shrink in dry conditions and expand in wet conditions. The calculated settlement for the largest column load was 7.8 inches while the calculated settlement for the smallest column load was 1 inch. This 6 inch difference made the square footing design impractical to use. To solve the settlement problem, a mat slab foundation was designed.

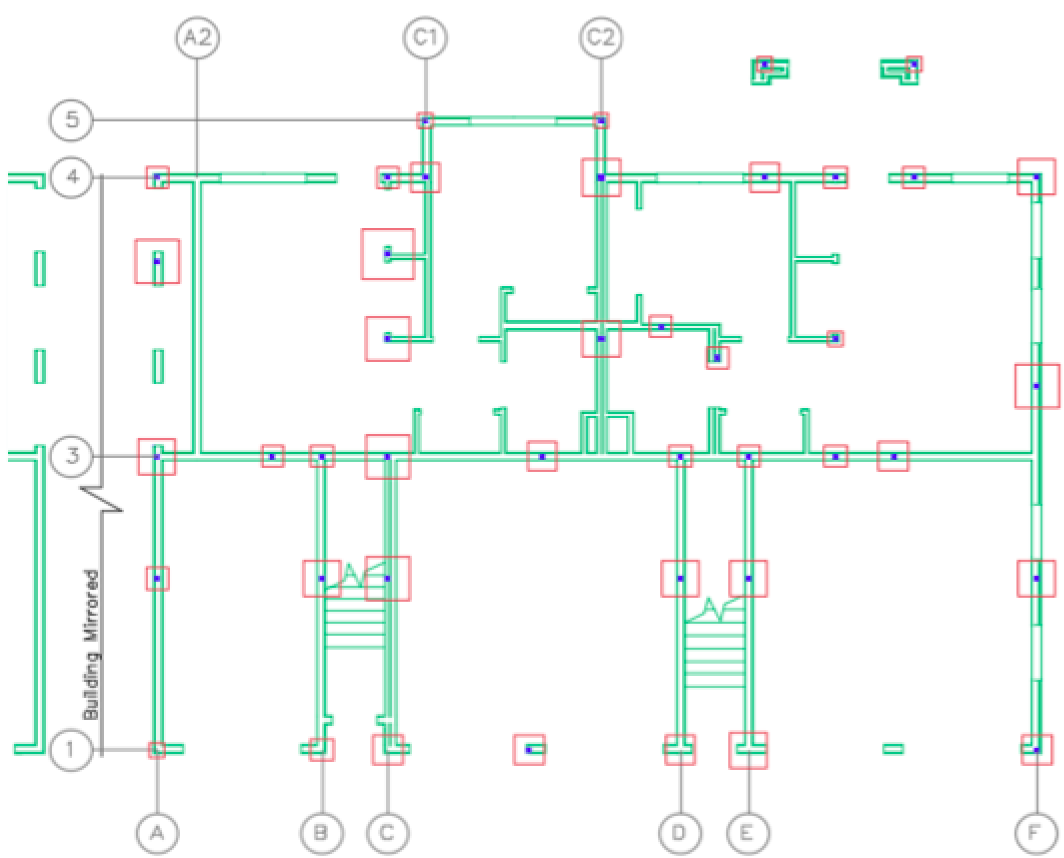


Figure 10. Square footing foundation design

5.5.4 Mat Slab Foundation Design

Two team members enrolled in the Foundation Design course offered by Santa Clara University in the spring quarter to learn how to design a mat slab foundation for the project. However, the instructor explained that a mat slab foundation structural design was beyond the scope of the class and that an analysis computer program should be used instead. A program was not available for students to use, so the instructor suggested outside references for the team to use for the project. The team taught themselves how to design a mat slab foundation using the traditional strip method.

With the traditional strip method, shear and moment diagrams were created for each gridline. The gridline with the highest shear and moment demand governed the design. Gridline 2 governed in the North-South direction and Gridline C governed in the East-West direction. Of these two, Gridline C had the highest moment and shear demand at 132 k-ft and 24.6 kips, respectively. This strip was then structurally designed like a reinforced concrete beam.

A concrete strength (f'c) of 2500 psi was used to find a mat slab thickness of 12 inches. Figure 11 shows a foundation detail with the rebar used to satisfy the load demand. Number 6 rebar was used for longitudinal reinforcement at 18 inches o.c. in both directions. Additionally, number 3 ties were used at 4 inches o.c. Though ties were not needed in the design, they were included for additional lateral support.

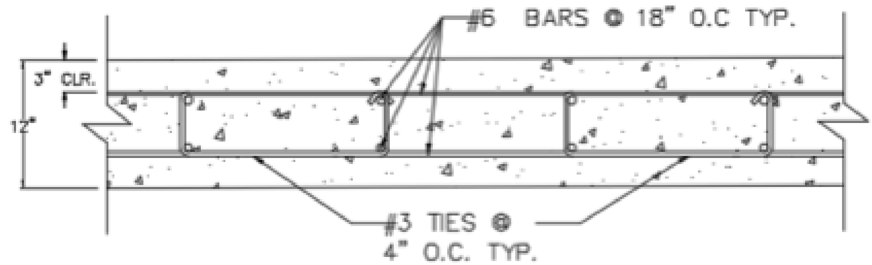


Figure 11. Mat slab foundation design detail

5.6 Construction Drawings

The team's goal was to complete a set of structural drawings to turn in to Habitat for Humanity that would be ready for a professional engineer's review. This set of drawings included the framing plan, lateral force resisting system plan, connection details, and foundation plan for Building Type A of the Las Juntas Way Project. This set of drawings were given to Habitat for Humanity in June 2016. See Appendix O for all construction drawings completed.

5.7 Challenges

The greatest challenge during the duration of the project included the alignment of the architectural floor plans. Because many of the interior walls did not align from floor to floor, the determination of the structural load path was difficult. Columns needed to be strategically placed throughout the three floors in order to distribute the gravity loads down through the framing. Beam span lengths were very large, posing issues when sizing members to comply with the necessary decrease in structure floor space.

The final placement of columns eventually led the team to recommend an extension of a wall in a second floor unit. The extension would allow for a column to be placed within the wall, directly transferring loads from the floors above. This would also aid in lessening the forces on surrounding beams, ultimately optimizing the space between floors in order to meet the height requirement.

In places where columns could not be added, beam sizes increased. The two-car garages on the first floor were areas in which this was a critical issue. Second story columns landing directly on the center of the beams spanning the width of the garage resulted in beam depths of an unacceptable 16 inches. This large size caused inflation in cost and necessary installation labor, and posed an ethical issue for Habitat for Humanity and the team. This challenge led the team to evaluate a design alternative that used more expensive floor joists, but reduced the large beam size.

Chapter 6: Cost Estimate

Because Habitat for Humanity strives to build affordable housing, cost was an important factor in this project. Two design solutions for the Walnut Creek height restriction were created. The more affordable option was recommended.

6.1 Unit Prices

Unit prices for member sizes used in the project were provided by Pine Cone Lumber. These prices aided in evaluating which beam or post type should be used. As expected, sawn lumber prices were less expensive than those for glulams and parallams. However, evaluation of the true cost varied per the size of each beam. A list of some of the most notable unit prices provided by Pine Cone Lumber can be seen below in Table 7. The most important one to note is the price difference between TJI 230 joists and TJI 210 joists because TJI 230 joists were less expensive and therefore used in the design.

Table 7. Unit prices received from Pine Cone Lumber

Type	Size	Unit Cost ($/LF)
Sawn Lumber	2 x 10	1.25
Sawn Lumber	4 x 10	3.5
Sawn Lumber	6 x 10	7.02
Glulam	3-½ x 9	8.47
Glulam	5-⅛ x 9	12.18
PSL	7 x 9-½	19.47
TJI 210	9 ½” depth @ 12” o.c.	2.58
TJI 230	9 ½” depth @ 12” o.c.	2.35

6.2 Alternative 1 Cost Analysis

The unit cost was taken of every beam, column and joist used in the sawn lumber design, and a total of $13,509 was calculated.

6.3 Alternative 2 Cost Analysis

The unit cost was taken of every beam, column and joist used in the TJI-Joist design, and a total of $12,713 was calculated.

6.4 Cost Comparison of Both Alternatives

The TJI joist design alternative ended up being almost $1000 less expensive than the sawn lumber version. This was due to the reduction in the number of beams needed to meet the required load and the increased lengths that the joists could span. It was found that the engineered lumber increased the cost of the beams in the sawn lumber design because there were so many parallam and glulam beams of such great lengths. A complete cost comparison of both designs can be found in Appendix M.

Chapter 7: GreenPoint Rating System

Sustainability is becoming a major part of the design and construction industry. Habitat for Humanity supports the green initiative by using a GreenPoint Rating system on most of their structures. Habitat for Humanity uses this rating system because it is centered in the Bay Area, is designed specifically for homes, and it is run by a nonprofit organization.

7.1 General Description

Build It Green (BIG) is a nonprofit organization that started in 2005. BIG is the result of the merger of the Green Resource Center and Bay Area Build it Green. BIG created a sustainable building rating system called GreenPoint Rating that focuses on environmentally friendly residential structures. To do this, the GreenPoint Rating system is divided into two categories: one for new homes and one for existing homes. Furthermore, these rating systems are adjusted for single family homes and multi-family homes. The scorecard used for the Las Juntas Way Project is version 6 for new home, multi-family units.

7.2 Point Distribution

The points for the new home, multi-family unit scorecard were awarded according to their sustainability with regards to the community, energy, indoor air quality and health, resources, and water. The different categories the scorecard addressed were pertaining to the site; the foundation; the landscape; the structural frame and building envelope; the exterior; the insulation; the plumbing; the heating, ventilation, and air conditioning; the renewable energy; the building performance and testing; the finishes; the flooring; the appliances and lighting; the community; and other design considerations. Some aspects of the scorecard drew upon the team’s own estimations and assumptions. For example, one section of the scorecard was based on the construction methods used. At the time of the scorecard's assessment, Habitat for Humanity had not specified the construction methods and practices that would be followed. The team used the assumption that Habitat for Humanity would follow similar construction practices as they did in the Central Commons Fremont Apartment Complex. Other factors taken into account for this scorecard were the number of resources within ½ mile of the of the project site. See Appendix N for the complete GreenPoint scorecard.

7.3 Total Points Achieved

The total number of points this completed project has the potential to achieve is 133 points, resulting in a gold rating, which is the second highest rating for GreenPoint. Some recommendations for further improvement that Habitat for Humanity could take into consideration were to increase the noise and vibration control practices due to the BART line running nearby. Also, they could select higher quality finishes in order to factor in indoor air quality, and finally they could consider the use of recycled water in their landscape irrigation.

Chapter 8: Modeling

Building Information Modeling (a.k.a. BIM) is becoming more common in the construction industry. Revit is a 4D technology that has a reputation of saving an owner both time and money. It is capable of mitigating risk, reducing errors in construction, and enhancing improving the quality of the final product. The architecture firm working with Habitat for Humanity on the Las Juntas Way Project uses Revit on their projects. The team wanted to provide a basic structural model for Habitat to use as reference for the project. Figure 12 shows the Revit model created and it highlights what the TJI-joist design looked like. It also shows the discontinuity in load paths that made the gravity design challenging.

Figure 12. Structural Revit model

Chapter 9: Conclusions

9.1 Lessons Learned

A variety of lessons were learned throughout this redesign. The project's completion provided the project team with invaluable experience that will be transferred to their future careers as structural engineers. A major lesson learned was that constructability is a crucial factor in design and often governs final design judgments. When sizing members and connections, the team was faced with the decision of using precisely calculated values or choosing a governing size when selecting members in order to ease construction and material ordering.

Another lesson learned was that it is beneficial to visit a project site in order to understand the area and make observations that may affect final design judgments. Without the Walnut Creek site visit completed prior to the completion of this redesign, sound insulation may have not been considered in the final design and suggestions given to Habitat for Humanity.

Lastly and most importantly, the team learned that structural design is extremely iterative and detailed. This redesign pushed the team members to think about all of the components throughout a structure and their respective load paths, being the first time they have completed a building design this comprehensive and complex. Despite its challenges, this project resulted in a successful redesign of Building Type A for the Las Juntas Way Apartment Complex.

9.2 Recommendations for Habitat for Humanity

This redesign resulted in a reduction of structural space, meeting the target structural depth of 9.5 inches and 8 feet interior clearances. In order to meet this target depth, it was recommended that Habitat for Humanity and their partners use TJI 230 joists at 12 inches o.c. for the entirety of the apartment complex. These joists require fewer beams and columns, lowering the project's overall cost. Costs saved on these gravity members may be redistributed toward the construction of a 12 inch mat slab foundation with the respective reinforcement.

Another recommendation was to use Steel Simpson Strong Walls in the garage area on the first floor. These walls would provide enough strength to meet both shear and axial capacities in this area, which requires more reinforcement due to the soft-story condition. The last recommendation was to extend an architectural wall on the second floor for the placement of a column to allow for load transfer down to the foundation. All of these recommendations can be used for the design of Building Types B and C, which were not included in this redesign.

APPENDIX A

Las Juntas Way Existing Architectural Floor Plans

Courtesy of Pyatok Architects, Inc.

1250 LAS JUNTAS WAY

PRELIMINARY REVIEW PACKAGE

SHEET INDEX

SITE INFORMATION

Parcels:	148-180-050, 148-180-051, 148-180-052
Zone:	M3 Multiple Family Residential 3,000
Height Overlay:	25' limit
Site Area:	+/- 2.14 acres
Dwelling Units:	52
Density:	24.30 units/acre
Lot Coverage:	33%

UNIT AND AREA SUMMARY

Unit Type	# Units	Area/Unit	Total Area
1 BR Flat	14	591 SF	8,274 SF
2 BR Flat	3	846 SF	2,538 SF
2 BR TH	9	1,030 SF	9,270 SF
3 BR Flat	2	1,154 SF	2,308 SF
3 BR TH	12	1,230 SF	14,760 SF
4 BR TH	12	1,383 SF	16,596 SF
TOTAL UNITS	**52**		**53,746 SF**
A GARAGES	9	1,081 SF	9,729 SF
B GARAGES	3	853 SF	2,559 SF
TOTAL GARAGE			**12,288 SF**
			66,034 SF

PARKING SUMMARY

BART-Proximate Requirements

Unit Req.	Spaces
1.25 per 1 BR	18
1.5 per 2 BR	18
2.0 per 3+ BR	52
TOTAL	**88**

HFH Standards

Unit Req.	Spaces
1.0 per 1 BR	14
1.0 per 2 BR	12
2.0 per 3+ BR	52
TOTAL	**78**

Proposed

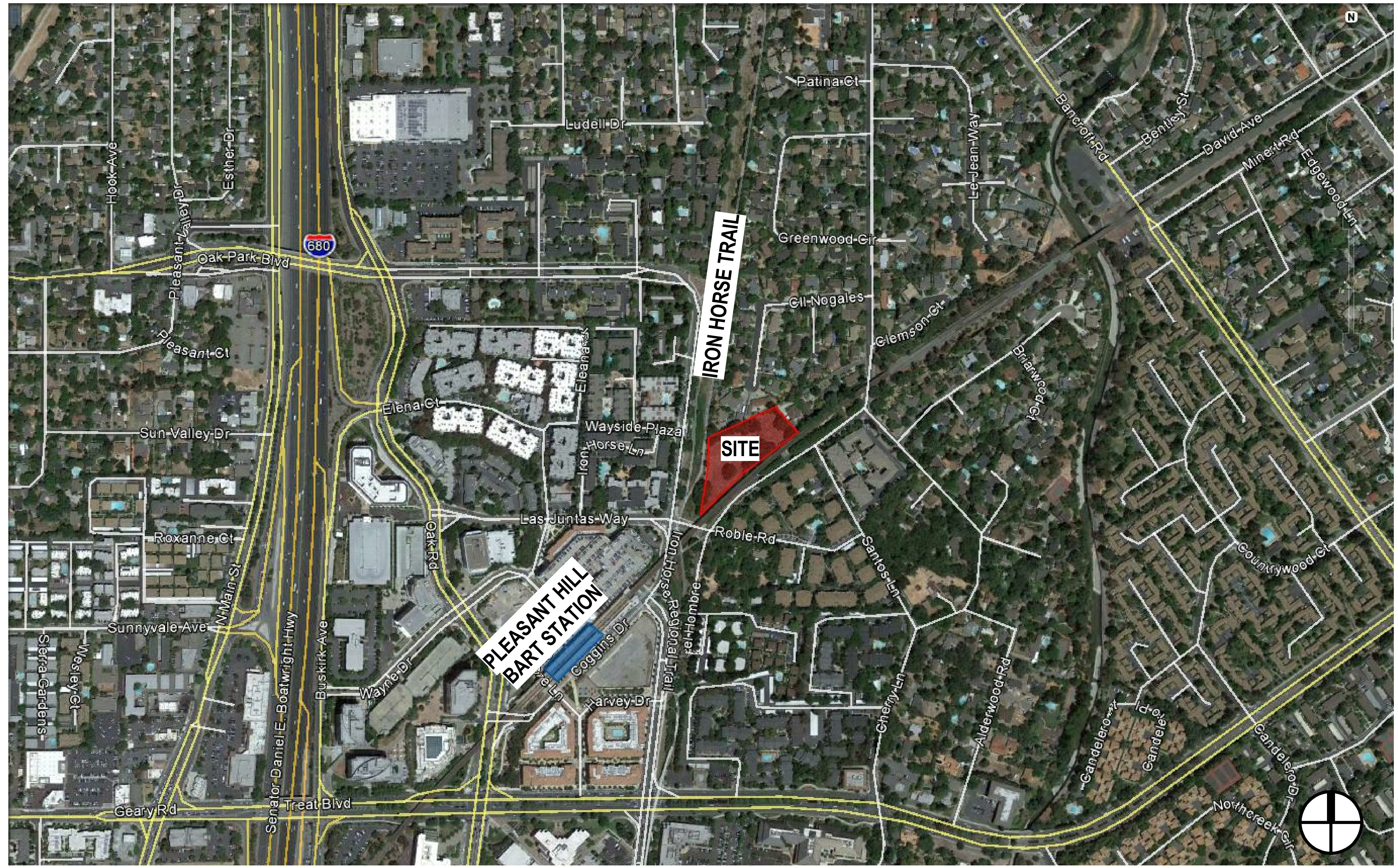
Parking Type	Spaces
Covered	57
Uncovered	30
TOTAL	**87**

Proposed Bike Parking

62 Outdoor Spaces

(Residents can also keep bikes in their garage)

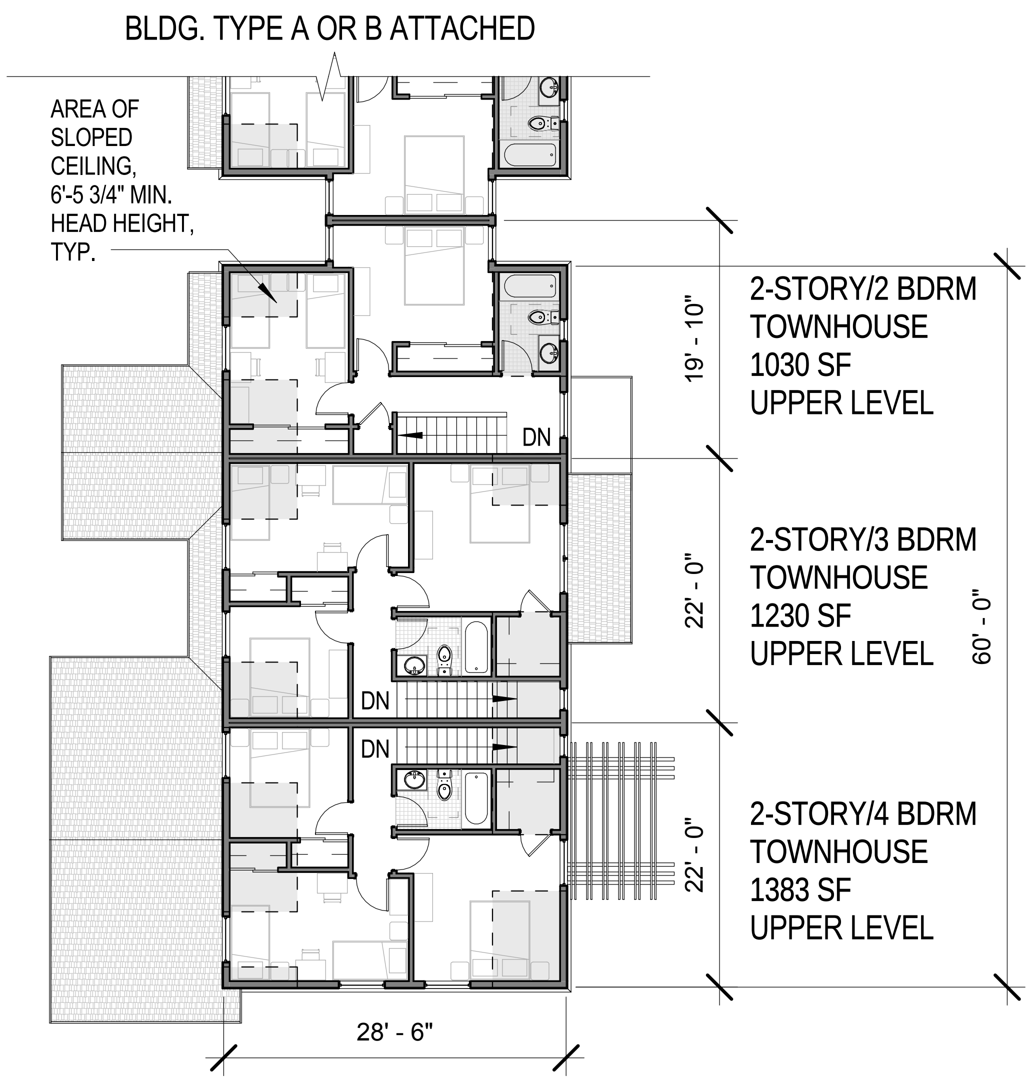
Scale: NONE



1. COVER SHEET

Scale: 1" = 40'-0" 0' 10' 20' 30' 40'

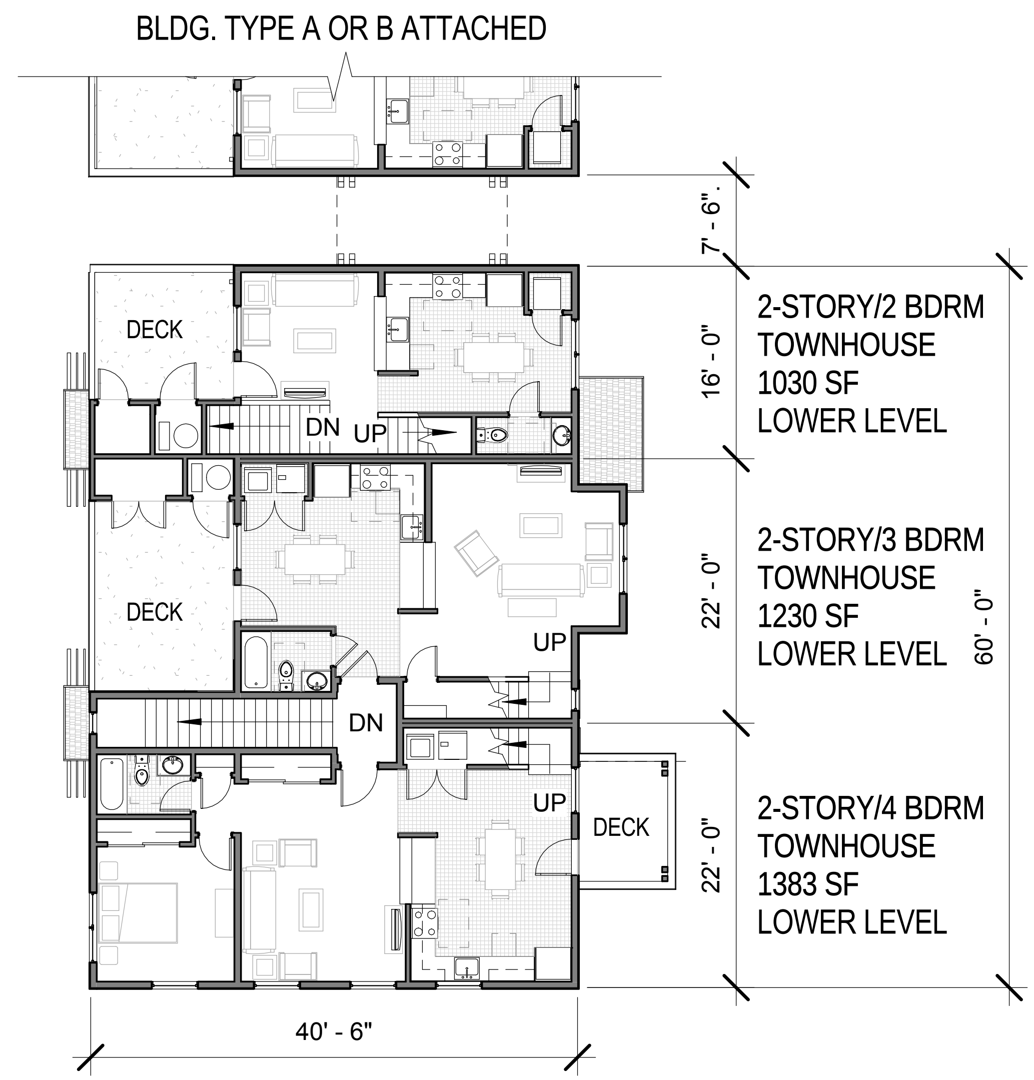
2. SITE PLAN



BLDG. TYPE A PLAN - LEVEL 3

NOTE: SIMILAR TO BLDG. TYPE C LEVEL 3

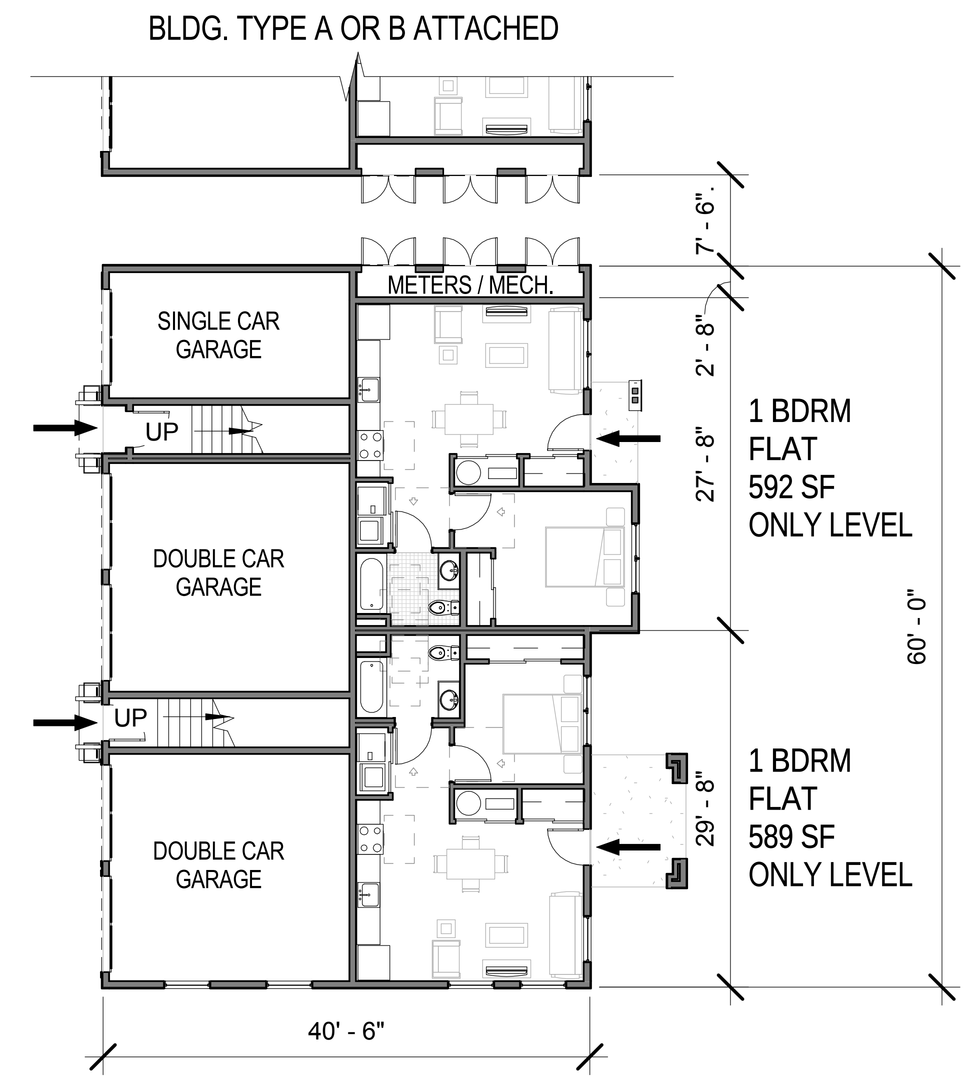
1/16" = 1'-0" 3



BLDG. TYPE A PLAN - LEVEL 2

NOTE: SIMILAR TO BLDG. TYPE C LEVEL 2

1/16" = 1'-0" 2

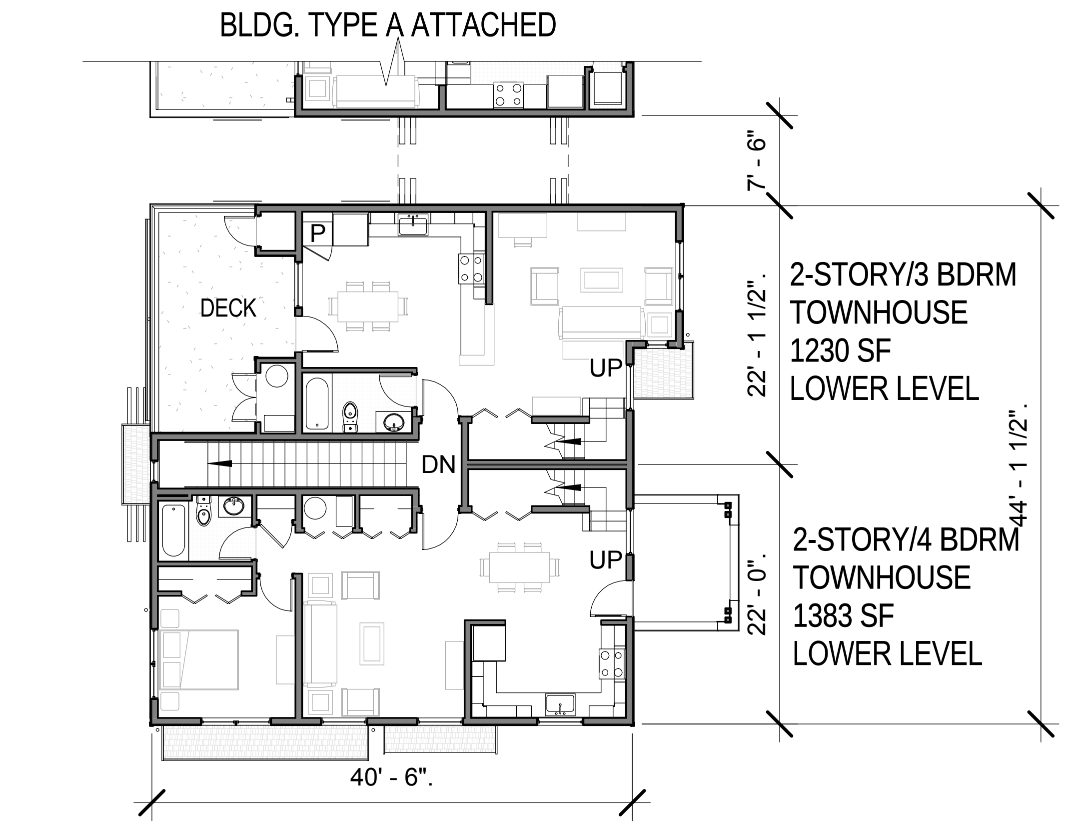


BLDG. TYPE A PLAN - LEVEL 1

1/16" = 1'-0" 1

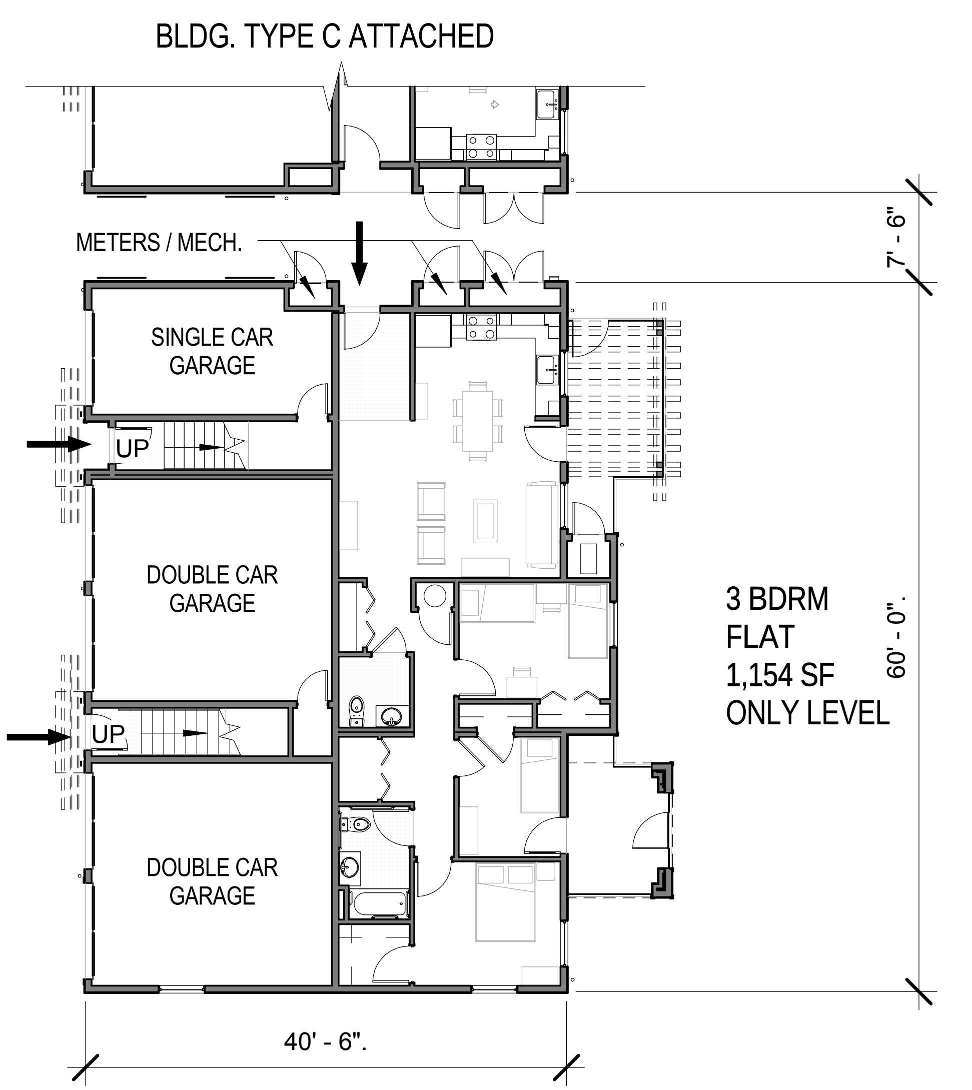
Scale: 1/16" = 1'-0" 0' 4' 8' 12' 16'

3. BUILDING PLANS - TYPE A



BLDG. TYPE B PLAN - LEVEL 2 (2)

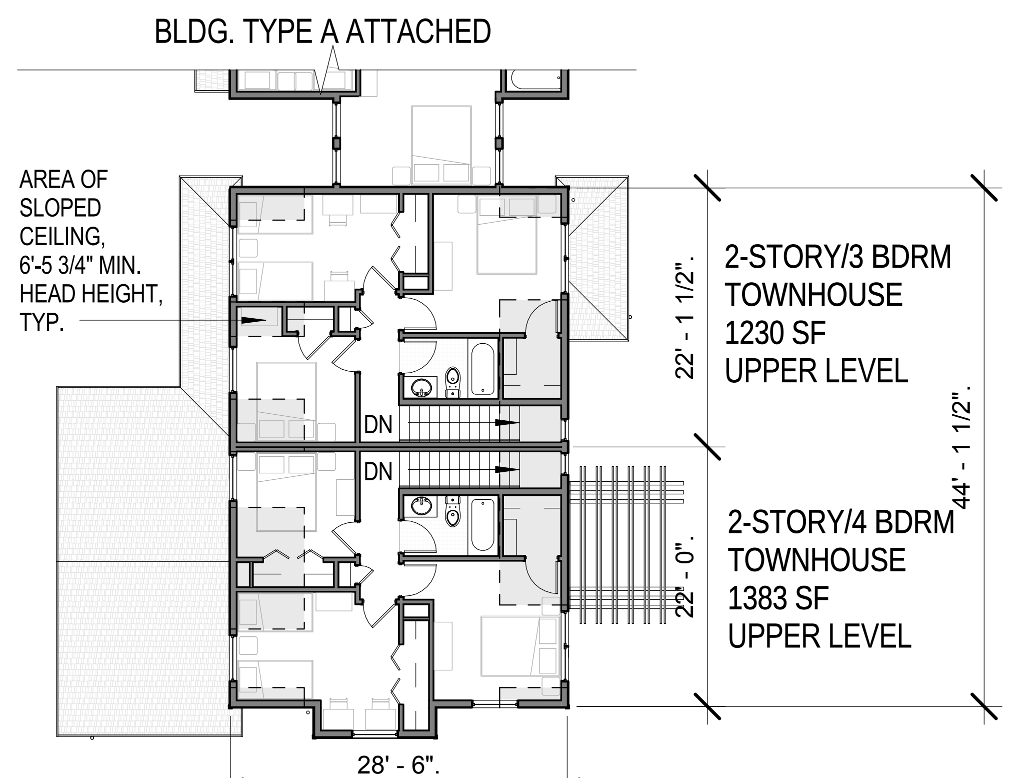
1/16" = 1'-0"



BLDG. TYPE C PLAN - LEVEL 1 (4)

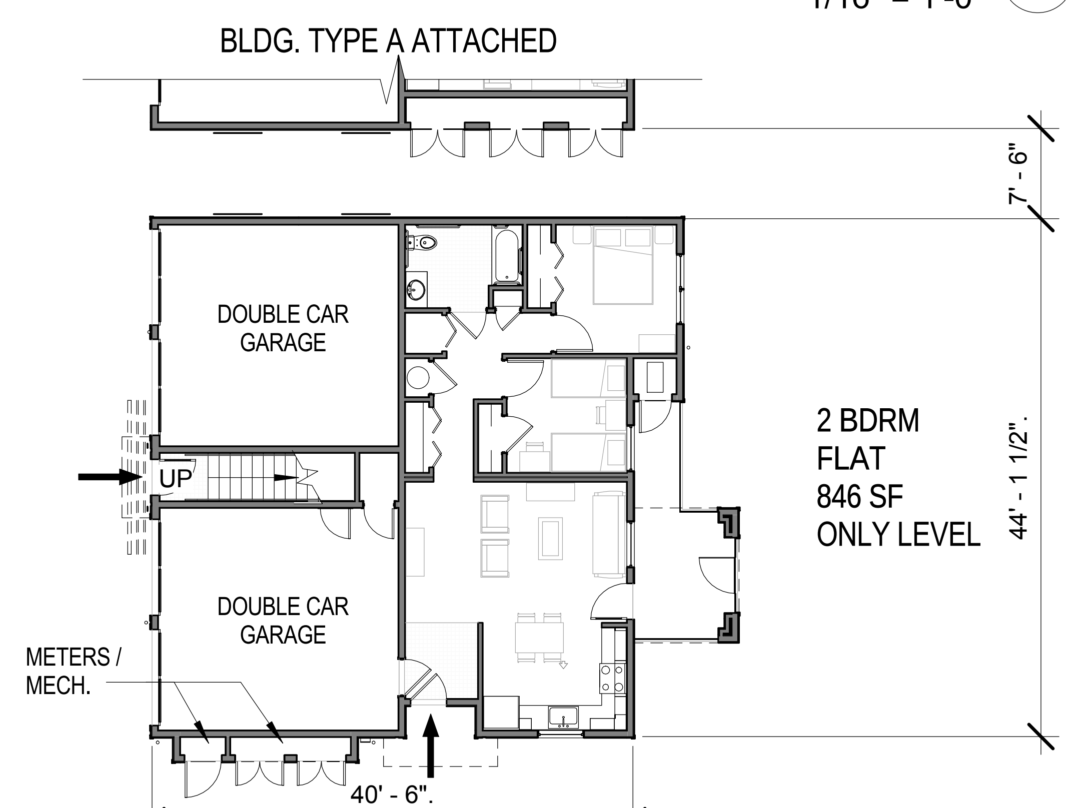
NOTE: SEE BLDG. TYPE A
PLANS FOR LEVELS 2 & 3

1/16" = 1'-0"



BLDG. TYPE B PLAN - LEVEL 3 (3)

1/16" = 1'-0"



BLDG. TYPE B PLAN - LEVEL 1 (1)

1/16" = 1'-0"

Scale: 1/16" = 1'-0" 0' 4' 8' 12' 16'

4. BUILDING PLANS - TYPES B & C

FRONT ELEVATION (TYPE A BLDGS. SHOWN) 2
1" = 10'-0"

DRIVEWAY ELEVATION (TYPE A BLDGS. SHOWN) 1
1" = 10'-0"

Scale: 1" = 10'-0" 0' 2' 4' 6' 8' 10'

5. TYPICAL ELEVATIONS

MATERIALS

HardiePlank fiber cement lap siding, wood textured, 8" exposure, painted

HardieShingle fiber cement panels with straight edge, 48" x 14," 5" exposure, painted

Roofing: CertainTeed Landmark Solaris Gold, Energy Star, "Resawn Shake" color, or equal

Milgard "Montecito" Energy Star vinyl windows, white color, or equal

Patio Fences: 1 x 8 cedar or redwood boards, unfinished (will weather to silvery-grey)

Trellises: cedar or redwood lumber, painted

Raised Planters and Post Bases: exposed poured-in-place concrete (planters may be Trex or an an alternative material)

"B" and "C" Terrace Paving: Pattern Paving Products colored and stamped asphaltic concrete paving, or equal (see colors below)

PAINT COLORS

Body:
Sandalwood
Valspar 6008-2B

Upper Stories & Bays:
Cooper Melon
Valspar 7003-2

Trim & Trellises:
Foggy Skies
Valspar 7002-4

Note: paint colors shown are only approximate, refer to Valspar paint chips for more accurate colors (see separate Valspar Paint Color Samples exhibit)

ASPHALT COLORS

Terrace "B" & "C" Borders:
Nutmeg
Pattern Paving Products RoadColor

Terrace "B" & "C" Main Field:
San Diego Buff
Pattern Paving Products RoadColor

Note: asphalt colors shown are only approximate, see manufacturer website for more information: <http://www.patternpaving.com/stampedasphaltcolors.html >

PYATOK

Habitat for Humanity East Bay/Silicon Valley

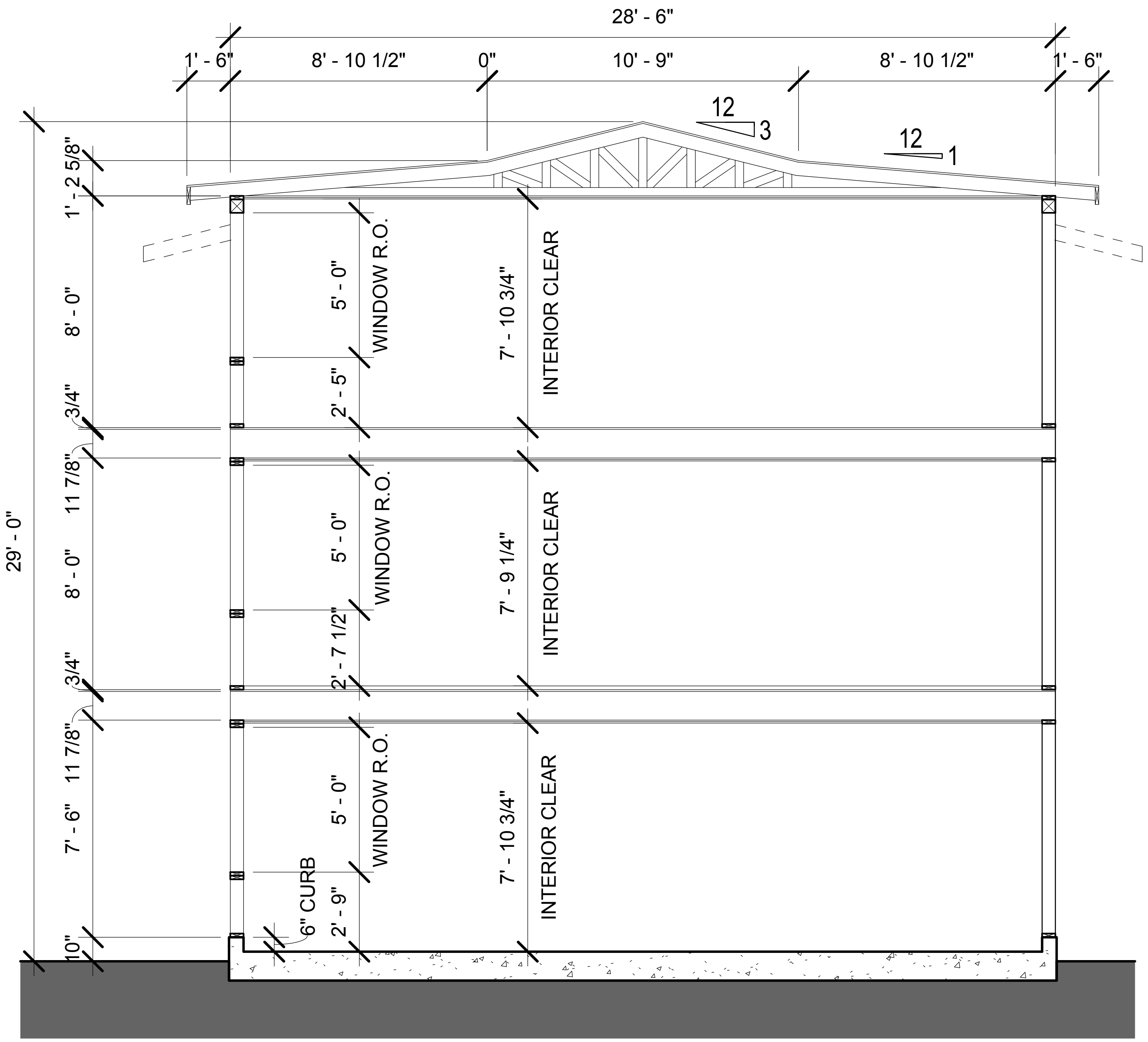
MATERIALS & COLORS
CENTRAL COMMONS
4369 Central Avenue
Fremont, CA

CENTRAL AVENUE ELEVATION - COLOR SCHEME A

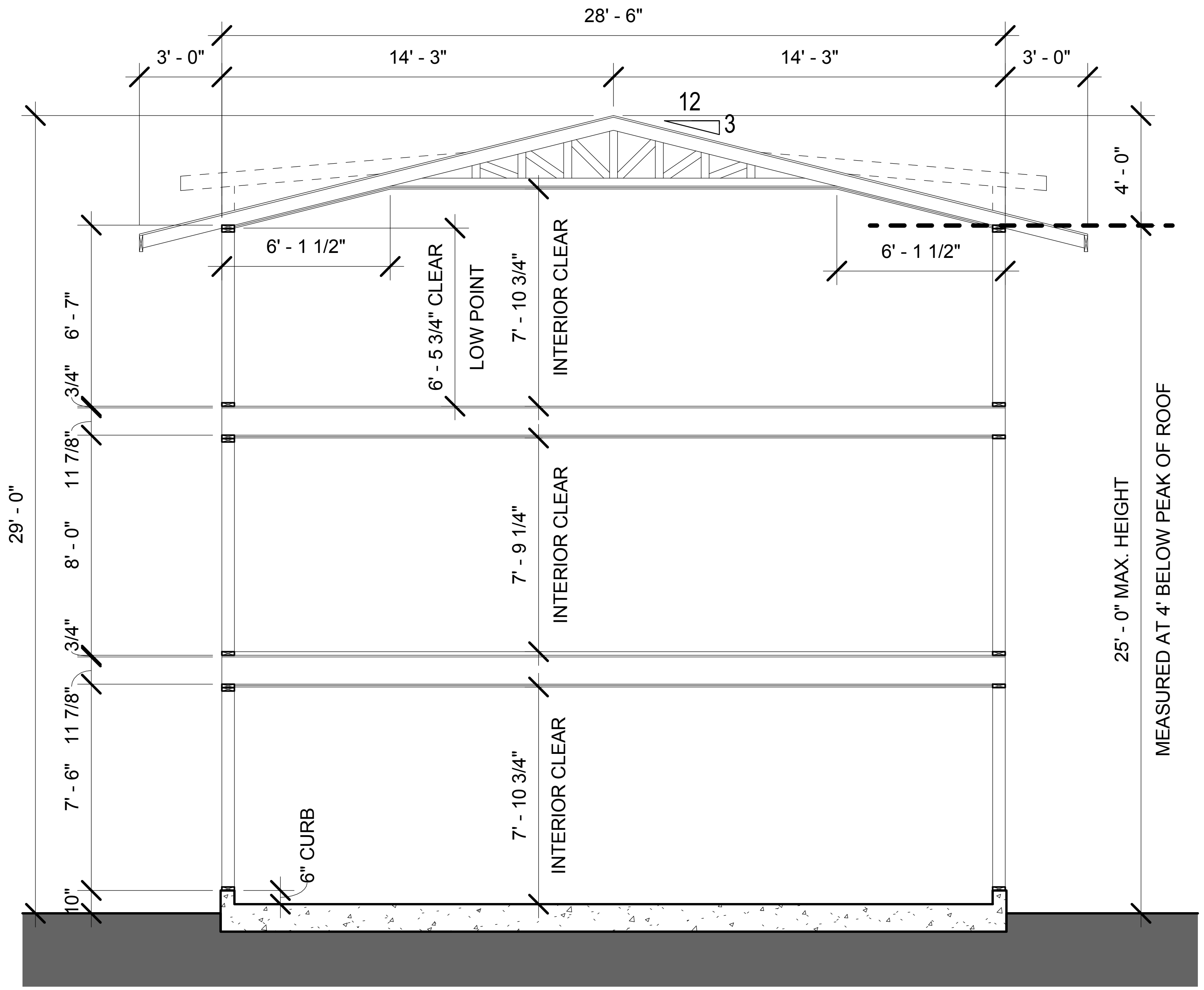
Color Schemes A and B will both be used for different buildings on the site

Scale:

6. SAMPLE ELEVATION & MATERIALS - CENTRAL COMMONS



DORMERS



TYPICAL ROOF

Scale: 3/16" = 1'-0" 0' 2' 4' 6' 8'

7. BUILDING HEIGHT SECTION STUDY

APPENDIX B

Walnut Creek Building Codes

ADDITIONAL DEVELOPMENT REGULATIONS	
D(10)	Except for those single family dwellings, duplex dwellings and accessory structures exempted from the provisions of this section, no new building shall be constructed or moved onto any building site, nor shall any existing non-residential building be enlarged, remodeled or otherwise altered on the exterior, nor shall any landscaping previously required pursuant to any permit be altered, nor shall any parking layout or dimension be altered until the design plan and site plan have received Design Review approval pursuant to **Part IV, Article 12.** of this Chapter. The provisions of this section D(10) shall not apply to: (a) Additions to existing single family and duplex dwellings. (b) Swimming pools, patios and covers, fences and other accessory structures except when design review is required for the main building and the accessory structure is to be constructed concurrently with the main building.

(§2, Ord. 2037, eff. 12/17/04; §6, Ord. 2108, eff. 4/7/12)

Article 3. Multiple Family Residential Districts (M)

Sec. 10-2.2.301. Purpose and Intent.

The purpose of the Multiple Family Residential Districts is to promote and encourage single and multiple family development at densities that are consistent with the General Plan land use designation and surrounding development. The intent is to provide for higher density classifications in and around the core area and adjacent to major transit centers. The lower density classifications will serve as a transition between single family development and commercial areas or higher density residential areas.

In the Core Area, ground floor commercial or retail uses may be permitted upon approval of a conditional use permit (subject to a specific set of findings) in multi-story, high density residential complexes. The intent is to provide convenient services for the tenants living in and around these higher density residential complexes.

Sec. 10-2.2.302. Land Use Regulations.

In the following table, the letters in the "Use Regulation" column are defined as follows:

P = A permitted use.

L = A use permitted subject to certain limitations prescribed by the "Use Regulations" that immediately follow the table.

U = A use permitted on approval of a Conditional Use Permit.

Letters in parentheses in the "Additional Regulations" column are described in the "Additional Regulations" section following the "Use Regulations". Where a Use Regulation or a letter in parentheses is opposite a use classification heading, the referenced regulations shall apply to all use classifications under the heading. Land uses not listed (indicated by strikeout) are not permitted.

LAND USE	USE REGULATIONS	ADDITIONAL REGULATIONS
A. Residential Use Classifications		(A)(B)(C)(G)
1. Adult Day Care Home	P	
2. Congregate Living Facility	U	
3. Family Day Care Home		
a. *Small Family Day Care Home*	P	(D)
b. *Large Family Day Care Home*	L(1)	(D)
4. Group Residential	P	
5. Multiple Family Residential	P	
6. Residential Care Home	P	
7. Second Family Unit	P	
8. Single Family Residential	L(2)	
B. Commercial Use Classifications		
~~1. Ambulance Services~~		
~~2. Animal Sales and Service~~		
~~a. *Animal Hospital*~~		
~~b. *Animal: Retail Sales and Grooming*~~		
~~c. *Horse Stables*~~		
~~d. *Kennel*~~		
~~3. Artist Studio~~		
4. Banks and Savings and Loans		
a. *Banks and Savings and Loans*	L(3)	
~~(1) *With Drive-up Service*~~		
(2) *With Automated Teller Machine*	L(4)	
~~5. Catering Services~~		
~~6. Communication Facilities~~		
~~7. Custom Manufacturing~~		
8. Eating and/or Drinking Establishments		(H)
a. *Eating and/or Drinking Establishments*	L(3)	
(1) *With Wine and Beer Service Ending at or Before 11:00 p.m.*	L(5)	
(2) *With Wine and Beer Service Ending After 11:00 p.m.*	L(6)	
(3) *With Full Alcoholic Beverage Service Ending at or Before 11:00 p.m.*	L(5)	

LAND USE	USE REGULATIONS	ADDITIONAL REGULATIONS
(4) *With Full Alcoholic Beverage Service Ending After 11:00 p.m.*	L(6)	
~~(5) *With Live Entertainment*~~		
~~(6) *With Dancing*~~		
(7) *With Take-out Service*	L(3)	
~~(a) *Drive-up*~~		
(8) *With Permanent Outdoor Seating*	L(3)	
~~(9) *With Off-site Distribution*~~		
(a) *Micro-brewery*	L(3)	
9. Food and Beverage Sales		
a. *Food and Beverage Sales*	L(3)	
b. *Convenience Market*	L(3)	
~~(1) With Gasoline Sales~~		
c. *Specialty Food Shops*	L(3)	
~~(1) *With Off-site Distribution*~~		
~~10. Funeral and Interment Services~~		
11. Health Clubs	L(3)	
~~12. Home Improvement Sales and Service~~		
~~13. Horticultural Establishment~~		
~~14. Lumber and Building Material Yard~~		
~~15. Maintenance and Repair Service/Small Equip~~		
~~16. Mini Storage~~		
~~17. Nursery~~		
~~18. Offices, Business and Professional~~		
~~a. *Offices, Business and Professional*~~		
~~b. *Offices, Medical*~~		
~~19. Parking, Commercial Facility~~		
~~20. Pawn Shop~~		
21. Personal Improvement Services	L(3)	
22. Personal Services	L(3)	
~~23. Recreation and Entertainment, Commercial~~		
~~a. *Within a building*~~		
~~b. *Outside a Building*~~		
~~24. Research and Development Services~~		
25. Retail Sales/Rental	L(3)	

LAND USE	USE REGULATIONS	ADDITIONAL REGULATIONS
~~26. Vehicle/Equipment Sales and Service~~		
~~a. *Automobile Rental/Leasing*~~		
~~b. *Automobile Sales/New and Used*~~		
~~c. *Automobile Washing*~~		
~~d. *Automobile Wrecking*~~		
~~e. *Service Stations*~~		
~~(1) *Automobile Washing*~~		
~~f. *Vehicle/Equipment Repair*~~		
~~(1) *Limited Vehicle Service*~~		
~~g. *Vehicle/Equipment Sales and Rentals*~~		
~~h. *Vehicle Storage*~~		
27. Visitor Accommodations		
a. *Bed and Breakfast Inns*	U	(E)
~~b. *Hotels*~~		
~~c. *Motels*~~		
~~**C. Industrial Use Classifications**~~		
~~1. General Industry~~		
~~2. Limited Industry~~		
~~3. Research Development Industry~~		
~~4. Wholesaling, Distribution and Storage~~		
~~**D. Agricultural Use Classifications**~~		
~~1. Animal Husbandry~~		
~~2. Crop Production~~		
E. Community Facility Use Classifications		
1. Adult Day Care Facility	U	
2. Child Day Care Facility (Day Care Center)	U	(D)
3. Clubs and Lodges	U	
4. College, Public or Private	U	
5. Cultural Institutions		
a. *Cultural Institutions*	U	
b. *Natural History/Science Museum*	U	
~~6. Emergency Medical Care~~		
~~7. Government Offices~~		
~~8. Hazardous Waste Management Facility~~		
~~9. Heliports~~		

LAND USE	USE REGULATIONS	ADDITIONAL REGULATIONS
10. Housing for the Homeless/Emergency Shelters	L(7)	
~~11. Hospitals~~		
~~a. *Acute Care*~~		
~~b. *Other*~~		
~~12. Maintenance and Service Facilities~~		
13. Park and Recreation Facilities	P	
~~14. Public Parking Facilities~~		
15. Public Safety Facilities	U	
~~16. Public Transit Terminals~~		
17. Recycling Facilities		
a. *Collection Facility*		
(1) *Reverse Vending Machine*	L(8)	(F)
(2) *Sml Collection Facility*	L(8)	(F)
~~(3) *Lrg Collection Facility*~~		
~~b. *Processing Facility*~~		
18. Religious Assembly	U	
19. Residential Care Facility	U	
20. Schools, Public or Private	U	
21. Skilled Nursing Facilities	U	
22. Utilities, Major	L(9)	
23. Utilities, Minor	P	
F. Accessory Uses		
1. Accessory Living Quarters	L(10)	
2. Accessory Structure	L(11)	
3. Accessory Use	L(12)	
a. *Garage Sales*	P	
b. *Home Occupations*	L(12)	
G. Temporary Uses		
1. Arts and Crafts Shows, Outdoor	L(13)	
2. Christmas Tree Sales	L(13)	
3. Civic/Community Events	L(13)	
4. Farmers Markets	L(13)	
5. Live Entertainment Events	L(13)	
~~6. Outdoor Seating/Eating and Drinking Estab~~		
7. Pumpkin Sales	L(13)	

LAND USE	USE REGULATIONS	ADDITIONAL REGULATIONS
~~8. Retail Sales, Outdoor~~		
9. Swap Meets, Non-Recurring	L(13)	
~~10. Swap Meets, Recurring~~		
~~11. Street Fairs~~		
~~12. Vendor Carts~~		

USE REGULATIONS	
L(1)	Permitted subject to the issuance of a Large Family Day Care Home Permit by the Zoning Administrator.
L(2)	Permitted in the M-3 zoning district upon approval of a conditional use permit by the Planning Commission. Not permitted in the M-2.5, M-2.0, M-1.5 and M-1.0 zoning districts. The maximum density for single family residential development in the M-3 zoning district shall be determined by the Planning Commission in the approval of the Use Permit.
L(3)	Permitted on the ground floor of a multi-story residential project in the Core Area upon approval of a Conditional Use Permit. Not permitted outside of the Core Area. In approving the Use Permit the Planning Commission must find that: a) The proposed use is located on a collector or arterial street in the Core Area; b) The use, in terms of activities, location, size, appearance and signage, will not alter nor detract from the residential character of the neighborhood.
L(4)	If the ATM is to be located on the exterior wall of an existing bank or an off-site building it shall be reviewed and approved by the Community Development Director. In approving the exterior ATM, the Community Development Director shall find that the ATM has adequate security and lighting and that queuing for the ATM does not impede pedestrian or vehicular traffic flow.
L(5)	Permitted subject to L(3) and an additional finding by the Planning Commission that the use is consistent with the Administrative Use Permit Compliance Checklist Conditions of Approval pursuant to Article 12 of Part III of the Zoning Ordinance.
L(6)	Not permitted if located within 600 feet of a school (as defined in Article 4, Sec. 10-2.1.403.E) if providing full alcoholic beverage service. Otherwise, permitted upon approval of a Conditional Use Permit pursuant to both L(3) and Article 12 of Part III of the Zoning Ordinance.
L(7)	Permitted in the M-1.5 and M-1.0 zoning districts upon approval of a Conditional Use Permit. Not permitted in the M-2.0, M-2.5 and M-3 zoning districts.
L(8)	Reverse vending machines used by occupants of single family homes, duplex units and multiple family housing projects for the sole collection and storage of recyclable material generated by on-site residents are permitted. Reverse vending machines and small collection facilities are permitted in Community Service Facilities (see Part III, Article 7. **Recycling Facilities.** for the definition of "Community Service Facilities") upon approval by the Community Development Director. Storage containers must be enclosed or placed out of view of any public right-of-way.
L(9)	Electrical substations, above-ground electrical transmission lines, water pumping stations and switching buildings are permitted uses. All other uses within this classification are not permitted.

USE REGULATIONS	
L(10)	Accessory living quarters, as defined in Part I, Article 4. **Use Classifications**, are living quarters within an accessory structure, without kitchen facilities. Accessory living quarters are permitted subject to the standards in Sec. 10-2.3.103. **Accessory Structures.**
L(11)	Accessory structures are permitted subject to the standards in Sec. 10-2.3.103. **Accessory Structures.**
L(12)	Home Occupations are permitted subject to the approval of a Home Occupation Permit (see Sec. 10-2.3.107. **Home Occupations**). For all other accessory uses, see the use regulation for the primary use classification.
L(13)	Permitted in neighborhood swim centers, cultural institutions, park and recreation facilities, religious assembly, schools and similar locations subject to the approval of a Temporary Activity Permit (see Sec. 10-2.3.118. **Temporary Activity Permits**).
L(14)	Permitted subject to the issuance of a Second Family Unit Permit. (See Part III, Article 5. **Second Family Residential Units.**)

ADDITIONAL USE REGULATIONS	
(A)	See Sec. 10-2.3.103. **Accessory Buildings.**
(B)	See Sec. 10-2.3.107. **Home Occupations.**
(C)	See Sec. 10-2.3.108. **Animals.**
(D)	See Part III, Article 6. **Child Day Care Facilities.**
(E)	See Sec. 10-2.3.109. **Bed and Breakfast Inns.**
(F)	See Part III, Article 7. **Recycling Facilities.**
(G)	See Part III, Article 9. **Inclusionary Housing.**
(H)	See Part III, Article 12. **Alcoholic Beverage Sales.**

(Ord. 1877, eff. 1/6/96; §§5, 6, 7, Ord. 2109, eff. 6/15/12; §7, Ord. 2129, eff. 7/3/14)

Sec. 10-2.2.303. Property Development Regulations.

The following schedule prescribes development regulations for the Multiple Family Residential Zoning District. The symbol "NA" indicates that there is no restriction for that particular development regulation or it is not applicable in this District. Letters in parentheses refer to the "Additional Development Regulations" following the schedule.

CLASSIFICATION	DEVELOPMENT REGULATIONS	ADDITIONAL REGULATIONS
A. Minimum Lot Area		D(1)
1. M-1	5,000 Sq Ft	
2. M-1.5	9,000 Sq Ft	
3. M-2	8,000 Sq Ft	
4. M-2.5	10,000 Sq Ft	
5. M-3	15,000 Sq Ft	D(2)
B. Minimum Lot Width		D(1)
1. M-1	50 Feet	
2. M-1.5	90 Feet	
3. M-2	60 Feet	
4. M-2.5	90 Feet	
5. M-3	90 Feet	D(2)
C. Minimum Lot Frontage		D(1)
1. M-1	50 Feet	
2. M-1.5	90 Feet	
3. M-2	60 Feet	
4. M-2.5	90 Feet	
5. M-3	90 Feet	D(2)
D. Minimum Lot Depth	NA	
E. Minimum Setbacks		D(1), D(3)
1. Front		
a. M-1, M-1.5, M-2, M-2.5	15 Feet	
b. M-3	20 Feet	D(2)
2. Side		D(1)
a. M-1, M-1.5, M-2, M-2.5		D(4)
b. M-3		D(5)
3. Corner Side		D(1)
a. M-1, M-1.5, M-2, M-2.5	10 Feet	
b. M-3	20 Feet	D(2)
4. Rear		
a. M-1, M-1.5		D(6)
b. M-2, M-2.5		D(7)
c. M-3		D(8)

CLASSIFICATION	DEVELOPMENT REGULATIONS	ADDITIONAL REGULATIONS
F. Maximum Height		D(9)
G. Density		
1. Residential		
a. M-1	1 dwelling unit per 1,000 sq. ft. of net lot area	
b. M-1.5	1 dwelling unit per 1,500 sq. ft. of net lot area	
c. M-2	1 dwelling unit per 2,000 sq. ft. of net lot area	
d. M-2.5	1 dwelling unit per 2,500 sq. ft. of net lot area	
e. M-3	1 dwelling unit per 3,000 sq. ft. of net lot area	D(2)
2. Commercial		D(10)
3. Mixed Use		D(10)
H. Maximum Lot Coverage		
1. M-1	70%	
2. M-1.5	70%	
3. M-2	60%	
4. M-2.5	50%	
5. M-3	50%	D(2)
I. Distance Between Buildings		D(11)
J. Maximum Net Floor Area Ratio		D(10)
K. Design Review	See **Sec. 10-2.4.1202.**	
L. Landscaping	See **Part III, Article 11.**	D(12)
M. Storage Space for Residential Units		D(13)
N. Fences and Walls	See **Sec. 10-2.3.104.**	
O. Antennas	See **Sec. 10-2.3.120.**	
P. Non-Conforming Conditions	See **Part III, Article 3.**	
Q. Elevators	See **Sec. 10-2.3.124.**	
R. Recycling Facilities	See **Part III, Article 7.**	
S. Parking and Loading	See **Part III, Article 2.**	D(3), D(10)
T. Signs	See **Title 10, Chapter 8.**	
U. Preservation of Trees	See **Title 3. Chapter 8.**	
V. Hillside Performance Standards	See **Part III, Article 4.**	
W. Stormwater Control	See **Title 9, Chapter 16.**	

ADDITIONAL DEVELOPMENT REGULATIONS	
D(1)	For development of uses within the Commercial and Community Facility Use Classifications, the minimum lot area, lot width, lot frontage and setbacks are to be determined by the Planning Commission in approval of the Conditional Use Permit.
D(2)	For single family residential development, the minimum lot area, lot width, lot frontage, maximum lot coverage and setbacks are to be determined by the Planning Commission in approval of the Conditional Use Permit.
D(3)	No parking shall occupy any portion of any required front yard or any required street side yard.
D(4)	The minimum interior side yards for one-story buildings in the M-1, M-1.5, M-2 and M-2.5 districts shall be 5 feet on each side. Every building over one story shall provide a setback, for the second story, of 5 feet, plus 3 inches of additional setback for each foot that such building exceeds 10 feet in height.
D(5)	The minimum interior side yard for one story buildings in the M-3 district shall be 10 feet on each side. Every building over one story shall provide a setback, for the second story, of 10 feet, plus 3 inches of additional setback for each foot that such building exceeds 10 feet in height. For new single family development see L(2). Additions to single family homes existing as of 2/16/96 (effective date of ordinance) shall conform to the M-3 standards.
D(6)	The minimum depth of the rear yard for buildings in the M-1 and M-1.5 districts shall be 3 inches per foot of building height, but not less than 5 feet.
D(7)	The minimum depth of the rear yard for buildings in the M-2 and M-2.5 districts shall be 6 inches per foot of building height, but not less than 10 feet.
D(8)	The minimum depth of the rear yard in the M-3 district shall be 20 feet when adjacent to any single family development. The minimum depth of the rear yard in the M-3 district, not adjacent to single family development, shall be 10 feet. The minimum depth of the rear yard for new single family development shall be as determined in L(2). Additions to single family homes existing as of 2/16/96 (effective date of ordinance) shall conform to the M-3 standards.
D(9)	The maximum building height for multi-family development shall be 30 feet unless otherwise specified in the Zoning Map. The maximum height for single family development shall be 25 feet.
D(10)	For commercial and mixed use development, the density and parking requirements are to be determined by the Planning Commission in the approval of a conditional Use Permit.
D(11)	The minimum distance between any two buildings on the same lot in the multiple family districts shall be not less than the sum of the side yards required for each building; except that such distance may be reduced or waived pursuant to the approval of a site plan upon the finding that such distances are not necessary for the maintenance of light, air and privacy for the individual units.
D(12)	Not less than 20% of any site shall be landscaped, the location, size and species of plant material to be determined by the Design Review Commission.
D(13)	Each residential unit shall have at least 200 cubic feet of enclosed, weather-proofed and lockable private storage space in addition to guest, linen, pantry and clothes closets customarily provided. Such space may be provided in any location approved by the Community Development Department, but shall not be divided into two or more locations.

(§2, Ord. 2037, eff. 12/17/04; §5, Ord. 2070, eff. 6/20/2008; §7, Ord. 2108, eff. 4/7/12)

APPENDIX C

Design Criteria

"Habitat for Humanity Apartment Complex Redesign" Design and Performance Criteria

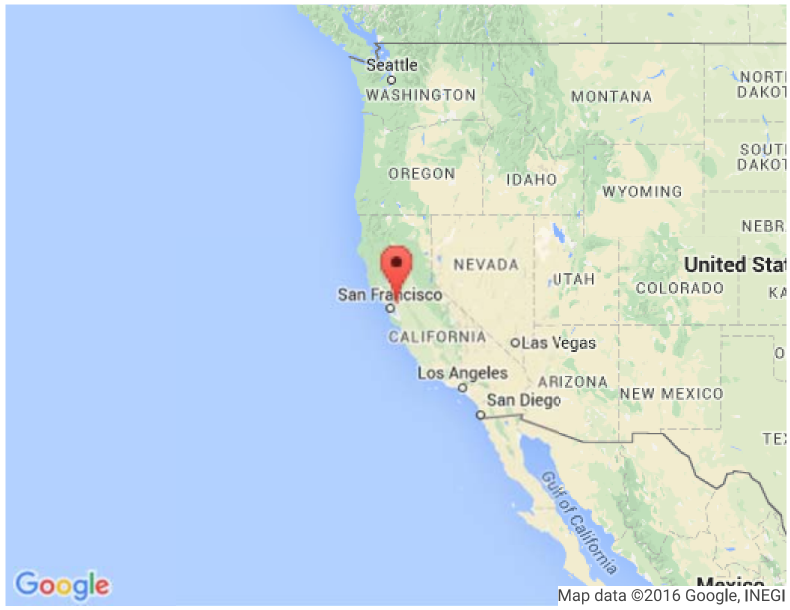
1. Height Clearance	29 feet (max.)
2. Roof Pitch	3:12 (min.)
3. Live Loads	
a. Roof Load	20 psf
b. Floor Load	40 psf
c. Snow Load	N/A
d. Walkway/Stairs Load	100 psf
e. Piping and Cable Trays	50 psf (min.)
f. Supporting Floor Beam Load	5 kips
g. Supporting Walkway/Stairs Beam Load	2 kips
h. Hand Railings (the governing load from)	50 plf horizontal 100 plf vertical 200 lb concentrated
h. Slab on Grade	250 psf
4. Dead Loads	Weight of structure (TBD)
5. Wind Speed	110 mph
6. Wind Exposure Category	B
7. Seismic Zone	D
8. Occupancy Category	3
9. Importance Factor	1
10. Factors of Safety	
a. Against Overturning	1.5
b. Against Sliding	1.5 (wind) 1.1 (seismic)
c. Against Uplift due to Wind	1.5

APPENDIX D

ATC Wind Speed Map

ASCE 7 Windspeed | ASCE 7 Ground Snow Load | Related Resources | Sponsors | About ATC | Contact

Search Results



Query Date: Mon Feb 22 2016
Latitude: 37.9306
Longitude: -122.0531

ASCE 7-10 Windspeeds
(3-sec peak gust in mph*):

Risk Category I: 100
Risk Category II: 110
Risk Category III-IV: 115
MRI 10-Year:** 72
MRI 25-Year:** 79
MRI 50-Year:** 85
MRI 100-Year:** 91

ASCE 7-05 Windspeed:
85 (3-sec peak gust in mph)
ASCE 7-93 Windspeed:
70 (fastest mile in mph)

*Miles per hour
**Mean Recurrence Interval

Users should consult with local building officials to determine if there are community-specific wind speed requirements that govern.

Print your results

WINDSPEED WEBSITE DISCLAIMER

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility or liability for its accuracy. The material presented in the windspeed report should not be used or relied upon for any specific application without competent examination and verification of its accuracy, suitability and applicability by engineers or other licensed professionals. ATC does not intend that the use of this information replace the sound judgment of such competent professionals, having experience and knowledge in the field of practice, nor to substitute for the standard of care required of such professionals in interpreting and applying the results of the windspeed report provided by this website. Users of the information from this website assume all liability arising from such use. Use of the output of this website does not imply approval by the governing building code bodies responsible for building code approval and interpretation for the building site described by latitude/longitude location in the windspeed load report.

Sponsored by the ATC Endowment Fund • Applied Technology Council • 201 Redwood Shores Parkway, Suite 240 • Redwood City, California 94065 • (650) 595-1542

D2

APPENDIX E

USGS Design Maps Detailed Report

Design Maps Summary Report

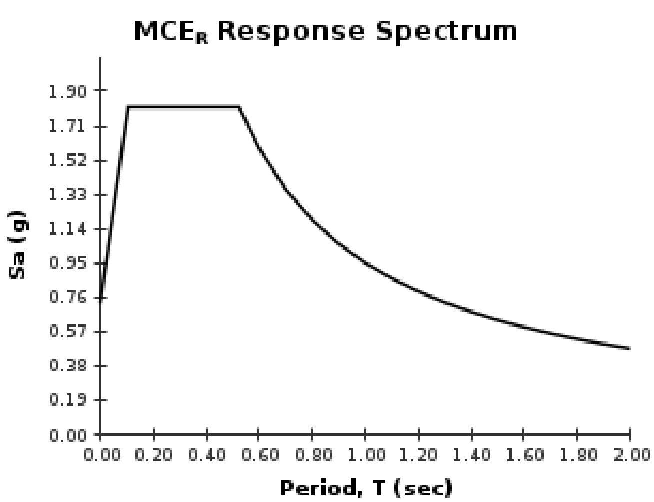
User–Specified Input

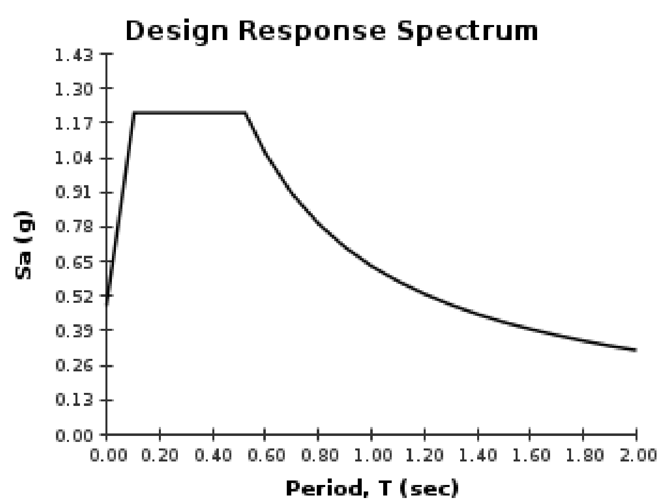
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	37.92983°N, 122.05292°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

USGS–Provided Output

S_S =	1.812 g	S_{MS} =	1.812 g	S_{DS} =	1.208 g
S_1 =	0.633 g	S_{M1} =	0.950 g	S_{D1} =	0.633 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





APPENDIX F

Weyerhaeuser Specifications

Trus Joist™
Weyerhaeuser

#TJ-4000 | SPECIFIER'S GUIDE

TJI® 110, TJI® 210, TJI® 230, TJI® 360, TJI® 560 AND TJI® 560D JOISTS

Featuring Trus Joist® TJI® Joists for Floor and Roof Applications

- Uniform and Predictable
- Lightweight for Fast Installation
- Resource Efficient
- Resists Bowing, Twisting, and Shrinking
- Significantly Reduces Callbacks
- Available in Long Lengths
- Limited Product Warranty

Now featuring 18" – 24" TJI® joists

The products in this guide are readily available through our nationwide network of distributors and dealers. For more information on other applications or other Trus Joist® products, contact your Weyerhaeuser representative.

Code Evaluations:
ICC ES ESR-1153; ESR-1387

TABLE OF CONTENTS

Why Choose Trus Joist® TJI® Joists?

- Engineered for strength and consistency
- Efficient installation saves time and labor
- Longer lengths allow more versatile floor plans
- Less jobsite waste
- Fewer red tags and callbacks

Now more than ever builders need solutions that really deliver. That's why Trus Joist® TJI® joists are designed to give you more—longer lengths, easier installation, higher span values, better strength-to-weight ratios, and faster cycle times.

TJI® joists are also available in deeper depths that are suitable for heavier-duty loads, such as those in multi-family structures and light commercial buildings.

This guide features TJI® joists in the following sizes:

Depths: 9½", 11⅞", 14", 16", 18", 20", 22", and 24"

Flange Widths: 1¾", 2⁵⁄₁₆", 2⁵⁄₁₆", and 3½"

Flange height and thickness vary by series; see the appropriate sections of this guide for specific sizes and relevant technical information:

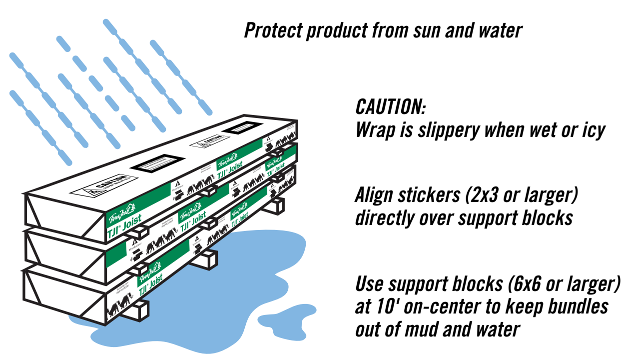
9½"-16" JOISTS **Section 1:**
Design information for 9½"–16" TJI® joists

18"-24" JOISTS **Section 2:**
Design information for 18" and 24" TJI® joists

ALL JOIST DEPTHS **Section 3:**
Framing details and design information for all joist depths in this guide

Not all sizes are available in all regions. Contact your Weyerhaeuser representative for joist availability.

PRODUCT STORAGE



SUSTAINABLE FORESTRY INITIATIVE
Certified Sourcing
www.sfiprogram.org

Fire-safe construction and life safety are major concerns for everyone in the building materials and construction industry. The 2011 U.S. Fire Administration statistics (usfa.fema.gov/data/statistics/) on residential and commercial fires in the U.S. alone include 3,005 fire fatalities and an estimated $11.7 billion in property damage. These numbers underscore the seriousness of the issue and the need for fire-safe construction.

For over 40 years, prefabricated wood I-joists and other Weyerhaeuser building products have established a record of safe and reliable performance in millions of structures. Many of these structures, such as one- or two-family residential dwellings, do not require specific fire-resistance ratings per building codes but may require unrated membrane protection. The information below is intended to help you specify and install Trus Joist® products with fire safety in mind.

Passive Fire Protection

Independent tests show that when compared to protected systems, unprotected framing systems (whether combustible or non-combustible) suffer increased structural degradation when exposed to fire. All floor framing materials—sawn lumber, wood I-joists, trusses, and light-gauge steel—succumb quickly to fire if not protected. Applying a protective membrane, such as gypsum ceiling board, to all types of floor framing within the structure will provide uniform protection to the structural framing members. Passive fire protection can do the following:

- Delay fire growth involving structural elements
- Reduce the potential for significant property damage to structural elements

Smoke Detectors

Smoke detectors are universally recognized as the most cost-effective life-saving devices. Although smoke detectors do not provide protection to the structure or to the contents in a home, they do alert occupants to potential fire hazards and allow them time to escape. Similarly, carbon monoxide detectors can also alert occupants to faulty heating appliances or air contamination in the early stages of a fire.

Active Fire Suppression

Automatic fire sprinkler systems are commonly required by building codes in schools, office buildings, factories, and other commercial buildings. Buildings designed with sprinkler systems are allowed larger areas and greater heights than buildings designed without sprinkler systems.

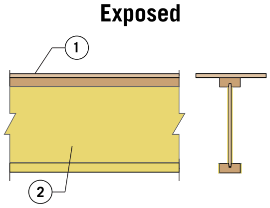
Fire service agencies such as the U.S. Fire Administration promote the use of residential sprinkler systems, citing benefits such as lower overall cost of construction for the homebuilder, plus a safer environment and lower insurance rates for the homeowner. Using automatic fire sprinkler systems provides the following benefits:

- Early and unsupervised suppression
- Reduced fire and smoke development
- Potentially enhanced life safety for the occupant(s)

TJI® joists with Flak Jacket® protection meet 2012 and 2015 IRC requirements for fire protection of floors and give you an effective one-hour-rated assembly for multi-family projects. This new solution helps you easily and efficiently meet code without impacting construction procedures or adding complexity to your jobs. TJI® joists with Flak Jacket® protection are available in limited markets; contact your Weyerhaeuser representative for more information.

Floor Assembly Compliant with 2012 IRC R501.3 and 2015 IRC R302.13

Exposed

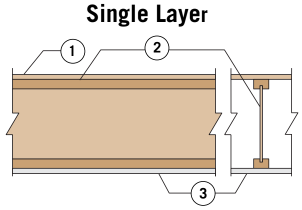


1. Appropriate span-rated sheathing (Exposure 1)
2. TJI® 210, 230, 360, or 560 series joist with Flak Jacket® protection

ICC ES ESR-1153

No gypsum board is required in this assembly when using TJI® joists with Flak Jacket® Protection

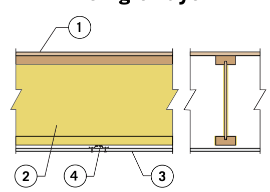
Single Layer



1. Appropriate span-rated sheathing (Exposure 1)
2. TJI® joist
3. Single-layer of ½" gypsum wall board

One-Hour Assembly for Rated Construction

Single Layer



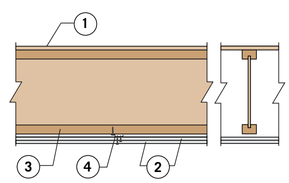
1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed
2. TJI® 210, 230, 360, or 560 joist with Flak Jacket® protection and joist o.c. spacing of 16" or less. For wider spacing (up to 24" o.c.) use a minimum of 11⅞" deep TJI® 230, 360, or 560 joists.
3. One layer of ⅝" Pabco® Type C gypsum board
4. Resilient channels at 16" on-center

Optional: Glass fiber insulation, 3½" thick in TJI® joist cavity, between TJI® joists above the bottom flange.

Note: Use 90% of the published TJI® joist bending moment capacity.

ICC ES ESR-1153

Double Layer



1. 48/24 tongue-and-groove, span-rated sheathing (Exposure 1), glued with a subfloor adhesive and nailed
2. Two layers of ⅝" Type X gypsum board
3. TJI® joist
4. Resilient channels (optional)*

Optional: Minimum 3½"-thick glass fiber insulation or non-combustible insulation, rated R-30 or less.*

***Resilient channels are required when insulation is used.**

ICC ES ESR-1153

For more information on fire assemblies and fire-safe construction, please refer to the Weyerhaeuser Fire-Rated Assemblies and Sprinkler Systems Guide, 1500, or visit our website at woodbywy.com.

TJ-PRO™ RATING AND FLOOR PERFORMANCE

A poor performing floor can harm a builder's image, compromise build efficiency, and cost money—**regardless of demographic.** That's why we developed TJ-Pro Rating. For over 50 years builders have looked to the Trus Joist name for guidance on floor performance, and our decades of proven success with TJ-Pro Rating is one of the biggest reasons why.

How TJ-Pro Rating Works:

Point values up to 65 are assigned using complex algorithms based on field and laboratory research conducted on over 600 floor system assemblies. It also factors in the variables listed under **Key Factors Affecting Performance** shown on page 5. Ranges can then be regularly correlated to performance expectations for the builder demographics listed below.

Entry-Level

Much of the focus in this demographic revolves around **Economy** (cost) and **Efficiency** concerns. Every dollar counts and cash conversion cycles are monitored closely so there is usually pressure around the construction schedule. TJ-Pro Rating is used in this market to make sure builders are not "overbuilders" by keeping the floor performance "in-check".

Move-Up / Mid-Level

Builders in this demographic are generally driven by **Efficiency** and **Image**. With constant changes to remain "fresh" and competitive, floor plans can be numerous and contain many options. Use TJ-Pro Rating to maintain consistency in floor feel across the base-model plan, all available options, throughout your subdivisions, and across your business.

High-End Luxury

Decision-drivers for builders in this demographic generally revolves around **Image** and **Efficiency**. In our experience, homeowners in this category expect point values of 45 and greater. Only TJ-Pro Rating can validate that your quality and your brand are not being compromised through changes in floor system design. If you look to improve efficiency by using different assemblies, make sure your TJ-Pro Rating remains relatively consistent.

ECONOMY CONSISTENCY RELIABILITY DIFFERENTIATION

Enhanced Options

Builder sales teams may be able to address a buyer's previous dissatisfaction with underperforming floor systems by offering upgrades, particularly in competitive subdivisions. Use base models with standard floor systems (and performance) to compete but consider an "improved floor option" to both create up-sell opportunities and address those homeowners who may be more sensitive to floor feel than most.

BY THE NUMBERS

Today's consumer understands technology. Explain how your business utilizes the industry's leading design tool that goes beyond the building codes' static deflection and looks at the entire floor system.

FREQUENCY + **DAMPING** + **PERCEPTION**

FREQUENCY

Frequency is the number of waves per second created when you step on the floor. Generally, low frequencies are uncomfortable. The less stiff the joist, the lower the frequency.

DAMPING

Damping is the ability of the floor sytem to "absorb" the wave that is introduced. The faster the wave is absorbed, the more solid the floor will feel.

PERCEPTION

How a floor feels is highly variable from one person to another. The proprietary algorithm behind TJ-Pro™ Rating takes this into account. TJ-Pro Ratings are correlated to customer satisfaction which takes the guesswork out of floor system design.

At 45 points, customer satisfaction is 84%. At 65 points, it's nearly 100%.

Key Factors Affecting Performance

- **Basic Stiffness** is a combination of joist depths and span.
- **Composite Action**—Careful nailing in conjunction with construction adhesives increases basic stiffness.
- **Continuity**—Continuous joists over several supports generally perform better than simple spans. Care must be taken if the joists continue into another occupancy.
- **Joist Spacing and Deck Stiffness**—Reduced spacing or increased deck thickness generally improves floor performance.
- **Ceilings** directly applied to the bottom edge of the floor members, or equivalent 1x or 2x strapping, is a performance enhancement.
- **Beams**—Floor systems supported by steel or wood beams tend to feel less stiff than those supported by solid bearing walls.
- **Bridging or Blocking** can be a contributor to improved floor performance.
- **Non-bearing Partition Walls** dampen vibration and improve floor performance when installed transverse to the floor joists.
- **Mass** reduces damping in a floor system causing a decrease in floor performance. This impact is more noticeable as span lengths increase.

TJ-Pro Rating is featured in these design software platforms.

JAVELIN® software by Weyerhaeuser

FORTE® software by Weyerhaeuser

Autodesk® Revit® linked to Forte®

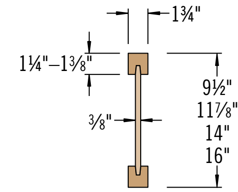
SECTION 1: 9½"–16" TJI® JOISTS

This section contains design information for 9½"–16" deep Trus Joist® TJI® joists.
These standard-size TJI® joists are readily available through your local Weyerhaeuser dealer or distributor. Offered with the flange sizes shown below, they come in lengths up to 60' (in 1' increments).

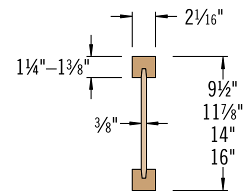
Design Properties (100% Load Duration)

Depth	TJI®	Basic Properties				Reaction Properties					
		Joist Weight (lbs/ft)	Maximum Resistive Moment(1) (ft-lbs)	Joist Only EI x 10⁶ (in.²-lbs)	Maximum Vertical Shear (lbs)	1¾" End Reaction (lbs)	3½" End Reaction (lbs)	3½" Intermediate Reaction (lbs)		5¼" Intermediate Reaction (lbs)	
								No Web Stiffeners	With Web Stiffeners(2)	No Web Stiffeners	With Web Stiffeners(2)
9½"	110	2.3	2,500	157	1,220	910	1,220	1,935	N.A.	2,350	N.A.
	210	2.6	3,000	186	1,330	1,005	1,330	2,145	N.A.	2,565	N.A.
	230	2.7	3,330	206	1,330	1,060	1,330	2,410	N.A.	2,790	N.A.
11⅞"	110	2.5	3,160	267	1,560	910	1,375	1,935	2,295	2,350	2,705
	210	2.8	3,795	315	1,655	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.0	4,215	347	1,655	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.0	6,180	419	1,705	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.0	9,500	636	2,050	1,265	1,725	3,000	3,475	3,455	3,930
14"	110	2.8	3,740	392	1,860	910	1,375	1,935	2,295	2,350	2,705
	210	3.1	4,490	462	1,945	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.3	4,990	509	1,945	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.3	7,335	612	1,955	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.2	11,275	926	2,390	1,265	1,725	3,000	3,475	3,455	3,930
16"	110	3.0	4,280	535	2,145	910	1,375	1,935	2,295	2,350	2,705
	210	3.3	5,140	629	2,190	1,005	1,460	2,145	2,505	2,565	2,925
	230	3.5	5,710	691	2,190	1,060	1,485	2,410	2,765	2,790	3,150
	360	3.5	8,405	830	2,190	1,080	1,505	2,460	2,815	3,000	3,360
	560	4.5	12,925	1,252	2,710	1,265	1,725	3,000	3,475	3,455	3,930

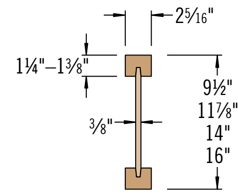
(1) **Caution: Do not** increase joist moment design properties by a repetitive member use factor.
(2) See detail W on page 27 for web stiffener requirements and nailing information.



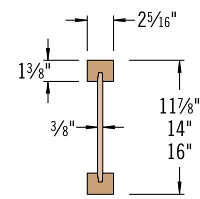
TJI® 110 joists



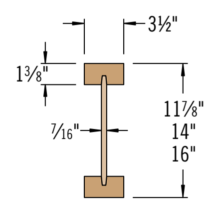
TJI® 210 joists



TJI® 230 joists



TJI® 360 joists



TJI® 560 joists

General Notes

- Design reaction includes all loads on the joist. Design shear is computed at the inside face of supports and includes all loads on the span(s). Allowable shear may sometimes be increased at interior supports in accordance with ICC ES ESR-1153, and these increases are reflected in span tables.
- The formulas at right approximate the uniform load deflection of Δ (inches).

For TJI® 110, 210, 230, and 360 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.67\ wL^2}{d \times 10^5}$$

For TJI® 560 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.29\ wL^2}{d \times 10^5}$$

w = uniform load in pounds per linear foot
L = span in feet
d = out-to-out depth of the joist in inches
EI = value from table above

TJI® joists are intended for dry-use applications

Some TJI® joist series may not be available in your region. Contact your Weyerhaeuser representative for information.


DO NOT walk on joists until braced. INJURY MAY RESULT.


DO NOT stack building materials on unsheathed joists. Stack only over beams or walls.


DO NOT walk on joists that are lying flat.

WARNING

Joists are unstable until braced laterally

Bracing Includes:
- **Blocking**
- **Hangers**
- **Rim Board**
- **Sheathing**
- **Rim Joist**
- **Strut Lines**

WARNING NOTES: *Lack of proper bracing during construction can result in serious accidents. Observe the following guidelines:*

1. All blocking, hangers, rim boards, and rim joists at the end supports of the TJI® joists must be completely installed and properly nailed.
2. Lateral strength, like a braced end wall or an existing deck, must be established at the ends of the bay. This can also be accomplished by a temporary or permanent deck (sheathing) fastened to the first 4 feet of joists at the end of the bay.
3. Safety bracing of 1x4 (minimum) must be nailed to a braced end wall or sheathed area (as in note 2) and to each joist. Without this bracing, buckling sideways or rollover is highly probable under light construction loads—such as a worker or one layer of unnailed sheathing.
4. Sheathing must be completely attached to each TJI® joist before additional loads can be placed on the system.
5. Ends of cantilevers require safety bracing on both the top and bottom flanges.
6. The flanges must remain straight within a tolerance of ½" from true alignment.

L/480 Live Load Deflection

Depth	TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
		12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
9½"	110	16'-11"	15'-6"	14'-7"	13'-7"	16'-11"	15'-6"	14'-3"	12'-9"
	210	17'-9"	16'-3"	15'-4"	14'-3"	17'-9"	16'-3"	15'-4"	14'-0"
	230	18'-3"	16'-8"	15'-9"	14'-8"	18'-3"	16'-8"	15'-9"	14'-8"
11⅞"	110	20'-2"	18'-5"	17'-4"	15'-9"(1)	20'-2"	17'-8"	16'-1"(1)	14'-4"(1)
	210	21'-1"	19'-3"	18'-2"	16'-11"	21'-1"	19'-3"	17'-8"	15'-9"(1)
	230	21'-8"	19'-10"	18'-8"	17'-5"	21'-8"	19'-10"	18'-7"	16'-7"(1)
	360	22'-11"	20'-11"	19'-8"	18'-4"	22'-11"	20'-11"	19'-8"	17'-10"(1)
	560	26'-1"	23'-8"	22'-4"	20'-9"	26'-1"	23'-8"	22'-4"	20'-9"(1)
14"	110	22'-10"	20'-11"	19'-2"	17'-2"(1)	22'-2"	19'-2"	17'-6"(1)	15'-0"(1)
	210	23'-11"	21'-10"	20'-8"	18'-10"(1)	23'-11"	21'-1"	19'-2"(1)	16'-7"(1)
	230	24'-8"	22'-6"	21'-2"	19'-9"(1)	24'-8"	22'-2"	20'-3"(1)	17'-6"(1)
	360	26'-0"	23'-8"	22'-4"	20'-9"(1)	26'-0"	23'-8"	22'-4"(1)	17'-10"(1)
	560	29'-6"	26'-10"	25'-4"	23'-6"	***29'-6"***	***26'-10"***	25'-4"(1)	20'-11"(1)
16"	110	25'-4"	22'-6"	20'-7"(1)	18'-1"(1)	23'-9"	20'-7"(1)	18'-9"(1)	15'-0"(1)
	210	26'-6"	24'-3"	22'-6"(1)	19'-11"(1)	26'-0"	22'-6"(1)	20'-7"(1)	16'-7"(1)
	230	27'-3"	24'-10"	23'-6"	21'-1"(1)	***27'-3"***	23'-9"	21'-8"(1)	17'-6"(1)
	360	28'-9"	26'-3"	24'-8"(1)	21'-5"(1)	***28'-9"***	26'-3"(1)	22'-4"(1)	17'-10"(1)
	560	32'-8"	29'-8"	28'-0"	25'-2"(1)	***32'-8"***	***29'-8"***	26'-3"(1)	20'-11"(1)

L/360 Live Load Deflection (Minimum Criteria per Code)

Depth	TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
		12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
9½"	110	18'-9"	17'-2"	15'-8"	14'-0"	18'-1"	15'-8"	14'-3"	12'-9"
	210	19'-8"	18'-0"	17'-0"	15'-4"	19'-8"	17'-2"	15'-8"	14'-0"
	230	20'-3"	18'-6"	17'-5"	16'-2"	***20'-3"***	18'-1"	16'-6"	14'-9"
11⅞"	110	22'-3"	19'-4"	17'-8"	15'-9"(1)	20'-5"	17'-8"	16'-1"(1)	14'-4"(1)
	210	23'-4"	21'-2"	19'-4"	17'-3"(1)	***22'-4"***	19'-4"	17'-8"	15'-9"(1)
	230	24'-0"	21'-11"	20'-5"	18'-3"	***23'-7"***	20'-5"	18'-7"	16'-7"(1)
	360	25'-4"	23'-2"	21'-10"	20'-4"(1)	***25'-4"***	***23'-2"***	***21'-10"(1)***	17'-10"(1)
	560	28'-10"	26'-3"	24'-9"	23'-0"	***28'-10"***	***26'-3"***	***24'-9"***	20'-11"(1)
14"	110	24'-4"	21'-0"	19'-2"	17'-2"(1)	22'-2"	19'-2"	17'-6"(1)	15'-0"(1)
	210	26'-6"	23'-1"	21'-1"	18'-10"(1)	24'-4"	21'-1"	19'-2"(1)	16'-7"(1)
	230	27'-3"	24'-4"	22'-2"	19'-10"(1)	***25'-8"***	22'-2"	20'-3"(1)	17'-6"(1)
	360	28'-9"	26'-3"	24'-9"(1)	21'-5"(1)	***28'-9"***	***26'-3"(1)***	22'-4"(1)	17'-10"(1)
	560	32'-8"	29'-9"	28'-0"	25'-2"(1)	***32'-8"***	***29'-9"***	***26'-3"(1)***	20'-11"(1)
16"	110	26'-0"	22'-6"	20'-7"(1)	18'-1"(1)	23'-9"	20'-7"(1)	18'-9"(1)	15'-0"(1)
	210	28'-6"	24'-8"	22'-6"(1)	19'-11"(1)	26'-0"	22'-6"(1)	20'-7"(1)	16'-7"(1)
	230	30'-1"	26'-0"	23'-9"	21'-1"(1)	***27'-5"***	23'-9"	21'-8"(1)	17'-6"(1)
	360	31'-10"	29'-0"	26'-10"(1)	21'-5"(1)	***31'-10"***	***26'-10"(1)***	22'-4"(1)	17'-10"(1)
	560	36'-1"	32'-11"	31'-0"(1)	25'-2"(1)	***36'-1"***	***31'-6"(1)***	26'-3"(1)	20'-11"(1)

(1) Web stiffeners are required at intermediate supports of continuous-span joists when the intermediate bearing length is ***less*** than 5¼" and the span on either side of the intermediate bearing is greater than the following spans:

TJI®	40 PSF Live Load / 10 PSF Dead Load				40 PSF Live Load / 20 PSF Dead Load			
	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.	12" o.c.	16" o.c.	19.2" o.c.	24" o.c.
110	Not Req.	Not Req.	19'-2"	15'-4"	Not Req.	19'-2"	16'-0"	12'-9"
210			21'-4"	17'-0"		21'-4"	17'-9"	14'-2"
230			Not Req.	19'-2"		Not Req.	19'-11"	15'-11"
360			24'-5"	19'-6"		24'-5"	20'-4"	16'-3"
560			29'-10"	23'-10"		29'-10"	24'-10"	19'-10"

- Long-term deflection under dead load, which includes the effect of creep, has not been considered. Bold italic spans reflect initial dead load deflection exceeding 0.33".

How to Use These Tables

1. Determine the appropriate live load deflection criteria.
2. Identify the live and dead load condition.
3. Select on-center spacing.
4. Scan down the column until you meet or exceed the span of your application.
5. Select TJI® joist and depth.

General Notes

- Tables are based on:
  - Uniform loads.
  - More restrictive of simple or continuous span.
  - Clear distance between supports
  - Minimum bearing length of 1¾" end (no web stiffeners) and 3½" intermediate.
- Assumed composite action with a single layer of 24" on-center span-rated, glue-nailed floor panels for deflection only. **Spans shall be reduced 6" when floor panels are nailed only.**
- Spans generated from Weyerhaeuser software may exceed the spans shown in these tables because software reflects actual design conditions.
- For multi-family applications and other loading conditions not shown, refer to Weyerhaeuser software or to the load table on page 8.

Live load deflection is not the only factor that affects how a floor will perform. To more accurately predict floor performance, use our TJ-Pro™ Ratings.

FLOOR LOAD TABLE

Floor—100% (PLF)

Depth	TJI®	Joist Clear Span																	
		8'		10'		12'		14'		16'		18'		20'		22'		24'	
		Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load	Live Load L/480	Total Load
9½"	110	*	190	140	152	85	127	56	99	38	76								
	210	*	210	161	169	99	141	65	119	45	90								
	230	*	236	175	190	108	158	71	133	49	99								
11⅞"	110	*	190	*	152	*	127	92	109	63	95	45	76						
	210	*	210	*	169	*	141	106	121	74	106	53	92						
	230	*	236	*	190	*	158	116	136	80	119	58	102	43	83				
	360	*	241	*	193	*	162	136	139	95	121	69	108	51	97	39	78		
	560	*	294	*	236	*	197	*	169	138	148	101	132	76	119	58	108	45	91
14"	110	*	190	*	152	*	127	*	109	91	95	66	85						
	210	*	210	*	169	*	141	*	121	*	106	76	94	57	85				
	230	*	236	*	190	*	158	*	136	115	119	83	106	62	95	47	81		
	360	*	241	*	193	*	162	*	139	*	121	98	108	73	97	56	88	44	81
	560	*	294	*	236	*	197	*	169	*	148	*	132	107	119	83	108	65	99
16"	110	*	190	*	152	*	127	*	109	*	95	*	85	66	76				
	210	*	210	*	169	*	141	*	121	*	106	*	94	76	85	58	77		
	230	*	236	*	190	*	158	*	136	*	119	*	106	83	95	64	87	50	78
	360	*	241	*	193	*	162	*	139	*	121	*	108	*	97	75	88	59	81
	560	*	294	*	236	*	197	*	169	*	148	*	132	*	119	*	108	86	99

* Indicates that **Total Load** value controls.

How to Use This Table

1. Calculate actual total and live load in pounds per linear foot (plf).
2. Select appropriate **Joist Clear Span**.
3. Scan down the column to find a TJI® joist that meets or exceeds actual total and live loads.

Refer to PSF to PLF Conversion table on page 31

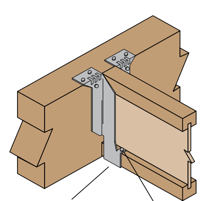
General Notes

- Table is based on:
  - Minimum bearing length of 1¾" end and 3½" intermediate, without web stiffeners
  - Uniform loads.
  - More restrictive of simple or continuous span
  - No composite action provided by sheathing.
- **Total Load** values are limited to deflection of L/240.
- **Live Load** is based on joist deflection of L/480.
- If a live load deflection limit of L/360 is desired, multiply value in **Live Load** column by 1.33. The resulting live load must not exceed the **Total Load** shown.
- Table does not account for concentrated loads. Use Weyerhaeuser software when this condition applies.

TIPS FOR PREVENTING FLOOR NOISE

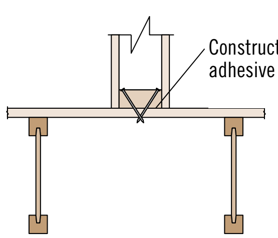
Trus Joist® TJI® joists are structurally uniform and dimensionally stable, and they resist shrinking and twisting. This helps prevent gaps from forming around the nails between the joist and the floor panels—gaps that can potentially cause squeaks or other floor noise. Using TJI® joists can help you build a quieter floor, but only if the entire floor system is installed properly. This is because other components of the floor system, such as hangers, connectors, and nails can be a source of floor noise.

Properly Seat Each Joist in Hanger



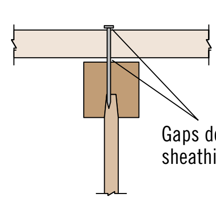
Seat the joist tight to the bottom of the hanger. When using hangers with tabs, bend the flange tabs over and nail to the TJI® joist bottom flange. Placing a dab of sublfoor adhesive* in the seat of the hanger prior to installing the joist can reduce squeaks.

Use Adhesive and Special Nailing When Needed



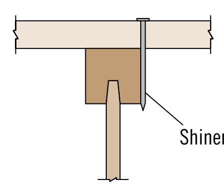
Nail interior partitions to the joists when possible. If the wall can be nailed only to the floor panel, run a bead of adhesive* under the wall and either cross nail, nail through and clinch tight, or screw tightly into the wall from below.

Prevent Shrinkage



Keep building materials dry, and properly glue floor panels to the joists. Panels that become excessively wet during construction shrink as they dry. This shrinkage may leave gaps that allow the panel to move when stepped on.

Avoid "Shiners"



Exercise care when nailing. Nails that barely hit the joists (shiners) do not hold the panel tight to the joist and should be removed. If left in, the nails will rub against the side of the joist when the panel deflects.

* Weyerhaeuser recommends using solvent-based subfloor adhesives that meet ASTM D3498 (AFG-01) performance standards. When latex subfloor adhesive is required, careful selection is necessary due to a wide range of performance between brands.

For more information and tips on how to prevent floor noise, refer to the Weyerhaeuser Prevention and Repair of Floor System Squeaks Technical Resource Sheet, 9009, or contact your Weyerhaeuser representative.

#TJ-9000 | SPECIFIER'S GUIDE

BEAMS, HEADERS, AND COLUMNS

Featuring Trus Joist® TimberStrand® LSL, Microllam® LVL, and Parallam® PSL

- Uniform and Predictable
- Minimal Bowing, Twisting, and Shrinking
- Strong and Straight
- Limited Product Warranty

The products in this guide are readily available through our nationwide network of distributors and dealers. For more information on other applications or other Trus Joist® products, contact your Weyerhaeuser representative.

TABLE OF CONTENTS

SUSTAINABLE FORESTRY INITIATIVE

Certified Sourcing

www.sfiprogram.org

SFI-00008

Why Choose Trus Joist® Beams, Columns, and Headers?

- Reliable performance
- Consistent quality and dependable uniformity
- Flexible solutions for your beam and header needs
- Backed by a limited product warranty

Using advanced technology, Weyerhaeuser manufactures engineered lumber that is consistently straight and strong, and resists bowing, twisting, and shrinking. That means less waste, easier installation, and higher design values for starters; plus fewer callbacks, shorter cycle times, more design flexibility, and lower overall installed cost in the end. Trus Joist® TimberStrand® LSL, Microllam® LVL, and Parallam® PSL are structural solutions you can count on—guaranteed.

This guide features Trus Joist® engineered lumber in the following widths and depths:

TimberStrand® LSL

1.55E TimberStrand® LSL sizes:
Widths: 1¾" and 3½"
Depths: 9¼", 9½", 11¼", 11⅞", 14", and 16"

1.3E TimberStrand® LSL header sizes:
Width: 3½"
Depths: 4⅜", 5½", 7¼", 8⅝", 9¼", and 11¼"

1.3E TimberStrand® LSL column and post sizes:
3½" x 3½"   3½" x 4⅜"   3½" x 5½"   3½" x 7¼"   3½" x 8⅝"

Microllam® LVL

2.0E Microllam® LVL header and beam sizes:
Width: 1¾"
Depths: 5½", 7¼", 9¼", 9½", 11¼", 11⅞", 14", 16", 18", and 20"

Parallam® PSL

2.0E Parallam® PSL header and beam sizes:
Widths: 3½", 5¼", and 7"
Depths: 9¼", 9½", 11¼", 11⅞", 14", 16", and 18"

1.8E Parallam® PSL column and post sizes:
3½" x 3½"   3½" x 5¼"   3½" x 7"   5¼" x 5¼"   5¼" x 7"   7" x 7"

For deeper depth Parallam® PSL beams, see the Trus Joist® 2.2E Parallam® PSL Deep Beam guide, TJ-7001, or contact your Weyerhaeuser representative.

Some sizes may not be available in your region.

Trus Joist® TimberStrand® Laminated Strand Lumber (LSL)

- One-piece members reduce labor time
- Every piece is straight and strong
- Unique properties allow you to drill larger holes through 1.55E TimberStrand® LSL. See Allowable Holes on page 36.

TimberStrand® LSL Grade Verification

TimberStrand® LSL is available in more than one grade. The product is stamped with its grade information, as shown in the examples below. With 1.55E TimberStrand® LSL, larger holes can be drilled through the beam.

TrusJoist TimberStrand® LSL 1.3E ICCES ESR-1387 CCMC 12627-R SFI Certified Sourcing SFI-00008 PFS ■ 0572 ■ Made in Canada 09-15-11 02 03:20

TrusJoist TimberStrand® LSL 1.55E ROUND HOLE ZONE NO holes within 8" of beam ends ICCES ESR-1387 CCMC 12627-R SFI Certified Sourcing SFI-00008 PFS ■ 0572 ■ Made in Canada 09-15-11 02 03:20

Actual stamps shown.

Code Evaluations: See ICC ES ESR-1387

Trus Joist® Microllam® Laminated Veneer Lumber (LVL)

- Can easily be built up on site to reduce heavy lifting
- Offers reliable and economical solutions for beam and header applications
- Manufacturing process minimizes many of the natural inconsistencies found in wood
- Available in some regions with a Watershed™ overlay for on-site weather protection

Code Evaluations: See ICC ES ESR-1387

Trus Joist® Parallam® Parallel Strand Lumber (PSL)

- Allows long spans for open floor plans without intermediate posts or columns
- Has warm, unique grain that is perfect for applications with exposed beams
- Provides ideal solutions for cantilever and multi-span applications
- Solid sections save time on site assembly
- Available in some regions with preservative treatment for exterior applications

Code Evaluations: See ICC ES ESR-1387

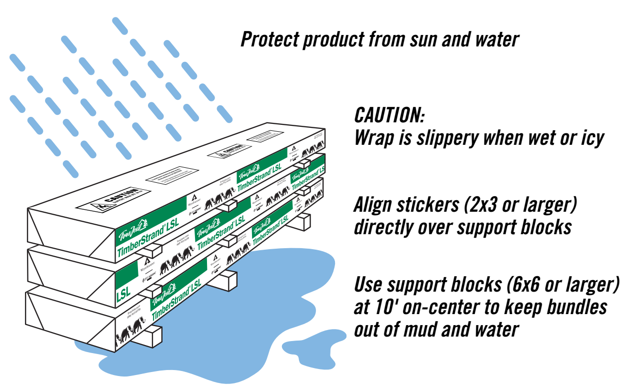
Allowable Design Properties(1) (100% Load Duration)

Grade	Width	Design Property	Depth												
			4⅜"	5½"	5½" Plank Orientation	7¼"	8⅝"	9¼"	9½"	11¼"	11⅞"	14"	16"	18"	20"
TimberStrand® LSL															
1.3E	3½"	Moment (ft-lbs)	1,735	2,685	1,780	4,550	6,335	7,240		10,520					
		Shear (lbs)	4,340	5,455	1,925	7,190	8,555	9,175		11,155					
		Moment of Inertia (in.^{4})	24	49	20	111	187	231		415					
		Weight (plf)	4.5	5.6	5.6	7.4	8.8	9.4		11.5					
1.55E	1¾"	Moment (ft-lbs)						4,950	5,210	7,195	7,975	10,920	14,090		
		Shear (lbs)						3,345	3,435	4,070	4,295	5,065	5,785		
		Moment of Inertia (in.^{4})						115	125	208	244	400	597		
		Weight (plf)						5.1	5.2	6.2	6.5	7.7	8.8		
	3½"	Moment (ft-lbs)						9,905	10,420	14,390	15,955	21,840	28,180		
		Shear (lbs)						6,690	6,870	8,140	8,590	10,125	11,575		
		Moment of Inertia (in.^{4})						231	250	415	488	800	1,195		
		Weight (plf)						10.1	10.4	12.3	13	15.3	17.5		
Microllam® LVL															
2.0E	1¾"	Moment (ft-lbs)		2,125		3,555		5,600	5,885	8,070	8,925	12,130	15,555	19,375	23,580
		Shear (lbs)		1,830		2,410		3,075	3,160	3,740	3,950	4,655	5,320	5,985	6,650
		Moment of Inertia (in.^{4})		24		56		115	125	208	244	400	597	851	1,167
		Weight (plf)		2.8		3.7		4.7	4.8	5.7	6.1	7.1	8.2	9.2	10.2
Parallam® PSL															
2.0E	3½"	Moment (ft-lbs)						12,415	13,055	17,970	19,900	27,160	34,955	43,665	
		Shear (lbs)						6,260	6,430	7,615	8,035	9,475	10,825	12,180	
		Moment of Inertia (in.^{4})						231	250	415	488	800	1,195	1,701	
		Weight (plf)						10.1	10.4	12.3	13.0	15.3	17.5	19.7	
	5¼"	Moment (ft-lbs)						18,625	19,585	26,955	29,855	40,740	52,430	65,495	
		Shear (lbs)						9,390	9,645	11,420	12,055	14,210	16,240	18,270	
		Moment of Inertia (in.^{4})						346	375	623	733	1,201	1,792	2,552	
		Weight (plf)						15.2	15.6	18.5	19.5	23.0	26.3	29.5	
	7"	Moment (ft-lbs)						24,830	26,115	35,940	39,805	54,325	69,905	87,325	
		Shear (lbs)						12,520	12,855	15,225	16,070	18,945	21,655	24,360	
		Moment of Inertia (in.^{4})						462	500	831	977	1,601	2,389	3,402	
		Weight (plf)						20.2	20.8	24.6	26.0	30.6	35.0	39.4	

(1) For product in beam orientation, unless otherwise noted.

Some sizes may not be available in your region.

PRODUCT STORAGE



APPENDIX G

Alternative 1 Gravity Design Calculations

Sawn Lumber - 2nd Floor, 1st Ceiling
Beam Design

Member	Size	
1	6x10	NOT OKAY
2	6x10	NOT OKAY
3	6x10	
4	GLU 5.5x9	
5	4x10	
6	4x10	
7	PSL 7x16	
8	GLU 5.5x9	
9	GLU 3.5x9	
10	6x10	
11	PSL 7x9.5	
12	GLU 3.125x9	
13	GLU 5.5x9	
14	PSL 7x9.5	

DESIGN VALUES				
2x or 4x			**5x or larger**	
Cd	1	Live Load	Cd	1.25
Cm	1	FbCf>1150	Cm	1
Ct	1		Ct	1
Ci	0.8		Ci	0.87
Cl	1		Cl	1
Cr	1.15		Cr	1.15
Fb	1000	No. 1 Lumber		

DIMENSIONS		
Member Size	2x10	
Base	1.5	
Width	9.25	
Length (ft)	14.66666667	
Length (in)	176	
Area (in^2)	13.88	
Trib. Width (ft)	1	12" O.C.

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	54

BENDING	OKAY
Mmax (lb-in)	17424
S (in^3)	21.39
fb (psi)	814.56
Fb (psi)	1000
Cf	1.1
Cfu	1.2
F'b (psi)	1214.40
D/C	0.67

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8
Vmax (lb)	396
fv (psi)	42.81
Fv	180
F'v	139.68
D/C	0.31

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.49
Δ (in)	0.07
D/C	0.13

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.733333333
Δ (in)	0.09
D/C	0.12

DESIGN VALUES				
2x or 4x			**5x or larger**	
Cd	1	Live Load	Cd	1.25
Cm	1	FbCf>1150	Cm	1
Ct	1		Ct	1
Ci	0.8		Ci	0.87
Cl	1		Cl	1
Cr	1.15		Cr	1.15
Fb	1000	No. 1 Lumber		

DIMENSIONS		
Member Size	2x10	
Base	1.5	
Width	9.25	
Length (ft)	12.08333333	
Length (in)	145	
Area (in^2)	13.88	
Trib. Width (ft)	1	12" O.C.

LOADS	
Dead (psf)	14
Live (psf)	50
w (plf)	64

BENDING	OKAY
Mmax (lb-in)	14016.66667
S (in^3)	21.39
fb (psi)	655.27

Fb (psi)	1000
Cf	1.1
Cfu	1.2
F'b (psi)	1214.40

D/C	0.54

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	386.6666667
fv (psi)	41.80

Fv	180
F'v	139.68

D/C	0.30

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.40
Δ (in)	0.04
D/C	0.09

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.604166667
Δ (in)	0.05
D/C	0.08

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	11.42
Length (in)	137
Area (in^2)	52.25
Trib. Width (ft)	10.86

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	587

BENDING	NOT OKAY
Mmax (lb-in)	114704
S (in^3)	82.73
fb (psi)	1386.49

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41

D/C	1.28

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	3349
fv (psi)	96.14

Fv	180
F'v	139.68

D/C	0.69

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.38
Δ (in)	0.26
D/C	0.68

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.57
Δ (in)	0.35
D/C	0.62

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	12.67
Length (in)	152
Area (in^2)	52.25
Trib. Width (ft)	7.96

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	429.75

BENDING	NOT OKAY
Mmax (lb-in)	103426.5
S (in^3)	82.73
fb (psi)	1250.18

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41

D/C	1.15

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2721.75
fv (psi)	78.14

Fv	180
F'v	139.68

D/C	0.56

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.42
Δ (in)	0.29
D/C	0.69

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.63
Δ (in)	0.39
D/C	0.62

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	12
Length (in)	144
Area (in^2)	52.25
Trib. Width (ft)	7.67

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	414

BENDING	OKAY
Mmax (lb-in)	89424
S (in^3)	82.73
fb (psi)	1080.92

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41

D/C	0.99

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2484
fv (psi)	71.31

Fv	180
F'v	139.68

D/C	0.51

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.40
Δ (in)	0.22
D/C	0.56

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.6
Δ (in)	0.30
D/C	0.50

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	529.875
P (lb)	7607.0988

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	14.48
Length (in)	173.75
Area (in^2)	49.50
Trib. Width (ft)	9.81
Length a (ft)	1.63
Length - b (ft)	12.83

BENDING	OKAY
Mmax (lb-in)	131477
S (in^3)	74.25
fb (psi)	1770.73

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.64

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	3836.07
fv (psi)	116.24

Fv	265
F'v	265

D/C	0.44

LIVE LOAD DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.48
Δ (in)	0.37
D/C	0.76

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.72
Δ (in)	0.37
D/C	0.51

DESIGN VALUES

2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	8.29
Length (in)	99.5
Area (in^2)	32.38
Trib. Width (ft)	3.94

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	212.625

BENDING	OKAY
Mmax (lb-in)	21927.50684
S (in^3)	49.91
fb (psi)	439.33

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.42

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	881.5078125
fv (psi)	40.84

Fv	180
F'v	139.68

D/C	0.29

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.28
Δ (in)	0.03
D/C	0.10

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.41
Δ (in)	0.04
D/C	0.09

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	11.29
Length (in)	135.50
Area (in^2)	32.38
Trib. Width (ft)	3.94

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	212.625

BENDING	OKAY
Mmax (lb-in)	40665.08
S (in^3)	49.91
fb (psi)	814.74

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.77

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1200.445313
fv (psi)	55.62

Fv	180
F'v	139.68

D/C	0.40

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.38
Δ (in)	0.09
D/C	0.24

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.56
Δ (in)	0.12
D/C	0.22

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	19.58
Length (in)	235.00
Area (in^2)	32.38
Trib. Width (ft)	10.33
Length a (ft)	9.83
Length - b (ft)	9.75

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	558
P (lb)	6768.24

BENDING	NOT OKAY
Mmax (lb-in)	718621.97
S (in^3)	49.91
fb (psi)	14397.94
Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880
D/C	16.36

SHEAR	NOT OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8
Vmax (lb)	8862.27
fv (psi)	410.61
Fv	180
F'v	139.68
D/C	2.94

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	230.84
E (psi)	17000000
Δallowable (in)	0.65
Δ (in)	3.95
D/C	6.05

SL and GLU NOT ADEQUATE
USE PSL 7x16
* DOES NOT MEET TARGET

TOTAL DEFLECTION	NOT OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.98
Δ (in)	5.17
D/C	5.28

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	7010.4204

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	13.67
Length (in)	164.00
Area (in^2)	49.50
Trib. Width (ft)	0
Length a (ft)	12.58
Length - b (ft)	1.08

BENDING	OKAY
Mmax (lb-in)	83911
S (in^3)	74.25
fb (psi)	1130.12

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.41

LIVE LOAD DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.46
Δ (in)	0.26
D/C	0.57

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.68
Δ (in)	0.26
D/C	0.38

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	6454.72
fv (psi)	195.60

Fv	265
F'v	265

D/C	0.74

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	586.6875
P (lb)	5233.1751

DIMENSIONS	
Member Size	3.5x9
Base	3.5
Width	9.00
Length (ft)	8.21
Length (in)	98.50
Area (in^2)	52.25
Trib. Width (ft)	10.86
Length a (ft)	4.96
Length - b (ft)	3.25

BENDING	OKAY
Mmax (lb-in)	123285.10
S (in^3)	47.25
fb (psi)	2609.21

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.94

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	2407.86
fv (psi)	69.13

Fv	265
F'v	265

D/C	0.26

LIVE LOAD DEFLECTION	OKAY
I (in^4)	212.63
E (psi)	1800000
Δallowable (in)	0.27
Δ (in)	0.26
D/C	0.94

TOTAL DEFLECTION	OKAY
I (in^4)	212.63
E (psi)	1800000
Δallowable (in)	0.41
Δ (in)	0.26
D/C	0.63

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	8.08
Length (in)	97.00
Area (in^2)	52.25
Trib. Width (ft)	0
Length a (ft)	4.83
Length - b (ft)	3.25

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Memb	12
P (lb)	3455.93

BENDING	OKAY
Mmax (lb-in)	80590.86
S (in^3)	82.73
fb (psi)	974.15
Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41
D/C	0.90

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8
Vmax (lb)	2066.43
fv (psi)	59.32
Fv	180
F'v	139.68
D/C	0.42

LIVE LOAD DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.27
Δ (in)	0.09
D/C	0.35

TOTAL DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.40
Δ (in)	0.09
D/C	0.23

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	429.75
P (lb)	17503.419

DIMENSIONS	
Member Size	7x9.5
Base	5.5
Width	9.00
Length (ft)	6.96
Length (in)	83.50
Area (in^2)	42.75
Trib. Width (ft)	7.96
Length a (ft)	4.96
Length - b (ft)	2

BENDING	NOT OKAY
Mmax (lb-in)	299340
S (in^3)	74.25
fb (psi)	4031.51

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	1.45

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.23
Δ (in)	0.27
D/C	1.18

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.35
Δ (in)	0.27
D/C	0.79

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	1495.17
fv (psi)	52.46

Fv	265
F'v	265

D/C	0.20

SL and GLU NOT ADEQUATE
USE PSL 7x9.5

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	3964.167

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	7.83
Length (in)	94.00
Area (in^2)	52.25
Trib. Width (ft)	0
Length a (ft)	3.71
Length - b (ft)	4.125

BENDING	OKAY
Mmax (lb-in)	92894
S (in^3)	42.19
fb (psi)	2201.94

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784

D/C	0.79

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	2087.513473
fv (psi)	59.93

Fv	265
F'v	265

D/C	0.23

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.26
Δ (in)	0.20
D/C	0.77

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.39
Δ (in)	0.20
D/C	0.51

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
CI	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	7302.53

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	7.875
Length (in)	94.5
Area (in^2)	52.25
Trib. Width (ft)	0
Length a (ft)	4.375
Length - b (ft)	3.5

BENDING	OKAY
Mmax (lb-in)	170392
S (in^3)	74.25
fb (psi)	2294.85

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.82

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	4056.961111
fv (psi)	116.47

Fv	265
F'v	265

D/C	0.44

LIVE LOAD DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.26
Δ (in)	0.21
D/C	0.80

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.39375
Δ (in)	0.21
D/C	0.53

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Cl	1
Cr	1
Fb	1000

5x or larger	
Cd	1.25
Cm	1
Ct	1
Ci	0.87
Cl	1
Cr	1

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	19.63
Length (in)	235.50
Area (in^2)	32.38
Trib. Width (ft)	7.88
Length a (ft)	6.33
Length - b (ft)	5.88

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	425.25
P1 (lb)	700
P2 (lb)	300

R1 (lb)	563.91
R2 (lb)	436.09

BENDING	NOT OKAY
M1 (lb-in)	288528.48
M2 (lb-in)	276416.16
S (in^3)	49.91
fb (psi)	5780.81

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	799.20

D/C	7.23

SHEAR	NOT OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	4736.67
fv (psi)	219.46

Fv	180
F'v	139.68

D/C	1.57

SL and GLU NOT ADEQUATE
USE PSL 7x9.5

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.65
Δ (in)	2.75
D/C	4.21

TOTAL DEFLECTION	NOT OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.98
Δ (in)	3.69
D/C	3.76

Sawn Lumber - 3rd Floor, 2nd Ceiling
Beam Design

Member	Size	
1	GLU 3.125x9	
2	GLU 3.125x9	
3	4x10	
4	4x10	
5	4x10	
6	4x10	
7	PSL 5.25x9.5	
8	6x10	
9	4x10	
10	PSL 3.5x9.5	FOR ALL CANTILEVERS
12	4x10	
14	PSL 3.5x9.25	
15	4x10	
16	4x10	
17	4x10	
18	6x10	

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
CI	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	691.59

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	9.76
Length (in)	117.13
Area (in^2)	28.13
Trib. Width (ft)	12.81

BENDING	OKAY
Mmax (lb-in)	98827.78
S (in^3)	42.19
fb (psi)	2342.58

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.84

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	3375.12
fv (psi)	180.01

Fv	265
F'v	265

D/C	0.68

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.33
Δ (in)	0.31
D/C	0.94

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.49
Δ (in)	0.41
D/C	0.85

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	691.59

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	9.81
Length (in)	117.75
Area (in^2)	28.13
Trib. Width (ft)	12.81

BENDING	OKAY
Mmax (lb-in)	99885.32
S (in^3)	42.19
fb (psi)	2367.65

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.85

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	3393.13
fv (psi)	180.97

Fv	265
F'v	265

D/C	0.68

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.33
Δ (in)	0.31
D/C	0.96

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.49
Δ (in)	0.42
D/C	0.86

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	5.92
Length (in)	71
Area (in^2)	32.38
Trib. Width (ft)	14.08

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5

BENDING	OKAY
Mmax (lb-in)	39934.17
S (in^3)	49.91
fb (psi)	800.10

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.76

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2249.81
fv (psi)	104.24

Fv	180
F'v	139.68

D/C	0.75

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.20
Δ (in)	0.02
D/C	0.12

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.30
Δ (in)	0.03
D/C	0.11

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5

DIMENSIONS	
Member Size	3.125x9
Base	5.5
Width	9.00
Length (ft)	12.58
Length (in)	151
Area (in^2)	49.50
Trib. Width (ft)	14.08

BENDING	OKAY
Mmax (lb-in)	180627
S (in^3)	74.25
fb (psi)	2432.68

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.87

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.42
Δ (in)	0.53
D/C	1.26

TOTAL DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.63
Δ (in)	0.71
D/C	1.13

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	4784.81
fv (psi)	144.99

Fv	265
F'v	265

D/C	0.55

SL and GLU NOT ADEQUATE
USE PSL 5.25x9.5

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	5.58
Length (in)	67
Area (in^2)	32.38
Trib. Width (ft)	13.14

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	709.59

BENDING	OKAY
Mmax (lb-in)	33181
S (in^3)	49.91
fb (psi)	664.80

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.63

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1980.95
fv (psi)	91.78

Fv	180
F'v	139.68

D/C	0.66

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375
E (psi)	1700000
Δallowable (in)	0.19
Δ (in)	0.02
D/C	0.10

TOTAL DEFLECTION	OKAY
I (in^4)	375
E (psi)	1700000
Δallowable (in)	0.28
Δ (in)	0.02
D/C	0.09

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	1980.97

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	4.17
Length (in)	50
Area (in^2)	28.13
Trib. Width (ft)	0
Length a (ft)	3.33
Length - b (ft)	0.875

BENDING	OKAY
Mmax (lb-in)	16640
S (in^3)	42.19
fb (psi)	394.43

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.14

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	1584.77
fv (psi)	84.52

Fv	265
F'v	265

D/C	0.32

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.14
Δ (in)	0.01
D/C	0.07

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.21
Δ (in)	0.01
D/C	0.05

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.92

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	12.84
Length (in)	154.125
Area (in^2)	49.50
Trib. Width (ft)	14.09

BENDING	OKAY
Mmax (lb-in)	188284.69
S (in^3)	74.25
fb (psi)	2535.82

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.0

D/C	0.91

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.43
Δ (in)	0.57
D/C	1.34

TOTAL DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.64
Δ (in)	0.77
D/C	1.21

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	4886.55
fv (psi)	148.08

Fv	265
F'v	265

D/C	0.56

SL and GLU NOT ADEQUATE
USE PSL 5.25x9.5

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	12
Length (in)	144
Area (in^2)	52.25
Trib. Width (ft)	5.23

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	282.38

BENDING	OKAY
Mmax (lb-in)	60993
S (in^3)	82.73
fb (psi)	737.26
Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41
D/C	0.68

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8
Vmax (lb)	1694.25
fv (psi)	48.64
Fv	180
F'v	139.68
D/C	0.35

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.40
Δ (in)	0.15
D/C	0.38

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.6
Δ (in)	0.21
D/C	0.34

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	4.5
Length (in)	54.00
Area (in^2)	32.38
Trib. Width (ft)	10.33

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	558

BENDING	OKAY
Mmax (lb-in)	16949.25
S (in^3)	49.91
fb (psi)	339.59

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.32

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1255.50
fv (psi)	58.17

Fv	180
F'v	139.68

D/C	0.42

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.15
Δ (in)	0.01
D/C	0.04

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.23
Δ (in)	0.01
D/C	0.04

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
CI	1
Cv	1
Cc	1
CI	1

LOADS	
Dead (psf)	14
Live (psf)	40
wLL (plf)	298.33
wDL (plf)	104.42

DIMENSIONS	
Member Size	3.125x9
Base	5.5
Width	9.00
Length (ft)	15.73
Length (in)	188.75
Area (in^2)	49.50
Trib. Width (ft)	7.46

x	7.5
l	15.75
a	3.83
x1	2

BENDING	OKAY
Mmax (lb-in)	95950.16
S (in^3)	74.25
fb (psi)	1292.26

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.46

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	2346.27
fv (psi)	71.10

Fv	265
F'v	265

D/C	0.27

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.52
Δ (in)	0.68
D/C	1.30

SL and GLU NOT ADEQUATE
USE PSL 3.5x9.5 FOR
3 CANTILEVER BEAMS

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.79
Δ (in)	0.68
D/C	0.87

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	3.5
Length (in)	42
Area (in^2)	32.38
Trib. Width (ft)	6.65

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	359.16

BENDING	OKAY
Mmax (lb-in)	6599
S (in^3)	49.91
fb (psi)	132.22
Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00
D/C	0.13

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8
Vmax (lb)	628.52
fv (psi)	29.12
Fv	180
F'v	139.68
D/C	0.21

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.12
Δ (in)	0.00
D/C	0.01

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.175
Δ (in)	0.00
D/C	0.01

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	4.63
Length (in)	55.5
Area (in^2)	32.38
Trib. Width (ft)	12.81
Length a (ft)	2.31
Length - b (ft)	2.31

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	691.875
Length of M	12
P (lb)	5346.54

BENDING	NOT OKAY
Mmax (lb-in)	96383
S (in^3)	49.91
fb (psi)	1931.07

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	2.19

SHEAR	NOT OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	4273.23
fv (psi)	197.99

Fv	180
F'v	139.68

D/C	1.42

SL and GLU NOT ADEQUATE
USE PSL 3.5x9.25

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.15
Δ (in)	0.06
D/C	0.40

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.23
Δ (in)	0.07
D/C	0.29

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Cl	1
Cr	1
Fb	1000

5x or larger	
Cd	1.25
Cm	1
Ct	1
Ci	0.87
Cl	1
Cr	1.15

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	3.25
Length (in)	39
Area (in^2)	32.38
Trib. Width (ft)	14.08
Length a (ft)	1.08
Length - b (ft)	2.17

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5
P (lb)	0

BENDING	OKAY
Mmax (lb-in)	12049
S (in^3)	49.91
fb (psi)	241.41

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	0.27

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1235.81
fv (psi)	57.26

Fv	180
F'v	139.68

D/C	0.41

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.11
Δ (in)	0.00
D/C	0.03

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.16
Δ (in)	0.00
D/C	0.03

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	3.71
Length (in)	44.5
Area (in^2)	32.38
Trib. Width (ft)	14.08
Length a (ft)	1.25
Length - b (ft)	2.46

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5
Length of Memb	12
P (lb)	0

BENDING	OKAY
Mmax (lb-in)	15687.29
S (in^3)	49.91
fb (psi)	314.30

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	0.36

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1410.09
fv (psi)	65.33

Fv	180
F'v	139.68

D/C	0.47

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.12
Δ (in)	0.01
D/C	0.05

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.19
Δ (in)	0.01
D/C	0.04

DESIGN VALUES			
2x or 4x		5x or larger	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	10.46
Length (in)	125.5
Area (in^2)	32.38
Trib. Width (ft)	0
Length a (ft)	4.58
Length - b (ft)	5.875

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Memb	12
P (lb)	628.52

BENDING	OKAY
Mmax (lb-in)	19419
S (in^3)	49.91
fb (psi)	389.07

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	0.44

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	353.07
fv (psi)	16.36

Fv	180
F'v	139.68

D/C	0.12

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.35
Δ (in)	0.06
D/C	0.19

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.52
Δ (in)	0.06
D/C	0.12

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	9.17
Length (in)	110
Area (in^2)	52.25
Trib. Width (ft)	0
Length a (ft)	6.33
Length - b (ft)	2.84

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	2921.94

BENDING	OKAY
Mmax (lb-in)	68709
S (in^3)	82.73
fb (psi)	830.52

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1086.41

D/C	0.76

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2017.13
fv (psi)	57.91

Fv	180
F'v	139.68

D/C	0.41

LIVE LOAD DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.31
Δ (in)	0.10
D/C	0.33

TOTAL DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.46
Δ (in)	0.10
D/C	0.22

Header	Column Size	Beam Size
1	4x4	6x10
2	4x4	4x10

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	6x10
Base	5.5
Width	9.50
Length (ft)	6.42
Length (in)	77.00
Area (in^2)	52.25
Trib. Width (ft)	0.00
Length a (ft)	3.83
Length - b (ft)	2.58

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	4675.709375

BENDING	OKAY
Mmax (lb-in)	86591.71
S (in^3)	82.73
fb (psi)	1046.69

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	1375.69

D/C	0.76

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2793.28
fv (psi)	80.19

Fv	180
F'v	139.68

D/C	0.57

LIVE LOAD DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.21
Δ (in)	0.06
D/C	0.30

TOTAL DEFLECTION	OKAY
I (in^4)	392.96
E (psi)	1700000
Δallowable (in)	0.32
Δ (in)	0.06
D/C	0.20

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	6.38
Length (in)	76.50
Area (in^2)	32.38
Trib. Width (ft)	0
Length a (ft)	4.33
Length - b (ft)	2.02

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Memb	12
P (lb)	2721.75

BENDING	OKAY
Mmax (lb-in)	44864.40
S (in^3)	49.91
fb (psi)	898.88

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	1.02

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.21
Δ (in)	0.05
D/C	0.25

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.32
Δ (in)	0.05
D/C	0.17

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1850.08
fv (psi)	85.72

Fv	180
F'v	139.68

D/C	0.61

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	33.71

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1820.08
fc	148.58
D/C	0.29

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2545.33
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	57.78

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5665.39
fc	462.48
D/C	0.89

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	6898.25
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	41.71

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9150.75
fc	475.36
D/C	0.92

Column 4

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2916.86
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	65.21

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6438.16
fc	525.56
D/C	1.02

Column 5

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	6158.8708
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	48.0887

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8755.6606
fc	454.84
D/C	0.88

Column 6

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2101.15
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	23.03

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3344.67
fc	273.03
D/C	0.53

Column 7

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	734.25
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	47.56

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3302.33
fc	269.58
D/C	0.52

Column 8

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2557.34
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	80.96

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6929.02
fc	565.63
D/C	1.09

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	29.29

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1581.80
fc	129.13
D/C	0.25

Column 10

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	56.2135

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3035.529
fc	247.80
D/C	0.48

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	5130.44
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	86.91

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9823.33
fc	510.30
D/C	0.99

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3984.74
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	45.33

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6432.59
fc	525.11
D/C	1.02

Column 13

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.38

LOADS	
Column Load Above (lb)	8539.11
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	77.08

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	12701.51
fc	500.55
D/C	0.97

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.38

LOADS	
Column Load Above (lb)	8172.98
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	108.04

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	14007.02
fc	552.00
D/C	1.07

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2056.73
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	75.08

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6111.22
fc	498.88
D/C	0.96

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	18.05

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	974.90
fc	79.58
D/C	0.15

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	111.35

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6012.85
fc	490.85
D/C	0.95

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	126.07

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6807.54
fc	555.72
D/C	1.07

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	7607.10
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	58.18

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10748.96
fc	558.39
D/C	1.08

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	2812.36
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	114.99

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9021.89
fc	468.67
D/C	0.91

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	18.00

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	971.74
fc	79.33
D/C	0.15

Column 22

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	19.172

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1035.288
fc	84.51
D/C	0.16

Column 23

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	4006.88
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	42.68

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6311.46
fc	515.22
D/C	1.00

Column 24

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4848.3522
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	72.0267

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8737.794
fc	453.91
D/C	0.88

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	52.97

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2860.52
fc	233.51
D/C	0.45

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	1662.83
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	26.88

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3114.20
fc	254.22
D/C	0.49

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	2667.95
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	84.30

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7220.15
fc	375.07
D/C	0.73

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2361.19
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	43.50

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4710.45
fc	384.53
D/C	0.74

Column 29

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3912.42
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	74.24

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7921.29
fc	411.50
D/C	0.80

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	40.33

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2177.60
fc	177.76
D/C	0.34

Column 31

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	48.3018

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2608.2972
fc	212.92
D/C	0.41

Column 32

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3201.07
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	117.93

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9569.49
fc	497.12
D/C	0.96

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	50.07

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2703.75
fc	220.71
D/C	0.43

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	34.63

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1869.81
fc	152.64
D/C	0.30

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	67.6585

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3653.559
fc	298.25
D/C	0.58

Column 36

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	20.34

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1098.19
fc	89.65
D/C	0.17

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	120.16

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6488.58
fc	529.68
D/C	1.02

Column 38

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3672.57
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	76.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7819.42
fc	406.20
D/C	0.79

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	20.33

COMPRESSON	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1097.68
fc	89.61
D/C	0.17

Column 40

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	1596.28
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	29.52

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3190.50
fc	260.45
D/C	0.50

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	6254.46
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8972.48
fc	466.10
D/C	0.90

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	65.56

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3540.07
fc	288.99
D/C	0.56

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4780.2294
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	51.234

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7546.8654
fc	392.04
D/C	0.76

Column	Gridline	Size
1	A	4x4
2	A	4x4
3	A	4x6
4	A	4x4
5	A	4x6
6	A	4x4
7	B	4x4
8	B	4x4
9	B	4x4
10	B	4x4
11	B	4x6
12	C	4x4
13	C	4x8
14	C	4x8
15	C.1	4x4
16	C.1	4x4
17	C.2	4x4
18	C.3	4x4
19	C.2	4x6
20	C.3	4x6
21	C.3	4x4
22	D	4x4
23	D	4x4
24	D	4x6
25	D	4x4
26	D	4x4
27	E	4x6
28	E	4x4
29	E	4x6
30	E	4x4
31	E	4x4
32	E.1	4x6
33	E.1	4x4
34	E.1	4x4
35	E.1	4x4
36	E.2	4x4
37	E.2	4x4
38	E.2	4x6
39	E.2	4x4
40	F	4x4
41	F	4x6
42	F	4x4
43	F	4x6

Sawn Lumber - 2nd Floor
Column Design

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	892.48
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	24.02

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2189.29
fc	178.72
D/C	0.35

Sawn Lumber - 2nd Floor
Column Design

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3741.02
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	58.47

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6898.25
fc	358.35
D/C	0.69

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	54.02

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2916.86
fc	238.11
D/C	0.46

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3334.26
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	52.31

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6158.87
fc	319.94
D/C	0.62

Sawn Lumber - 2nd Floor
Column Design

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	852.0582
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	23.1313

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2101.1484
fc	171.52
D/C	0.33

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	13.60

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	734.25
fc	59.94
D/C	0.12

Sawn Lumber - 2nd Floor
Column Design

Column 7

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2197.59
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	47.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4754.93
fc	388.16
D/C	0.75

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	151.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8172.98
fc	424.57
D/C	0.82

Column 9

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.38

LOADS	
Column Load Above (lb)	9900.34
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	62.57

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13279.01
fc	523.31
D/C	1.01

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	47.72

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2576.62
fc	210.34
D/C	0.41

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3682.60
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	26.81

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5130.44
fc	418.81
D/C	0.81

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	73.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3984.74
fc	325.28
D/C	0.63

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4369.53
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	77.21

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8539.11
fc	443.59
D/C	0.86

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	140.87

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7607.10
fc	395.17
D/C	0.76

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	38.09

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2056.73
fc	167.90
D/C	0.32

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	74.20

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4006.88
fc	327.09
D/C	0.63

Sawn Lumber - 2nd Floor
Column Design

Column 17

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Abo	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	127.07

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6861.90
fc	356.46
D/C	0.69

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	73.41

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3964.17
fc	323.61
D/C	0.63

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	52.08

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2812.36
fc	229.58
D/C	0.44

Sawn Lumber - 2nd Floor
Column Design

Column 20

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	89.78

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4848.35
fc	395.78
D/C	0.77

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	30.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1662.83
fc	135.74
D/C	0.26

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	43.73

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2361.19
fc	192.75
D/C	0.37

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	72.45

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3912.42
fc	319.38
D/C	0.62

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.38

LOADS	
Column Load Above (lb)	11157.21
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	48.82

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13793.37
fc	543.58
D/C	1.05

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	5807.06
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	40.89

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8015.26
fc	416.38
D/C	0.81

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	59.28

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3201.07
fc	261.31
D/C	0.51

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	125.34

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6768.24
fc	552.51
D/C	1.07

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	64.00

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3455.93
fc	282.12
D/C	0.55

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	49.41

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2667.95
fc	217.79
D/C	0.42

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	129.82

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7010.42
fc	364.18
D/C	0.70

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	68.01

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3672.57
fc	299.80
D/C	0.58

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	29.56

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1596.28
fc	130.31
D/C	0.25

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2879.35
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	62.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6254.46
fc	510.57
D/C	0.99

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	6007.11
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	88.69

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10796.17
fc	560.84
D/C	1.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3126.60
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	30.62

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4780.23
fc	390.22
D/C	0.75

Column	Gridline	Size	Actual Size
1	A	4x4	4x4
2	A	4x6	4x6
3	A	4x4	4x4
4	A	4x6	4x6
5	A	4x4	4x4
6	B	4x4	4x4
7	B	4x4	4x4
8	C	4x6	4x6
9	C	4x8	4x8
10	B	4x4	4x4
11	C	4x4	4x6
12	C	4x4	4x4
13	C	4x6	4x8
14	C.2	4x6	4x6
15	C.1	4x4	4x4
16	D	4x4	4x4
17	C.2	4x6	4x6
18	D	4x4	4x4
19	C.2	4x4	4x6
20	D	4x4	4x6
21	D	4x4	4x4
22	E	4x4	4x4
23	E	4x4	4x6
24	E	4x8	4x8
25	E	4x6	4x6
26	E.1	4x4	4x6
27	E.1	4x4	4x4
28	E	4x4	4x4
29	E	4x4	4x6
30	E.1	4x6	4x6
31	E.1	4x4	4x6
32	F	4x4	4x4
33	F	4x4	4x6
34	F	4x6	4x6
35	F	4x4	4x6

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	77.82

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2879.35
fc	235.05
D/C	0.45

Sawn Lumber -3rd Floor
Column Design

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	162.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6007.11
fc	490.38
D/C	0.95

Column 3

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	84.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3126.60
fc	255.23
D/C	0.49

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	144.50

COMPRESSON	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5346.54
fc	436.45
D/C	0.84

Column 5

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.38

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	301.55

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	11157.21
fc	439.69
D/C	0.85

Column 6

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	156.95

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5807.06
fc	474.05
D/C	0.92

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	118.10

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4369.53
fc	356.70
D/C	0.69

Column 8

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	267.58

COMPRESSON	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9900.34
fc	514.30
D/C	0.99

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	99.53

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3682.60
fc	300.62
D/C	0.58

Sawn Lumber -3rd Floor
Column Design

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	24.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	892.48
fc	72.86
D/C	0.14

Sawn Lumber -3rd Floor
Column Design

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	101.11

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3741.02
fc	305.39
D/C	0.59

Sawn Lumber -3rd Floor
Column Design

Column 12

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	90.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3334.26
fc	272.18
D/C	0.53

Column 13

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	23.03

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	852.06
fc	69.56
D/C	0.13

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.54

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	500.96
fc	40.89
D/C	0.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	494.39
fc	40.36
D/C	0.08

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	59.39

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2197.59
fc	179.40
D/C	0.35

Column	Gridline	Size	Actual Size
1	F	4x4	4x6
2	F	4x4	4x6
3	F	4x4	4x6
4	E	4x4	4x4
5	E	4x8	4x8
6	E	4x4	4x6
7	C	4x4	4x8
8	C	4x4	4x8
9	C	4x4	4x6
10	A	4x4	4x4
11	A	4x4	4x6
12	A	4x4	4x6
13	A	4x4	4x4
14	A.1	4x4	4x4
15	A.1	4x4	4x4
16	B	4x4	4x4

APPENDIX H

Alternative 2 Gravity Design Calculations

TJI - 2nd Floor, 1st Ceiling
Beam Design

Member	Size
1	Glulam:3-1/8x9
2	4x10
3	4x10
4	Glulam:3-1/8x9
5	Glulam:5-1/2x9
6	6x10

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	814.5

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	8.28
Length (in)	99.38
Area (in^2)	28.13
Trib. Width (ft)	15.08

BENDING	OKAY
Mmax (lb-in)	83786.52
S (in^3)	42.19
fb (psi)	1986.05

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.71

SHEAR	OKAY
Cd	1.25
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	3372.54
fv (psi)	179.87

Fv	265
F'v	257.05

D/C	0.70

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.28
Δ (in)	0.19
D/C	0.68

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.41
Δ (in)	0.25
D/C	0.61

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	6
Length (in)	72
Area (in^2)	32.38
Trib. Width (ft)	15.08

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	814.50

BENDING	OKAY
Mmax (lb-in)	43983
S (in^3)	49.91
fb (psi)	881.22

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.83

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2443.50
fv (psi)	113.21

Fv	180
F'v	139.68

D/C	0.81

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.20
Δ (in)	0.03
D/C	0.14

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.30
Δ (in)	0.04
D/C	0.12

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	814.50

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	11.34
Length (in)	136.13
Area (in^2)	49.50
Trib. Width (ft)	15.08

BENDING	OKAY
Mmax (lb-in)	157216
S (in^3)	74.25
fb (psi)	2117.38

Fb (psi)	2400
Cf	1
Cfu	1.1
F'b (psi)	2640.00

D/C	0.80

SHEAR	OKAY
Cd	1.25
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	4619.74
fv (psi)	139.99

Fv	265
F'v	257.05

D/C	0.54

LIVE LOAD DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.38
Δ (in)	0.37
D/C	0.99

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.57
Δ (in)	0.50
D/C	0.89

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	799.875

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	8.208333
Length (in)	98.499996
Area (in^2)	28.13
Trib. Width (ft)	14.8125

BENDING	OKAY
Mmax (lb-in)	80839.44
S (in^3)	42.19
fb (psi)	1916.19

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.69

SHEAR	OKAY
Cd	1.25
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	3282.82
fv (psi)	175.08

Fv	265
F'v	257.05

D/C	0.68

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.27
Δ (in)	0.18
D/C	0.65

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.41
Δ (in)	0.24
D/C	0.58

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	799.88

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	11.52
Length (in)	138.25
Area (in^2)	49.50
Trib. Width (ft)	14.81

BENDING	OKAY
Mmax (lb-in)	159251
S (in^3)	74.25
fb (psi)	2144.79

Fb (psi)	2400
Cf	1
Cfu	1.1
F'b (psi)	2640.00

D/C	0.81

SHEAR	OKAY
Cd	1.25
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	4607.61
fv (psi)	139.62

Fv	265
F'v	257.05

D/C	0.54

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.38
Δ (in)	0.39
D/C	1.02

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.58
Δ (in)	0.53
D/C	0.92

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
CI	1
Cv	1
Cc	1
CI	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
P (lb)	7607.10

DIMENSIONS	
Member Size	5.5x9
Base	5.5
Width	9.00
Length (ft)	14.48
Length (in)	173.75
Area (in^2)	49.50
Trib. Width (ft)	0.00
Length a (ft)	1.63
Length - b (ft)	12.83

BENDING	OKAY
Mmax (lb-in)	131477
S (in^3)	74.25
fb (psi)	1770.73

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.64

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	6742.41
fv (psi)	204.32

Fv	265
F'v	265

D/C	0.77

LIVE LOAD DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.48
Δ (in)	0.37
D/C	0.76

TOTAL DEFLECTION	OKAY
I (in^4)	334.13
E (psi)	1800000
Δallowable (in)	0.72
Δ (in)	0.37
D/C	0.51

TJI - 3rd Floor, 2nd Ceiling
Beam Design

Member	Size
1	4x10
2	GLU 3.125x9
3	4x10
4	4x10
5	GLU 3.125x9
6	PSL 5.25x9.5
7	4x10

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	12.84
Length (in)	154.13
Area (in^2)	32.38
Trib. Width (ft)	16.21

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	875.25

BENDING	NOT OKAY
Mmax (lb-in)	216576
S (in^3)	49.91
fb (psi)	4339.21

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	4.11

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.43
Δ (in)	0.62
D/C	1.45

TOTAL DEFLECTION	NOT OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.64
Δ (in)	0.84
D/C	1.31

SHEAR	NOT OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	5620.77
fv (psi)	260.42

Fv	180
F'v	139.68

D/C	1.86

SL and GLU NOT ADEQUATE
USE PSL 5.25x9.5

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Member Framing In (ft)	
P (lb)	2443.40625

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	4.791666667
Length (in)	57.5
Area (in^2)	28.13
Trib. Width (ft)	0
Length a (ft)	2.395833333
Length - b (ft)	2.395833333

BENDING	OKAY
Mmax (lb-in)	35123.96484
S (in^3)	42.19
fb (psi)	832.57

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.30

SHEAR	OKAY
Cd	1
Cm	1
Ct	1
Ci	1

Vmax (lb)	1221.703125
fv (psi)	65.16

Fv	265
F'v	265

D/C	0.25

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.16
Δ (in)	0.03
D/C	0.18

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.239583333
Δ (in)	0.03
D/C	0.12

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Cl	1
Cr	1
Fb	1000

5x or larger	
Cd	1.25
Cm	1
Ct	1
Ci	0.87
Cl	1
Cr	1.15

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	5.58
Length (in)	67
Area (in^2)	32.38
Trib. Width (ft)	16.21

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	875.25

BENDING	OKAY
Mmax (lb-in)	40927
S (in^3)	49.91
fb (psi)	819.99

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.78

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2443.41
fv (psi)	113.21

Fv	180
F'v	139.68

D/C	0.81

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.19
Δ (in)	0.02
D/C	0.12

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.28
Δ (in)	0.03
D/C	0.11

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	4.63
Length (in)	55.50
Area (in^2)	32.38
Trib. Width (ft)	12.83

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	693

BENDING	OKAY
Mmax (lb-in)	22236
S (in^3)	49.91
fb (psi)	445.50

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.42

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	1602.56
fv (psi)	74.25

Fv	180
F'v	139.68

D/C	0.53

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.15
Δ (in)	0.01
D/C	0.05

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.23
Δ (in)	0.01
D/C	0.05

DESIGN VALUES	
Cd	1
Cm	1
Ct	1
Cl	1
Cv	1
Cc	1
Cl	1

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	693

DIMENSIONS	
Member Size	3.125x9
Base	3.125
Width	9.00
Length (ft)	9.81
Length (in)	117.75
Area (in^2)	28.13
Trib. Width (ft)	12.83

BENDING	OKAY
Mmax (lb-in)	100088
S (in^3)	42.19
fb (psi)	2372.47

Fb (psi)	2400
Cf	1
Cfu	1.16
F'b (psi)	2784.00

D/C	0.85

SHEAR	OKAY
Cd	1.25
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	3400.03
fv (psi)	181.34

Fv	265
F'v	257.05

D/C	0.71

LIVE LOAD DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.33
Δ (in)	0.31
D/C	0.96

TOTAL DEFLECTION	OKAY
I (in^4)	189.84
E (psi)	1800000
Δallowable (in)	0.49
Δ (in)	0.42
D/C	0.86

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Cl	1
Cr	1
Fb	1000

5x or larger	
Cd	1.25
Cm	1
Ct	1
Ci	0.87
Cl	1
Cr	1.15

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	12.44
Length (in)	149.25
Area (in^2)	32.38
Trib. Width (ft)	14.08

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5

BENDING	NOT OKAY
Mmax (lb-in)	176464
S (in^3)	49.91
fb (psi)	3535.55

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	3.35

SHEAR	NOT OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	4729.36
fv (psi)	219.12

Fv	180
F'v	139.68

D/C	1.57

SL and GLU NOT ADEQUATE
USE PSL 5.25x9.5

LIVE LOAD DEFLECTION	NOT OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.41
Δ (in)	0.48
D/C	1.15

TOTAL DEFLECTION	NOT OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.62
Δ (in)	0.64
D/C	1.03

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	5.92
Length (in)	71.00
Area (in^2)	32.38
Trib. Width (ft)	14.08

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	760.5

BENDING	OKAY
Mmax (lb-in)	39934
S (in^3)	49.91
fb (psi)	800.10

Fb (psi)	1000
Cf	1.2
Cfu	1.1
F'b (psi)	1056.00

D/C	0.76

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	2249.81
fv (psi)	104.24

Fv	180
F'v	139.68

D/C	0.75

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.20
Δ (in)	0.02
D/C	0.12

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.30
Δ (in)	0.03
D/C	0.11

Header	Column Size	Beam Size
1	4x4	4x10

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	6.38
Length (in)	76.50
Area (in^2)	32.38
Trib. Width (ft)	0
Length a (ft)	4.33
Length - b (ft)	2.02

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Memb	12
P (lb)	628.52

BENDING	OKAY
Mmax (lb-in)	10360.37
S (in^3)	49.91
fb (psi)	207.57

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	0.24

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.21
Δ (in)	0.01
D/C	0.06

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.32
Δ (in)	0.01
D/C	0.04

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	427.23
fv (psi)	19.79

Fv	180
F'v	139.68

D/C	0.14

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	33.71

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1820.08
fc	148.58
D/C	0.29

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2189.29
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	57.78

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5309.35
fc	433.42
D/C	0.84

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	8571.26
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	41.85

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10831.05
fc	562.65
D/C	1.09

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	7430.23
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	89.40

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	12257.98
fc	483.07
D/C	0.93

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	1968.74
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	22.43

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3179.91
fc	259.58
D/C	0.50

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	734.25
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	47.56

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3302.33
fc	269.58
D/C	0.52

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4754.93
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	80.96

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9126.65
fc	474.11
D/C	0.92

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	63.78

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3444.27
fc	281.16
D/C	0.54

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	45.98

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2482.80
fc	202.68
D/C	0.39

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3017.30
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	22.671

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4241.53
fc	346.25
D/C	0.67

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3984.74
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	45.33

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6432.59
fc	525.11
D/C	1.02

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	8539.11
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	77.08

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	12701.51
fc	500.55
D/C	0.97

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	8172.98
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	89.88

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13026.52
fc	513.36
D/C	0.99

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2425.04
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	49.06

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5074.44
fc	414.24
D/C	0.80

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	13.33

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	720.08
fc	58.78
D/C	0.11

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	111.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6012.85
fc	490.85
D/C	0.95

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	126.07

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6807.54
fc	353.64
D/C	0.68

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4991.09
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	58.18

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8132.95
fc	422.49
D/C	0.82

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	2812.36
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	117.63

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	9164.43
fc	476.07
D/C	0.92

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	13.23

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	714.58
fc	58.33
D/C	0.11

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	4006.88
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	42.68

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6311.46
fc	515.22
D/C	1.00

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4848.4
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	72.0

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8737.8
fc	453.91
D/C	0.88

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	52.97

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2860.52
fc	233.51
D/C	0.45

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	19.17

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1035.29
fc	84.51
D/C	0.16

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	1662.83
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	26.88

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3114.20
fc	254.22
D/C	0.49

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3882.51
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	71.47

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7741.97
fc	402.18
D/C	0.78

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4992.42
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	93.98

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10067.12
fc	522.97
D/C	1.01

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	40.31

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2176.53
fc	177.68
D/C	0.34

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	48.30

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2608.30
fc	212.92
D/C	0.41

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	86.4483

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4668.21
fc	381.08
D/C	0.74

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	58.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3151.43
fc	257.26
D/C	0.50

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	34.63

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1869.81
fc	152.64
D/C	0.30

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	76.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4146.84
fc	338.52
D/C	0.65

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	20.34

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1098.19
fc	89.65
D/C	0.17

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	20.33

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1097.68
fc	89.61
D/C	0.17

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	120.16

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6488.58
fc	529.68
D/C	1.02

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	76.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4146.84
fc	338.52
D/C	0.65

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	3276.03
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	60.48

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6541.70
fc	534.02
D/C	1.03

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	6335.3
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	95.7

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	11500.6
fc	453.23
D/C	0.88

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	10796.03
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	51.69

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13587.20
fc	535.46
D/C	1.04

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	7528.46
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	51

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10291.50
fc	534.62
D/C	1.03

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	6559.43
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	118

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	12921.44
fc	509.22
D/C	0.98

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	84.5

LOADS	
Column Load Above (lb)	13755.91
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	118

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	20117.92
fc	238.08
D/C	0.46

Column	Gridline	Size
1	A	4x4
2	A	4x4
3	A	4x6
4	A	4x8
5	A	4x4
8	A.2	4x4
6	B	4x4
7	B	4x6
9	B	4x4
10	C	4x4
11	C	4x4
12	C	4x8
13	C	4x8
14	C.1	4x4
15	C.1	4x4
16	C.2	4x4
17	C.2	4x6
18	C.2	4x6
19	C.2	4x6
20	C.2	4x4
24	C.2	4x4
21	D	4x4
22	D	4x6
23	D	4x4
25	D	4x4
26	E	4x6
27	E	4x6
28	E	4x4
29	E	4x4
30	E	4x4
34	E	4x4
31	E.1	4x4
32	E.1	4x4
33	E.1	4x4
35	E.2	4x4
36	E.2	4x4
37	E.2	4x4
38	F	4x4
39	F	4x8
40	F	4x8
41	F	4x6
42	F	4x8

43	F	4x8

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	892.48
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	24.02

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2189.29
fc	178.72
D/C	0.35

Column 2

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3741.02
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	89.45

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8571.26
fc	445.26
D/C	0.86

Column 3

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3334.26
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	75.85

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7430.23
fc	385.99
D/C	0.75

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	852.06
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	20.68

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1968.74
fc	160.71
D/C	0.31

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	13.60

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	734.25
fc	59.94
D/C	0.12

Column 6

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2197.59
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	47.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4754.93
fc	388.16
D/C	0.75

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	151.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8173.0
fc	424.57
D/C	0.82

Column 8

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	8163.84
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	103.56

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13755.91
fc	542.10
D/C	1.05

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	1725.03
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	23.93

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3017.30
fc	246.31
D/C	0.48

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	73.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3984.74
fc	325.28
D/C	0.63

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	4369.53
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	77.21

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8539.11
fc	443.59
D/C	0.86

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	74.2

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4006.9
fc	327.09
D/C	0.63

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	127.07

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6861.90
fc	356.46
D/C	0.69

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	73.41

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3964.17
fc	323.61
D/C	0.63

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	92.43

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4991.09
fc	407.44
D/C	0.79

Column 16

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	44.91

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2425.04
fc	197.96
D/C	0.38

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	89.78

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4848.35
fc	395.78
D/C	0.77

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	30.79

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1662.83
fc	135.74
D/C	0.26

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	52.08

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2812.36
fc	229.58
D/C	0.44

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	71.90

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3882.51
fc	316.94
D/C	0.61

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	92.45

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4992.42
fc	407.54
D/C	0.79

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000.00		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	11157.21
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	48.82

COMPRESSION	NOT OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	13793.37
fc	543.58
D/C	1.05

Column 23

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	63.98

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3454.85
fc	282.03
D/C	0.55

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	5807.06
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	107.42

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	11607.55
fc	457.44
D/C	0.88

Column 25

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	60.67

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3276.03
fc	267.43
D/C	0.52

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	125.34

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6768.24
fc	351.60
D/C	0.68

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	0
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	129.82

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7010.42
fc	364.18
D/C	0.70

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Column Load Above (lb)	2879.35
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	64.00

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6335.28
fc	517.17
D/C	1.00

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Column Load Above (lb)	6007.11
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	88.68

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	10796.03
fc	425.46
D/C	0.82

Column 30

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3126.60
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	81.52

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	7528.46
fc	391.09
D/C	0.76

DESIGN VALUES			
2x or 4x		Emin	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Column Load Above (lb)	3693.92
DL (psf)	14
LL (psf)	40
Trib Area (sq ft)	53.06

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6559.43
fc	340.75
D/C	0.66

Column	Gridline	Size	Actual Size
1	A	4x4	4x4
2	A	4x4	4x4
3	A	4x6	4x6
4	A	4x4	4x4
5	B	4x4	4x4
6	B	4x4	4x4
7	C	4x6	4x6
8	C	4x8	4x8
9	C	4x4	4x4
10	C	4x4	4x4
11	C	4x6	4x6
12	D	4x4	4x4
13	C.2	4x6	4x6
14	D	4x4	4x4
15	C.2	4x4	4x4
16	C.1	4x4	4x4
17	D	4x4	4x4
18	D	4x4	4x4
19	C.2	4x4	4x4
20	E	4x4	4x4
21	E	4x4	4x4
22	E	4x8	4x8
23	E	4x4	4x4
24	E	4x8	4x8
25	F	4x4	4x4
26	E.1	4x6	4x6
27	E.1	4x6	4x6
28	F	4x4	4x4
29	F	4x8	4x8
30	F	4x6	4x6
31	C	4x4	4x6

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	77.82

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2879.35
fc	235.05
D/C	0.45

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	162.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6007.11
fc	490.38
D/C	0.95

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	84.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3126.60
fc	255.23
D/C	0.49

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	144.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5346.54
fc	436.45
D/C	0.84

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	301.55

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	11157.21
fc	439.69
D/C	0.85

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	156.95

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5807.06
fc	474.05
D/C	0.92

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	118.10

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4369.53
fc	356.70
D/C	0.69

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	220.64

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8163.84
fc	424.10
D/C	0.82

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	46.62

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1725.03
fc	140.82
D/C	0.27

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	24.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	892.48
fc	72.86
D/C	0.14

DESIGN VALUES				
2x or 4x			**Emin**	
Cd	1		Cm	0.9
Cm	1		Ct	1
Ct	1		Ci	0.95
Ci	0.8			
Fc	1500			
Emin	620000			

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	101.11

COMPRESSION	**OKAY**
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3741.02
fc	305.39
D/C	0.59

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	90.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3334.26
fc	272.18
D/C	0.53

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	23.03

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	852.06
fc	69.56
D/C	0.13

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.54

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	500.96
fc	40.89
D/C	0.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	494.39
fc	40.36
D/C	0.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	59.39

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2197.59
fc	179.40
D/C	0.35

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	99.84

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3693.92
fc	301.54
D/C	0.58

Column	Gridline	Size	Actual Size
1	F	4x4	4x4
2	F	4x4	4x4
3	F	4x4	4x4
4	E	4x4	4x4
5	E	4x8	4x8
6	E	4x4	4x6
7	C	4x4	4x4
8	C	4x6	4x6
9	C	4x4	4x4
10	A	4x4	4x4
11	A	4x4	4x4
12	A	4x4	4x4
13	A	4x4	4x4
14	A.1	4x4	4x4
15	A.1	4x4	4x4
16	A.1	4x4	4x4
17	C.1	4x4	4x4

DESIGN VALUES

2x or 4x	
Cd	1
Cm	1
Ct	1
Ci	0.8
Fc	1500
Emin	620000

Emin	
Cm	0.9
Ct	1
Ci	0.95

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	77.82

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2879.35
fc	235.05
D/C	0.45

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	162.35

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	6007.11
fc	490.38
D/C	0.95

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	84.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3126.60
fc	255.23
D/C	0.49

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	144.50

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5346.54
fc	436.45
D/C	0.84

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x8
Base	3.5
Width	7.25
Length (ft)	8
Total Length (in)	96
Area	25.375

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	301.55

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	13.24

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	11157.21
fc	439.69
D/C	0.85

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	156.95

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	5807.06
fc	474.05
D/C	0.92

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	118.10

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	4369.53
fc	356.70
D/C	0.69

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x6
Base	3.5
Width	5.5
Length (ft)	8
Total Length (in)	96
Area	19.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	220.64

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	17.45

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	8163.84
fc	424.10
D/C	0.82

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	46.62

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	1725.03
fc	140.82
D/C	0.27

DESIGN VALUES				
2x or 4x			**Emin**	
Cd	1		Cm	0.9
Cm	1		Ct	1
Ct	1		Ci	0.95
Ci	0.8			
Fc	1500			
Emin	620000			

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	24.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	892.48
fc	72.86
D/C	0.14

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	101.11

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3741.02
fc	305.39
D/C	0.59

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	90.12

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3334.26
fc	272.18
D/C	0.53

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	23.03

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	852.06
fc	69.56
D/C	0.13

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.54

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	500.96
fc	40.89
D/C	0.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	13.36

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	494.39
fc	40.36
D/C	0.08

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	59.39

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	2197.59
fc	179.40
D/C	0.35

DESIGN VALUES			
2x or 4x		**Emin**	
Cd	1	Cm	0.9
Cm	1	Ct	1
Ct	1	Ci	0.95
Ci	0.8		
Fc	1500		
Emin	620000		

DIMENSIONS	
Member Size	4x4
Base	3.5
Width	3.5
Length (ft)	8
Total Length (in)	96
Area	12.25

LOADS	
Top Chord DL (psf)	9
Bottom Chord DL (psf)	8
LL (lb)	20
Trib Area (sq ft)	99.84

COMPRESSION	OKAY
Assume K=1 (Pinned-Pinned)	
Weak	27.43
Strong	27.43

Emin	620000
E'min	530100

Fce	579.19

Cf	1.15
Fc	1500
Fc*	1380

Cp - A	0.89
Cp - B	0.52
Cp	0.37

F'c	517.19
Demand Load	3693.92
fc	301.54
D/C	0.58

Header	Column Size	Beam Size
1	4x4	4x10

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	4x10
Base	3.5
Width	9.25
Length (ft)	6.38
Length (in)	76.50
Area (in^2)	32.38
Trib. Width (ft)	0
Length a (ft)	4.33
Length - b (ft)	2.02

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	0
Length of Memb	12
P (lb)	628.52

BENDING	OKAY
Mmax (lb-in)	10360.37
S (in^3)	49.91
fb (psi)	207.57

Fb (psi)	1000
Cf	1.1
Cfu	1
F'b (psi)	880.00

D/C	0.24

LIVE LOAD DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.21
Δ (in)	0.01
D/C	0.06

TOTAL DEFLECTION	OKAY
I (in^4)	230.84
E (psi)	1700000
Δallowable (in)	0.32
Δ (in)	0.01
D/C	0.04

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	427.23
fv (psi)	19.79

Fv	180
F'v	139.68

D/C	0.14

DESIGN VALUES			
2x or 4x		**5x or larger**	
Cd	1	Cd	1.25
Cm	1	Cm	1
Ct	1	Ct	1
Ci	0.8	Ci	0.87
Cl	1	Cl	1
Cr	1	Cr	1.15
Fb	1000		

DIMENSIONS	
Member Size	6x12
Base	5.5
Width	5.50
Length (ft)	12.81
Length (in)	153.67
Area (in^2)	30.25
Trib. Width (ft)	1.5

LOADS	
Dead (psf)	14
Live (psf)	40
w (plf)	81

BENDING	OKAY
Mmax (lb-in)	19926
S (in^3)	27.73
fb (psi)	718.59

Fb (psi)	1350
Cf	1
Cfu	0.74
F'b (psi)	1249.37

D/C	0.58

SHEAR	OKAY
Cd	1
Cm	0.97
Ct	1
Ci	0.8

Vmax (lb)	518.65
fv (psi)	25.72

Fv	180
F'v	139.68

D/C	0.18

USE LSL 1 1/2 x 11 7/8

LIVE LOAD DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.43
Δ (in)	0.06
D/C	0.13

TOTAL DEFLECTION	OKAY
I (in^4)	375.00
E (psi)	1700000
Δallowable (in)	0.64
Δ (in)	0.08
D/C	0.12

APPENDIX I

Lateral & Connection Design Calculations

Seismic Forces:
Equivalent Lateral Force Method

Dead Loads	
Roof Top Chord (psf)	9
Roof Bottom Chord (psf	8
Dead Load (psf)	14
Live Loads	
Floor Live Load (psf)	40
Roof Live Load (psf)	20

Allowable Story Drift (ASCE 12.12-1)	
Δ=0.025hsx (in)	5.4

USE 12" BETWEEN BUILDINGS

Areas	
2nd Floor (ft^2)	2503
3rd Floor (ft^2)	2597
Roof (ft^2)	1783

Weights	
2nd Floor (k)	34.23
3rd Floor (k)	34.23
Roof (k)	29.07

Sds (g)	1.21	<=0.50g
Sd1 (g)	0.63	<=0.20g
S1 (g)	0.63	
Ct	0.02	ASCE Table 12.8-2
x	0.75	ASCE Table 12.8-2
h (ft)	29	
R	6.5	ASCE Table 12.2-1
Ie	1	

SDC: D

Ta (sec)	0.25	
Cs (g) - Calc	0.19	
Csmax (g)	0.39	
Csmin (g)	0.05	
Csmin (g)	0.05	
Cs (g) - Governs	0.19	
Wt (k)	97.53	
Base Shear, V (k)	18.13	
k	1	ASCE Section 12.8.3

Level	Weight (k)	Height (ft)	WxHx^k	Cvx	Fx (k)	HFx (k-ft)
1	135.16	8.92	1205.19	0.23	4.11	36.63
2	140.24	17.83	2500.91	0.47	8.53	152.04
Roof	65.97	24.42	1610.79	0.30	5.49	134.08

OTM (k-ft) 322.76

WIND LOADS & PRESSURE					
kzt	1	Flat Area	**G**	0.85	ASCE Sec. 6.5.8
kd	0.85		**Cp**	0.8	ASCE Fig. 6-6
v (mph)	110	ATC	**GCpi**	0.18	
Exposure	B			-0.18	

DESIGN LOADS						
Height (ft)	**Kz**	**qz (psf)**	**p (psf)**	**Diaphragm Force (plf)**	**Story Shear Force: N-S (k)**	**Story Shear Force: E-W (k)**
0-15	0.57	15.01	12.91	116	5.52	11.62
15-20	0.62	16.32	14.04	126	2.00	4.21
20-25	0.66	17.38	14.94	135	2.13	4.48
25-30	0.70	18.43	14.28	129	1.63	4.29
				Σ =	11.28	24.60

SEISMIC FORCES FOR SHEAR WALLS			
Floor	**Seismic Force (k)**	**E-W (plf)**	**N-S (plf)**
First	4.1	68	101
Second	8.5	142	210
Third	5.5	92	136

SEISMIC FORCES FOR DIAPHRAGMS				
Floor	**Seismic Force (k)**	**N-S (plf)**	**E-W (plf)**	**Governing Force (plf)**
First	4.1	101	64	101
Second	8.5	210	133	210
Third	5.5	136	86	136
Σ =	18.1			

Floor	Governing Loads (plf)	Load Type	Nail Spacing at Boundaries	Nail Spacing	Diaphragm Capacity (plf)
1st	116	Seismic	10d @ 6" O.C.	10d @ 6" O.C.	360
2nd	126	Seismic	10d @ 6" O.C.	10d @ 6" O.C.	360
3rd	135	Seismic	10d @ 6" O.C.	10d @ 6" O.C.	360

Shear Wall Calculations:
First Floor

Grid	Wall Length	Wind Pressure (psf)	Trib. Width (ft)	Wind Shear (plf)	2nd Flr Tension Force (lb)	Tension Force (lb)	Seismic Total Shear (plf)	Seismic Shear (plf)	Governing Shear (plf)	Edge Nailing	Holdown	Sill Plate Nail Spacing	A35 Spacing
A	21'-6"	12.91	1.4	18	2075	2217	68	1	18	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
3	14'-5"	12.91	20.2	260	0	2082	101	50	260	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
3	15'-0"	12.91	20.2	260	0	2082	101	50	260	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	4'-5"	12.91	9.8	127	4118	5133	101	25	127	10d @ 6" O.C.	HDU4	16d @ 4" O.C.	16" O.C.
A2	18'-11"	12.91	5.6	72	0	577	68	6	72	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
B	20'-7"	12.91	6.5	84	0	671	68	7	84	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
C	20'-7"	12.91	3.6	47	3291	3665	68	4	47	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
C1	4'-0"	12.91	7.2	92	814	1554	68	8	92	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
5	3'-3"	12.91	2.0	26	297	508	101	5	26	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
5	3'-4"	12.91	2.0	26	297	508	101	5	26	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
C2	13'-9"	12.91	8.7	112	973	1868	68	9	112	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
D	20'-7"	12.91	5.0	65	880	1396	68	5	65	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
F	20'-7"	12.91	12.0	155	880	2119	68	13	155	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	6'-11"	12.91	9.8	127	4118	5133	101	25	127	10d @ 6" O.C.	HDU5	16d @ 4" O.C.	16" O.C.
4	4'-3"	12.91	9.8	127	4118	5133	101	25	127	10d @ 6" O.C.	HDU5	16d @ 4" O.C.	16" O.C.
G	11'-3"	12.91	9.9	128	2484	3508	68	11	128	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
G	4'-8"	12.91	9.9	128	2484	3508	68	11	128	10d @ 6" O.C.	HDU4	16d @ 4" O.C.	16" O.C.
G	5'-1"	12.91	9.9	128	2484	3508	68	11	128	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
1	(SSW)	12.91	10.3	133	1007	2074	101	26	133	SSW15x8	HDU2	---	16" O.C.
1	(SSW)	12.91	10.3	133	1007	2074	101	26	133	SSW15x8	HDU2	---	16" O.C.
1	(SSW)	12.91	10.3	133	1007	2074	101	26	133	SSW15x8	HDU2	---	16" O.C.
1	(SSW)	12.91	10.3	133	1007	2074	101	26	133	SSW15x8	HDU2	---	16" O.C.
1	(SSW)	12.91	10.3	133	1007	2074	101	26	133	SSW15x8	HDU2	---	16" O.C.

Shear Wall Calculations:
Second Floor

Grid	Wall Length	Wind Pressure (psf)	Trib. Width (ft)	Wind Shear (plf)	3rd Flr Tension Force (lb)	Tension Force (lb)	Seismic Total Shear (plf)	Seismic Shear (plf)	Governing Shear (plf)	Edge Nailing	Holdown	Sill Plate Nail Spacing	A35 Spacing
A	28'-9"	14.0	7.8	110	1195	2075	142	17	110	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	4'-5"	14.0	16.0	225	1783	3585	210	83	225	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
1	8'-4"	14.0	6.9	97	0	777	210	36	97	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
C	40-6"	14.0	9.1	128	2271	3291	142	20	128	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
2	5'-6"	14.0	20.3	285	1783	4067	210	105	285	10d @ 6" O.C.	HDU4	16d @ 4" O.C.	16" O.C.
C1	4'-0"	14.0	7.3	102	0	814	142	16	102	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
2	5'-11"	14.0	20.3	285	1783	4067	210	105	285	10d @ 6" O.C.	HDU4	16d @ 4" O.C.	16" O.C.
C2	4'-0"	14.0	8.7	122	0	973	142	19	122	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	5'-2"	14.0	16.0	225	1783	3585	210	83	225	10d @ 6" O.C.	HDU4	16d @ 4" O.C.	16" O.C.
D	20'-7"	14.0	3.9	55	0	440	142	9	55	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
E	14'-1"	14.0	3.5	49	2629	3022	142	8	49	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
F	20'-7"	14.0	9.3	130	0	1039	142	21	130	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
1	13'-2"	14.0	6.9	97	0	777	210	36	97	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
2	12'-5"	14.0	20.3	285	1783	4067	210	105	285	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
4	8'-11"	14.0	16.0	225	1783	3585	210	83	225	10d @ 6" O.C.	HDU4	10d @ 4" O.C.	16" O.C.
G	4'-7"	14.0	10.5	147	1305	2484	142	23	147	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
G	4'-8"	14.0	10.5	147	1305	2484	142	23	147	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
G	4'-2"	14.0	10.5	147	1305	2484	142	23	147	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
G	7'-11"	14.0	10.5	147	1305	2484	142	23	147	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.

Shear Wall Calculations:
Third Floor

Grid	Wall Length	Wind Pressure (psf)	Trib. Width (ft)	Wind Shear (plf)	Tension Force (lb)	Seismic Total Shear (plf)	Seismic Shear (plf)	Governing Shear (plf)	Edge Nailing	Holdown	Sill Plate Nail Spacing	A35 Spacing
A1	13'-0"	14.9	2.0	30	239	92	3	30	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
A	10'-0"	14.9	10.0	149	1195	136	34	149	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
A	6'-0"	14.9	10.0	149	1195	136	34	149	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	4'-0"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	4'-2"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
2	12'-8"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
C	27'-7"	14.9	19.0	284	2271	92	27	284	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	7'-1"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	7'-10"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
2	6'-2"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
E	27'-7"	14.9	22.0	329	2629	92	9	329	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	6'-10"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
2	11'-6"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
4	8'-0"	14.9	14.9	223	1783	136	50	223	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
G	9'-1"	14.9	10.9	163	1305	92	16	163	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.
G	7'-6"	14.9	10.9	163	1305	92	16	163	10d @ 6" O.C.	HDU2	10d @ 4" O.C.	16" O.C.

Floor	Wall	Area (in^2)	b (ft)	da (in)	E (psi)	vnail (lbf/nail)	en (in)	Gt (psi)	h (ft)	v (plf)	Deflection (in)	Drift (in)	
1st	1	10.5	2	0.088	2E+06	9	0.000003	83500	8	18	0.356	2.31	OKAY
1st	2	10.5	60	0.088	2E+06	130	0.009170	83500	8	260	0.093	0.60	OKAY
1st	3	10.5	5	0.115	2E+06	63	0.001049	83500	8	127	0.230	1.49	OKAY
1st	4	10.5	19	0.088	2E+06	36	0.000190	83500	8	72	0.046	0.30	OKAY
1st	5	10.5	18	0.088	2E+06	42	0.000301	83500	8	84	0.050	0.33	OKAY
1st	7	10.5	18	0.114	2E+06	23	0.000052	83500	8	47	0.056	0.36	OKAY
1st	8	10.5	3	0.115	2E+06	63	0.001049	83500	8	127	0.364	2.37	OKAY
1st	9	10.5	4	0.088	2E+06	46	0.000404	83500	8	92	0.193	1.25	OKAY
1st	10	10.5	3	0.088	2E+06	13	0.000009	83500	8	26	0.218	1.42	OKAY
1st	11	10.5	3	0.088	2E+06	13	0.000009	83500	8	26	0.227	1.48	OKAY
1st	12	10.5	24	0.088	2E+06	56	0.000717	83500	8	112	0.046	0.30	OKAY
1st	13	10.5	18	0.088	2E+06	32	0.000136	83500	8	65	0.047	0.31	OKAY
1st	14	10.5	18	0.088	2E+06	77	0.001914	83500	8	155	0.068	0.44	OKAY
1st	15	10.5	7	0.115	2E+06	63	0.001049	83500	8	127	0.156	1.01	OKAY
1st	16	10.5	4	0.115	2E+06	63	0.001049	83500	8	127	0.284	1.84	OKAY
1st	17	10.5	4	0.115	2E+06	63	0.001049	83500	8	127	0.244	1.59	OKAY
1st	20	10.5	11	0.114	2E+06	64	0.001077	83500	8	128	0.103	0.67	OKAY
1st	21	10.5	5	0.114	2E+06	64	0.001077	83500	8	128	0.223	1.45	OKAY
1st	22	10.5	5	0.114	2E+06	64	0.001077	83500	8	128	0.201	1.31	OKAY
1st	23	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	24	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	25	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	26	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	27	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	28	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	29	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
1st	30	10.5	--------	0.088	2E+06	67	0.001219	83500	8	133	0.420	2.73	OKAY
2nd	1	10.5	29	0.088	2E+06	55	0.000681	83500	8	110	0.040	0.26	OKAY
2nd	3	10.5	4	0.114	2E+06	113	0.005924	83500	8	225	0.276	1.79	OKAY
2nd	4	10.5	8	0.088	2E+06	49	0.000468	83500	8	97	0.099	0.64	OKAY
2nd	5	10.5	41	0.114	2E+06	64	0.001065	83500	8	128	0.042	0.27	OKAY
2nd	6	10.5	8	0.114	2E+06	113	0.005924	83500	8	225	0.181	1.17	OKAY
2nd	7	10.5	5	0.115	2E+06	143	0.012116	83500	8	285	0.298	1.94	OKAY
2nd	8	10.5	4	0.088	2E+06	51	0.000539	83500	8	102	0.195	1.27	OKAY
2nd	11	10.5	6	0.115	2E+06	143	0.012116	83500	8	285	0.267	1.74	OKAY
2nd	12	10.5	4	0.088	2E+06	61	0.000924	83500	8	122	0.201	1.30	OKAY
2nd	13	10.5	5	0.114	2E+06	113	0.005924	83500	8	225	0.268	1.74	OKAY
2nd	14	10.5	21	0.088	2E+06	27	0.000084	83500	8	55	0.040	0.26	OKAY
2nd	15	10.5	14	0.088	2E+06	25	0.000060	83500	8	49	0.056	0.37	OKAY
2nd	16	10.5	21	0.088	2E+06	65	0.001125	83500	8	130	0.055	0.36	OKAY
2nd	17	10.5	13	0.088	2E+06	49	0.000468	83500	8	97	0.068	0.44	OKAY
2nd	18	10.5	12	0.115	2E+06	143	0.012116	83500	8	285	0.180	1.17	OKAY
2nd	19	10.5	9	0.114	2E+06	113	0.005924	83500	8	225	0.161	1.04	OKAY
2nd	20	10.5	5	0.088	2E+06	74	0.001649	83500	8	147	0.172	1.12	OKAY
2nd	21	10.5	5	0.088	2E+06	74	0.001649	83500	8	147	0.185	1.21	OKAY
2nd	22	10.5	4	0.088	2E+06	74	0.001649	83500	8	147	0.205	1.33	OKAY
2nd	23	10.5	3	0.088	2E+06	74	0.001649	83500	8	147	0.252	1.64	OKAY
2nd	24	10.5	8	0.088	2E+06	74	0.001649	83500	8	147	0.117	0.76	OKAY
3rd	1	10.5	13	0.088	2E+06	15	0.000013	83500	8	30	0.058	0.37	OKAY
3rd	2	10.5	11	0.088	2E+06	75	0.001717	83500	8	149	0.092	0.60	OKAY
3rd	3	10.5	6	0.088	2E+06	75	0.001717	83500	8	149	0.051	0.33	OKAY
3rd	4	10.5	4	0.088	2E+06	111	0.005739	83500	8	223	0.227	1.48	OKAY
3rd	5	10.5	4	0.088	2E+06	111	0.005739	83500	8	223	0.238	1.55	OKAY
3rd	6	10.5	13	0.088	2E+06	111	0.005739	83500	8	223	0.116	0.75	OKAY
3rd	7	10.5	28	0.088	2E+06	142	0.011913	83500	8	284	0.127	0.82	OKAY
3rd	8	10.5	7	0.088	2E+06	111	0.005739	83500	8	223	0.164	1.07	OKAY

3rd	9	10.5	3	0.088	2E+06	111	0.005739	83500	8	223	0.278	1.81	OKAY
Floor	**Wall**	**Area (in^2)**	**b (ft)**	**da (in)**	**E (psi)**	**vnail (lbf/nail)**	**en (in)**	**Gt (psi)**	**h (ft)**	**v (plf)**	**Deflection (in)**	**Drift (in)**	
3rd	10	10.5	8	0.088	2E+06	111	0.005739	83500	8	223	0.153	0.99	OKAY
3rd	11	10.5	6	0.088	2E+06	111	0.005739	83500	8	223	0.179	1.16	OKAY
3rd	12	10.5	28	0.088	2E+06	164	0.018542	83500	8	329	0.171	1.11	OKAY
3rd	13	10.5	7	0.088	2E+06	111	0.005739	83500	8	223	0.167	1.08	OKAY
3rd	14	10.5	11	0.088	2E+06	111	0.005739	83500	8	223	0.122	0.79	OKAY
3rd	15	10.5	8	0.088	2E+06	111	0.005739	83500	8	223	0.146	0.95	OKAY
3rd	16	10.5	10	0.088	2E+06	82	0.002237	83500	8	163	0.107	0.70	OKAY
3rd	17	10.5	3	0.088	2E+06	82	0.002237	83500	8	163	0.258	1.68	OKAY
3rd	18	10.5	8	0.088	2E+06	82	0.002237	83500	8	163	0.123	0.80	OKAY

APPENDIX J

Foundation Design Calculations

Foundation Design:
Load Distribution

Gridline	Column Size	Column Load (lb)	Column Load (k)	Load (k)/Gridline (L=60')
1	4x4	1820	1.82	38.163
	4x4	3302	3.302	
	4x4	6433	6.433	
	4x4	6013	6.013	
	4x4	6311	6.311	
	4x6	7742	7.742	
	4x4	6542	6.542	
2	4x4	5309	5.309	57.444
	4x6	9127	9.127	
	4x8	12702	12.702	
	4x6	8738	8.738	
	4x6	10067	10.067	
	4x8	11501	11.501	
3	4x6	10831	10.831	51.271
	4x4	3444	3.444	
	4x4	2483	2.483	
	4x8	13027	13.027	
	4x6	6808	6.808	
	4x4	2861	2.861	
	4x4	2177	2.177	
	4x4	3151	3.151	
	4x4	6489	6.489	
3.1	4x8	12921	12.921	42.233
	4x6	8133	8.133	
	4x4	3114	3.114	
	4x4	2608	2.608	
	4x4	1870	1.87	
	4x8	13587	13.587	
3.2	4x8	12258	12.258	32.376
	4x8	20118	20.118	
4	4x4	3180	3.18	44.913
	4x4	4242	4.242	
	4x4	5074	5.074	
	4x6	9164	9.164	
	4x4	4668	4.668	
	4x4	4147	4.147	
	4x4	4147	4.147	
	4x6	10291	10.291	
5	4x4	720	0.72	1.435
	4x4	715	0.715	
6	4x4	1098	1.098	2.196
	4x4	1098	1.098	

	GOVERNS

Maximum Load (k):	20.118
Minimum Load (k):	0.715

Foundation Design:
Load Distribution

Gridline	Column Size	Column Load (lb)	Column Load (k)	Load (k)/Gridline (W=45')
A	4x4	1820	1.82	33.398
	4x4	5309	5.309	
	4x6	10831	10.831	
	4x8	12258	12.258	
	4x4	3180	3.18	
B	4x4	3302	3.302	15.873
	4x6	9127	9.127	
	4x4	3444	3.444	
C	4x4	6433	6.433	69.443
	4x8	12702	12.702	
	4x8	13027	13.027	
	4x8	12921	12.921	
	4x8	20118	20.118	
	4x4	4242	4.242	
C1	4x4	5074	5.074	5.794
	4x4	720	0.72	
C1.5	4x4	6013	6.013	12.821
	4x6	6808	6.808	
C2	4x6	8133	8.133	18.012
	4x6	9164	9.164	
	4x4	715	0.715	
D	4x4	6311	6.311	23.632
	4x6	8738	8.738	
	4x4	2861	2.861	
	4x4	3114	3.114	
	4x4	2608	2.608	
E	4x6	7742	7.742	25.752
	4x6	10067	10.067	
	4x4	2177	2.177	
	4x4	4668	4.668	
	4x4	1098	1.098	
E1	4x4	3151	3.151	9.168
	4x4	1870	1.87	
	4x4	4147	4.147	
E2	4x4	6489	6.489	11.734
	4x4	4147	4.147	
	4x4	1098	1.098	
F	4x4	6542	6.542	41.921
	4x8	11501	11.501	
	4x8	13587	13.587	
	4x6	10291	10.291	

(yellow)	**GOVERNS**

Foundation Design:
Terzaghi Bearing Capacity

Maximum Load (k):	20.12
Minimum Load (k):	0.72

Layer	**Type of Soil**	**Depth of Layer from Surface**	**Height of Layer**	**N-Value**	**Phi (Degrees)**	**Gamma (pcf)**	**C (psf)**	**Terzaghi Factors from Pearson 3rd ed. Table 7.1**		
								Nc	**Nq**	**Ngamma**
1	Clay (CL)	0-30 ft	30	11	0	110	920	5.7	1	0
2	Clay (CL)	30-45 ft	15	35	0	120	1650	5.7	1	0
3	Sand (SP, SM, SC, CC)	45-50 ft	5	50	38	128	0	77.5	61.5	82.3

Because water table depth was not listed in the geotechnical report, assume it is very deep for calculations

Assume FS=3

Assume Df = 3'

Maximum Load Bearing Capacity (Square Footing):	
Formulas Used:	
Qall = Qult/FS	
P/B^2=Qult/3	
Qult=1.3*Nc*C+Gamma*Df*Nf+.4*Gamma*B*Ngamma	
Qult (psf):	7147.20
Qall (psf):	2382.40
B^2 (ft^2):	8.44
B (ft):	2.91

Minimum Load Bearing Capacity (Square Footing):	
Formulas Used:	
Qall = Qult/FS	
P/B^2=Qult/3	
Qult=1.3*Nc*C+Gamma*Df*Nf+.4*Gamma*B*Ngamma	
Qult (psf):	7147.20
Qall (psf):	2382.40
B^2 (ft^2):	0.30
B (ft):	0.55

Depth of Impact (z)	
Formula Used:	.1*Sigmazd=P/(B+z)^2
.1*Sigmazd =	223.53
(B+z)^2 =	90.00
B+z =	9.49
z (ft) =	6.49

Foundation Design:
Footing Sizes

*High differential settlement led to the design of a mat slab foundation

Qall (psf): 2382.4

[yellow] Bumped up footing size to be under Qall

Minimum Size: 18"

SQUARE FOOTING DIMENSIONS

Gridline	Column Size	Column Load (lb)	Column Load (k)	Calculated B (ft)	Actual B (ft)	Area (ft^2)	Weight of Footing (lb)	Check Qall
1	4x4	1820	1.82	0.87	1.5	2.25	1012.5	1258.89
	4x4	3302	3.3	1.18	1.5	2.25	1012.5	1917.56
	4x4	6433	6.43	1.64	2	4	1800	2058.25
	4x4	6013	6.01	1.59	2	4	1800	1953.25
	4x4	6311	6.31	1.63	2	4	1800	2027.75
	4x6	7742	7.74	1.8	2.5	6.25	2812.5	1688.72
	4x4	6542	6.54	1.66	2	4	1800	2085.5
2	4x4	5309	5.31	1.49	2	4	1800	1777.25
	4x6	9127	9.13	1.96	2.5	6.25	2812.5	1910.32
	4x8	12702	12.7	2.31	3	9	4050	1861.33
	4x6	8738	8.74	1.92	2.5	6.25	2812.5	1848.08
	4x6	10067	10.07	2.06	2.5	6.25	2812.5	2060.72
	4x8	11501	11.5	2.2	2.5	6.25	2812.5	2290.16
3	4x6	10831	10.83	2.13	2.5	6.25	2812.5	2182.96
	4x4	3444	3.44	1.2	1.5	2.25	1012.5	1980.67
	4x4	2483	2.48	1.02	1.5	2.25	1012.5	1553.56
	4x8	13027	13.03	2.34	3	9	4050	1897.44
	4x6	6808	6.81	1.69	2	4	1800	2152
	4x4	2861	2.86	1.1	1.5	2.25	1012.5	1721.56
	4x4	2177	2.18	0.96	1.5	2.25	1012.5	1417.56
	4x4	3151	3.15	1.15	1.5	2.25	1012.5	1850.44
	4x4	6489	6.49	1.65	2	4	1800	2072.25
3.1	4x8	12921	12.92	2.33	3	9	4050	1885.67
	4x6	8133	8.13	1.85	2.5	6.25	2812.5	1751.28
	4x4	3114	3.11	1.14	1.5	2.25	1012.5	1834
	4x4	2608	2.61	1.05	1.5	2.25	1012.5	1609.11
	4x4	1870	1.87	0.89	1.5	2.25	1012.5	1281.11
	4x8	13587	13.59	2.39	3	9	4050	1959.67
3.2	4x8	12258	12.26	2.27	3	9	4050	1812
	4x8	20118	20.12	2.91	3.5	12.25	5512.5	2092.29
4	4x4	3180	3.18	1.16	1.5	2.25	1012.5	1863.33
	4x4	4242	4.24	1.33	1.5	2.25	1012.5	2335.33
	4x4	5074	5.07	1.46	2	4	1800	1718.5
	4x6	9164	9.16	1.96	2.5	6.25	2812.5	1916.24
	4x4	4668	4.67	1.4	2	4	1800	1617
	4x4	4147	4.15	1.32	1.5	2.25	1012.5	2293.11
	4x4	4147	4.15	1.32	1.5	2.25	1012.5	2293.11
	4x6	10291	10.29	2.08	2.5	6.25	2812.5	2096.56
5	4x4	720	0.72	0.55	1.5	2.25	1012.5	770
	4x4	715	0.72	0.55	1.5	2.25	1012.5	767.78
6	4x4	1098	1.1	0.68	1.5	2.25	1012.5	938
	4x4	1098	1.1	0.68	1.5	2.25	1012.5	938

Foundation Design:
Mat Foundation

MAT FOUNDATION					
Gridline	Column Size	Column Load (lb)	Column Load (k)	X from G1 (ft)	Q*X (k-ft)
1	4x4	1820	1.82	0.00	0.00
	4x4	3302	3.30	0.00	0.00
	4x4	6433	6.43	0.00	0.00
	4x4	6013	6.01	0.00	0.00
	4x4	6311	6.31	0.00	0.00
	4x6	7742	7.74	0.00	0.00
	4x4	6542	6.54	0.00	0.00
2	4x4	5309	5.31	12.00	63.71
	4x6	9127	9.13	12.00	109.52
	4x8	12702	12.70	12.00	152.42
	4x6	8738	8.74	12.00	104.86
	4x6	10067	10.07	12.00	120.80
	4x8	11501	11.50	12.00	138.01
3	4x6	10831	10.83	20.58	222.94
	4x4	3444	3.44	20.58	70.89
	4x4	2483	2.48	20.58	51.11
	4x8	13027	13.03	20.58	268.14
	4x6	6808	6.81	20.58	140.13
	4x4	2861	2.86	20.58	58.89
	4x4	2177	2.18	20.58	44.81
	4x4	3151	3.15	20.58	64.86
	4x4	6489	6.49	20.58	133.57
3.1	4x8	12921	12.92	29.00	374.71
	4x6	8133	8.13	29.00	235.86
	4x4	3114	3.11	29.75	92.64
	4x4	2608	2.61	27.58	71.94
	4x4	1870	1.87	28.92	54.07
	4x8	13587	13.59	25.58	347.60
3.2	4x8	12258	12.26	35.00	429.03
	4x8	20118	20.12	35.00	704.13
4	4x4	3180	3.18	40.17	127.73
	4x4	4242	4.24	40.17	170.39
	4x4	5074	5.07	40.17	203.81
	4x6	9164	9.16	40.17	368.09
	4x4	4668	4.67	40.17	187.50
	4x4	4147	4.15	40.17	166.57
	4x4	4147	4.15	40.17	166.57
	4x6	10291	10.29	40.17	413.36
5	4x4	720	0.72	44.17	31.80
	4x4	715	0.72	44.17	31.58
6	4x4	1098	1.10	48.17	52.89
	4x4	1098	1.10	48.17	52.89

Foundation Design:
Mat Foundation

Qall (ksf):	2.38
Total Load (k):	270.03
X Bar (ft):	22.32

Minimum Dimensions	
Width of Mat (ft):	44.65
Length of Mat (ft):	14.41

Actual Dimensions	
Width of Mat (ft):	45.00
Length of Mat (ft):	60.00

For loads, use 1.6 factor (more conservative)

Governing Gridline		
Gridline	**Vu (k)**	**Mu (k-ft)**
2	18.9	118.2
C	28	132

Design for Gridline C:

Mat Slab Dimensions		
Unit	**ft**	**in**
L = Length:	60	720
B = Width:	45	540
H = Depth:	1	12

Gridline C Dimensions		
Unit	**ft**	**in**
L = Length:	45	540
B = Width:	7.5	90
H = Depth:	1	12

Steel Area	
As,min = .0018bh	
As,min (in^2)=	1.944

Bar Size Determnination		
Bar Size	**Area (in^2)**	**N (bars)**
3	0.11	17.67
4	0.2	9.72
5	0.31	6.27
6	0.44	4.42

Use (8) #5 bars	
Actual As (in^2):	2.48
Fy (ksi):	60
f'c (ksi):	2.5

Check Moment Capacity		
Phi:	0.9	
B1:	0.85	
d (in):	8.69	
a (in) = (AsFy)/(.85f'cb):	0.78	
c (in) = a/B1:	0.92	
Mn (k-in) = AsFy(d-a/2):	1234.81	
Mn (k-ft):	102.90	
Moment Capacity (k-ft):	92.61	< Mu so TRY AGAIN!

Use (10) #6 bars	
Actual As (in^2):	4.4
Fy (ksi):	60
f'c (ksi):	2.5

Check Moment Capacity		
Phi:	0.9	
B1:	0.85	
d (in):	8.63	
a (in) = (AsFy)/(.85f'cb):	1.38	
c (in) = a/B1:	1.62	
Mn (k-in) = AsFy(d-a/2):	2094.79	
Mn (k-ft):	174.57	
Moment Capacity (k-ft):	157.11	> Mu OKAY!

Transverse Reinforcement (#3 Ties)	
Area (in^2):	0.11
Spacing (in):	4
Fy (ksi):	60

Check Shear Capacity		
Phi:	0.75	
Gamma (Assume NW Con):	1	
Vc (k) = 2*Gamma*SQRT(f'c)bd:	77.63	
Phi*Vc/2:	29.11	
Vu<Phi*Vc/2:	No ties req'd so use min. reinf.	
Type of Shear? LOW	116.44	
Av (in^2) = 2As:	0.22	
Vs (k) = (AvFyd)/s:	28.46	
Vn (k) = Vc+Vs:	106.09	
Shear Capacity (k):	79.565625	>Vu so OKAY

Check Two-Way Shear		
Alpha:	40	
Max Column Load (k):	20.1	
Long Side of Column (in):	7.25	
Short Side of Column (in):	3.5	
Beta,c:	2.07	
d (in):	8.63	
d/2 (in):	4.31	
b0 (in):	38.75	
Vc (min of these 3) (k):	**65.69**	*GOVERNS
	182.20	
	66.84	
Phi*Vc (k):	50.13	> Vu so OKAY

Final Design: Use #6 bars @ 18" O.C. each way and #3 ties @ 4" O.C

GRIDLINE 2

Elements

Element	Length	Weight
A-B	60.000 ft	

Forces

Force	Direction	Size	Angle
F_1		8500.000 lb	270.0°
F_2		14600.000 lb	270.0°
F_3		20300.000 lb	270.0°
F_4		14000.000 lb	270.0°
F_5		16100.000 lb	270.0°
F_6		18400.000 lb	270.0°

Distributed Loads

Distributed Load	Direction	Size
Q_1		141000.000 lb (2350.000 lb/ft)
Q_2		49200.000 lb (820.000 lb/ft)

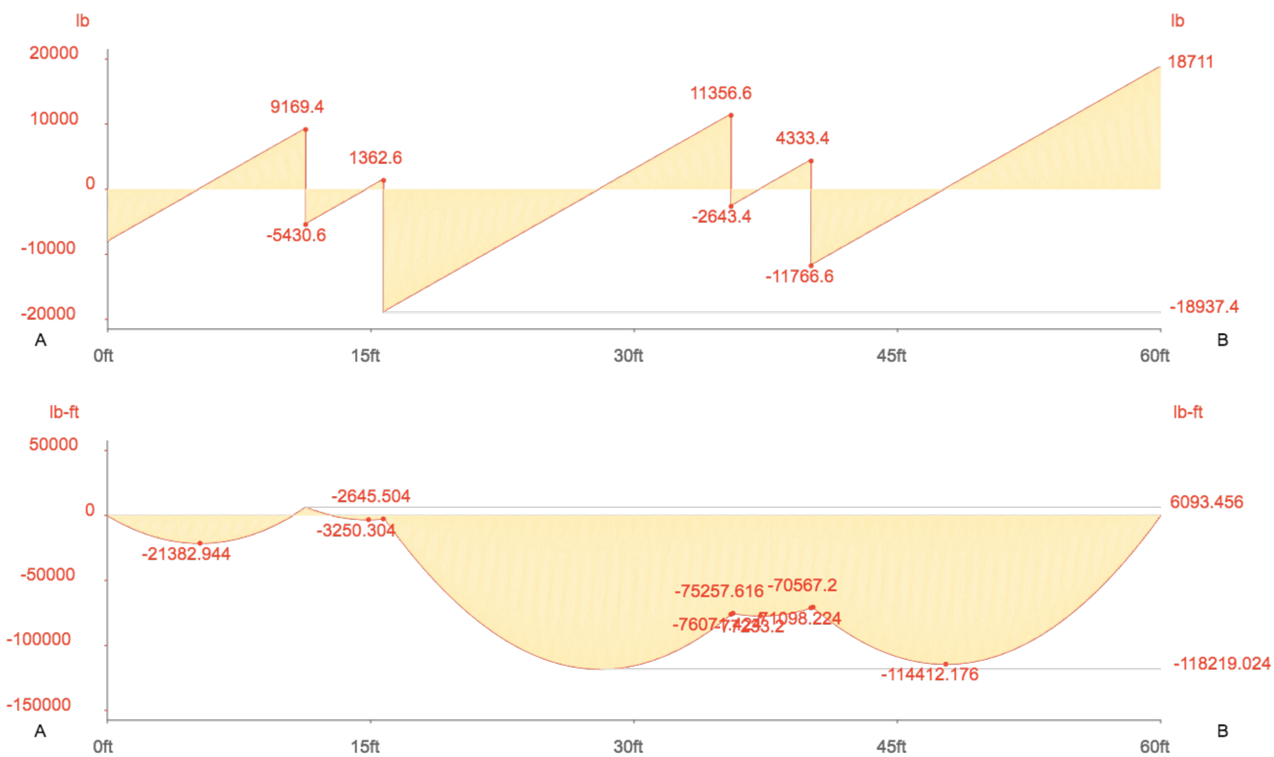
Results:

Reaction Forces

Force	Direction	Size	Angle
R_A		411.000 lb	90.0°
R_B		311.000 lb	270.0°

Equations	Results
$\sum M = 0 \Rightarrow 60.000 \times R_{B3[Y]} = -Q_{1[Y]} \times 30.000 - F_{2[Y]} \times 11.300 - F_{3[Y]} \times 15.800 - F_{4[Y]} \times 35.600 - F_{5[X]} \times 0.000 - F_{5[Y]} \times 40.200 - Q_{2[Y]} \times 30.000$	$R_{A3[X]} = -0.000$ lb
$\sum F_{[X]} = 0 \Rightarrow R_{A3[X]} + R_{B3[X]} = -Q_{1[X]} - F_{2[X]} - F_{3[X]} - F_{4[X]} - F_{5[X]} - Q_{2[X]}$	$R_{A3[Y]} = -8089.000$ lb
$\sum F_{[Y]} = 0 \Rightarrow R_{A3[Y]} + R_{B3[Y]} = -Q_{1[Y]} - F_{2[Y]} - F_{3[Y]} - F_{4[Y]} - F_{5[Y]} - Q_{2[Y]}$	$R_{B3[X]} = 0.000$ lb
$\sum F_{[X]} = 0 \Rightarrow R_{A[X]} - R_{A3[X]} = -F_{1[X]}$	$R_{B3[Y]} = -18711.000$ lb
$\sum F_{[Y]} = 0 \Rightarrow R_{A[Y]} - R_{A3[Y]} = -F_{1[Y]}$	
$\sum F_{[X]} = 0 \Rightarrow R_B \times \cos(270.0) - R_{B3[X]} = -F_{6[X]}$	
$\sum F_{[Y]} = 0 \Rightarrow R_B \times \sin(270.0) - R_{B3[Y]} = -F_{6[Y]}$	

Shear Force and Moment Diagram



Gridline C (W/ Foundation Weight)

Elements

Element	Length	Weight
A-B	45.000 ft	

Forces

Force	Direction	Size	Angle
F_1		10200.000 lb	270.0°
F_2		20300.000 lb	270.8°
F_3		20800.000 lb	270.8°
F_4		32200.000 lb	270.0°
F_5		6700.000 lb	270.0°
F_6		20600.000 lb	270.0°

Distributed Loads

Distributed Load	Direction	Size
Q_1		77625.000 lb (1725.000 lb/ft)
Q_2		218610.000 lb (4858.000 lb/ft)

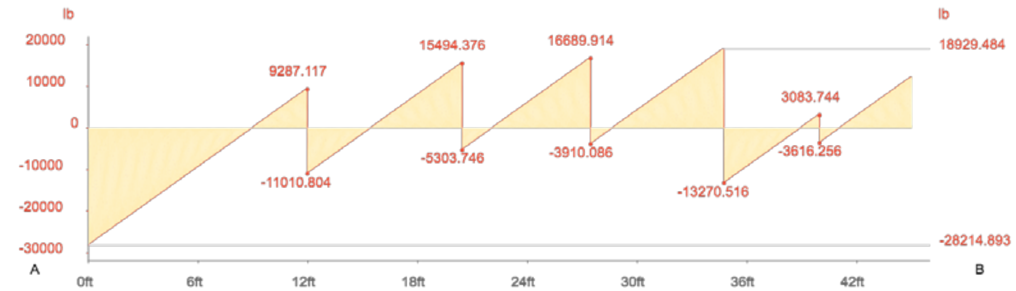
Results:

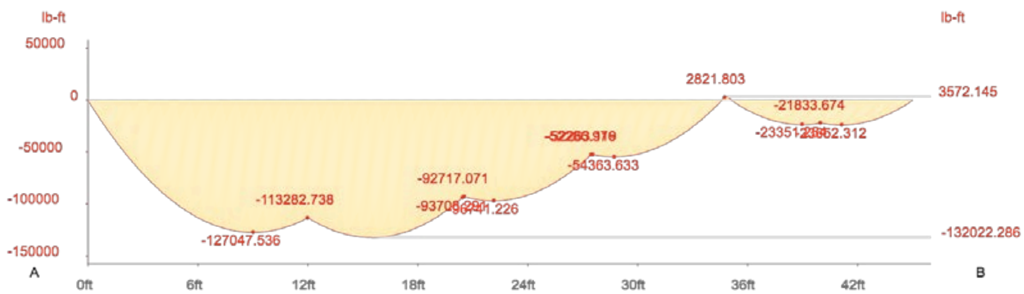
Reaction Forces

Force	Direction	Size	Angle
R_A		18023.908 lb	268.2°
R_B		12174.064 lb	270.0°

Equations	Results
$\sum M = 0 \Rightarrow 45.000 \times R_{B3[Y]} = -F_{2[Y]} \times 12.000 - F_{3[Y]} \times 20.500 - F_{4[Y]} \times$	$R_{A3[X]} = -569.988$ lb

$34.800 - F_{5[Y]} \times 40.000 - F_{6[Y]} \times 27.468 - Q_{1[Y]} \times 22.500 - Q_{2[Y]} \times 22.500$ $\sum F_{[X]} = 0 \Rightarrow R_{A3[X]} + R_{B3[X]} = -F_{2[X]} - F_{3[X]} - F_{4[X]} - F_{5[X]} - F_{6[X]} - Q_{1[X]} - Q_{2[X]}$ $\sum F_{[Y]} = 0 \Rightarrow R_{A3[Y]} + R_{B3[Y]} = -F_{2[Y]} - F_{3[Y]} - F_{4[Y]} - F_{5[Y]} - F_{6[Y]} - Q_{1[Y]} - Q_{2[Y]}$ $\sum F_{[X]} = 0 \Rightarrow R_{A[X]} - R_{A3[X]} = -F_{1[X]}$ $\sum F_{[Y]} = 0 \Rightarrow R_{A[Y]} - R_{A3[Y]} = -F_{1[Y]}$ $\sum F_{[X]} = 0 \Rightarrow R_B \times \cos(270.0) - R_{B3[X]} = 0$ $\sum F_{[Y]} = 0 \Rightarrow R_B \times \sin(270.0) - R_{B3[Y]} = 0$	$R_{A3[Y]} = -28214.893$ lb $R_{B3[X]} = -0.000$ lb $R_{B3[Y]} = -12174.064$ lb





SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date May 15, 2016
Identification Largest Load Settlement (G3.2-2)

Input

Units	E	E or SI
Shape	SQ	SQ, CI, CO, or RE
B =	3.5	ft
L =	3.5	ft
D =	3	ft
P =	20.12	k
Dw =	200	ft
r =	0.85	

Results

q =	2092	lb/ft^2
delta =	7.83	in

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	delta (in)
0.0	3.0				110							
3.0	3.5	0.96	0.192	920	110	0.25	1278	358	1759	2116	26.91	1.615
3.5	4.0	0.96	0.192	920	110	0.75	1333	413	1679	2091	24.28	1.457
4.0	4.5	0.96	0.192	920	110	1.25	1388	468	1482	1949	19.76	1.186
4.5	5.0	0.96	0.192	920	110	1.75	1443	523	1235	1758	14.20	0.852
5.0	5.5	0.96	0.192	920	110	2.25	1498	578	1003	1580	8.66	0.519
5.5	6.0	0.96	0.192	920	110	2.75	1553	633	809	1441	5.84	0.350
6.0	6.5	0.96	0.192	920	110	3.25	1608	688	656	1343	4.75	0.285
6.5	7.0	0.96	0.192	920	110	3.75	1663	743	537	1279	3.86	0.231
7.0	7.5	0.96	0.192	920	110	4.25	1718	798	444	1242	3.14	0.188
7.5	8.0	0.96	0.192	920	110	4.75	1773	853	372	1225	2.57	0.154
8.0	8.5	0.96	0.192	920	110	5.25	1828	908	315	1223	2.11	0.127
8.5	9.0	0.96	0.192	920	110	5.75	1883	963	270	1232	1.75	0.105
9.0	9.5	0.96	0.192	920	110	6.25	1938	1018	233	1251	1.46	0.088
9.5	10.0	0.96	0.192	920	110	6.75	1993	1073	203	1276	1.23	0.074
10.0	10.5	0.96	0.192	920	110	7.25	2048	1128	179	1306	1.04	0.063
10.5	11.0	0.96	0.192	920	110	7.75	2103	1183	158	1341	0.89	0.053
11.0	11.5	0.96	0.192	920	110	8.25	2158	1238	141	1378	0.76	0.046
11.5	12.0	0.96	0.192	920	110	8.75	2213	1293	126	1419	0.66	0.040
12.0	12.5	0.96	0.192	920	110	9.25	2268	1348	114	1461	0.57	0.034
12.5	13.0	0.96	0.192	920	110	9.75	2323	1403	103	1505	0.50	0.030
13.0	13.5	0.96	0.192	920	110	10.25	2378	1458	94	1551	0.44	0.026
13.5	14.0	0.96	0.192	920	110	10.75	2433	1513	85	1598	0.39	0.023
14.0	14.5	0.96	0.192	920	110	11.25	2488	1568	78	1646	0.35	0.021
14.5	15.0	0.96	0.192	920	110	11.75	2543	1623	72	1695	0.31	0.018
15.0	15.5	0.96	0.192	920	110	12.25	2598	1678	66	1744	0.28	0.017
15.5	16.0	0.96	0.192	920	110	12.75	2653	1733	61	1794	0.25	0.015
16.0	16.5	0.96	0.192	920	110	13.25	2708	1788	57	1845	0.22	0.013
16.5	17.0	0.96	0.192	920	110	13.75	2763	1843	53	1896	0.20	0.012
17.0	17.5	0.96	0.192	920	110	14.25	2818	1898	50	1947	0.18	0.011
17.5	18.0	0.96	0.192	920	110	14.75	2873	1953	46	1999	0.17	0.010
18.0	18.5	0.96	0.192	920	110	15.25	2928	2008	43	2051	0.15	0.009
18.5	19.0	0.96	0.192	920	110	15.75	2983	2063	41	2103	0.14	0.008
19.0	19.5	0.96	0.192	920	110	16.25	3038	2118	38	2156	0.13	0.008
19.5	20.0	0.96	0.192	920	110	16.75	3093	2173	36	2209	0.12	0.007
20.0	20.5	0.96	0.192	920	110	17.25	3148	2228	34	2262	0.11	0.006
20.5	21.0	0.96	0.192	920	110	17.75	3203	2283	32	2315	0.10	0.006
21.0	21.5	0.96	0.192	920	110	18.25	3258	2338	30	2368	0.09	0.006
21.5	22.0	0.96	0.192	920	110	18.75	3313	2393	29	2421	0.09	0.005
22.0	22.5	0.96	0.192	920	110	19.25	3368	2448	27	2475	0.08	0.005
22.5	23.0	0.96	0.192	920	110	19.75	3423	2503	26	2529	0.07	0.004
23.0	23.5	0.96	0.192	920	110	20.25	3478	2558	25	2582	0.07	0.004
23.5	24.0	0.96	0.192	920	110	20.75	3533	2613	24	2636	0.06	0.004
24.0	24.5	0.96	0.192	920	110	21.25	3588	2668	23	2690	0.06	0.004
24.5	25.0	0.96	0.192	920	110	21.75	3643	2723	22	2744	0.06	0.003

25.0	25.5	0.96	0.192	920	110	22.25	3698	2778	21	2798	0.05	0.003
25.5	26.0	0.96	0.192	920	110	22.75	3753	2833	20	2852	0.05	0.003
26.0	26.5	0.96	0.192	920	110	23.25	3808	2888	19	2906	0.05	0.003
26.5	27.0	0.96	0.192	920	110	23.75	3863	2943	18	2961	0.04	0.003
27.0	27.5	0.96	0.192	920	110	24.25	3918	2998	17	3015	0.04	0.002
27.5	28.0	0.96	0.192	920	110	24.75	3973	3053	17	3069	0.04	0.002
28.0	28.5	0.96	0.192	920	110	25.25	4028	3108	16	3124	0.04	0.002
28.5	29.0	0.96	0.192	920	110	25.75	4083	3163	15	3178	0.03	0.002
29.0	29.5	0.96	0.192	920	110	26.25	4138	3218	15	3232	0.03	0.002
29.5	30.0	0.96	0.192	920	110	26.75	4193	3273	14	3287	0.03	0.002
30.0	30.5	0.96	0.192	1650	120	27.25	4980	3330	14	3344	0.03	0.002
30.5	31.0	0.96	0.192	1650	120	27.75	5040	3390	13	3403	0.03	0.002
31.0	31.5	0.96	0.192	1650	120	28.25	5100	3450	13	3463	0.03	0.002
31.5	32.0	0.96	0.192	1650	120	28.75	5160	3510	12	3522	0.02	0.001
32.0	32.5	0.96	0.192	1650	120	29.25	5220	3570	12	3582	0.02	0.001
32.5	33.0	0.96	0.192	1650	120	29.75	5280	3630	12	3642	0.02	0.001
33.0	33.5	0.96	0.192	1650	120	30.25	5340	3690	11	3701	0.02	0.001
33.5	34.0	0.96	0.192	1650	120	30.75	5400	3750	11	3761	0.02	0.001
34.0	34.5	0.96	0.192	1650	120	31.25	5460	3810	11	3821	0.02	0.001
34.5	35.0	0.96	0.192	1650	120	31.75	5520	3870	10	3880	0.02	0.001
35.0	35.5	0.96	0.192	1650	120	32.25	5580	3930	10	3940	0.02	0.001
35.5	36.0	0.96	0.192	1650	120	32.75	5640	3990	10	4000	0.02	0.001
36.0	36.5	0.96	0.192	1650	120	33.25	5700	4050	9	4059	0.02	0.001
36.5	37.0	0.96	0.192	1650	120	33.75	5760	4110	9	4119	0.02	0.001
37.0	37.5	0.96	0.192	1650	120	34.25	5820	4170	9	4179	0.01	0.001
37.5	38.0	0.96	0.192	1650	120	34.75	5880	4230	9	4239	0.01	0.001
38.0	38.5	0.96	0.192	1650	120	35.25	5940	4290	8	4298	0.01	0.001
38.5	39.0	0.96	0.192	1650	120	35.75	6000	4350	8	4358	0.01	0.001
39.0	39.5	0.96	0.192	1650	120	36.25	6060	4410	8	4418	0.01	0.001
39.5	40.0	0.96	0.192	1650	120	36.75	6120	4470	8	4478	0.01	0.001
40.0	40.5	0.96	0.192	1650	120	37.25	6180	4530	7	4537	0.01	0.001
40.5	41.0	0.96	0.192	1650	120	37.75	6240	4590	7	4597	0.01	0.001
41.0	41.5	0.96	0.192	1650	120	38.25	6300	4650	7	4657	0.01	0.001
41.5	42.0	0.96	0.192	1650	120	38.75	6360	4710	7	4717	0.01	0.001
42.0	42.5	0.96	0.192	1650	120	39.25	6420	4770	7	4777	0.01	0.001
42.5	43.0	0.96	0.192	1650	120	39.75	6480	4830	7	4837	0.01	0.001
43.0	43.5	0.96	0.192	1650	120	40.25	6540	4890	6	4896	0.01	0.001
43.5	44.0	0.96	0.192	1650	120	40.75	6600	4950	6	4956	0.01	0.001
44.0	44.5	0.96	0.192	1650	120	41.25	6660	5010	6	5016	0.01	0.001
44.5	45.0	0.96	0.192	1650	120	41.75	6720	5070	6	5076	0.01	0.000
45.0	45.5	0.96	0.192	0	128	42.25	5132	5132	6	5138	0.04	0.002
45.5	46.0	0.96	0.192	0	128	42.75	5196	5196	6	5202	0.04	0.002
46.0	46.5	0.96	0.192	0	128	43.25	5260	5260	5	5265	0.04	0.002
46.5	47.0	0.96	0.192	0	128	43.75	5324	5324	5	5329	0.04	0.002
47.0	47.5	0.96	0.192	0	128	44.25	5388	5388	5	5393	0.03	0.002
47.5	48.0	0.96	0.192	0	128	44.75	5452	5452	5	5457	0.03	0.002
48.0	48.5	0.96	0.192	0	128	45.25	5516	5516	5	5521	0.03	0.002
48.5	49.0	0.96	0.192	0	128	45.75	5580	5580	5	5585	0.03	0.002
49.0	49.5	0.96	0.192	0	128	46.25	5644	5644	5	5649	0.03	0.002
49.5	50.0	0.96	0.192	0	128	46.75	5708	5708	5	5713	0.03	0.002
50.0	50.5	0.96	0.192	0	128	47.25	5772	5772	5	5777	0.03	0.002
50.5	51.0	0.96	0.192	0	128	47.75	5836	5836	5	5841	0.03	0.002
51.0	51.5	0.96	0.192	0	128	48.25	5900	5900	4	5904	0.03	0.002
51.5	52.0	0.96	0.192	0	128	48.75	5964	5964	4	5968	0.03	0.002
52.0	52.5	0.96	0.192	0	128	49.25	6028	6028	4	6032	0.02	0.001
52.5	53.0	0.96	0.192	0	128	49.75	6092	6092	4	6096	0.02	0.001
53.0	53.5	0.96	0.192	0	128	50.25	6156	6156	4	6160	0.02	0.001
53.5	54.0	0.96	0.192	0	128	50.75	6220	6220	4	6224	0.02	0.001
54.0	54.5	0.96	0.192	0	128	51.25	6284	6284	4	6288	0.02	0.001
54.5	55.0	0.96	0.192	0	128	51.75	6348	6348	4	6352	0.02	0.001
55.0	55.5	0.96	0.192	0	128	52.25	6412	6412	4	6416	0.02	0.001
55.5	56.0	0.96	0.192	0	128	52.75	6476	6476	4	6480	0.02	0.001

SETTLEMENT ANALYSIS OF SHALLOW FOUNDATIONS
Classical Method

Date May 15, 2016
Identification Load Settlement to Right (1) (G4-2)

Input

Units	E	E or SI
Shape	SQ	SQ, CI, CO, or RE
B =	1.5	ft
L =	1.5	ft
D =	3	ft
P =	0.72	k
Dw =	200	ft
r =	0.85	

Results

q = 770 lb/ft^2
delta = 1.01 in

Depth to Soil Layer Top (ft)	Bottom (ft)	Cc/(1+e)	Cr/(1+e)	sigma m' (lb/ft^2)	gamma (lb/ft^3)	zf (ft)	sigma c' (lb/ft^2)	sigma zo' (lb/ft^2)	delta sigma (lb/ft^2)	sigma zf' (lb/ft^2)	strain (%)	delta (in)
0.0	3.0				110							
3.0	3.5	0.96	0.192	920	110	0.25	1278	358	429	787	5.59	0.335
3.5	4.0	0.96	0.192	920	110	0.75	1333	413	308	721	3.96	0.237
4.0	4.5	0.96	0.192	920	110	1.25	1388	468	188	656	2.40	0.144
4.5	5.0	0.96	0.192	920	110	1.75	1443	523	118	640	1.44	0.087
5.0	5.5	0.96	0.192	920	110	2.25	1498	578	79	656	0.91	0.054
5.5	6.0	0.96	0.192	920	110	2.75	1553	633	56	688	0.60	0.036
6.0	6.5	0.96	0.192	920	110	3.25	1608	688	41	729	0.41	0.025
6.5	7.0	0.96	0.192	920	110	3.75	1663	743	32	774	0.29	0.018
7.0	7.5	0.96	0.192	920	110	4.25	1718	798	25	822	0.22	0.013
7.5	8.0	0.96	0.192	920	110	4.75	1773	853	20	873	0.17	0.010
8.0	8.5	0.96	0.192	920	110	5.25	1828	908	17	924	0.13	0.008
8.5	9.0	0.96	0.192	920	110	5.75	1883	963	14	976	0.10	0.006
9.0	9.5	0.96	0.192	920	110	6.25	1938	1018	12	1029	0.08	0.005
9.5	10.0	0.96	0.192	920	110	6.75	1993	1073	10	1083	0.07	0.004
10.0	10.5	0.96	0.192	920	110	7.25	2048	1128	9	1136	0.06	0.003
10.5	11.0	0.96	0.192	920	110	7.75	2103	1183	8	1190	0.05	0.003
11.0	11.5	0.96	0.192	920	110	8.25	2158	1238	7	1244	0.04	0.002
11.5	12.0	0.96	0.192	920	110	8.75	2213	1293	6	1299	0.03	0.002
12.0	12.5	0.96	0.192	920	110	9.25	2268	1348	5	1353	0.03	0.002
12.5	13.0	0.96	0.192	920	110	9.75	2323	1403	5	1407	0.02	0.001
13.0	13.5	0.96	0.192	920	110	10.25	2378	1458	4	1462	0.02	0.001
13.5	14.0	0.96	0.192	920	110	10.75	2433	1513	4	1517	0.02	0.001
14.0	14.5	0.96	0.192	920	110	11.25	2488	1568	4	1571	0.02	0.001
14.5	15.0	0.96	0.192	920	110	11.75	2543	1623	3	1626	0.01	0.001
15.0	15.5	0.96	0.192	920	110	12.25	2598	1678	3	1681	0.01	0.001
15.5	16.0	0.96	0.192	920	110	12.75	2653	1733	3	1735	0.01	0.001
16.0	16.5	0.96	0.192	920	110	13.25	2708	1788	3	1790	0.01	0.001
16.5	17.0	0.96	0.192	920	110	13.75	2763	1843	2	1845	0.01	0.001
17.0	17.5	0.96	0.192	920	110	14.25	2818	1898	2	1900	0.01	0.001
17.5	18.0	0.96	0.192	920	110	14.75	2873	1953	2	1955	0.01	0.000
18.0	18.5	0.96	0.192	920	110	15.25	2928	2008	2	2010	0.01	0.000
18.5	19.0	0.96	0.192	920	110	15.75	2983	2063	2	2064	0.01	0.000
19.0	19.5	0.96	0.192	920	110	16.25	3038	2118	2	2119	0.01	0.000
19.5	20.0	0.96	0.192	920	110	16.75	3093	2173	2	2174	0.01	0.000
20.0	20.5	0.96	0.192	920	110	17.25	3148	2228	2	2229	0.01	0.000
20.5	21.0	0.96	0.192	920	110	17.75	3203	2283	1	2284	0.00	0.000
21.0	21.5	0.96	0.192	920	110	18.25	3258	2338	1	2339	0.00	0.000
21.5	22.0	0.96	0.192	920	110	18.75	3313	2393	1	2394	0.00	0.000
22.0	22.5	0.96	0.192	920	110	19.25	3368	2448	1	2449	0.00	0.000
22.5	23.0	0.96	0.192	920	110	19.75	3423	2503	1	2504	0.00	0.000
23.0	23.5	0.96	0.192	920	110	20.25	3478	2558	1	2559	0.00	0.000
23.5	24.0	0.96	0.192	920	110	20.75	3533	2613	1	2614	0.00	0.000
24.0	24.5	0.96	0.192	920	110	21.25	3588	2668	1	2669	0.00	0.000
24.5	25.0	0.96	0.192	920	110	21.75	3643	2723	1	2723	0.00	0.000
25.0	25.5	0.96	0.192	920	110	22.25	3698	2778	1	2778	0.00	0.000
25.5	26.0	0.96	0.192	920	110	22.75	3753	2833	1	2833	0.00	0.000
26.0	26.5	0.96	0.192	920	110	23.25	3808	2888	1	2888	0.00	0.000
26.5	27.0	0.96	0.192	920	110	23.75	3863	2943	1	2943	0.00	0.000
27.0	27.5	0.96	0.192	920	110	24.25	3918	2998	1	2998	0.00	0.000

27.5	28.0	0.96	0.192	920	110	24.75	3973	3053	1	3053	0.00	0.000
28.0	28.5	0.96	0.192	920	110	25.25	4028	3108	1	3108	0.00	0.000
28.5	29.0	0.96	0.192	920	110	25.75	4083	3163	1	3163	0.00	0.000
29.0	29.5	0.96	0.192	920	110	26.25	4138	3218	1	3218	0.00	0.000
29.5	30.0	0.96	0.192	920	110	26.75	4193	3273	1	3273	0.00	0.000
30.0	30.5	0.96	0.192	1650	120	27.25	4980	3330	1	3331	0.00	0.000
30.5	31.0	0.96	0.192	1650	120	27.75	5040	3390	1	3391	0.00	0.000
31.0	31.5	0.96	0.192	1650	120	28.25	5100	3450	1	3451	0.00	0.000
31.5	32.0	0.96	0.192	1650	120	28.75	5160	3510	1	3511	0.00	0.000
32.0	32.5	0.96	0.192	1650	120	29.25	5220	3570	1	3571	0.00	0.000
32.5	33.0	0.96	0.192	1650	120	29.75	5280	3630	1	3631	0.00	0.000
33.0	33.5	0.96	0.192	1650	120	30.25	5340	3690	1	3691	0.00	0.000
33.5	34.0	0.96	0.192	1650	120	30.75	5400	3750	0	3750	0.00	0.000
34.0	34.5	0.96	0.192	1650	120	31.25	5460	3810	0	3810	0.00	0.000
34.5	35.0	0.96	0.192	1650	120	31.75	5520	3870	0	3870	0.00	0.000
35.0	35.5	0.96	0.192	1650	120	32.25	5580	3930	0	3930	0.00	0.000
35.5	36.0	0.96	0.192	1650	120	32.75	5640	3990	0	3990	0.00	0.000
36.0	36.5	0.96	0.192	1650	120	33.25	5700	4050	0	4050	0.00	0.000
36.5	37.0	0.96	0.192	1650	120	33.75	5760	4110	0	4110	0.00	0.000
37.0	37.5	0.96	0.192	1650	120	34.25	5820	4170	0	4170	0.00	0.000
37.5	38.0	0.96	0.192	1650	120	34.75	5880	4230	0	4230	0.00	0.000
38.0	38.5	0.96	0.192	1650	120	35.25	5940	4290	0	4290	0.00	0.000
38.5	39.0	0.96	0.192	1650	120	35.75	6000	4350	0	4350	0.00	0.000
39.0	39.5	0.96	0.192	1650	120	36.25	6060	4410	0	4410	0.00	0.000
39.5	40.0	0.96	0.192	1650	120	36.75	6120	4470	0	4470	0.00	0.000
40.0	40.5	0.96	0.192	1650	120	37.25	6180	4530	0	4530	0.00	0.000
40.5	41.0	0.96	0.192	1650	120	37.75	6240	4590	0	4590	0.00	0.000
41.0	41.5	0.96	0.192	1650	120	38.25	6300	4650	0	4650	0.00	0.000
41.5	42.0	0.96	0.192	1650	120	38.75	6360	4710	0	4710	0.00	0.000
42.0	42.5	0.96	0.192	1650	120	39.25	6420	4770	0	4770	0.00	0.000
42.5	43.0	0.96	0.192	1650	120	39.75	6480	4830	0	4830	0.00	0.000
43.0	43.5	0.96	0.192	1650	120	40.25	6540	4890	0	4890	0.00	0.000
43.5	44.0	0.96	0.192	1650	120	40.75	6600	4950	0	4950	0.00	0.000
44.0	44.5	0.96	0.192	1650	120	41.25	6660	5010	0	5010	0.00	0.000
44.5	45.0	0.96	0.192	1650	120	41.75	6720	5070	0	5070	0.00	0.000
45.0	45.5	0.96	0.192	0	128	42.25	5132	5132	0	5132	0.00	0.000
45.5	46.0	0.96	0.192	0	128	42.75	5196	5196	0	5196	0.00	0.000
46.0	46.5	0.96	0.192	0	128	43.25	5260	5260	0	5260	0.00	0.000
46.5	47.0	0.96	0.192	0	128	43.75	5324	5324	0	5324	0.00	0.000
47.0	47.5	0.96	0.192	0	128	44.25	5388	5388	0	5388	0.00	0.000
47.5	48.0	0.96	0.192	0	128	44.75	5452	5452	0	5452	0.00	0.000
48.0	48.5	0.96	0.192	0	128	45.25	5516	5516	0	5516	0.00	0.000
48.5	49.0	0.96	0.192	0	128	45.75	5580	5580	0	5580	0.00	0.000
49.0	49.5	0.96	0.192	0	128	46.25	5644	5644	0	5644	0.00	0.000
49.5	50.0	0.96	0.192	0	128	46.75	5708	5708	0	5708	0.00	0.000
50.0	50.5	0.96	0.192	0	128	47.25	5772	5772	0	5772	0.00	0.000
50.5	51.0	0.96	0.192	0	128	47.75	5836	5836	0	5836	0.00	0.000
51.0	51.5	0.96	0.192	0	128	48.25	5900	5900	0	5900	0.00	0.000
51.5	52.0	0.96	0.192	0	128	48.75	5964	5964	0	5964	0.00	0.000
52.0	52.5	0.96	0.192	0	128	49.25	6028	6028	0	6028	0.00	0.000
52.5	53.0	0.96	0.192	0	128	49.75	6092	6092	0	6092	0.00	0.000
53.0	53.5	0.96	0.192	0	128	50.25	6156	6156	0	6156	0.00	0.000
53.5	54.0	0.96	0.192	0	128	50.75	6220	6220	0	6220	0.00	0.000
54.0	54.5	0.96	0.192	0	128	51.25	6284	6284	0	6284	0.00	0.000
54.5	55.0	0.96	0.192	0	128	51.75	6348	6348	0	6348	0.00	0.000
55.0	55.5	0.96	0.192	0	128	52.25	6412	6412	0	6412	0.00	0.000
55.5	56.0	0.96	0.192	0	128	52.75	6476	6476	0	6476	0.00	0.000

Steel Strength of Anchor Bolt in Shear	
n	1
Ase,v (in^2)	0.226
futa (psi)	114000
Vsa (lb)	15458.4

Simplified Development Length	
Fy	60000
Db (in)	6
ld (in)	7.35
USE 7" DEVELOPMENT LENGTH	

Steel Strength of Anchor Bolt in Tension	
n	1
Ase,n (in^2)	0.23
futa (psi)	114000
Nsa (lb)	25764

Concrete Breakout Strength of Anchor in Tension	
Anc (in^2)	441
Anco (in^2)	441
Ψedn	0.81
Ψcn	1.25
Ψcpn	17.50
Nb (lb)	22224.31
Ncb (lb)	395870.54

Concrete Pullout Strength of Anchor in Tension	
Ψc,p	1.40
Np (lb)	2636.72
Npn (lb)	3691.41

Side-Face Blowout Strength	
Ca1 (in)	7
Abrg (in^2)	0.31
f'c (psi)	2500
Nsb (lb)	31018

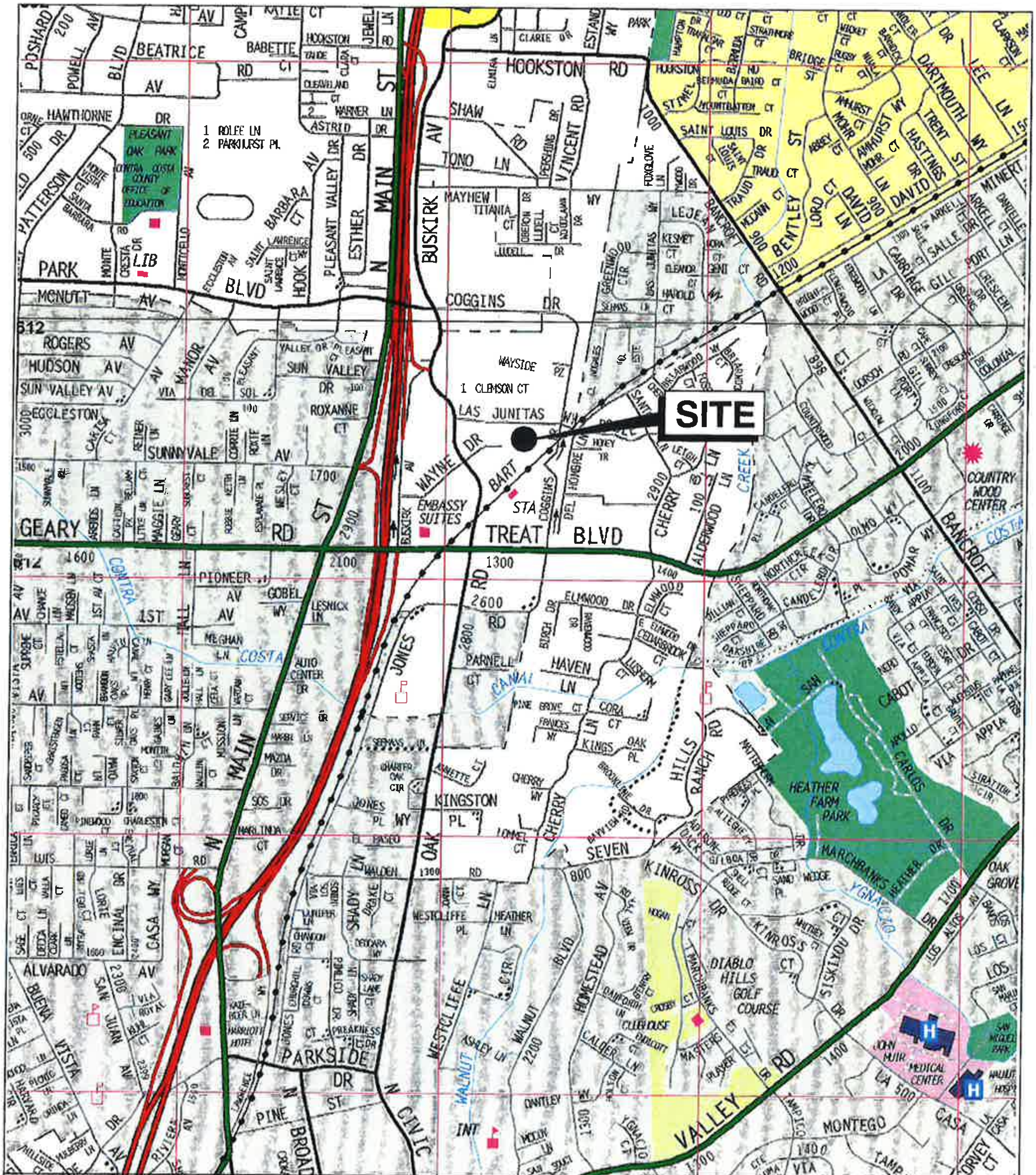
Pullout Controls
5/8 bolts at 16" o.c.

USE CODE MINIMUM 48" O.C.

APPENDIX K

Geotechnical Report

Courtesy of Treadwell and Rollo



Base map: The Thomas Guide
Contra Costa County
1999

0 1/4 1/2 Mile

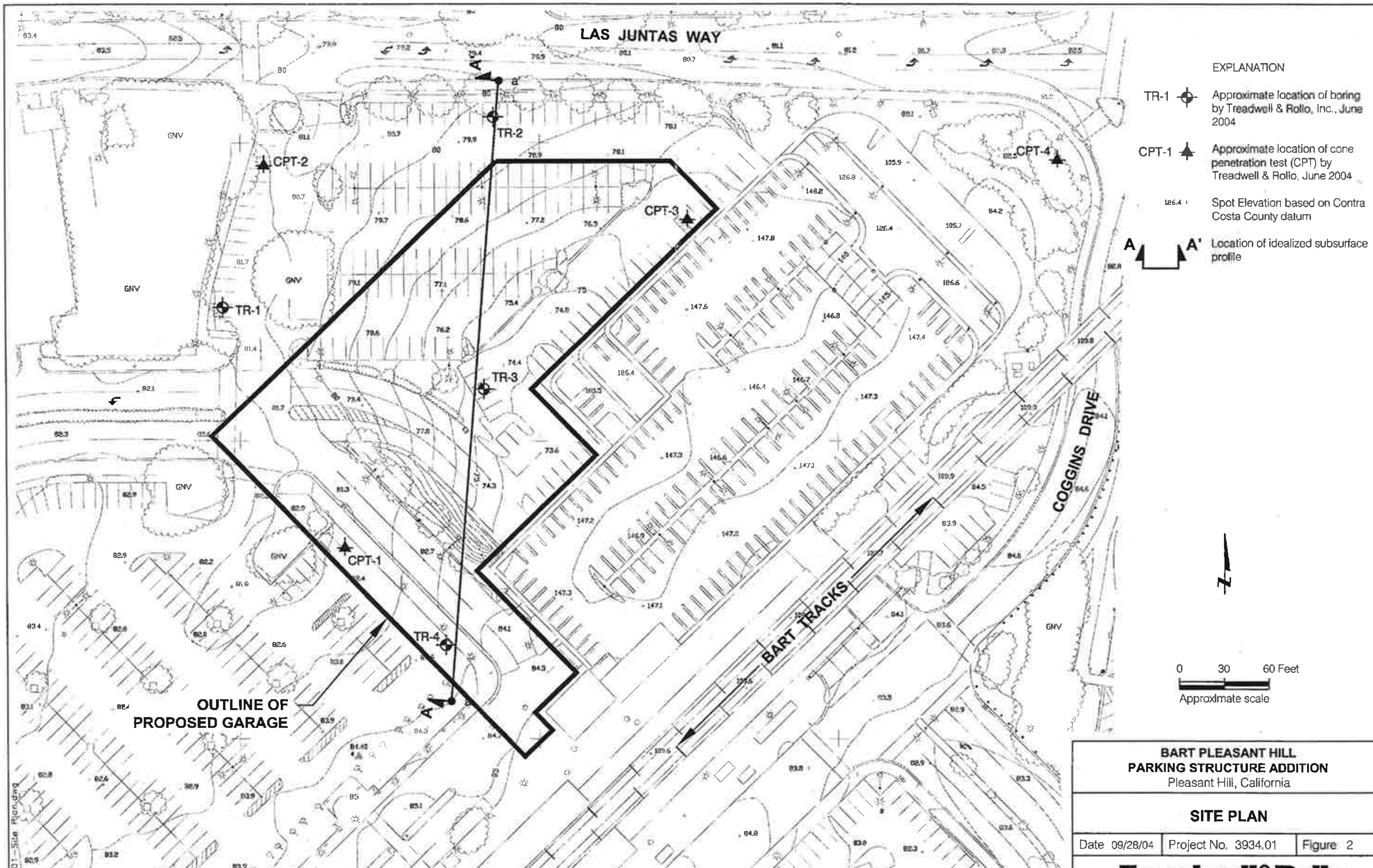
Approximate scale

BART PLEASANT HILL
PARKING STRUCTURE ADDITION
Pleasant Hill, California

Treadwell&Rollo

SITE LOCATION MAP

Date 9/28/04	Project No. 3934.01	Figure 1



Reference: "Boundary and Topographic Survey of the Pleasant Hill BART Station", by Luk and Associates dated December 2003.

BART PLEASANT HILL
PARKING STRUCTURE ADDITION
Pleasant Hill, California

SITE PLAN

Date 09/28/04	Project No. 3934.01	Figure 2

Treadwell&Rollo

PROJECT: **BART PLEASANT HILL PARKING STRUCTURE ADDITION**
Pleasant Hill

Log of Boring TR-2

Boring location: See Site Plan, Figure 2

Logged by: P. Levine

Date started: 6/10/04 | Date finished: 6/10/04

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30-inches | Hammer type: Rope & Pulley, Safety

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Pitcher Tube (Core)

Ground Surface Elevation: 79.9 feet[2]

DEPTH (feet)	Sampler Type	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0				3-inches of Asphalt Concrete						
				11-inches of Aggregate Baserock						
1–2	SPT	28	CL	CLAY (CL) black, very stiff, moist, trace silt						
5–6	S&H	45	CL	becomes hard LL=56, PI=35						
8–9			SM	SILTY SAND (SM) orange brown, medium dense, moist, fine-medium grained sand						
9–10	S&H	18	CL	SANDY CLAY (CL) yellow brown, very stiff, moist, silty						
13–15	S&H	22	SP-SM /CL	SAND with SILT (SP-SM) yellow brown, medium dense, moist, silty sand interbeds, with 1/4 inch CLAY (CL) lenses yellow brown, very stiff, moist, with trace fine sand						
17–20	SPT	42	GW	GRAVEL (GW) gray brown, dense, wet, silty sandy gravel, medium to coarse grained gravel						
22–25	S&H	50/ 11"	SM	SILTY SAND (SM) gray brown, very dense, moist, silty fine sand				11.8	19.3	
27–30	SPT	15	MH	SILT (MH) gray brown, stiff, moist, clayey silt, trace brown peat						

Treadwell&Rollo

Project No.: 3934.01 | Figure: A-2a

PROJECT:	BART PLEASANT HILL PARKING STRUCTURE ADDITION Pleasant Hill	Log of Boring TR-2

DEPTH (feet)	Sampler Type	Sample	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
30–32	SPT		15	MH	SILT (MH) (continued)						
32–35	S&H		31	GW	GRAVEL (GW) gray, dense, moist, well graded sandy gravel						
35–39				CL	CLAY (CL) gray, very stiff, moist, sandy, gravelly, clay						
40	S&H		16	CL	olive gray, stiff, moist, with trace silt and fine gravel	TxUU	4,000	570		30.9	93
45	S&H		21	CL	very stiff, lenses of fine sand	TxUU	4,500	490		22.8	105
50	S&H		15	CL	trace fine sand						
52.5–60	SPT		50/ 2.5"		SANDSTONE olive-brown to yellow brown, crushed, low hardness, friable, deep weathering						
58–60	CORE										

Boring terminated at 60 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscured by rotary wash drilling method.

[1] S&H blow counts converted to SPT N-Values using a factor of 0.6.
[2] Elevations based on Contra Costa County datum as shown on survey by Luk and Associates dated December 2003.

Treadwell&Rollo

Project No.: 3934.01 | Figure: A-2b

TEST GEOTECH LOG 393401.GPJ TR.GDT 9/28/04

PROJECT: **BART PLEASANT HILL PARKING STRUCTURE ADDITION** Pleasant Hill

Log of Boring TR-3

Boring location: See Site Plan, Figure 2

Logged by: P. Levine

Date started: 6/10/04 | Date finished: 6/11/04

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30-inches | Hammer type: Rope & Pulley, Safety

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Pitcher Tube (Core)

Ground Surface Elevation: 75.0 feet[2]

DEPTH (feet)	Sampler Type	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0–1				3-inches of Asphalt Concrete 9-inches of Aggregate Baserock						
1–3	SPT	15		CLAY (CL) dark brown, very stiff, moist, with trace fine sand and silt						
4–6	S&H	22	CL	yellow brown LL=35, PI=15						
7–9				SANDY CLAY with SILT (CL) yellow-brown, stiff, moist						
9–11	S&H	10		wet						
14–16	S&H	10	CL					58.5	27.4	96
19–21	SPT	11		trace fine gravel						
24				CLAY (CL) olive gray, stiff, wet, with trace sand						
25–26	CORE	150 psi			Consol				23.1	97
27			CL							
29–30	S&H	33		very stiff, with trace gravel					22.9	105

Treadwell&Rollo

Project No.: 3934.01 | Figure: A-3a

PROJECT: **BART PLEASANT HILL PARKING STRUCTURE ADDITION**
Pleasant Hill

Log of Boring TR-3

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
30–31	S&H		33	CL	CLAY (CL) (continued)						
35	S&H		37	CL	hard	TxUU	3,500	1,650		30.4	91
40	S&H		24	CL	gray-brown, very stiff						
42.5				SW/GW	SAND (SW)/ GRAVEL (GW) olive gray, very dense, wet, sand and gravel mix, trace silt						
45	SPT		58	SW/GW							
50	SPT		43	SW/GW	dense						
52	SPT		50/ 2"	SW/GW	very dense						
57	CORE			SW/GW							
58					SANDSTONE gray, closely to moderately fractured, moderately hard, weak, moderate weathering, wet						
58.5	SPT		50/ 3"								
60											

Boring terminated at 58.75 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscured by rotary wash drilling method.

[1] S&H blow counts converted to SPT N-Values using a factor of 0.6.
[2] Elevations based on Contra Costa County datum as shown on survey by Luk and Associates dated December 2003.

Treadwell&Rollo

Project No.: 3934.01 | Figure: A-3b

PROJECT:	BART PLEASANT HILL PARKING STRUCTURE ADDITION Pleasant Hill	Log of Boring TR-4	PAGE 1 OF 3

Boring location: See Site Plan, Figure 2

Logged by: P. Levine

Date started: 6/11/04 | Date finished: 6/11/04

Drilling method: Rotary Wash

Hammer weight/drop: 140 lbs./30-inches | Hammer type: Rope & Pulley, Safety

Sampler: Sprague & Henwood (S&H), Standard Penetration Test (SPT), Pitcher Tube (Core)

Ground Surface Elevation: 83.6 feet [2]

DEPTH (feet)	Sampler Type	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
0				3-inches of Asphalt Concrete						
0.25				9-inches of Aggregate Baserock						
1			CL	CLAY (CL) black very stiff, moist, with trace silt						
2–3	SPT	29		R-Value = 7, see Appendix C						
5–6.5	S&H	28								
9–10	S&H	28		dark brown				24.4	100	
13				CLAY with SAND (CL) yellow brown, stiff, wet, with trace silt						
14–15	S&H	10			Consol				26.4	91
19–20.5	S&H	10								
24–25	S&H	10			TxUU	2,500	920		27.4	96
28			CL	CLAY with SAND and SILT (CL) yellow brown, stiff, wet						
29–30	S&H	10								

Treadwell&Rollo

Project No.: 3934.01

Figure: A-4a

TEST GEOTECH LOG 393401.GPJ TR.GDT 10/5/04

PROJECT:	BART PLEASANT HILL PARKING STRUCTURE ADDITION Pleasant Hill	**Log of Boring TR-4**

DEPTH (feet)	SAMPLES: Sampler Type	SAMPLES: Sample	SAMPLES: SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
	S&H		10								
31–33				SC	CLAYEY SAND (SC) yellow brown, medium dense, moist to wet						
34				GW	interbedded lense of fine-coarse gravel (GW)						
35–38	S&H		27	SM	SILTY SAND (SM) yellow brown, medium dense, moist to wet, trace clay				18.6	21.8	
39–40	SPT		32	SM/ GC	SILTY SAND (SM)/ CLAYEY GRAVEL (GC) (interbedded) gray brown, dense, moist to wet, occasional clay lens						
41–48	S&H (45)		20	CL	CLAY (CL) olive gray, very stiff, moist, silty, trace rootlets, trace fine sand						
48–53	S&H (50)		35	SC	CLAYEY SAND (SC) olive gray, dense, moist to wet, fine grained sand				41.9	18.7	108
53–55	S&H		30/ 4"	CL	CLAY (CL) olive gray, hard, moist, trace fine sand						
55–58				SP	SAND (SP) olive gray, very dense, moist, with trace fine gravel						
58–60	SPT		50/ 4"	SC	CLAYEY SAND (SC) olive gray, very dense, moist, trace fine gravel, occasional rock fragments						

Treadwell&Rollo

Project No.: 3934.01	Figure: A-4b

PROJECT:	BART PLEASANT HILL PARKING STRUCTURE ADDITION Pleasant Hill	Log of Boring TR-4

DEPTH (feet)	SAMPLES: Sampler Type	Sample	SPT N-Value[1]	LITHOLOGY	MATERIAL DESCRIPTION	LABORATORY TEST DATA: Type of Strength Test	Confining Pressure Lbs/Sq Ft	Shear Strength Lbs/Sq Ft	Fines %	Natural Moisture Content, %	Dry Density Lbs/Cu Ft
61					SILTSTONE dark blue-gray, crushed, soft, friable, deep weathering						
62											
63											
64											
65											
66											
67											
68											
69											
70											
71											
72											
73											
74											
75											
76											
77											
78											
79											
80											
81											
82											
83											
84											
85											
86											
87											
88											
89											
90											

Boring terminated at 60 feet below ground surface.
Boring backfilled with cement grout.
Groundwater obscured by rotary wash drilling method.

[1] S&H blow counts converted to SPT N-Values using a factor of 0.6.
[2] Elevations based on Contra Costa County datum as shown on survey by Luk and Associates dated December 2003.

Treadwell&Rollo

Project No.:	Figure:
3934.01	A-4c

TEST GEOTECH LOG 393401.GPJ TR.GDT 9/28/04

UNIFIED SOIL CLASSIFICATION SYSTEM

Major Divisions		Symbols	Typical Names
Coarse-Grained Soils (more than half of soil > no. 200 sieve size)	Gravels (More than half of coarse fraction > no. 4 sieve size)	GW	Well-graded gravels or gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
	Sands (More than half of coarse fraction < no. 4 sieve size)	SW	Well-graded sands or gravelly sands, little or no fines
		SP	Poorly-graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures
Fine -Grained Soils (more than half of soil < no. 200 sieve size)	Silts and Clays LL = < 50	ML	Inorganic silts and clayey silts of low plasticity, sandy silts, gravelly silts
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, lean clays
		OL	Organic silts and organic silt-clays of low plasticity
	Silts and Clays LL = > 50	MH	Inorganic silts of high plasticity
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic silts and clays of high plasticity
Highly Organic Soils		PT	Peat and other highly organic soils

GRAIN SIZE CHART

Classification	Range of Grain Sizes	
	U.S. Standard Sieve Size	Grain Size in Millimeters
Boulders	Above 12"	Above 305
Cobbles	12" to 3"	305 to 76.2
Gravel	3" to No. 4	76.2 to 4.76
coarse	3" to 3/4"	76.2 to 19.1
fine	3/4" to No. 4	19.1 to 4.76
Sand	No. 4 to No. 200	4.76 to 0.074
coarse	No. 4 to No. 10	4.76 to 2.00
medium	No. 10 to No. 40	2.00 to 0.420
fine	No. 40 to No. 200	0.420 to 0.074
Silt and Clay	Below No. 200	Below 0.074

Unstabilized groundwater level

Stabilized groundwater level

SAMPLE DESIGNATIONS/SYMBOLS

Sample taken with Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter. Darkened area indicates soil recovered

Classification sample taken with Standard Penetration Test sampler

Undisturbed sample taken with thin-walled tube

Disturbed sample

Sampling attempted with no recovery

Core sample

Analytical laboratory sample

Sample taken with Direct Push sampler

SAMPLER TYPE

- C — Core barrel
- CA — California split-barrel sampler with 2.5-inch outside diameter and a 1.93-inch inside diameter
- D&M — Dames & Moore piston sampler using 2.5-inch outside diameter, thin-walled tube
- O — Osterberg piston sampler using 3.0-inch outside diameter, thin-walled Shelby tube
- PT — Pitcher tube sampler using 3.0-inch outside diameter, thin-walled Shelby tube
- S&H — Sprague & Henwood split-barrel sampler with a 3.0-inch outside diameter and a 2.43-inch inside diameter
- SPT — Standard Penetration Test (SPT) split-barrel sampler with a 2.0-inch outside diameter and a 1.5-inch inside diameter
- ST — Shelby Tube (3.0-inch outside diameter, thin-walled tube) advanced with hydraulic pressure

BART PLEASANT HILL
PARKING STRUCTURE ADDITION
Pleasant Hill, California

Treadwell&Rollo

CLASSIFICATION CHART

Date 09/28/04 | Project No. 3934.01 | Figure A-5

APPENDIX L

Simpson Stong Tie Product Specifications

SSTB® Anchor Bolts

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

The SSTB anchor bolt is designed for maximum performance as an anchor bolt for holdowns and Simpson Strong-Tie® Strong-Wall® shearwalls. Extensive testing has been done to determine the design load capacity of the SSTB when installed in many common applications.

The Simpson Strong-Tie® SSTB anchor bolts are now code listed by ICC-ES under the 2009 and 2012 IBC® and IRC® to meet the requirements of ICC-ES acceptance criteria AC 399. ICC-ES ESR-2611 is the industry's first code report issued for proprietary anchor bolts evaluated to the criteria of AC 399.

Special Features:

- Identification on the bolt head showing embedment angle and model
- Offset angle reduces side bursting, and provides more concrete cover
- Rolled thread for higher tensile capacity
- Stamped embedment line aids installation
- Available in HDG for additional corrosion resistance

MATERIAL: ASTM F-1554, Grade 36

FINISH: None. May be ordered HDG; contact Simpson Strong-Tie.

INSTALLATION:

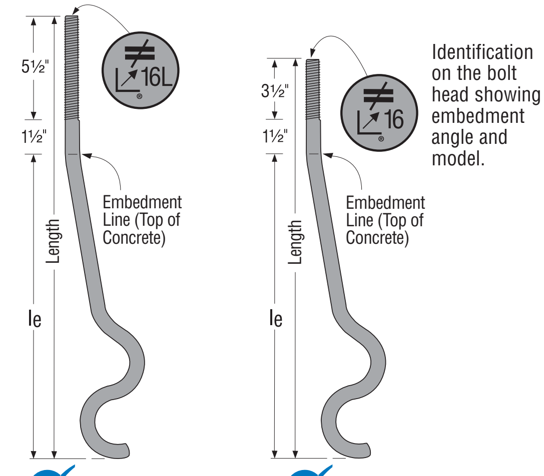
- SSTB is suitable for monolithic and two-pour concrete applications.
- Nuts and washers for holdown attachment are not supplied with the SSTB; install standard nuts, couplers and/or washers as required.
- On HDG SSTB anchors, chase the threads to use standard nuts or couplers or use overtapped products in accordance with ASTM A563, for example Simpson Strong-Tie® NUT⅝-OST, NUT⅞-OST, CNW⅝-OST, CNW⅞-OST.
- Install SSTB before the concrete pour using AnchorMates®. Install the SSTB per the plan view detail.
- Minimum concrete compressive strength is 2500 psi.
- When rebar is required it does not need to be tied to the SSTB.
- Order SSTBL Models *(example: SSTB16L)* for longer thread length (16L= 5½", 20L = 6½", 24L = 6", 28L = 6½"). SSTB and SSTBL load values are the same. SSTB34 and SSTB36 feature 4½" and 6½" of thread respectively and are not available in "L" versions.

CMU

- One horizontal #4 rebar in the second course.
- One vertical #4 rebar in adjacent cell for ⅝" diameter SSTB.
- One vertical #4 rebar in an adjacent cell and additional vertical #4 rebar(s) at 24" o.c. max. for ⅞" diameter SSTBs *(2 total vertical rebars for end wall corner, 3 total vertical rebars for midwall).*

CODES: See page 12 for Code Reference Key Chart.

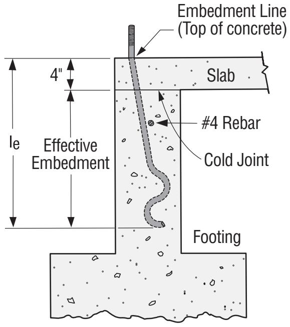
These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.



SSTB16L *(other models similar)*

SSTB16 *(other models similar)*

See pages 36-37 for additional installation details.



Two Pour Installation
(SSTB20, 24, 34 and 36)

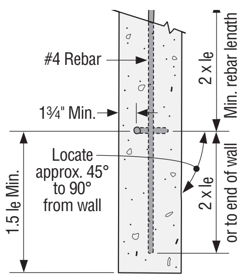
For two-pour (4" slab) installation loads:

- When using the SSTB20, use the equivalent loads of the SSTB16.
- When using the SSTB24, use the equivalent loads of the SSTB20.
- When using the SSTB34 or 36, use the equivalent loads of the SSTB28.

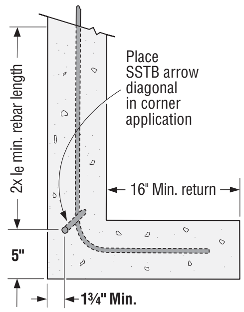
SSTB Bolts at Stemwall

Model No.	Dimensions				Allowable Tension Loads						Code Ref.
	Stemwall Width (in.)	Dia. (in.)	Length (in.)	Min. Embed. (le)	Wind & SDC A&B			SDC C - F			
					Midwall	Corner	End Wall[2]	Midwall	Corner	End Wall[2]	
SSTB16	6	⅝	17⅝ (16L = 19⅝)	12⅝	3610	3610	3610	2550	2550	2550	I23, F30, L20
SSTB20	6	⅝	21⅝ (20L = 24⅝)	16⅝	4315	4040	4040	3145	2960	2960	
SSTB24	6	⅝	25⅝ (24L = 28⅛)	20⅝	5025	4470	4470	3740	3325	3325	
SSTB28	8	⅞	29⅞ (28L = 32⅞)	24⅞	9900	8710	7615	8315	7315	6395	
SSTB34	8	⅞	34⅞	28⅞	9900	8710	7615	8315	7315	6395	
SSTB36	8	⅞	36⅞	28⅞	9900	8710	7615	8315	7315	6395	

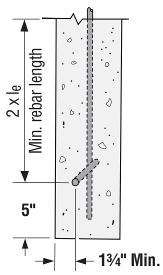
1. See page 36 for notes to the Designer.
2. SSTB28, SSTB34 and SSTB36 with 3⅞" end distance allowable loads are 6605 lbs. (Wind and SDC A&B) and 5550 lbs (SDC C-F).



Midwall

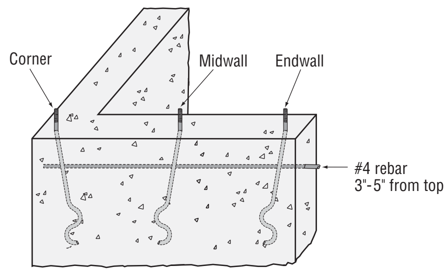


Corner



End Wall

STEMWALL PLAN VIEWS



Perspective View

HDU/DTT *Holdowns*

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

HDU holdowns are pre-deflected during the manufacturing process, virtually eliminating deflection under load due to material stretch. They use Simpson Strong-Tie® Strong-Drive® SDS Heavy-Duty Connector screws which install easily, reduce fastener slip and provide a greater net section when compared to bolts.

The HDU series of holdowns are designed to replace previous versions of the product such as PHDs as well as bolted holdowns. The HDU2, 4 and 5 are direct replacements for the PHD2, 5 and 6, respectively.

The DTT tension ties are designed for lighter-duty holdown applications on single 2x posts. The new DTT1Z is installed with nails or Simpson Strong-Tie Strong-Drive SD Connector screws and the DTT2Z installs easily with the Strong-Drive SDS Heavy-Duty Connector screws *(included)*. The DTT1Z holdowns have been tested for use in designed shearwalls and prescriptive braced wall panels as well as prescriptive wood-deck applications *(see page 209 for deck applications)*.

For more information on holdown options, contact Simpson Strong-Tie.

HDU SPECIAL FEATURES:

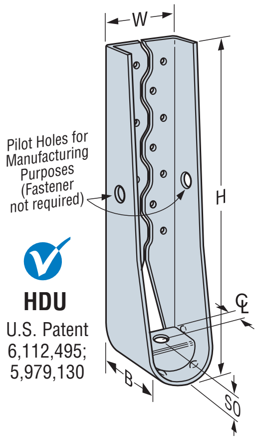
- Holdown designs virtually eliminate deflection due to material stretch.
- Uses Strong-Drive SDS Heavy-Duty Connector screws which install easily, reduce fastener slip, and provide a greater net section area of the post compared to bolts.
- Strong-Drive SDS Heavy-Duty Connector screws are supplied with the holdowns to ensure proper fasteners are used.
- No stud bolts to countersink at openings.

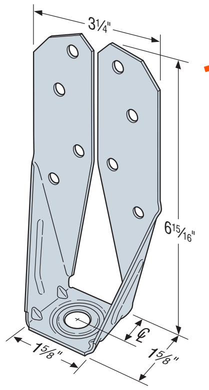
MATERIAL: See table

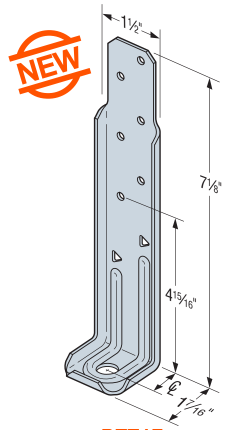
FINISH: HDU – Galvanized; DTT1Z and DTT2Z – ZMAX® coating; DTT2SS – stainless steel

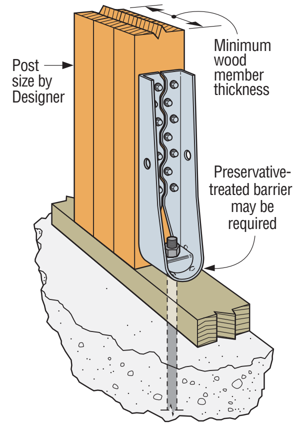
INSTALLATION:
- See General Notes on page 45.
- The HDU requires no additional washer, the DTT requires a standard cut washer *(included with DTT2Z)* be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low speed high torque drill with a ⅜" hex head driver.

CODES: See page 12 for Code Reference Key Chart.

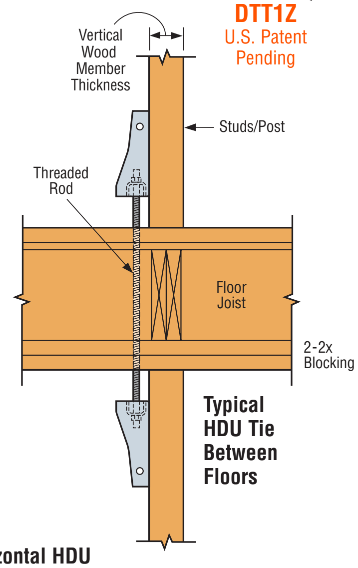




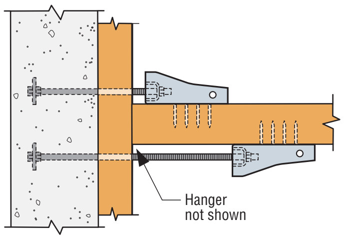




Vertical HDU Installation



Typical HDU Tie Between Floors



Horizontal HDU Offset Installation *(Plan View)*

See Holdown and Tension Tie General Notes on page 45.

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Model No.	Ga	Dimensions (in.)					Fasteners		Minimum Wood Member Thickness (in.)	Allowable Tension Loads (160)[1]			Code Ref.
		W	H	B	℄	SO	Anchor Bolt Dia. (in.)	Post Fasteners		DF/SP	SPF/HF	Deflection at Allowable Load (in.)	
DTT1Z (NEW)	14	1½	7⅛	1⁷⁄₁₆	¾	³⁄₁₆	⅜	6-SD #9x1½	1½	840	840	0.170	160
								6-10dx1½		910	640	0.167	
								8-10dx1½		910	850	0.167	
DTT2Z	14	3¼	6¹⁵⁄₁₆	1⅝	¹³⁄₁₆	³⁄₁₆	½	8-SDS ¼"x1½"	1½	1825	1800	0.105	I6, L8, F5
								8-SDS ¼"x1½"	3	2145	1835	0.128	
DTT2Z-SDS2.5								8-SDS ¼"x2½"	3	2145	2105	0.128	
HDU2-SDS2.5	14	3	8¹¹⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	6-SDS ¼"x2½"	3	3075	2215	0.088	
HDU4-SDS2.5	14	3	10¹⁵⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	10-SDS ¼"x2½"	3	4565	3285	0.114	
HDU5-SDS2.5	14	3	13³⁄₁₆	3¼	1⁵⁄₁₆	1⅜	⅝	14-SDS ¼"x2½"	3	5645	4065	0.115	
HDU8-SDS2.5	10	3	16⅝	3½	1⅜	1½	⅞	20-SDS ¼"x2½"	3	6765	4870	0.084	
									3½	6970	5020	0.116	
									4½	7870	5665	0.113	
HDU11-SDS2.5	10	3	22¼	3½	1⅜	1½	1	30-SDS ¼"x2½"	5½	9535	6865	0.137	
									7¼	11175	8045	0.137	
HDU14-SDS2.5	7	3	25¹¹⁄₁₆	3½	1⁹⁄₁₆	1⁹⁄₁₆	1	36-SDS ¼"x2½"	4x6[3,4]	10770	7755	0.122	170
									7¼[3]	14390	10435	0.177	I6, L8, F5
									5½[2,3]	14445	10350	0.177	

1. See page 45 for Holdown and Tension Tie General Notes.
2. Noted HDU14 allowable loads are based on a 5½" wide post *(6x6 min.)*.
3. HDU14 requires heavy hex anchor nut to achieve tabulated loads *(supplied with holdown)*.
4. Loads are applicable to installation on either narrow or wide face of post.

L3

UPDATED 03/27/15

SIMPSON Strong-Tie®

Standard Application on Concrete Foundations

Simpson Strong-Tie® Steel Strong-Wall® shearwalls provide superior performance, design flexibility and ease of installation. All Steel Strong-Wall shearwalls are evaluated to the 2012 IRC/IBC and are listed by ICC-ES.

Material: Vertical Panel—10 gauge

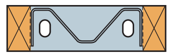
Finish: Vertical Panel—Galvanized
Top and Base Plates—Simpson Strong-Tie® gray paint
Codes: ICC-ES ESR-1679;
City of L.A. RR 25625;
State of Florida FL5113

Naming Legend

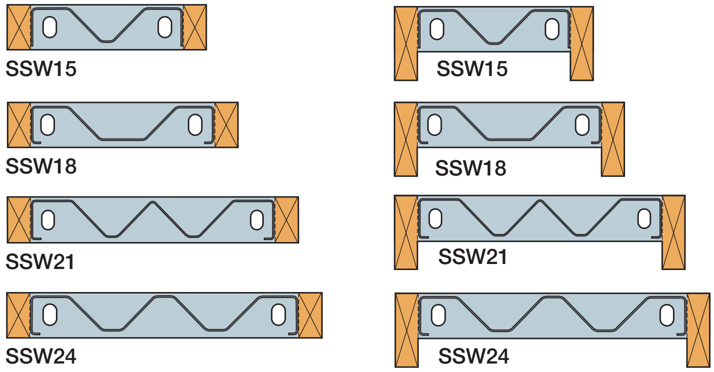
SSW24x8

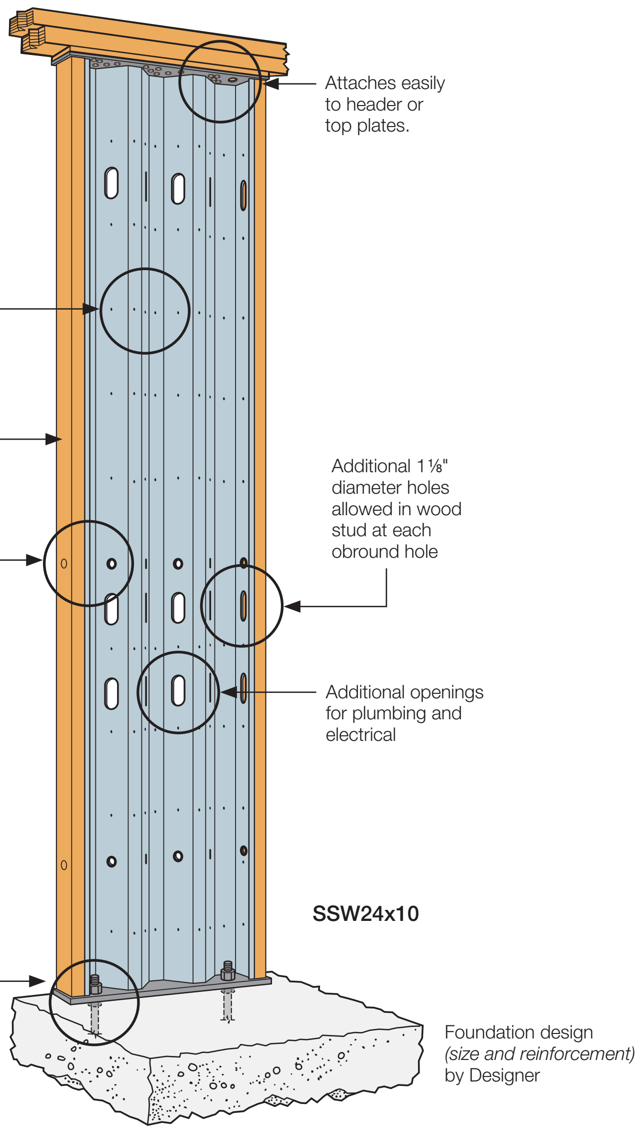
Steel Strong-Wall — Width (in.) — Nominal Height (ft.)

Wall Profiles

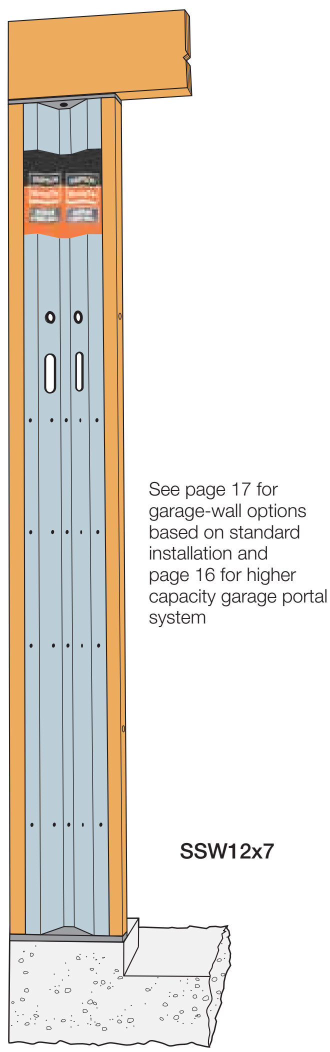


Pre-attached wood studs are 2x4 for walls 7'-10' tall, and 2x6 for walls 11'-13' tall.





Standard Installation
U.S. Patent 8,281,551
Canadian Patent 2,489,845



Garage Installation
U.S. Patent 8,281,551
Canadian Patent 2,489,845

Standard Application on Concrete Foundations

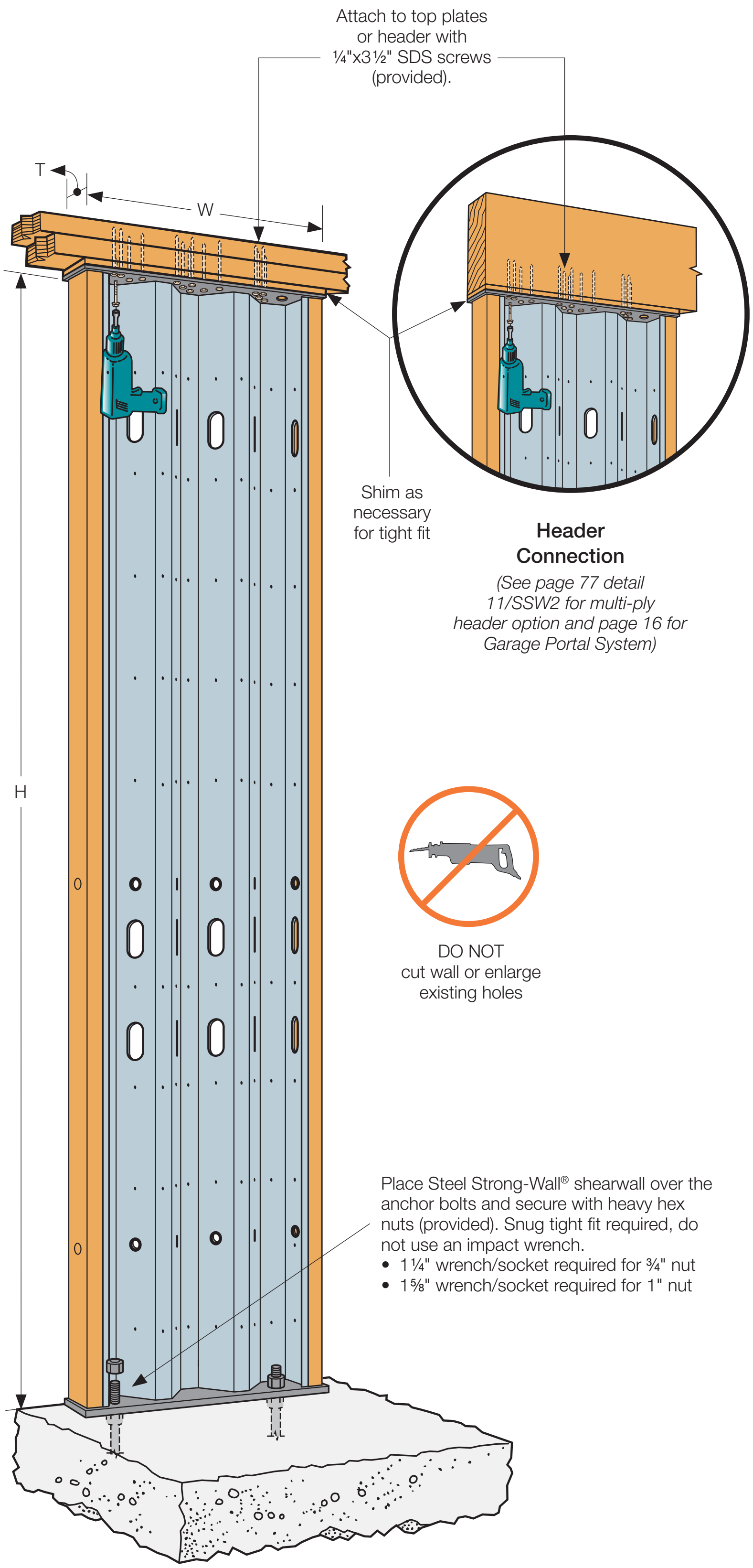
SIMPSON Strong-Tie

Installation Information

- Do not cut the Steel Strong-Wall® or enlarge existing holes. Doing so will compromise the performance of the wall.
- Do not use an impact wrench to tighten nuts on the anchor bolts.
- Maximum shim thickness between the Steel Strong-Wall and top plates or header is ⅞" using Simpson Strong-Tie® Strong-Drive® ¼"x3½" SDS Heavy-Duty Connector screws. For additional shim thicknesses, see detail 5/SSW2 on page 76.
- Walls with 2x4 pre-attached studs may also be used in 2x6 wall framing. Install the wall flush to one face of the framing and add furring to the opposite side.
- Walls may be installed with solid or multi-ply headers, see detail 11/SSW2 page 77 for details.

Steel Strong-Wall® Product Data

Model No.	W (in.)	H (in.)	T (in.)	Anchor Bolts Qty.	Anchor Bolts Dia. (in.)	Number of Screws in Top of Wall	Total Wall Weight (lbs.)
SSW12x7	12	80	3½	2	¾	4	74
SSW15x7	15	80	3½	2	1	6	86
SSW18x7	18	80	3½	2	1	9	99
SSW21x7	21	80	3½	2	1	12	117
SSW24x7	24	80	3½	2	1	14	127
SSW12x7.4	12	85½	3½	2	¾	4	78
SSW15x7.4	15	85½	3½	2	1	6	91
SSW18x7.4	18	85½	3½	2	1	9	104
SSW21x7.4	21	85½	3½	2	1	12	122
SSW24x7.4	24	85½	3½	2	1	14	134
SSW12x8	12	93¼	3½	2	¾	4	85
SSW15x8	15	93¼	3½	2	1	6	99
SSW18x8	18	93¼	3½	2	1	9	113
SSW21x8	21	93¼	3½	2	1	12	132
SSW24x8	24	93¼	3½	2	1	14	144
SSW12x9	12	105¼	3½	2	¾	4	94
SSW15x9	15	105¼	3½	2	1	6	110
SSW18x9	18	105¼	3½	2	1	9	125
SSW21x9	21	105¼	3½	2	1	12	147
SSW24x9	24	105¼	3½	2	1	14	160
SSW12x10	12	117¼	3½	2	¾	4	104
SSW15x10	15	117¼	3½	2	1	6	121
SSW18x10	18	117¼	3½	2	1	9	138
SSW21x10	21	117¼	3½	2	1	12	162
SSW24x10	24	117¼	3½	2	1	14	177
SSW15x11	15	129¼	5½	2	1	6	148
SSW18x11	18	129¼	5½	2	1	9	167
SSW21x11	21	129¼	5½	2	1	12	193
SSW24x11	24	129¼	5½	2	1	14	209
SSW15x12	15	141¼	5½	2	1	6	160
SSW18x12	18	141¼	5½	2	1	9	180
SSW21x12	21	141¼	5½	2	1	12	208
SSW24x12	24	141¼	5½	2	1	14	225
SSW18x13	18	153¼	5½	2	1	9	194
SSW21x13	21	153¼	5½	2	1	12	224
SSW24x13	24	153¼	5½	2	1	14	243



Standard Installation

U.S. Patent 8,281,551
Canadian Patent 2,489,845

SIMPSON Strong-Tie

Standard Application on Concrete Foundations

SSW Model	Allowable Axial Load (lbs.)	Seismic[2]			Wind		
		Allowable ASD Shear Load V (lbs.)	Drift at Allowable Shear (in.)	Anchor Tension at Allowable Shear[5] (lbs.)	Allowable ASD Shear Load V (lbs.)	Drift at Allowable Shear (in.)	Anchor Tension at Allowable Shear[5] (lbs.)
SSW12x7	1000	955	0.36	9840	1215	0.46	13620
	4000	955	0.36	9840	1095	0.42	11765
	7500	890	0.34	9010	890	0.34	9010
SSW15x7	1000	1855	0.36	15655	1860	0.36	15715
	4000	1665	0.33	13550	1665	0.33	13550
	7500	1445	0.28	11340	1445	0.28	11340
SSW18x7	1000	2905	0.34	19660	3480	0.41	25805
	4000	2905	0.34	19660	3250	0.38	23135
	7500	2905	0.34	19660	2980	0.35	20370
SSW21x7	1000	4200	0.32	23755	4440	0.34	25710
	4000	4200	0.32	23755	4440	0.34	25710
	7500	4200	0.32	23755	4310	0.33	24635
SSW24x7	1000	5495	0.29	26270	5730	0.31	27835
	4000	5495	0.29	26270	5730	0.31	27835
	7500	5495	0.29	26270	5730	0.31	27835
SSW12x7.4	1000	870	0.39	9515	1105	0.49	13070
	4000	870	0.39	9515	970	0.43	10940
	7500	750	0.33	7940	750	0.33	7940
SSW15x7.4	1000	1685	0.39	15035	1700	0.39	15215
	4000	1500	0.34	12905	1500	0.34	12905
	7500	1270	0.29	10510	1270	0.29	10510
SSW18x7.4	1000	2700	0.37	19475	3255	0.44	25790
	4000	2700	0.37	19475	3040	0.42	23125
	7500	2700	0.37	19475	2790	0.38	20390
SSW21x7.4	1000	3890	0.35	23420	4230	0.38	26405
	4000	3890	0.35	23420	4230	0.38	26405
	7500	3890	0.35	23420	4035	0.36	24655
SSW24x7.4	1000	5330	0.34	27610	5450	0.34	28485
	4000	5330	0.34	27610	5450	0.34	28485
	7500	5330	0.34	27610	5450	0.34	28485
SSW12x8	1000	775	0.42	9180	985	0.53	12560
	4000	775	0.42	9180	865	0.47	10550
	7500	665	0.36	7630	665	0.36	7630
SSW15x8	1000	1505	0.42	14515	1530	0.43	14835
	4000	1345	0.37	12545	1345	0.37	12545
	7500	1135	0.32	10190	1135	0.32	10190
SSW18x8	1000	2480	0.41	19525	2985	0.50	25795
	4000	2480	0.41	19525	2790	0.47	23160
	7500	2480	0.41	19525	2560	0.43	20410
SSW21x8	1000	3560	0.39	23360	3960	0.43	27240
	4000	3560	0.39	23360	3960	0.43	27240
	7500	3560	0.39	23360	3700	0.41	24660
SSW24x8	1000	4865	0.37	27435	5105	0.39	29370
	4000	4865	0.37	27435	5105	0.39	29370
	7500	4865	0.37	27435	5055	0.39	28960
SSW12x9	1000	660	0.47	8745	840	0.60	11915
	4000	660	0.47	8745	705	0.50	9485
	7500	505	0.36	6380	505	0.36	6380
SSW15x9	1000	1315	0.45	14250	1315	0.47	14250
	4000	1130	0.38	11740	1130	0.40	11740
	7500	925	0.31	9235	925	0.33	9235
SSW18x9	1000	2145	0.47	18890	2645	0.58	25800
	4000	2145	0.47	18890	2470	0.54	23130
	7500	2145	0.47	18890	2265	0.50	20370
SSW21x9	1000	3145	0.46	23265	3590	0.52	28215
	4000	3145	0.46	23265	3530	0.51	27490
	7500	3145	0.46	23265	3280	0.47	24680
SSW24x9	1000	4285	0.44	27210	4605	0.47	30150
	4000	4285	0.44	27210	4605	0.47	30150
	7500	4285	0.44	27210	4480	0.46	28970

See footnotes on page 13.

L6

APPENDIX M

Cost Estimate

Pine Cone Lumber Unit Prices

Type	Size	Unit Cost
Sawn Lumber	2X10	1.25
Sawn Lumber	4X10	3.50
Sawn Lumber	6X10	7.02
Sawn Lumber	4X4	1.40
Sawn Lumber	5X5	4.69
Sawn Lumber	6X6	4.21
Glulam	3-⅛ x 7-½	—
Glulam	3-⅛ x 9	—
Glulam	3-½ x 7-½	8.08
Glulam	3-½ x 9	8.47
Glulam	5-⅛ x 7-½ (5½")	10.83
Glulam	5-⅛ x 9 (5½")	12.18
LSL (1.55 E)	3-½ x 9-½	7.55
LSL (1.55 E)	3-½ x 9-¼	-
LVL	3-½ x 9-½	8.35
LVL	3-½ x 9-¼	—
PSL	3-½ x 9-½	9.32
PSL	3-½ x 9-¼	—

ATTN: MOLLY
FROM: JIM (x-126)
PINE CONE LUMBER

Beam Cost	4575
Column Cost	1344
Joist Cost	15733
Total Cost ($)	**21652**

Framing: 3rd Floor, 2nd Ceiling				
Member	**Size**	**Unit Cost ($/LF)**	**Length (ft)**	**Cost ($)**
1	Glulam:3-1/8x9	8.08	9.76	78.9
2	Glulam:3-1/8x9	8.08	9.81	79.3
3	4x10	3.5	5.92	20.7
4	4x10	3.5	13.5	47.3
5	4x10	3.5	13.5	47.3
6	PSL 5.25x9.5	14.3	12.6	180
7	4x10	3.5	5.58	19.5
8	PSL 5.25x9.5	14.3	12.8	184
9	6x10	7.02	12	84.2
10	4x10	3.5	4.5	15.8
11	PSL 3.5x9.5	9.32	19.6	182
12	PSL 5.25x9.25	14.3	19.6	280
13	4x10	3.5	3.5	12.3
14	PSL 5.25x9.25	14.3	19.6	280
15	PSL: 3.5x9.25	9.32	4.63	43.1
			Total Cost ($)	1553.7

Framing: 2nd Floor, 1st Ceiling				
Member	**Size**	**Unit Cost ($/LF)**	**Length (ft)**	**Cost ($)**
4	6x10	7.02	11.4	80.1
5	6x10	7.02	12.7	88.9
7	6x10	7.02	12	84.2
8	GLU 5.5x9	12.18	14.5	176
10	4x10	3.5	8.29	29.0
11	4x10	3.5	5.58	19.5
12	4x10	3.5	5.77	20.2
20	GLU 5.5x9	12.18	13.7	166
21	GLU 3.5x9	8.47	8.21	69.5
22	6x10	7.02	8.08	56.7
23	PSL 7x9.5	19.47	6.96	135
24	GLU 3.125x9	8.08	7.83	63.3
26	GLU 5.5x9	12.18	7.88	95.9
27	PSL 7x9.5	19.47	19.6	382
			Total Cost ($)	**4575**

3rd Floor Columns (Roof to 3rd Floor)					
Post	**Size**	**Quantity**	**Unit Cost ($/LF)**	**Length (FT)**	**Cost ($)**
1	4x6	1	2.1	8	16.8
2	4x6	1	2.1	8	16.8
3	4x6	1	2.1	8	16.8
4	4x4	1	1.4	8	11.2
5	4x8	1	2.8	8	22.4
6	4x6	1	2.1	8	16.8
7	4x8	1	2.8	8	22.4
8	4x8	1	2.8	8	22.4
9	4x6	1	2.1	8	16.8
10	4x4	1	1.4	8	11.2
11	4x6	1	2.1	8	16.8
12	4x6	1	2.1	8	16.8
13	4x4	1	1.4	8	11.2
14	4x4	1	1.4	8	11.2
15	4x4	1	1.4	8	11.2
16	4x4	1	1.4	8	11.2
				Total Cost ($)	252

2nd Floor Columns (3rd Floor to 2nd Floor)								
Post	**Size (2nd Floor)**	**Size (3rd Floor)**	**3rd**	**Governing Size**	**Quantity**	**Unit Cost ($/LF)**	**Length (FT)**	**Cost ($)**
1	4x4	4x4	10	4x4	1	1.4	8	11.2
2	4x6	4x4	11	4x6	1	2.1	8	16.8
3	4x4		n/a	4x4	1	1.4	8	11.2
4	4x6	4x4	12	4x6	1	2.1	8	16.8
5	4x4	4x4	13	4x4	1	1.4	8	11.2
6	4x4		n/a	4x4	1	1.4	8	11.2
7	4x4	4x4	16	4x4	1	1.4	8	11.2
8	4x6		n/a	4x8	1	2.8	8	22.4
9	4x8	4x4	8	4x8	1	2.8	8	22.4
10	4x4		n/a	4x4	1	1.4	8	11.2
11	4x4	4x4	9	4x6	1	2.1	8	16.8

12	4x4		n/a	4x4	1	1.4	8	11.2
13	4x6	4x4	7	4x8	1	2.8	8	22.4
14	4x6		n/a	4x6	1	2.1	8	16.8
15	4x4		n/a	4x4	1	1.4	8	11.2
16	4x4		n/a	4x4	1	1.4	8	11.2
17	4x6		n/a	4x4	1	1.4	8	11.2
18	4x4		n/a	4x4	1	1.4	8	11.2
19	4x4		n/a	4x6	1	2.1	8	16.8
20	4x4		n/a	4x6	1	2.1	8	16.8
21	4x4		n/a	4x4	1	1.4	8	11.2
22	4x4		n/a	4x4	1	1.4	8	11.2
23	4x4		n/a	4x6	1	2.1	8	16.8
24	4x8	4x8	5	4x8	1	2.8	8	22.4
25	4x6	4x4	6	4x6	1	2.1	8	16.8
26	4x4		n/a	4x6	1	2.1	8	16.8
27	4x4		n/a	4x4	1	1.4	8	11.2
28	4x4		n/a	4x4	1	1.4	8	11.2
29	4x4		n/a	4x6	1	2.1	8	16.8
30	4x6		n/a	4x6	1	2.1	8	16.8
31	4x4		n/a	4x6	1	2.1	8	16.8
32	4x4		n/a	4x4	1	1.4	8	11.2
33	4x4	4x4	1	4x6	1	2.1	8	16.8
34	4x6	4x4	2	4x6	1	2.1	8	16.8
35	4x4	4x4	3	4x6	1	2.1	8	16.8
							Total Cost ($)	520.8

1st Floor Columns (2nd Floor to 1st Floor)									
Post	**Size**	**Size (2nd Floor)**	**Governing Size**	**Size**	**2nd/3rd**	**Unit Cost**	**Quantity**	**Length (FT)**	**Cost ($)**
1	4x4		4x4	4x4	n/a	1.4	1	8	11.2
2	4x4	4x4	4x4	4x4	1,10	1.4	1	8	11.2
3	4x6	4x6	4x6	4x6	2,11	2.1	1	8	16.8
4	4x4	4x4	4x4	4x4	3,0	1.4	1	8	11.2
5	4x6	4x6	4x6	4x6	4,12	2.1	1	8	16.8
6	4x4	4x4	4x4	4x4	5,13	1.4	1	8	11.2
7	4x4	4x4	4x4	4x4	6,0	1.4	1	8	11.2
8	4x4	4x4	4x4	4x4	7,16	1.4	1	8	11.2
9	4x4		4x4	4x4	n/a	1.4	1	8	11.2
10	4x4		4x4	4x4	n/a	1.4	1	8	11.2

11	4x6	4x4	4x6	4x6	11,0	2.1	1	8	16.8
12	4x4	4x4	4x4	4x4	12,0	1.4	1	8	11.2
13	4x8	4x6	4x8	4x8	13,7	2.8	1	8	22.4
14	4x8	4x6	4x8	4x8	8,0	2.8	1	8	22.4
15	4x4	4x4	4x4	4x4	15,0	1.4	1	8	11.2
16	4x4		4x4	4x4	n/a	1.4	1	8	11.2
17	4x4		4x4	4x4	n/a	1.4	1	8	11.2
18	4x4		4x4	4x4	n/a	1.4	1	8	11.2
19	4x6	4x6	4x6	4x6	14,0	2.1	1	8	16.8
20	4x6	4x4	4x6	4x6	19,0	2.1	1	8	16.8
21	4x4		4x4	4x4	n/a	1.4	1	8	11.2
22	4x4		4x4	4x4	n/a	1.4	1	8	11.2
23	4x4	4x4	4x4	4x4	16,0	1.4	1	8	11.2
24	4x6	4x4	4x6	4x6	20,0	2.1	1	8	16.8
25	4x4		4x4	4x4	n/a	1.4	1	8	11.2
26	4x4	4x4	4x4	4x4	21,0	1.4	1	8	11.2
27	4x6	4x4	4x6	4x6	29,0	2.1	1	8	16.8
28	4x4	4x4	4x4	4x4	22,0	1.4	1	8	11.2
29	4x6	4x4	4x6	4x6	23,0	2.1	1	8	16.8
30	4x4		4x4	4x4	n/a	1.4	1	8	11.2
31	4x4		4x4	4x4	n/a	1.4	1	8	11.2
32	4x6	4x4	4x6	4x6	26,0	2.1	1	8	16.8
33	4x4		4x4	4x4	n/a	1.4	1	8	11.2
34	4x4		4x4	4x4	n/a	1.4	1	8	11.2
35	4x4		4x4	4x4	n/a	1.4	1	8	11.2
36	4x4		4x4	4x4	n/a	1.4	1	8	11.2
37	4x4		4x4	4x4	n/a	1.4	1	8	11.2
38	4x6	4x4	4x6	4x6	31,0	2.1	1	8	16.8
39	4x4		4x4	4x4	n/a	1.4	1	8	11.2
40	4x4	4x4	4x4	4x4	32,0	1.4	1	8	11.2
41	4x6	4x4	4x6	4x6	33,1	2.1	1	8	16.8
42	4x4		4x4	4x4	n/a	1.4	1	8	11.2
43	4x6	4x4	4x6	4x6	35,3	2.1	1	8	16.8
								Total Cost ($)	571.2

Total Column Cost ($) **1344**

Framing: 2nd Floor, 1st Ceiling				
Size	**Unit Cost ($/ft)**	**Length (ft)**	**Quantity**	**Total**
4x10	3.5	11.2	20	785
4x10	3.5	7.88	35	965
4x10	3.5	8.33	14	408
4x10	3.5	11.3	3	119
4x10	3.5	15.3	11	590
4x10	3.5	7.83	18	494
4x10	3.5	8.08	18	509
4x10	3.5	13.7	18	633
4x10	3.5	10.0	7	246
TJI 230	2.35	20.7	19	923
TJI 230	2.35	20.6	19	919
			Total Cost ($)	**6590**

Framing: 3rd Floor, 2nd Ceiling				
Size	**Unit Cost ($/ft)**	**Length (ft)**	**Quantity**	**Total**
2x10	1.25	8.58	16	172
2x10	1.25	6.27	16	125
2x10	1.25	6.42	16	128
2x10	1.25	5.13	16	103
2x10	1.25	10.5	19	248
2x10	1.25	17.7	18	398
2x10	1.25	12.1	9	136
2x10	1.25	14.7	25	458
2x10	1.25	13.5	24	405
2x10	1.25	12.1	25	379
			Total Cost ($)	**15733**

Beam Cost	916
Column Cost	1383
Joist Cost	10414
Total Cost ($)	**12713**

TJI Framing: 3rd Floor, 2nd Ceiling				
Summary	**Size**	**Unit Cost ($/LF)**	**Length (ft)**	**Cost ($)**
1	PSL 5.25x9.5	14.3	12.8	184
2	4x10	3.5	4.2	15
3	4x10	3.5	5.58	19.5
4	4x10	3.5	4.63	16.2
5	Glulam:3-1/8x9	8.08	9.81	79.3
6	Glulam:3-1/8x9	8.08	9.76	78.9
7	PSL 5.25x9.5	14.3	12.4	178
8	4x10	3.5	5.92	20.7
9	4X10	3.5	4.17	14.6

TJI Framing: 2nd Floor, 1st Ceiling				
Summary	**Size**	**Unit Cost ($/LF)**	**Length (ft)**	**Cost ($)**
1	Glulam:3-1/8x9	8.08	8.28	66.9
2	4x10	3.5	5.1	18
3	4x10	3.5	5.4	19
4	Glulam:3-1/8x9	8.08	8.21	66.3
5	Glulam:5-1/2x9	12.18	11.5	140

Total Cost ($) **916**

3rd Floor Columns (Roof to 3rd Floor)					
Post	**Size**	**Quantity**	**Unit Cost ($/LF)**	**Length (FT)**	**Cost ($)**
1	4x8	1	2.8	8	22.4
2	4x8	1	2.8	8	22.4
3	4x6	1	2.1	8	16.8
4	4x4	1	1.4	8	11.2
5	4x8	1	2.8	8	22.4
6	4x8	1	2.8	8	22.4
7	4x6	1	2.1	8	16.8
8	4x8	1	2.8	8	22.4
9	4x4	1	1.4	8	11.2
10	4x4	1	1.4	8	11.2
11	4x6	1	2.1	8	16.8
12	4x8	1	2.8	8	22.4
13	4x4	1	1.4	8	11.2
14	4x4	1	1.4	8	11.2
15	4x4	1	1.4	8	11.2
16	4x6	1	2.1	8	16.8
17	4x8	1	2.8	8	22.4
				Total Cost ($)	291.2

2nd Floor Columns (3rd Floor to 2nd Floor)								
Post	**Size (2nd Floor)**	**Size (3rd Floor)**	**3rd**	**Governing Size**	**Quantity**	**Unit Cost ($/LF)**	**Length (FT)**	**Cost ($)**
1	4x4	4x4	10	4x4	1	1.4	8	11.2
2	4x4	4x4	11	4x6	1	2.1	8	16.8
3	4x6	4x4	12	4x8	1	2.8	8	22.4
4	4x4	4x4	13	4x4	1	1.4	8	11.2
5	4x4		n/a	4x4	1	1.4	8	11.2
6	4x4	4x4	16	4x6	1	2.1	8	16.8
7	4x6		n/a	4x8	1	2.8	8	22.4
8	4x8	4x6	8	4x8	1	2.8	8	22.4
9	4x4	4x4	9	4x4	1	1.4	8	11.2
10	4x4		n/a	4x4	1	1.4	8	11.2

11	4x6	4x4	7	4x6	1	2.1	8	16.8
12	4x4		n/a	4x4	1	1.4	8	11.2
13	4x6		n/a	4x6	1	2.1	8	16.8
14	4x4		n/a	4x4	1	1.4	8	11.2
15	4x4		n/a	4x6	1	2.1	8	16.8
16	4x4		n/a	4x4	1	1.4	8	11.2
17	4x4		n/a	4x6	1	2.1	8	16.8
18	4x4		n/a	4x4	1	1.4	8	11.2
19	4x4		n/a	4x6	1	2.1	8	16.8
20	4x4		n/a	4x6	1	2.1	8	16.8
21	4x4		n/a	4x6	1	2.1	8	16.8
22	4x8	4x8	5	4x8	1	2.8	8	22.4
23	4x4		n/a	4x4	1	1.4	8	11.2
24	4x8	4x4	6	4x8	1	2.8	8	22.4
25	4x4		n/a	4x4	1	1.4	8	11.2
26	4x6		n/a	4x6	1	2.1	8	16.8
27	4x6		n/a	4x6	1	2.1	8	16.8
28	4x4	4x4	1	4x8	1	2.8	8	22.4
29	4x8	4x4	2	4x8	1	2.8	8	22.4
30	4x6	4x4	3	4x6	1	2.1	8	16.8
31	4x4	4x6	17	4x8	1	2.8	8	22.4
							Total Cost ($)	504

1st Floor Columns (2nd Floor to 1st Floor)									
Post	**Size**	**Size (2nd Floor)**	**Governing Size**	**Size**	**2nd/3rd**	**Unit Cost**	**Quantity**	**Length (FT)**	**Cost ($)**
1	4x4		4x4	4x4	n/a	1.4	1	8	11.2
2	4x4	4x4	4x4	4x4	1,10	1.4	1	8	11.2
3	4x6	4x4	4x6	4x6	2,11	2.1	1	8	16.8
4	4x8	4x6	4x8	4x8	3,12	2.8	1	8	22.4
5	4x4	4x4	4x4	4x4	4,13	1.4	1	8	11.2
6	4x4	4x4	4x4	4x4	5,0	1.4	1	8	11.2
7	4x6	4x4	4x6	4x6	6,16	2.1	1	8	16.8
8	4x4		4x4	4x4	n/a	1.4	1	8	11.2
9	4x4		4x4	4x4	n/a	1.4	1	8	11.2
10	4x4	4x4	4x4	4x4	9,9	1.4	1	8	11.2
11	4x4	4x4	4x4	4x4	10,0	1.4	1	8	11.2
12	4x8	4x8	4x8	4x8	11,7	2.8	1	8	22.4
13	4x8	4x6	4x8	4x8	7,0	2.8	1	8	22.4

14	4x4	4x4	4x4	4x4	16,0	1.4	1	8	11.2
15	4x4		4x4	4x4	n/a	1.4	1	8	11.2
16	4x4		4x4	4x4	n/a	1.4	1	8	11.2
17	4x6		4x6	4x6	n/a	2.1	1	8	16.8
18	4x6	4x4	4x6	4x6	15,0	2.1	1	8	16.8
19	4x6	4x4	4x6	4x6	19,0	2.1	1	8	16.8
20	4x4		4x4	4x4	n/a	1.4	1	8	11.2
21	4x4	4x4	4x4	4x4	12,0	1.4	1	8	11.2
22	4x6	4x4	4x6	4x6	17,0	2.1	1	8	16.8
23	4x4		4x4	4x4	n/a	1.4	1	8	11.2
24	4x4		4x4	4x4	n/a	1.4	1	8	11.2
25	4x4	4x4	4x4	4x4	18,0	1.4	1	8	11.2
26	4x6	4x4	4x6	4x6	20,0	2.1	1	8	16.8
27	4x6	4x4	4x6	4x6	21,0	2.1	1	8	16.8
28	4x4		4x4	4x4	n/a	1.4	1	8	11.2
29	4x4		4x4	4x4	n/a	1.4	1	8	11.2
30	4x4		4x4	4x4	n/a	1.4	1	8	11.2
31	4x4		4x4	4x4	n/a	1.4	1	8	11.2
32	4x4		4x4	4x4	n/a	1.4	1	8	11.2
33	4x4		4x4	4x4	n/a	1.4	1	8	11.2
34	4x4		4x4	4x4	n/a	1.4	1	8	11.2
35	4x4		4x4	4x4	n/a	1.4	1	8	11.2
36	4x4		4x4	4x4	n/a	1.4	1	8	11.2
37	4x4		4x4	4x4	n/a	1.4	1	8	11.2
38	4x4	4x4	4x4	4x4	25,0	1.4	1	8	11.2
39	4x8	4x4	4x8	4x8	28,1	2.8	1	8	22.4
40	4x8	4x8	4x8	4x8	29,2	2.8	1	8	22.4
41	4x6	4x6	4x6	4x6	30,3	2.1	1	8	16.8
42	4x6	4x8	4x8	4x8	31,17	2.8	1	8	22.4
								Total Cost ($)	588

Total Column Cost ($) **1383**

Framing: 3rd Floor, 2nd Ceiling				
Size	**Unit Cost ($/ft)**	**Length (ft)**	**Quantity**	**Total**
TJI 230	2.35	8	11	207
TJI 230	2.35	4.52	1	10.6
TJI 230	2.35	15.8	27	999
TJI 230	2.35	10.5	6	149
TJI 230	2.35	14.7	41	1413
TJI 230	2.35	17.7	18	749
TJI 230	2.35	12.2	25	715
TJI 230	2.35	13.5	25	796

Framing: 2nd Floor, 1st Ceiling				
Size	**Unit Cost ($/ft)**	**Length (ft)**	**Quantity**	
TJI 230	2.35	11.20833333	20	527
TJI 230	2.35	15.75	19	703
TJI 230	2.35	14.45833333	19	646
TJI 230	2.35	11.95833333	4	112
TJI 230	2.35	15.875	19	709
TJI 230	2.35	13.70833333	19	612
TJI 230	2.35	10.04166667	9	212
TJI 230	2.35	19.875	20	934
TJI 230	2.35	19.58333333	20	920

Total Cost ($) 10414

APPENDIX N

GreenPoint Rating System Scorecard

NEW HOME RATING SYSTEM, VERSION 6.0

MULTIFAMILY CHECKLIST

GreenPoint RATED

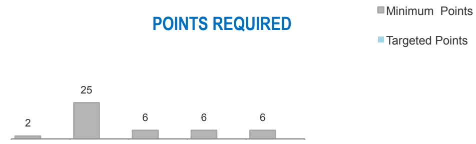
Total Points Targeted: 133

Certfication Level: Gold

The GreenPoint Rated checklist tracks green features incorporated into the home. GreenPoint Rated is administered by Build It Green, a non-profit whose mission is to promote healthy, energy and resource efficient buildings in California.
The minimum requirements of GreenPoint Rated are: verification of 50 or more points; Earn the following minimum points per category: Commuity (2) Energy (25), Indoor Air Quality/Health (6), Resources (6), and Water (8); and meet the prerequisites CALGreen Mandatory, E5.2 , H6.1, J5.1, O1, O7.

The criteria for the green building practices listed below are described in the GreenPoint Rated Single Family Rating Manual. For more information please visit **www.builditgreen.org/greenpointrated**
Build It Green is not a code enforcement agency.

A home is only GreenPoint Rated if all features are verified by a Certified GreenPoint Rater through Build It Green. This is the public version of the Checklist and cannot be used for certification.



New Home Multifamily Version 6.0.2

Project Name	Measures	Points Achieved	Community	Energy	IAQ/Health	Resources	Water	Notes
			Possible Points					
CALGreen								
Yes	**CALGreen Res** (REQUIRED)	4		1	1	1	1	
A. SITE								
No	**A1. Construction Footprint**	0				1		
	A2. Job Site Construction Waste Diversion							
Yes	A2.1 65% C&D Waste Diversion **(Including** Alternative Daily Cover)	2				2		
No	A2.2 65% C&D Waste Diversion **(Excluding** Alternative Daily Cover)	0				2		
No	A2.3 Recycling Rates from Third-Party Verified Mixed-Use Waste Facility	0				1		
TBD	**A3. Recycled Content Base Material**					1		
No	**A4. Heat Island Effect Reduction (Non-Roof)**	0		1				
No	**A5. Construction Environmental Quality Management Plan Including Flush-Out**	0			1			
	A6. Stormwater Control: Prescriptive Path	0						
No	A6.1 Permeable Paving Material	0					1	
No	A6.2 Filtration and/or Bio-Retention Features	0					1	
No	A6.3 Non-Leaching Roofing Materials	0					1	
No	A6.4 Smart Stormwater Street Design	0	1					
Yes	**A7. Stormwater Control: Performance Path**	3					3	
B. FOUNDATION								
Yes	**B1. Fly Ash and/or Slag in Concrete**	1				1		
No	**B2. Radon-Resistant Construction**	0			2			
No	**B3. Foundation Drainage System**	0				2		
No	**B4. Moisture Controlled Crawlspace**	0			1			
	B5. Structural Pest Controls	0						
No	B5.1 Termite Shields and Separated Exterior Wood-to-Concrete Connections	0				1		
No	B5.2 Plant Trunks, Bases, or Stems at Least 36 Inches from the Foundation	0				1		
C. LANDSCAPE								
5.15%	Enter the landscape area percentage							
Yes	**C1. Plants Grouped by Water Needs (Hydrozoning)**	1					1	
Yes	**C2. Three Inches of Mulch in Planting Beds**	1					1	
	C3. Resource Efficient Landscapes							
Yes	C3.1 No Invasive Species Listed by Cal-IPC	1				1		
Yes	C3.2 Plants Chosen and Located to Grow to Natural Size	0				1		
Yes	C3.3 Drought Tolerant, California Native, Mediterranean Species, or Other Appropriate Species	0					3	
	C4. Minimal Turf in Landscape							
Yes	C4.1 No Turf on Slopes Exceeding 10% and No Overhead Sprinklers Installed in Areas Less Than Eight Feet Wide	0					2	
Yes	C4.2 Turf on a Small Percentage of Landscaped Area	0					2	
No	**C5. Trees to Moderate Building Temperature**	0	1	1			1	
Yes	**C6. High-Efficiency Irrigation System**	0					2	
Yes	**C7. One Inch of Compost in the Top Six to Twelve Inches of Soil**	0					2	
No	**C8. Rainwater Harvesting System**	0					3	
No	**C9. Recycled Wastewater Irrigation System**	0					1	
Yes	**C10. Submeter or Dedicated Meter for Landscape Irrigation**	0					2	
≤0.65 ETo	**C11. Landscape Meets Water Budget**	0					2	
	C12. Environmentally Preferable Materials for Site							
No	C12.1 Environmentally Preferable Materials for 70% of Non-Plant Landscape Elements and Fencing	0				1		
No	C12.2 Play Structures and Surfaces Have an Average Recycled Content ≥20%	0				1		
TBD	**C13. Reduced Light Pollution**	0	1					
No	**C14. Large Stature Tree(s)**	0	1					
No	**C15. Third Party Landscape Program Certification**	0					1	
Yes	**C16. Maintenance Contract with Certified Professional**	1					1	
No	**C17. Community Garden**	0	2					
D. STRUCTURAL FRAME AND BUILDING ENVELOPE								
	D1. Optimal Value Engineering							
No	D1.1 Joists, Rafters, and Studs at 24 Inches on Center	0		1		2		
Yes	D1.2 Non-Load Bearing Door and Window Headers Sized for Load	1				1		
Yes	D1.3 Advanced Framing Measures	2				2		
No	**D2. Construction Material Efficiencies**					1		
	D3. Engineered Lumber							
Yes	D3.1 Engineered Beams and Headers	1				1		
Yes	D3.2 Wood I-Joists or Web Trusses for Floors	1				1		
No	D3.3 Enginered Lumber for Roof Rafters	0				1		
No	D3.4 Engineered or Finger-Jointed Studs for Vertical Applications	0				1		
Yes	D3.5 OSB for Subfloor	0.5				0.5		
Yes	D3.6 OSB for Wall and Roof Sheathing	0.5				0.5		
Yes	**D4. Insulated Headers**	1		1				
	D5. FSC-Certified Wood							
No	D5.1 Dimensional Lumber, Studs, and Timber	0				6		
No	D5.2 Panel Products	0				3		
	D6. Solid Wall Systems							
No	D6.1 At Least 90% of Floors	0				1		
No	D6.2 At Least 90% of Exterior Walls	0		1		1		
No	D6.3 At Least 90% of Roofs	0		1		1		
Yes	**D7. Energy Heels on Roof Trusses**	1		1				
24 inches	**D8. Overhangs and Gutters**	2		1		1		
	D9. Reduced Pollution Entering the Home from the Garage							
No	D9.1 Detached Garage	0			2			
Yes	D9.2 Mitigation Strategies for Attached Garage	1			1			
	D10. Structural Pest and Rot Controls							
No	D10.1 All Wood Located At Least 12 Inches Above the Soil	0				1		
No	D10.2 Wood Framing Treating With Borates or Factory-Impregnated, or Wall Materials Other Than Wood	0				1		
No	**D11. Moisture-Resistant Materials in Wet Areas (such as Kitchen, Bathrooms, Utility Rooms, and Basements)**	0			1	1		
E. EXTERIOR								
No	**E1. Environmentally Preferable Decking**	0				1		
No	**E2. Flashing Installation Third-Party Verified**	0				2		
No	**E3. Rain Screen Wall System**	0				2		
Yes	**E4. Durable and Non-Combustible Cladding Materials**	1				1		
	E5. Durable Roofing Materials							
Yes	E5.1 Durable and Fire Resistant Roofing Materials or Assembly	1				1		
Yes	E5.2 Roofing Warranty for Shingle Roofing	Y	R	R	R	R	R	
No	**E6. Vegetated Roof**	0	2	2				

F. INSULATION								
	F1. Insulation with 30% Post-Consumer or 60% Post-Industrial Recycled Content							
Yes	F1.1 Walls and Floors	1				1		
Yes	F1.2 Ceilings	1				1		
	F2. Insulation that Meets the CDPH Standard Method—Residential for Low Emissions							
Yes	F2.1 Walls and Floors	1			1			
Yes	F2.2 Ceilings	1			1			
	F3. Insulation That Does Not Contain Fire Retardants							
Yes	F3.1 Cavity Walls and Floors	1			1			
Yes	F3.2 Ceilings	1			1			
Yes	F3.3 Interior and Exterior Insulation	1			1			
G. PLUMBING								
	G1. Efficient Distribution of Domestic Hot Water							
Yes	G1.1 Insulated Hot Water Pipes	1		1				
No	G1.2 WaterSense Volume Limit for Hot Water Distribution	0					1	
No	G1.3 Increased Efficiency in Hot Water Distribution	0					2	
	G2. Install Water-Efficient Fixtures							
Yes	G2.1 WaterSense Showerheads with Matching Compensation Valve	2					2	
Yes	G2.2 WaterSense Bathroom Faucets	1					1	
Yes	G2.3 WaterSense Toilets with a Maximum Performance (MaP) Threshold of No Less Than 500 Grams	1					1	
No	G2.4 Urinals with Flush Rate of ≤ 0.1 Gallons/Flush	0					1	
No	**G3. Pre-Plumbing for Graywater System**	0					1	
No	**G4. Operational Graywater System**	0					3	
Yes	**G5. Submeter Water for Tenants**	2					2	
H. HEATING, VENTILATION, AND AIR CONDITIONING								
	H1. Sealed Combustion Units							
Yes	H1.1 Sealed Combustion Furnace	1			1			
Yes	H1.2 Sealed Combustion Water Heater	2			2			
No	**H2. High Performing Zoned Hydronic Radiant Heating System**	0		1	1			
	H3. Effective Ductwork							
Yes	H3.1 Duct Mastic on Duct Joints and Seams	1		1				
Yes	H3.2 Pressure Balance the Ductwork System	1		1				
Yes	**H4. ENERGY STAR® Bathroom Fans Per HVI Standards with Air Flow Verified**	1			1			
	H5. Advanced Practices for Cooling							
No	H5.1 ENERGY STAR Ceiling Fans in Living Areas and Bedrooms	0		1				
Yes	H5.2 Operable Windows and Skylights Located to Induce Cross Ventilation in At Least One Room in 80% of Units	1		1				
	H6. Whole House Mechanical Ventilation Practices to Improve Indoor Air Quality							
Yes	H6.1 Meet ASHRAE Standard 62.2-2010 Ventilation Residential Standards	Y	R	R	R	R	R	
No	H6.2 Advanced Ventilation Standards	0			1			
No	H6.3 Outdoor Air Ducted to Bedroom and Living Areas	0			2			
	H7. Effective Range Design and Installation							
No	H7.1 Effective Range Hood Ducting and Design	0			1			
No	H7.2 Automatic Range Hood Control	0			1			
I. RENEWABLE ENERGY								
No	**I1. Pre-Plumbing for Solar Water Heating**	0		1				
No	**I2. Preparation for Future Photovoltaic Installation**	0		1				
	I3. Onsite Renewable Generation (Solar PV, Solar Thermal, and Wind)	0		25				
	I4. Net Zero Energy Home							
No	I4.1 Near Zero Energy Home	0		2				
No	I4.2 Net Zero Electric	0		4				
No	**I5. Solar Hot Water Systems to Preheat Domestic Hot Water**	0		4				
≥90% of common area	**I6. Photovoltaic System for Multifamily Projects**	8		12				
J. BUILDING PERFORMANCE AND TESTING								
Yes	**J1. Third-Party Verification of Quality of Insulation Installation**	1			1			
Yes	**J2. Supply and Return Air Flow Testing**	2		1	1			
Yes	**J3. Mechanical Ventilation Testing and Low Leakage**	1			1			
Yes	**J4. Combustion Appliance Safety Testing**	1			1			
2013	**J5. Building Performance Exceeds Title 24 Part 6**							
10.0%	J5.1 Home Outperforms Title 24	25		30				
0.0%	J5.2 Non-Residential Spaces Outperform Title 24	0		15				
Yes	**J6. Title 24 Prepared and Signed by a CABEC Certified Energy Analyst**	1		1				
No	**J7. Participation in Utility Program with Third-Party Plan Review**	0		1				
No	**J8. ENERGY STAR for Homes**	0		1				
No	**J9. EPA Indoor airPlus Certification**	0			1			
K. FINISHES								
	K1. Entryways Designed to Reduce Tracked-In Contaminants							
No	K1.1 Entryways to Individual Units	0			1			
No	K1.2 Entryways to Buildiings	0			1			
No	**K2. Zero-VOC Interior Wall and Ceiling Paints**	0			2			
Yes	**K3. Low-VOC Caulks and Adhesives**	1			1			
	K4. Environmentally Preferable Materials for Interior Finish							
≥50%	K4.1 Cabinets	1				2		
No	K4.2 Interior Trim	0				2		
No	K4.3 Shelving	0				2		
No	K4.4 Doors	0				2		
No	K4.5 Countertops	0				1		
	K5. Formaldehyde Emissions in Interior Finish Exceed CARB							
TBD	K5.1 Doors				1			
Yes	K5.2 Cabinets and Countertops	2			2			
TBD	K5.3 Interior Trim and Shelving				2			
No	**K6. Products That Comply With the Health Product Declaration Open Standard**	0			2			
No	**K7. Indoor Air Formaldehyde Level Less Than 27 Parts Per Billion**	0			2			
No	**K8. Comprehensive Inclusion of Low Emitting Finishes**				1			
No	**K9. Durable Cabinets**	0			2			
No	**K10. At Least 25% of Interior Furniture Has Environmentally Preferable Attributes**	0			1			
L. FLOORING								
≥50%	**L1. Environmentally Preferable Flooring**	2				3		
≥50%	**L2. Low-Emitting Flooring Meets CDPH 2010 Standard Method—Residential**	2			3			
No	**L3. Durable Flooring**	0				1		
No	**L4. Thermal Mass Flooring**	0		1				
M. APPLIANCES AND LIGHTING								
No	**M1. ENERGY STAR® Dishwasher**	0					1	
No	**M2. CEE-Rated Clothes Washer**	0		1			2	
<25 cubic feet	**M3. Size-Efficient ENERGY STAR Refrigerator**	1		2				
	M4. Permanent Centers for Waste Reduction Strategies							
TBD	M4.1 Built-In Recycling Center					1		
No	M4.2 Built-In Composting Center	0				1		
	M5. Lighting Efficiency							
Yes	M5.1 High-Efficacy Lighting	2		2				
No	M5.2 Lighting System Designed to IESNA Footcandle Standards or Designed by Lighting Consultant	0		2				
No	**M6. Central Laundry**	0					1	
No	**M7. Gearless Elevator**	0		1				
N. COMMUNITY								
	N1. Smart Development							
Yes	N1.1 Infill Site	2	1			1		
No	N1.2 Designated Brownfield Site	0	1		1			
>25	N1.3 Conserve Resources by Increasing Density	2		2		2		
No	N1.4 Cluster Homes for Land Preservation	0	1			1		
	N1.5 Home Size Efficiency	9				9		
1154	Enter the area of the home, in square feet							
3	Enter the number of bedrooms							
Yes	**N2. Home(s)/Development Located Within 1/2 Mile of a Major Transit Stop**	2	2					
	N3. Pedestrian and Bicycle Access							
	N3.1 Pedestrian Access to Services Within 1/2 Mile of Community Services	2	2					
3	Enter the number of Tier 1 services							
8	Enter the number of Tier 2 services							
Yes	N3.2 Connection to Pedestrian Pathways	1	1					
No	N3.3 Traffic Calming Strategies	0	2					
Yes	N3.4 Sidewalks Buffered from Roadways and 5-8 Feet Wide	1	1					
Yes	N3.5 Bicycle Storage for Residents	1	1					
No	N3.6 Bicycle Storage for Non-Residents	0	1					
1.5 spaces per unit	N3.7 Reduced Parking Capacity	1	2					
	N4. Outdoor Gathering Places							

Yes	N4.1 Public or Semi-Public Outdoor Gathering Places for Residents	1	1					
No	N4.2 Public Outdoor Gathering Places with Direct Access to Tier 1 Community Services	0	1					
	N5. Social Interaction							
Yes	N5.1 Residence Entries with Views to Callers	1	1					
Yes	N5.2 Entrances Visible from Street and/or Other Front Doors	1	1					
No	N5.3 Porches Oriented to Street and Public Space	0	1					
Yes	N5.4 Social Gathering Space	1	1					
	N6. Passive Solar Design							
No	N6.1 Heating Load	0		2				
No	N6.2 Cooling Load	0		2				
	N7. Adaptable Building							
No	N7.1 Universal Design Principles in Units	0	1		1			
No	N7.2 Full-Function Independent Rental Unit	0	1					
	N8. Affordability							
≥50%	N8.1 Dedicated Units for Households Making 80% of AMI or Less	2	2					
Yes	N8.2 Units with Multiple Bedrooms for Households Making 80% of AMI or Less	1	1					
Yes	N8.3 At Least 20% of Units at 120% AMI or Less are For Sale	1	1					
	N9. Mixed-Use Developments							
No	N9.1 Live/Work Units Include a Dedicated Commercial Entrance	0	1					
No	N9.2 At Least 2% of Development Floor Space Supports Mixed Use	0	1					
No	N9.3 Half of the Non-Residential Floor Space is Dedicated to Community Service	0	1					
O. OTHER								
Yes	**O1. GreenPoint Rated Checklist in Blueprints**	Y	R	R	R	R	R	
Yes	**O2. Pre-Construction Kickoff Meeting with Rater and Subcontractors**	2		0.5		1	0.5	
Yes	**O3. Orientation and Training to Occupants—Conduct Educational Walkthroughs**	2		0.5	0.5	0.5	0.5	
TBD	**O4. Builder's or Developer's Management Staff are Certified Green Building Professionals**			0.5	0.5	0.5	0.5	
No	**O5. Home System Monitors**	0		2			1	
	O6. Green Building Education							
Yes	O6.1 Marketing Green Building	2	2					
No	O6.2 Green Building Signage	0		0.5			0.5	
Yes	**O7. Green Appraisal Addendum**	Y	R	R	R	R	R	
No	**O8. Detailed Durability Plan and Third-Party Verification of Plan Implementation**	0				1		
No	**O9. Residents Are Offered Free or Discounted Transit Passes**	0	2					
No	**O10. Vandalism Deterrence Practices and Vandalism Management Plan**	0				1		
P. DESIGN CONSIDERATIONS								
	P1. Acoustics: Noise and Vibration Control		1		1			
5	Enter the number of Tier 1 practices							
0	Enter the number of Tier 2 practices							
	P2. Mixed-Use Design Strategies							
No	P2.1 Tenant Improvement Requirements for Build-Outs	0			1		1	
No	P2.2 Commercial Loading Area Separated for Residential Area	0			1			
No	P2.3 Separate Mechanical and Plumbing Systems	0			1			
	P3. Commissioning							
No	P3.1 Design Phase	0		1	1			
No	P3.2 Construction Phase	0		1	1			
No	P3.3 Post-Construction Phase	0		1	1			
No	**P4. Building Enclosure Testing**	0		1	1	1		
Summary								
	Total Available Points in Specific Categories	381	43	138	61	86	53	
	Minimum Points Required in Specific Categories	50	2	25	6	6	6	
Total Points Achieved		133.0	43.0	138.0	61.0	86.0	53.0	

APPENDIX O

Construction Drawings

STRUCTURAL NOTES

GENERAL

APPLYING TO ALL STRUCTURAL FEATURES UNLESS OTHERWISE SHOWN OR NOTED.

1. ALL WORK SHALL BE PERFORMED IN CONFORMANCE WITH THE 2013 CALIFORNIA BUILDING CODE (CBC).
2. THE CONTRACTOR SHALL VERIFY ALL DIMENSIONS AND SITE CONDITIONS BEFORE STARTING WORK. THE ENGINEER SHALL BE NOTIFIED OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
3. UNLESS OTHERWISE SHOWN OR NOTED, ALL TYPICAL DETAILS SHALL BE USED WHERE APPLICABLE. ALL DETAILS SHALL BE CONSIDERED TYPICAL AT SIMILAR CONDITIONS.
4. UNLESS OTHERWISE SHOWN OR NOTED, FOLLOW MANUFACTURER'S INSTALLATION RECOMMENDATIONS FOR ALL STRUCTURAL PRODUCTS USED ON THIS PROJECT.
5. THE APPROVED DRAWINGS SHALL BE KEPT ON THE JOB SITE AND SHALL BE AVAILABLE TO AUTHORIZED REPRESENTATIVES OF THE BUILDING OFFICIAL. THERE SHALL BE NO DEVIATION FROM THE STAMPED DRAWINGS WITHOUT OFFICIAL APPROVAL.
6. SAFETY MEASURES: AT ALL TIMES, THE CONTRACTOR SHALL BE SOLELY AND COMPLETELY RESPONSIBLE FOR THE CONDITIONS OF THE JOB SITE INCLUDING SAFETY OF PEOPLE AND PROPERTY, AND FOR ALL NECESSARY INDEPENDENT ENGINEERING REVIEWS OF THESE CONDITIONS.
7. ANY OPENING, HOLES, CUTS OR DISCONTINUITIES NOT SHOWN ON THE STRUCTURAL DRAWINGS AND EXTENDING INTO OR THROUGH STRUCTURAL ELEMENTS REQUIRE THE PRIOR APPROVAL OF THE ENGINEER, AND MAY REQUIRE SPECIAL STRUCTURAL DETAILING.
8. CONTRACTORS SHALL SCHEDULE WORK TO MINIMIZE INTERRUPTION AND INCONVENIENCE TO THE ACTIVITIES OF THE ADJACENT BUILDING INHABITANTS.
9. CONTRACTOR SHALL COMPLY WITH CITY OF WALNUT CREEK REQUIREMENTS FOR THE PROTECTION OF PUBLIC RIGHT-OF-WAY (SIDEWALKS).
10. THE LOCATION OF EXISTING UTILITY LINES IS THE RESPONSIBILITY OF THE CONTRACTOR.
11. INTENT:
 IF CERTAIN FEATURES ARE NOT FULLY SHOWN OR CALLED FOR ON THE DRAWINGS OR SPECIFICATIONS, THEIR CONSTRUCTION SHALL BE OF THE SAME CHARACTER AS FOR SIMILAR CONDITIONS THAT ARE SHOWN OR SPECIFIED.
12. REFERENCE TO OTHER DRAWINGS:
 12.1 SEE DRAWINGS OTHER THAN STRUCTURAL FOR KINDS OF FLOOR FINISH AND THEIR LOCATION, FOR DEPRESSIONS IN FLOOR SLABS, FOR OPENINGS IN WALLS AND FLOORS REQUIRED BY ARCHITECTURAL AND MECHANICAL FEATURES, FOR DRIVEWAY PAVING, WALKS, RAMPS, STAIRS, CURBS, ETC.
 12.2 HOLES AND OPENINGS THROUGH WALLS AND FLOORS FOR DUCTS, PIPING AND VENTILATION SHALL BE CHECKED BY THE CONTRACTOR WHO SHALL VERIFY SIZES AND LOCATION OF SUCH HOLES OR OPENINGS WITH THE PLUMBING, HEATING, VENTILATING AND ELECTRICAL DRAWINGS AND SUB-CONTRACTORS.

DESIGN DATA

1. CODE: CALIFORNIA BUILDING CODE, 2013 EDITION.
2. DESIGN VERTICAL LOADS: DL LL
 FLOOR --14 PSF 40 PSF
 ROOF -- 15 PSF 20 PSF
 WALLS --12 PSF ---
3. LATERAL LOAD:
 A. WIND DESIGN LOADS - PER CBC SECTION 1609

BASIC WIND SPEED 110 MPH
EXPOSURE CATEGORY B
IMPORTANCE FACTOR, Iw 1.0

 B. SEISMIC DESIGN - PER CBC SECTION 1613

OCCUPANCY CATEGORY II
SEISMIC DESIGN CATEGORY D
SITE CLASS D
BASIC LATERAL FORCE RESISTING SYSTEM LIGHT-FRAMED (WOOD) WALLS SHEATHED WITH WOOD STRUCTURAL PANELS RATED FOR SHEAR RESISTANCE.
DESIGN SHORT PERIOD ACCELERATION SDS = 1.21g
MAPPED ONE SECOND PERIOD ACCELERATION S1 = 0.63g
DESIGN ONE SECOND ACCELERATION SD1 = 0.63g
RESPONSE MODIFICATION FACTOR R = 6.5
IMPORTANCE FACTOR I = 1.0
SEISMIC RESPONSE COFFICIENT, (SDS*I/R) Cs = 0.19
BASE SHEAR, V = Cs * W = 0.19 W [ASD]

TESTS
& SPECIAL INSPECTIONS

1. PROVIDE TESTS AND INSPECTIONS FOR ALL ITEMS AS REQUIRED BY THE 2013 CBC CODE.
2. THE OWNER SHALL RETAIN AN INDEPENDENT TESTING LAB TO PERFORM ALL REQUIRED TESTING AND INSPECTIONS.
3. THE CONTRACTOR SHALL PROVIDE THE TESTING LAB WITH CONSTRUCTION SCHEDULES TO ENSURE PROPER COORDINATION OF WORK.
4. THE FOLLOWING SPECIFIC ITEMS SHALL BE INSPECTED OR TESTED BY THE TESTING LAB (CBC 1705):
 4.1 PLACEMENT OF REINFORCING STEEL (WITH ADEQUATE LEAD TIME TO MAKE ANY REQUIRED CORRECTIONS. CBC 1705.3)
 4.2 OBSERVATION OF SOIL EXCAVATION AND FOUNDATION CONSTRUCTION OPERATIONS BY GEOTECHNICAL ENGINEER. CBC 1705.6
 4.3 SHEARWALL NAILING & HOLDOWNS CBC1705.10.1 & CBC1705.11.2.
5. STRUCTURAL OBSERVATION SHALL BE REQUIRED BY THE ENGINEER FOR STRUCTURAL CONFORMANCE TO THE APPROVED DESIGN CBC1704.5.1.

FOUNDATIONS

1. THE FOUNDATION DESIGN IS BASED ON THE REQUIREMENTS OF A SOILS & FOUNDATION REPORT PREPARED BY A THIRD PARTY GEOTECHNICAL FIRM
2. ALLOWABLE SOIL BEARING PRESSURE; 2380 PSF FOR ALL LOADS.
3. EXCEPT WHERE OTHERWISE SHOWN, EXCAVATIONS SHALL BE MADE AS NEAR AS POSSIBLE TO THE NEAT LINES REQUIRED BY THE SIZE AND SHAPE OF THE STRUCTURE. ALL FOUNDATIONS SHALL BE PLACED WITHOUT THE USE OF SIDE FORMS WHEREVER POSSIBLE. IF THE TRENCHES CANNOT STAND, FULLY FORM SIDES TO DIMENSIONS SHOWN.
4. DO NOT ALLOW WATER TO STAND IN TRENCHES. IF BOTTOMS OF TRENCHES BECOME SOFTENED DUE TO RAIN OR OTHER WATER BEFORE CONCRETE IS CAST, EXCAVATE SOFTENED MATERIAL AND REPLACE WITH PROPERLY COMPACTED BACKFILL OR CONCRETE AT NO COST TO THE OWNER.
5. ALL EXCAVATIONS, FORMS AND REINFORCING ARE TO BE INSPECTED BY THE LOCAL BUILDING INSPECTOR PRIOR TO PLACING CONCRETE.
6. SITE PREPARATION & GRADING SHALL FOLLOW THE REQUIREMENTS OF THE SOILS & FOUNDATION REPORT & UPDATED DOCUMENTATIONS BY THE THIRD PARTY GEOTECHNICAL FIRM.
7. SOIL ENGINEER SHALL BE RETAINED TO PROVIDE OBSERVATION & TESTING SERVICES DURING THE GRADING & FOUNDATION PHASE OF CONSTRUCTION PER SOILS REPORT RECOMMENDATIONS. INSPECTION & TESTING REPORTS SHALL BE SUBMITTED TO THE BUILDING DEPARTMENT.
8. COMPACT ALL FILL BELOW THE INTERIOR MAT SLAB TO 98% RELATIVE DENSITY, PER ASTM D1557, CURRENT EDITION.

ROUGH CARPENTRY

1. FOR SCHEDULE OF MINIMUM NAILING SEE TABLE 2304.9.1, CALIFORNIA BUILDING CODE, 2013 EDITION. UNLESS OTHERWISE NOTED, ALL NAILS SHALL BE COMMON NAILS.
2. METAL FRAMING DEVICES:
 PROVIDE TYPICAL CONNECTORS FOR WOOD FRAMING BY SIMPSON CO. OR EQUAL. ALL CONNECTIONS SHALL BE 16 GA. GALVANIZED SHEET METAL OR THICKER, U.O.N., FULLY NAILED IN ALL PUNCHED HOLES WITH NAILS OF SIZE AND LENGTH SPECIFIED AND/OR PROVIDED BY MANUFACTURER. IF CONNECTORS ARE AVAILABLE IN DIFFERENT SIZES, THE SIZE USED SHALL BE AS SHOWN IN DETAILS OR ELSE THE LARGEST SIZE MADE FOR THE DEPTH OF MEMBER BEING FRAMED. COMPARABLE FASTENERS BY OTHER MANUFACTURERS MAY BE USED IF APPROVED IN ADVANCE BY THE DESIGN ENGINEER.
3. ALL FRAMING LUMBER SHALL BE GRADE STAMPED S-DRY (19% MOISTURE CONTENT)
4. SAWN LUMBER:
 U.O.N. ALL FRAMING LUMBER SHALL BE DOUGLAS FIR LARCH (COAST REGION), GRADED AND MARKED IN ACCORDANCE WITH THE STANDARD GRADING RULES NUMBER 16 OF THE WEST COAST LUMBER INSPECTION BUREAU.
 POSTS, JOISTS, RAFTERS & BEAMS -----------------------------NO. 1 GRADE
 STUDS --STUD GRADE
5. STRUCTURAL STUD WALLS:
 5.1 USE SINGLE BOTTOM PLATE AND DOUBLE TOP PLATE UNLESS OTHERWISE NOTED OR SHOWN. STAGGER JOINTS IN UPPER AND LOWER MEMBERS OF TOP PLATES NOT LESS THAN 4'-0".
 5.2 BOLT SILL PLATE TO CONCRETE AS PER ANCHOR BOLT SCHEDULE. ONE BOLT SHALL BE WITHIN 9" OF EACH END OF EACH PIECE OF PLATE. PROVIDE 2 BOLTS MINIMUM PER PIECE. AT CONTRACTOR'S OPTION, SIMPSON MUDSILL ANCHORS ARE ACCEPTABLE IN LIEU OF ANCHOR BOLTS, SEE SHEARWALL SCHED.
6. BOLTS:
 6.1 BOLTS SHALL BE PER ASTM A307, U.O.N.
 6.2 BOLT HOLES 1/16" OVERSIZE. THREADS SHALL NOT BEAR ON WOOD OR STEEL.
 6.3 USE STANDARD MALLEABLE IRON WASHERS AGAINST WOOD. 2 3/4" Øx 5/16" THICK FOR 5/8" BOLTS. 3" Øx7/16" THICK FOR 3/4" BOLTS
 6.4 ALL BOLTS EXPOSED TO WEATHER OR PROLONGED DAMPNESS SHALL BE HOT-DIPPED GALVANIZED.
7. SCREWS:
 7.1 (WOOD OR LAG) SCREWS SHALL BE SCREWED AND NOT DRIVEN INTO PLACE.
 7.2 IN SPACING SCREWS, THE HOLES SHALL BE BORED TO THE SAME DIAMETER AND DEPTH OF THE SCREW SHANK. THE HOLES FOR THE THREADED PORTION OF THE SCREWS SHALL BE BORED WITH A BIT NOT LARGER THAN THE DIAMETER OF THE BASE OF THE THREAD.
8. WOOD PRESERVATIVE:
 ALL WOOD FRAMING IN CONTACT WITH CONCRETE AND/OR EXPOSED TO WEATHER OR PROLONGED DAMPNESS SHALL BE TREATED WITH 'BORATE' AT THE RATE OF 0.23 POUNDS PER CUBIC FOOT IN ACCORDANCE WITH AWPA SPECIFICATIONS, OR SHALL BE WOOD OF NATURAL RESISTANCE TO DECAY.
9. REGULAR, NON-GALVANIZED BOLTS MAY BE USED WITH BORATE-TREATED MUDSILLS.
10. MANUFACTURED LUMBER SHALL BE BY "TRUSJOIST", OR APPROVED EQUAL.

SHEATHING

1. U.O.N., USE DOUGLAS FIR APA EXTERIOR, EXPOSURE 1, RATED SHEATHING IN CONFORMANCE WITH THE U.S. COMMERCIAL STANDARDS PSI-95, PS2-92, OR NER-108 (PRP-108).
2. FLOOR SHEATHING SHALL BE 15/32" T&G OSB w/ EDGES LOCATED OVER BLOCKING AND NAILED w/ 10d @ 6"o.c. EDGE NAILING & 6"o.c. FIELD NAILING, U.O.N. SPAN RATING 48/24, UNBLOCKED. GLUE TO FLOOR JOISTS, U.O.N.
3. SHEARWALL SHEATHING SHALL BE 15/32" OSB WITH EDGE NAILING AS INDICATED ON THE DRAWINGS, 16d SINKER NAILS MAY BE SUBSTITUTED FOR THE 10d COMMON NAILS INDICATED, BLOCK AT PANEL EDGES' AS REQ'D. WHERE SHEATHING IS REQ'D FOR WALL FINISH ONLY, EDGE NAILING SHALL BE 10d.

CONCRETE

1. CONCRETE CEMENT SHALL CONFORM TO 2013 CBC STND. NO. 19-1, AND SHALL BE TYPE II. TYPE I CEMENT MAY BE USED IN AREAS NOT IN CONTACT WITH EARTH. AGGREGATE SHALL BE HARDROCK, CONFORMING TO ASTM C-33, AND FREE OF ALKALI-REACTIVITY. WATER/CEMENT RATIO SHALL NOT EXCEED 55%. FLY ASH / SLAG CONTENT SHALL BE NO MORE THAN 50%. ACID SOLUBLE CHLORIDE CONTENT SHALL NOT EXCEED 0.2 PERCENT OF CEMENT WEIGHT. CHLORIDE-FREE ADMIXTURES AND PLASTICIZERS FOR WORKABILITY MAY BE USED IF APPROVED BY THE TESTING LABORATORY AND ENGINEER. BECAUSE EXCESS WATER REDUCES CONCRETE STRENGTH, ADDING WATER AT THE SITE IS DISCOURAGED AND SHALL NOT EXCEED ONE GALLON PER CUBIC YARD.
2. INSTALL ALL INSERTS, BOLTS, ANCHORS, AND REINFORCING BARS AND SECURELY TIE PRIOR TO PLACING CONCRETE.
3. CONCRETE SHALL ATTAIN A MINIMUM ULTIMATE COMPRESSIVE STRENGTHS AT 28 DAYS OF 2500 PSI.
4. CONCRETE SHALL BE PLACED IN A CONTINUOUS OPERATION BETWEEN PREDETERMINED CONSTRUCTION JOINTS.
5. CONCRETE SHALL BE CONTINUOUSLY CURED FOR 5 DAYS AFTER PLACEMENT IN ANY APPROVED MANNER.
6. THE LOCATION AND PROTECTION OF EXISTING UTILITIES IS THE RESPONSIBILITY OF THE CONTRACTOR. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IF UTILITY PIPES RUN THROUGH, OR WITHIN 24" BELOW, ANY NEW CONCRETE CONSTRUCTION.
7. PIPE OR DUCTS EXCEEDING ONE-THIRD THE SLAB OR WALL THICKNESS SHALL NOT BE PLACED IN STRUCTURAL CONCRETE UNLESS SPECIFICALLY DETAILED.
8. PIPES MAY PASS THROUGH STRUCTURAL CONCRETE IN SLEEVES, BUT SHALL NOT BE EMBEDDED THEREIN.
9. CONCRETE SHALL NOT BE ALLOWED TO CURE IN TEMPERATURES LESS THAN 40º FAHRENHEIT FOR THE FIRST THREE DAYS.
10. MAXIMUM SLUMP: 4 INCHES.

REINFORCING STEEL

1 USE ASTM A615 REINFORCEMENT GR. 60
2 ALL REINFORCEMENT SHALL BE CONTINUOUS. STAGGER SPLICES WHERE POSSIBLE. LAPS FOR SPLICES SHALL BE AS PER THE LAP SPLICE SCHEDULE SHOWN IN THESE DRAWINGS.
3 HOLD REINFORCEMENT IN ITS TRUE HORIZONTAL AND VERTICAL POSITION WITH DEVICES SUFFICIENTLY NUMEROUS TO PREVENT DISPLACEMENT.

ROOF TRUSSES

1. FABRICATED TRUSSES FOR ROOF FRAMING SHALL BE DESIGNED BY A CALIFORNIA LICENSED ENGINEER. PRIOR TO FABRICATION OF TRUSSES, THE FOLLOWING MATERIALS BEARING APPROVAL OF THE PROJECT ENGINEER SHALL BE SUBMITTED TO THE BUILDING OFFICIAL FOR REVIEW AND APPROVAL:
1.1. 2 SETS OF TRUSS DRAWINGS.
1.2. 2 LAYOUT PLANS DELINEATING THE LOCATIONS OF ALL TRUSSES.
1.3. ONE SET OF DESIGN CALCULATIONS SHOWING
 *AXIAL AND BENDING STRESSES
 *JOINT DESIGN
2. DESIGN LOADS ARE AS FOLLOWS:
2.1 DEAD LOAD
 2.1.1. TOP CHORD - 9 PSF
 2.1.2. BOTTOM CHORD - 8 PSF
2.2 LIVE LOAD - 20 PSF
2.3 WIND LOAD - 18 PSF

ABBREVIATIONS

A.B.	ANCHOR BOLT
BM.	BEAM
CLR.	CLEAR
COL.	COLUMN
CONC.	CONCRETE
CONN.	CONNECTION
DIA.	DIAMETER
EMBED.	EMBEDMENT
E.N.	EDGE NAILING
F.J.	FLOOR JOIST
FL.	FLOOR
FT	FOOT OR FEET
JST	JOIST
HDR.	HEADER
O.C.	ON CENTER
REINF.	REINFORCEMENT
SCHED.	SCHEDULE
S.W.	SHEAR WALL
TYP.	TYPICAL

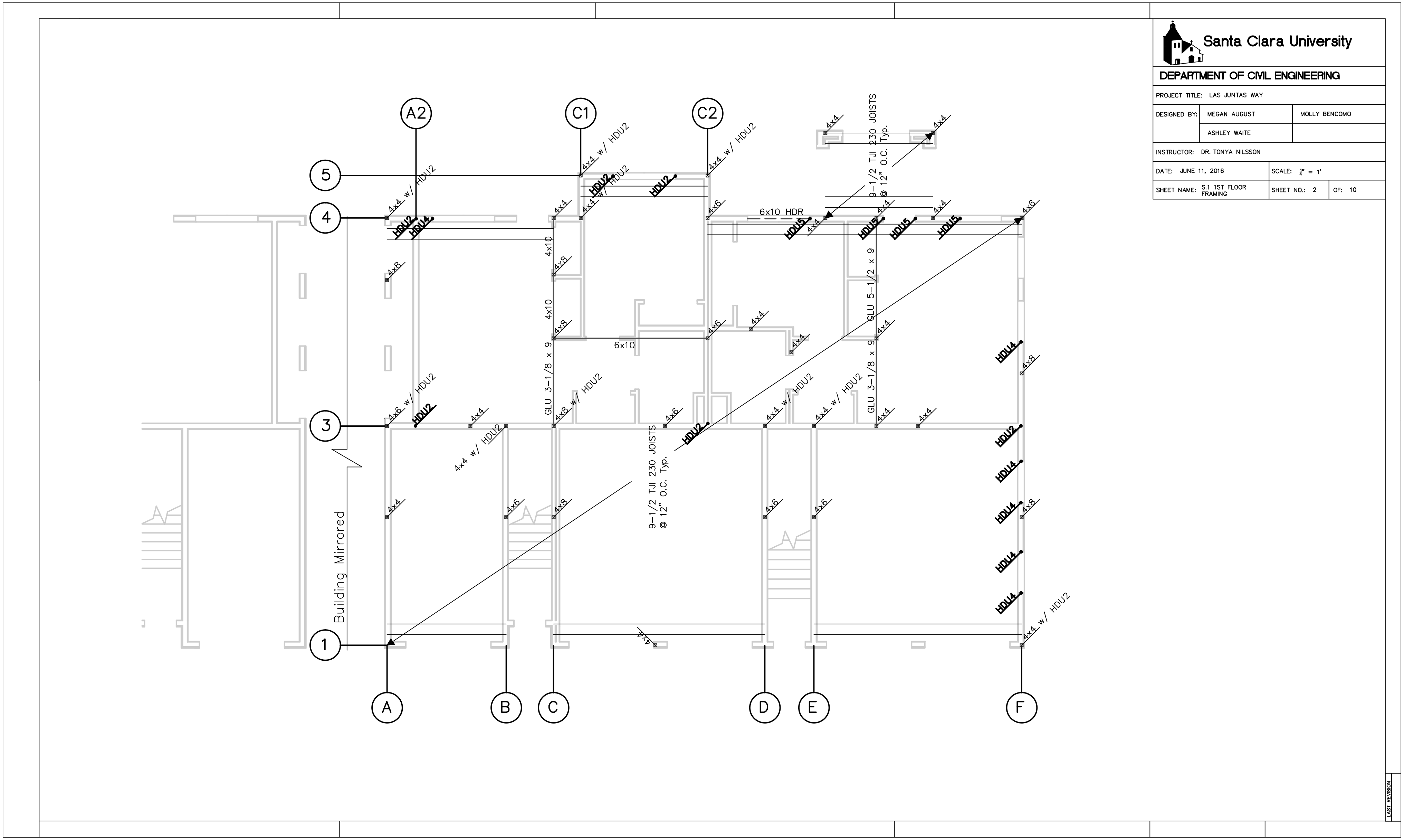
SPECIAL CHARACTERS
& AND
@ AT
Ø DIAMETER OR ROUND

Santa Clara University

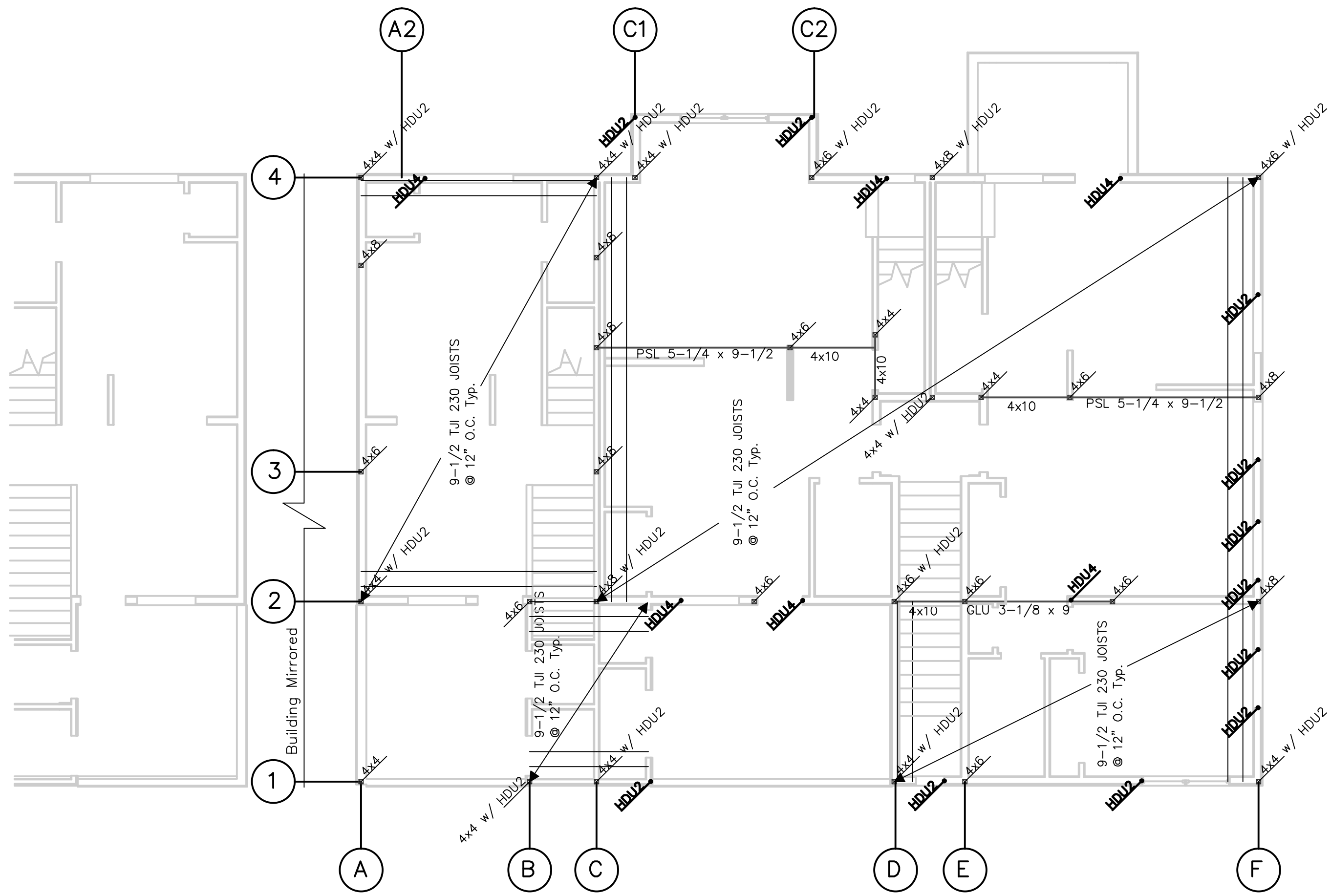
DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY		
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO
	ASHLEY WAITE	
INSTRUCTOR: DR. TONYA NILSSON		
DATE: JUNE 11, 2016	SCALE: NONE	
SHEET NAME: S.0 GENERAL NOTES	SHEET NO.: 1	OF: 10

LAST REVISION



A2
C1
C2
5
4
3
1
A
B
C
D
E
F
Building Mirrored
4x4 w/ HDU2
HDU2
HDU4
4x8
4x10
6x10
6x10 HDR
HDU5
9-1/2 TJI 230 JOISTS @ 12" O.C. Typ.
GLU 3-1/8 x 9
GLU 5-1/2 x 9
4x6 w/ HDU2
4x8 w/ HDU2
4x4
4x6
4x8
Santa Clara University
DEPARTMENT OF CIVIL ENGINEERING
PROJECT TITLE: LAS JUNTAS WAY
DESIGNED BY: MEGAN AUGUST
MOLLY BENCOMO
ASHLEY WAITE
INSTRUCTOR: DR. TONYA NILSSON
DATE: JUNE 11, 2016
SCALE: ¼" = 1'
SHEET NAME: S.1 1ST FLOOR FRAMING
SHEET NO.: 2
OF: 10
LAST REVISION

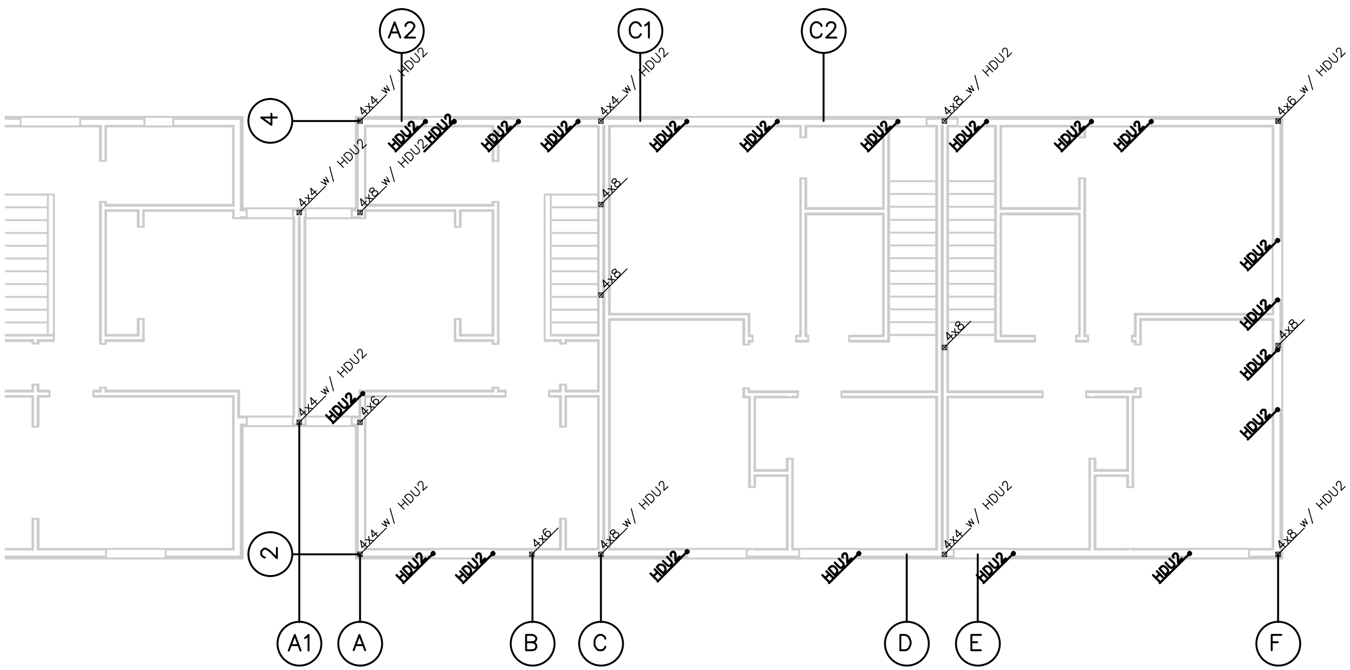


Santa Clara University

DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY			
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO	
	ASHLEY WAITE		
INSTRUCTOR: DR. TONYA NILSSON			
DATE: JUNE 11, 2016		SCALE: ⅛" = 1'	
SHEET NAME: S.2 2ND FLOOR FRAMING		SHEET NO.: 3	OF: 10

LAST REVISION



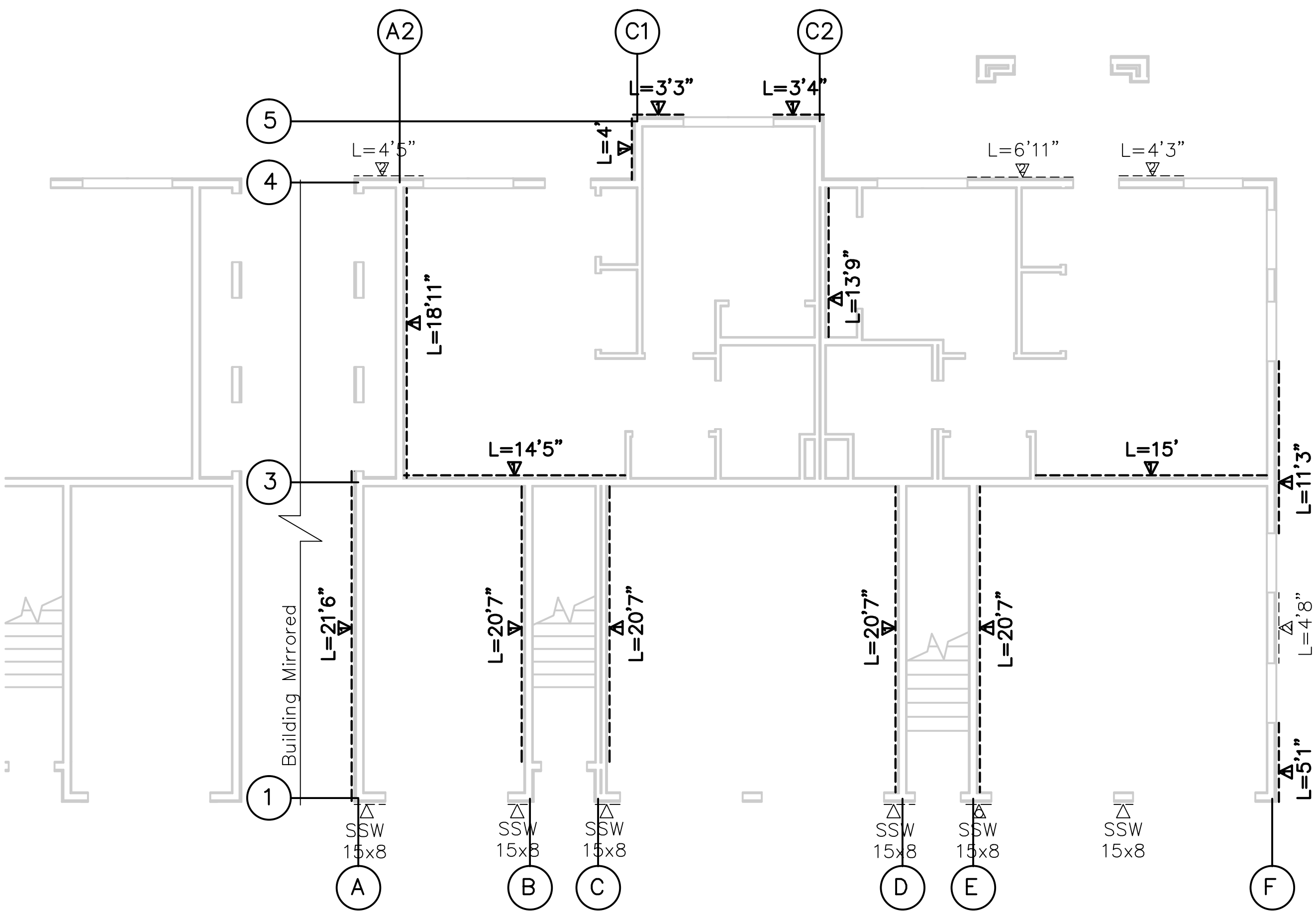
Santa Clara University

DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY			
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO	
	ASHLEY WAITE		
INSTRUCTOR: DR. TONYA NILSSON			
DATE: JUNE 11, 2016	SCALE: ¼" = 1'		
SHEET NAME: S.3 3RD FLOOR FRAMING	SHEET NO.: 4	OF: 10	

LAST REVISION

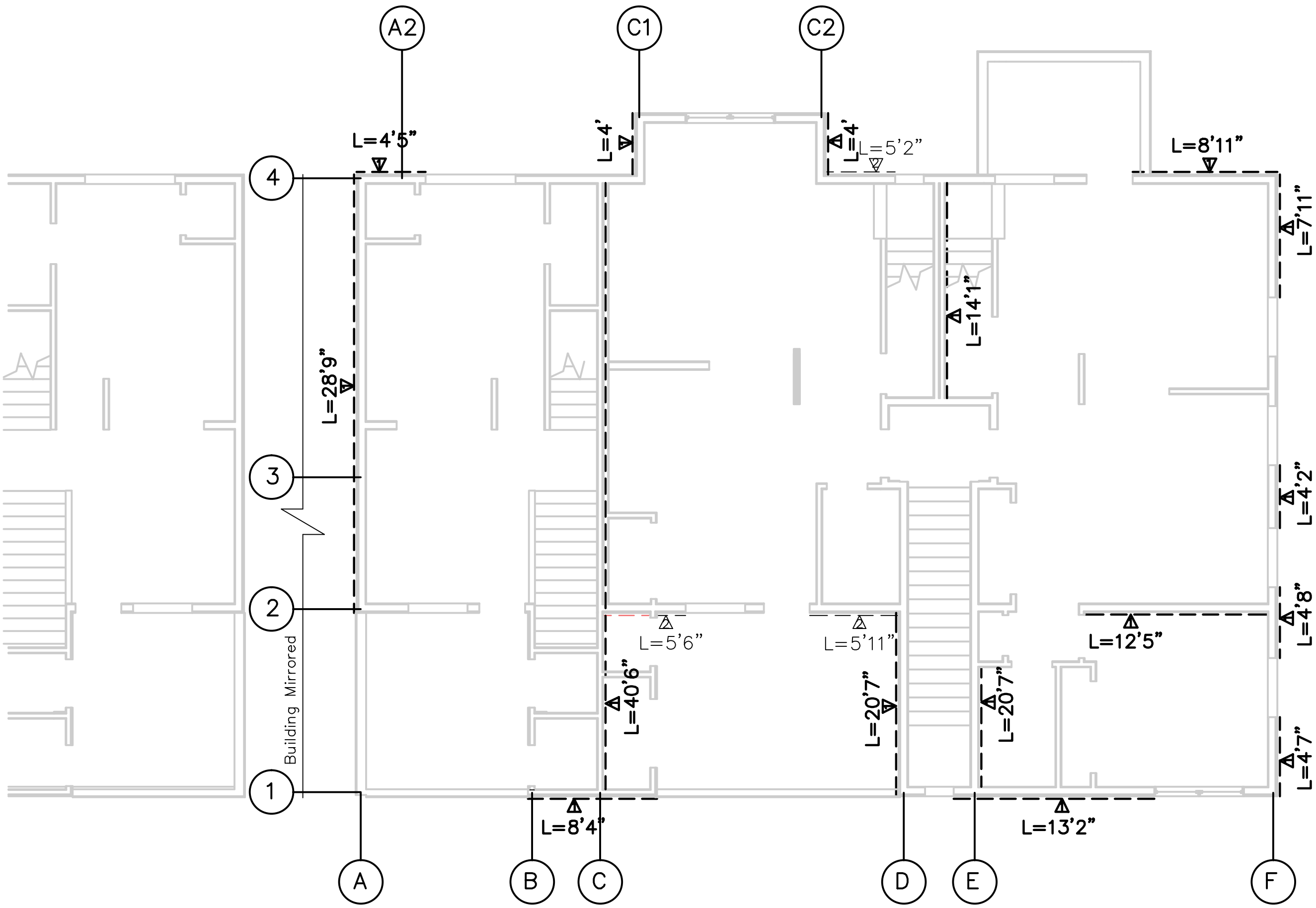
Santa Clara University	
DEPARTMENT OF CIVIL ENGINEERING	
PROJECT TITLE: LAS JUNTAS WAY	
DESIGNED BY: MEGAN AUGUST	MOLLY BENCOMO
ASHLEY WAITE	
INSTRUCTOR: DR. TONYA NILSSON	
DATE: JUNE 11, 2016	SCALE: ¼" = 1'
SHEET NAME: S.4 1ST FLOOR SHEAR WALL LAYOUT	SHEET NO.: 5 OF: 10



SHEAR WALL SCHEDULE

WALL MARK	ALLOWABLE SHEAR LOAD (PLF)	EDGE NAILING	SIMPSON CLIP SIZE & SPACING	SILL PLATE NAILING SIZE & SPACING	ANCHOR BOLTS SPACING
1	310	10d @ 6" O.C.	A35 @ 16" O.C.	10d @ 4" O.C.	48" O.C.
2	310	10d @ 6" O.C.	A35 @ 16" O.C.	16d @ 4" O.C.	48" O.C.
△	SIMPSON STEEL STRONGWALLS, MODEL SSW 15x8				
△ (double)	DOUBLE SIMPSON STEEL STRONGWALLS, MODEL SSW 15x8				

LAST REVISION



Santa Clara University

DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY

DESIGNED BY: MEGAN AUGUST, MOLLY BENCOMO, ASHLEY WAITE

INSTRUCTOR: DR. TONYA NILSSON

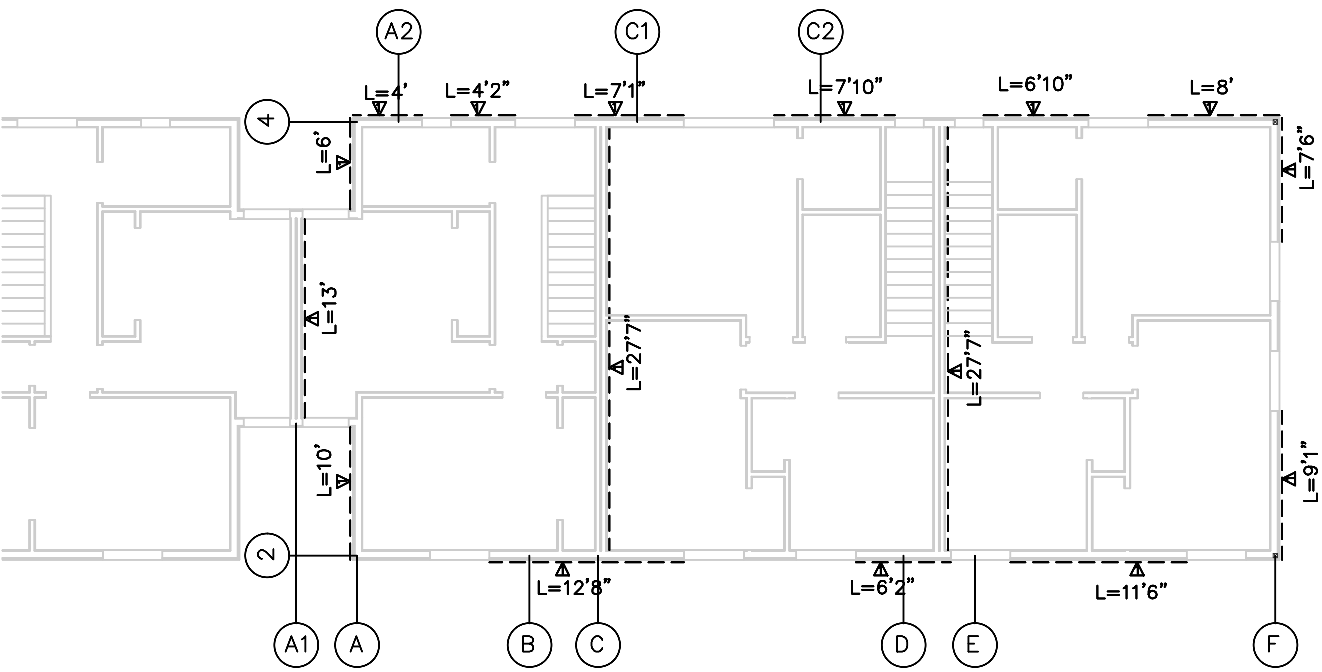
DATE: JUNE 11, 2016 | SCALE: ¼" = 1'

SHEET NAME: S.5 2ND FLOOR SHEAR WALL LAYOUT | SHEET NO.: 6 | OF: 10

SHEAR WALL SCHEDULE

WALL MARK	ALLOWABLE SHEAR LOAD (PLF)	EDGE NAILING	SIMPSON CLIP SIZE & SPACING	SILL PLATE NAILING SIZE & SPACING
1	310	10d @ 6" O.C.	A35 @ 16" O.C.	10d @ 4" O.C.
2	310	10d @ 6" O.C.	A35 @ 16" O.C.	16d @ 4" O.C.

LAST REVISION



Santa Clara University

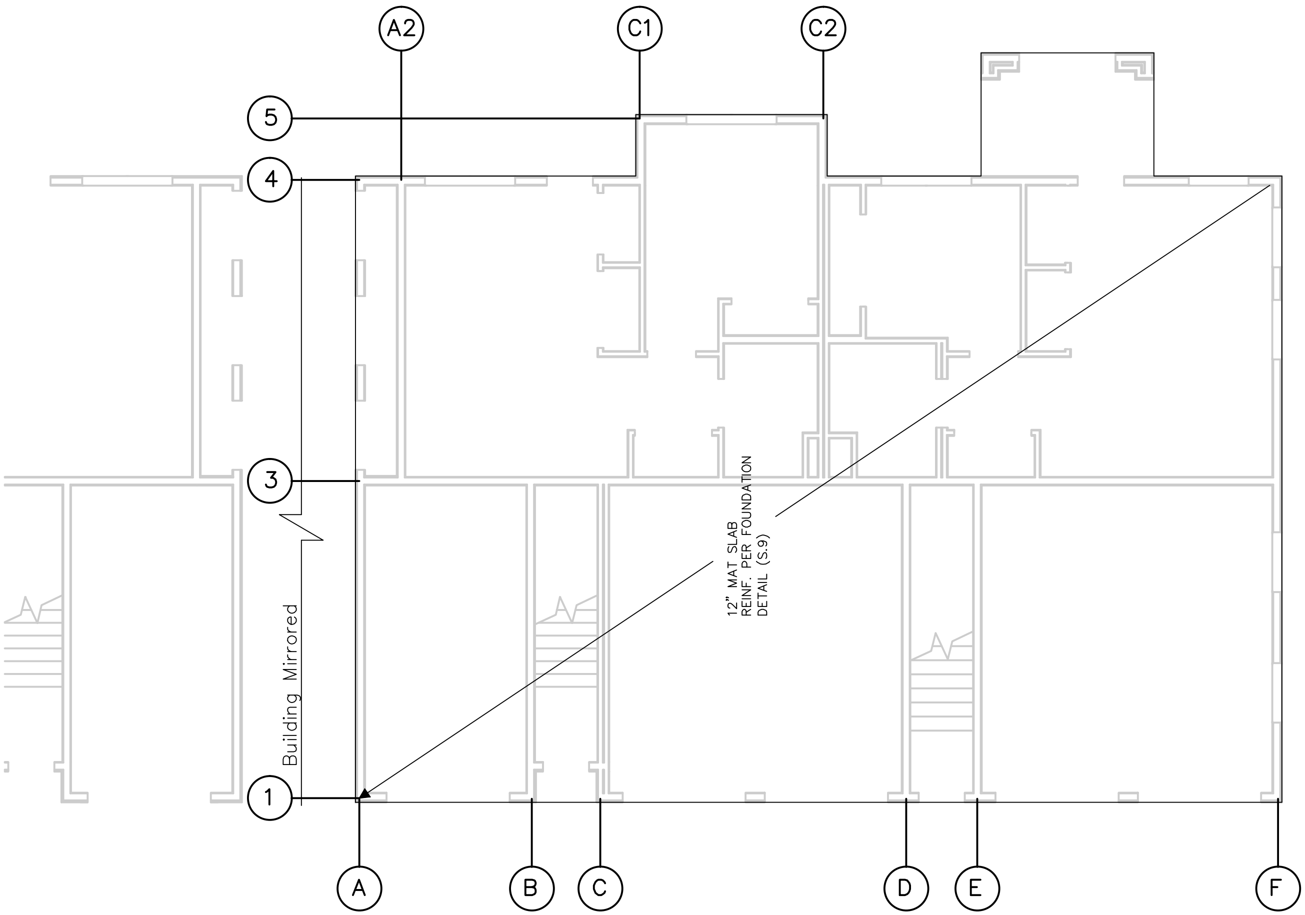
DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY		
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO
	ASHLEY WAITE	
INSTRUCTOR: DR. TONYA NILSSON		
DATE: JUNE 11, 2016	SCALE: ¼" = 1'	
SHEET NAME: S.6 3RD FLOOR SHEAR WALL LAYOUT	SHEET NO.: 7	OF: 10

SHEAR WALL SCHEDULE

WALL MARK	ALLOWABLE SHEAR LOAD (PLF)	EDGE NAILING	SIMPSON CLIP SIZE & SPACING	SILL PLATE NAILING SIZE & SPACING
1	310	10d @ 6" O.C.	A35 @ 16" O.C.	10d @ 4" O.C.

LAST REVISION

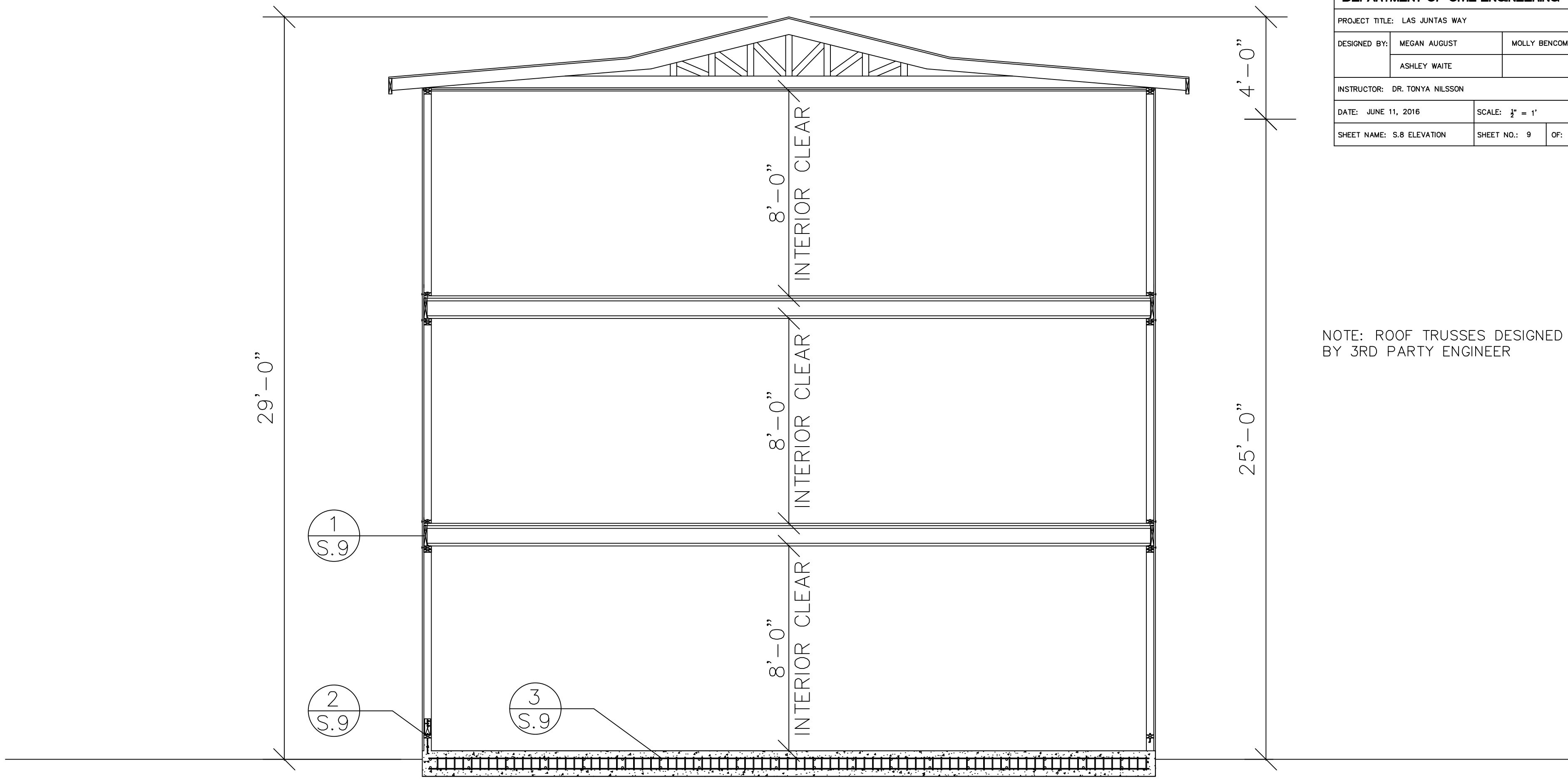


Santa Clara University

DEPARTMENT OF CIVIL ENGINEERING

PROJECT TITLE: LAS JUNTAS WAY		
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO
	ASHLEY WAITE	
INSTRUCTOR: DR. TONYA NILSSON		
DATE: JUNE 11, 2016	SCALE: $\frac{1}{4}$" = 1'	
SHEET NAME: S.7 FOUNDATION	SHEET NO.: 8	OF: 10

LAST REVISION



NOTE: ROOF TRUSSES DESIGNED BY 3RD PARTY ENGINEER

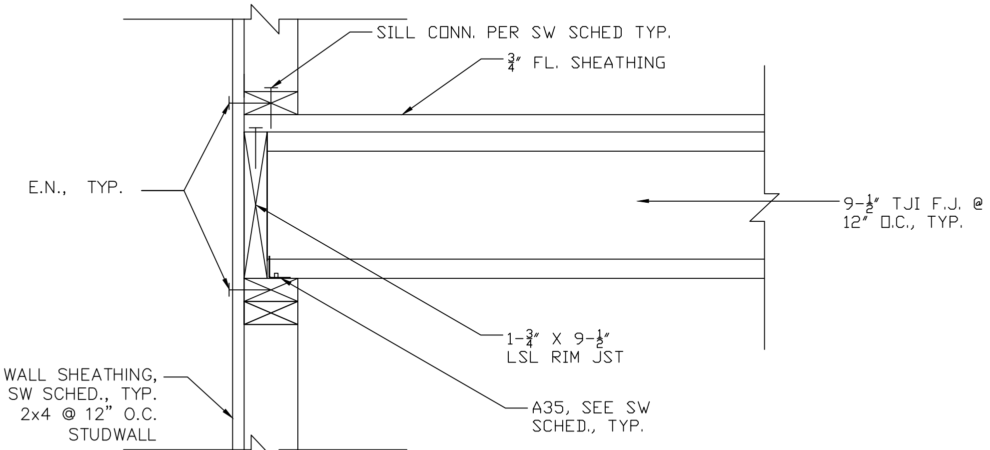
Santa Clara University

DEPARTMENT OF CIVIL ENGINEERING

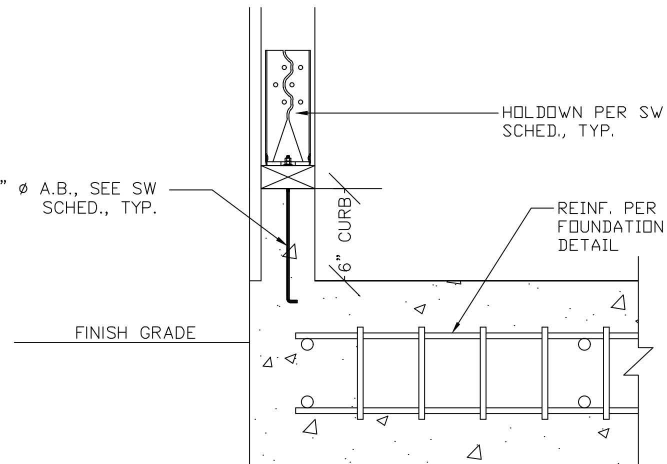
PROJECT TITLE: LAS JUNTAS WAY	
DESIGNED BY: MEGAN AUGUST	MOLLY BENCOMO
ASHLEY WAITE	
INSTRUCTOR: DR. TONYA NILSSON	
DATE: JUNE 11, 2016	SCALE: 1/2" = 1'
SHEET NAME: S.8 ELEVATION	SHEET NO.: 9 OF: 10

LAST REVISION

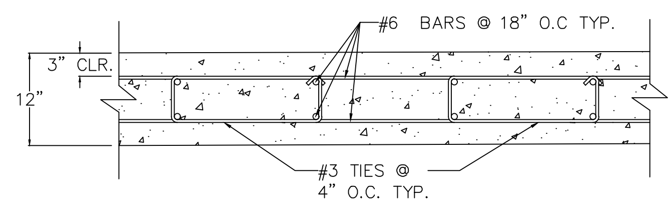
Santa Clara University			
DEPARTMENT OF CIVIL ENGINEERING			
PROJECT TITLE: LAS JUNTAS WAY			
DESIGNED BY:	MEGAN AUGUST	MOLLY BENCOMO	
	ASHLEY WAITE		
INSTRUCTOR: DR. TONYA NILSSON			
DATE: JUNE 11, 2016		SCALE: VARIES	
SHEET NAME: S.9 DETAILS		SHEET NO.: 10	OF: 10



1 LOAD TRANSFER DETAIL
SCALE: 3" = 1'



2 FOUNDATION CONNECTION DETAIL
SCALE: 3" = 1'



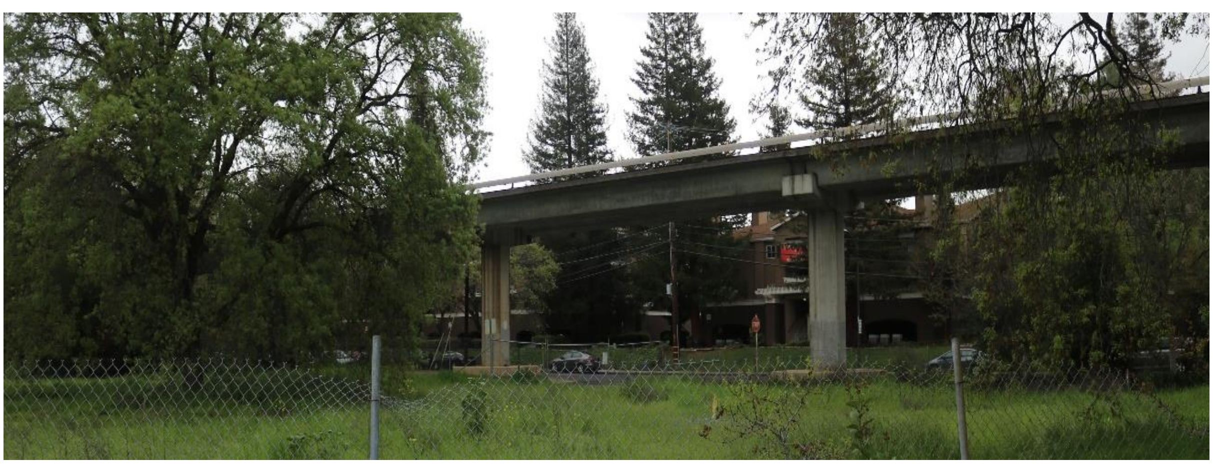
3 FOUNDATION REINF. DETAIL
SCALE: 1-1/2" = 1'

LAST REVISION

APPENDIX P

Field Visit Photos





APPENDIX Q

Literature Review

Literature Review

Prior to meeting with representatives from Habitat for Humanity, we knew nothing about the organization's operations or qualification process. We only knew, like most, that Habitat for Humanity builds homes for low-income families using volunteer work. From our face-to-face meeting with representatives and Smith's (2013) article, we have learned so much more.

Habitat for Humanity is the only international organization of its kind to offer its partner families "for-sale" housing, instead of "for-rent" housing. Since its founding in the 1970s, Habitat has grown internationally and helps thousands of families each year. According to Smith (2013), Habitat has moved more towards multi-family housing projects in recent years, in order to meet affordable housing demands more quickly (pg. 99). Our project is a great example of this push for multi-family structures. Housed on just over two acres, the apartment complex for our project will have fifty-two apartment units once completed. If the homes were, instead, single-family homes, only ten to twelve units would fit on the property. This means that our project has four-hundred percent more impact with this configuration than another. Knowing that our project will eventually help over fifty families is both humbling and inspiring.

Connections are important in structural designs because they transfer all loads from each floor to the foundation. Chowdhury et al.'s (2013) piece presents useful information on the design of connections (p. 388, 392). For example, the research paper on connection design does an extensive analysis of the relationship between the capacity of the connection and its proportionality to the number of fasteners per joint (Ahmed, Canino & Chowdhury, 2011). This allows us to start thinking about our process for deciding what connections to use and the spacing and sizing of the connections. We will take the article's advice to use prefabricated metal connectors, as we are planning to use Simpson Strong-Tie products.

Because the structure is three stories tall with aspects like large beam spans and load-bearing walls, the structure acts as a much larger system than we've seen before with a multitude of design components. This will affect how we determine our load paths, as there are many pieces to consider. We will need to look at the structure as an entire system when analyzing possible modes of failure, just as Bulleit et al. mentions in his article. Likewise, we will attempt to look at our project using the concepts of building science explained in "Residential Building Construction: State-of-the-Art Review," as the project as a whole fits the description of the buildings described (Memari et. al., 2014, p. B4014005-17-B4014005-18). Because a variety of experts will be working on the project once it is handed over to Habitat, we will make sure to take a multidisciplinary approach.

Depending on the loads that are applied to our structure's beam, a stronger timber material called glulams may be required. Another source that helps us is the research paper discussing the use of glulam beams in timber design (Tomasi, Parisi & Piazza, 2009). Our apartment building will be constructed completely out of timber beams except for the concrete foundation. As our group was brainstorming different methods of designing the building, one option we came up with was the use of glulams. Glulams are an engineered lumber and they are usually very effective because they provide stronger members and are more ductile; thus, they can be formed into unconventional shapes. The disadvantage of glulams is that they are generally more expensive than regular beams. As we are working for Habitat for Humanity, it is especially important to keep cost in mind. We do not have extra funding to waste and we want to present as economical a design as possible while still maintaining a high level of safety. The research paper title "Ductile Design of Glued-Laminated Timber Beams" does a good job of detailing the advantages of glulams. It also discusses the use of glulams made out of Douglas Fir, which is the type of lumber that is typically used in the Bay Area. The research paper makes sure to emphasize that glulams are most often useful in structures where a high level of ductility is necessary. This is a good factor to keep in mind as we approach our design and start looking closely at the design constraints.

Foundation design is another focus of our research due to our team's lack of background knowledge on this subject. Foundation design is an important component to any project because a building cannot be constructed without one. It needs to be designed correctly in order to make the rest of the building stand safely. Our team intends to redesign the foundation for Habitat's apartment building. Walnut Creek is located in the East San Francisco Bay Area. The Bay Area, in general, is known to have expansive soils below ground surface, making foundation design very difficult. Expansive soils make design challenging because they shrink in dry conditions and expand drastically in wet conditions. Based on trial and error, residential foundation types have changed dramatically in the Bay Area over the past 60 years (Kropp, 2011). A gradual transition occurred among structural engineers on the preferred foundation type. Initially, isolated footings were used since they were easy to construct. After experimentation, isolated footings gradually shifted to drilled piers, and finally ended with a post-tensioned mat slab foundation. Even with post-tensioned mat slab foundations, liquefaction is still an issue. Solutions to the liquefaction phenomena are still being researched today. It is beneficial for our team to be aware of what foundations have been used historically in order to determine which design is best for our project. Now that we know liquefaction is an issue, we can discuss possible solutions with our professors and advisors to make our design structurally safe.

Lateral design is used to make sure a building can withstand horizontal movement. Since our project is a residential apartment complex in the Bay Area, the lateral design components include both wind and seismic. However, since it is a residential building, wind design will govern seismic design. The weakest point for wind design in any basic structure is the corner of it. This is because roof uplift pressures are higher at the four corners of a building. Fortunately, several tests have been conducted for wind design capacities. It is concluded that standardized tests are sufficient for design capacities. However, they are not useful for extreme wind conditions (Dixon, 2010). It is unlikely for Walnut Creek to experience extreme wind conditions; thus, making basic wind design considerations enough for the scope of our project.

After our structural design is complete, we intend to create a 3D model of our design in Revit Structure. We want to do this in order to visually see what we designed and whether or not it is feasible to construct. Additionally, it would be useful for Habitat for Humanity to have this model. The model can mitigate risks, reduce errors, save time and cost, as well as enhance the quality of their final product (Alizadehsalehi, 2015). The architecture firm working with Habitat also uses Revit. They would be able to constructively look at our model and determine how it can best be used to benefit Habitat's organization.

Overall, we aspire to create a project for Habitat for Humanity that can be used as reference for their final design. Through research and aid from our advisors, we believe this goal can be achieved.

APPENDIX R

Works Cited

Works Cited

Ahmed, S. S., Canino, I., & Chowdhury, A. G. (2011). Study of the Capability of Multiple Mechanical Fasteners in Roof-to-Wall Connections of Timber Residential Buildings. *Practice Periodical On Structural Design & Construction*,*16*(1), 2-9.

Alizadehsalehi, S., Koseoglu, O., and Celikag, M. (2015). "Integration of Building Information Modeling (BIM) and Laser Scanning in Construction Industry." *AEI*, 2015, 163-174.

ASCE 7 Windspeed. *Windspeed.atcouncil.org*. N.p. 2016. Web. 3 June 2016.

Bulleit, W., Rosowsky, D., Fridley, K., and Criswell, M. (1993). "Reliability of Wood Structural Systems." *J. Struct. Eng.*, 119(9), 2629–2641.

California Earthquake Information. *Earthquake.usgs.gov*. N.p., 2016. Web. 3 June 2016.

Chowdhury, A., Canino, I., Mirmiran, A., Suksawang, N., and Baheru, T. (2013). "Wind-Loading Effects on Roof-to-Wall Connections of Timber Residential Buildings." *J. Eng. Mech. 139, SPECIAL ISSUE: Experimental Methods in Damage Detection and Wind Engineering*, 386–395.

Dixon, C. and Prevatt, D. (2010). "What Do We Learn from Wind Uplift Tests of Roof Systems?" *Structures Congress*, 2010, 2405-2416.

Ekstrom, L., Franke, K., Youd, T., Fonseca, F., and Francis, M. (2015). "Liquefaction and Residential Foundations: Lessons Learned from Past Earthquakes." *IFCEE*, 2015, 1227-1236.

Fragiacomo, M., & Schänzlin, J. (2013). Proposal to Account for Concrete Shrinkage and Environmental Strains in Design of Timber-Concrete Composite Beams. *Journal Of Structural Engineering*, *139*(1), 162-167.

"Greenpoint Rated". *Builditgreen.org.* N.p., 2016. Web. 23 May 2016.

Gupta, R., & Limkatanyoo, P. (2008). Practical Approach to Designing Wood Roof Truss Assemblies. Practice Periodical On Structural Design & Construction, 13(3), 135-146.

Habitat for Humanity East Bay/Silicon Valley. "Providing Low-Income Housing for Families in Need in Oakland, San Jose, Silicon Valley, and the East Bay". *Habitatebsv.org.* N.p., 2016. Web. 23 May 2016.

Kildsgaard, I. i., Jarnehammar, A. a., Widheden, A. a., & Wall, M. (2013). "Energy and Environmental Performance of Multi-Story Apartment Buildings Built in Timber Construction Using Passive House Principles." *Buildings*, *3*(1), 258-277.

Kropp, A. (2011). "Survey of Residential Foundation Design Practice on Expansive Soils in the San Francisco Bay Area." *J. Perform. Constr. Facil.*, 10.1061, 24-30.

Lee, K. J., Kim, H. W., & Lee, J. K. (1998). Case- and constraint-based project planning for apartment construction. *AI Magazine*, *19*(1), 13-24.

Memari, A., Huelman, P., Iulo, L., Laquatra, J., Martin, C., McCoy, A., Nahmens, I., and Williamson, T. (2014). "Residential Building Construction: State-of-the-Art Review." *J. Archit. Eng.* 20, SPECIAL SECTION: Housing and Residential Building Construction, B4014005-1-B4014005-32.

Schmidt, R. and Miller, J. (2012). "Considerations for Design of Rafters in Timber Buildings." *Pract. Periodical Structural Design Construction*, 17(3), 127–132.

"Simpson Strong-Tie". *Simpson Strong-Tie Site.* N.p. 2016. Web. 23 May 2016.

Smith, C. A. (2013). The Rise of Habitat for Humanity Subdivisions. *American Geographical Society's Focus On Geography*, 56(3), 95-104.

Tomasi, R., Parisi, M. A., & Piazza, M. (2009). Ductile Design of Glued-Laminated Timber Beams. *Practice Periodical On Structural Design & Construction*, *14*(3), 113-122.

“Weyerhaeuser: Home”. *Weyerhaeuser.com.* N.p., 2016. Web. 23 May 2016.