ANTELOPE SPRINGS METHODIST CHURCH REVIVAL

Mile High Consultants

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A report submitted to the University of Colorado at Denver, Civil Engineering Department in partial fulfillment of the Senior Design course.

Spring 2021
Submitted April 26, 2021
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April 26, 2021

Mr. Kim Grant  
Colorado Preservation, Inc.  
1420 Ogden Street, Suite 103  
Denver, Colorado, 80218

The Wolever Family, Ms. Sharon Wolever, Property Owner

Re: Final Report of Findings and Recommendations  
Antelope Springs Methodist Church Revival  
Snyder, Colorado 80750

Dear Messrs. Grant and Wolever,

Mile High Consultants would like to thank you for the privilege of analyzing and developing solutions for the revival of the Antelope Springs Methodist Church as part of our Senior Design project. It is our understanding you wish to rehabilitate one of the most endangered places in Colorado which is the Antelope Springs Methodist Church. The purpose of involvement was to provide a historical account of the site, its historical significance, and providing building elevations and floor, roof, structural plans, and structural assessment and analysis of the building. Also, to provide improvements that stabilize the historical church without changing its historical aesthetics. We researched the importance of the historic church as it serves the main heritage to the people in Morgan County. As a part of our investigation, we performed two site visits on January 31, and March 6, 2021. We met with Mr. Grant, and he provided us with background information. Also, we obtained measurements and checked out the affected parts of the Antelope Springs Methodist Church. We also consulted with Dr. Chengyu Li, P.E., S.E., professor at the University of Colorado Denver. The professor provided us with some structural advice that should be considered. This report contains our findings, conclusions, and recommendations.
1.0 Project Background

The Antelope Springs Methodist Church was founded in 1915 by a community of local farmers. The church is located in Morgan Country, which one of 64 counties of the state of Colorado, and its building style is an example of the styles used in the late 19th and early 20th century by the American Movements. The church is currently the only remaining building from this community that serves as the main heritage to the people around that region. The Antelope Springs Methodist Church served religious purposes and was also used by the community members to hold important meetings. Important festivities such as weddings, harvest festivals, family reunions, and club meetings among others were also held at the Antelope Springs Church. As such, the building holds many precious memories to the community members who were part of its history. The church also has a two-story which was added in 1932 that grants access to a full basement. The Antelope Springs Methodist Church is a renowned historical building that still serves the purpose of reuniting members of this community as was its initial goal when it was developed in 1915 (“Antelope Springs Methodist Episcopal Church,” 2020).

The Antelope Springs Methodist Church’s current owner is under the local Wolever family. Notably, this historical creation has withstood various tragedies including a fire incident that happened around 3 a.m. on Sunday, July 14, 2019. It almost destroyed its entire existence. The building escaped a fire disaster after locals and passers-by reacted quickly to the signals that were coming from inside. The suspicious activity from within the church prompted the locals to act quickly and help apprehend the suspect responsible who was charged with arson. The firefighters from the New Raymer Volunteer Fire Department and the Hillrose Volunteer Fire Department responded quickly to the reports made and managed to save the building before it was destroyed.
(“Public Safety: Multiple Fires in Morgan County on Sunday”, 2019). The incident led to the destruction of the ceiling beam and some parts of the roof although the interior was considerably saved from massive destruction. According to “Public Safety: Multiple Fires in Morgan County on Sunday” (2019), the two suspects Kyle Floyd and Jacob Roper were arrested on the same day and they were charged with first-degree arson, second-degree burglary, and first-degree criminal trespass. Juvenile, a 17-year-old occupant, turned himself on Monday. He was driving the car that was leaving the church while it was on fire. Despite this unfortunate incident, the Antelope Springs Church remains intact and there is hope for its restoration. However, this can only be achieved if a determined group or community members are willing and ready to sacrifice their time and resources to bring back the glory of the Antelope Springs Church after the disaster.

The Wolever family who is the current owners of the Antelope Springs church have also had their fair shares of tragedies. Prior to the fire, Kim Wolever lost his husband Craig to a road accident (“Antelope Springs Methodist Episcopal Church,” 2020). The tragedy occurred at a time when the family was in the process of restoring the church through non-profit corporations. They are determined to return the original purpose of the church which is transforming it back to a community center where members can share the historical value. The Wolever family also intends to include schools and organizations in the sharing of these values to ensure that everyone learns something from this great historical building. This goal will be made possible and realistic given the support the church has received from other community members after the attempted arson. The community is determined to help and has shown efforts such as helping the family find additional partners, providing technical support, and offering funds for rehabilitation to restore the glory of Antelope Springs Church.
In the spirit of conserving historical sites, the Colorado Preservation Inc. (CPI) was introduced. The institution provides advocacy, education, and preservation services to members of the community as well as individuals. CPI was founded in 1984 and has for decades served to achieve its mission through education, training, and advocacy. It has formed sustainable partnerships with various organizations and agencies including educators, property owners, and local governments to ensure that all historical buildings are preserved and restored to their initial glory. The company serves the main vision which is honoring and protecting heritage by encouraging citizens to be part of the process. In so doing, CPI leads individuals to build a sustainable future with historic places such as the Antelope Springs Church in addition to inspiring them to accept and prioritize their past as a legacy (Colorado Preservation Inc., 2021). As earlier stated, CPI is actively involved in the reconstruction of the Antelope Springs Church and with the help of the community and external support from partners, the organization is determined to achieve this goal and restore the heritage of the building.

1.1 Building Location

The Antelope Springs Church is located in a small town called Snyder. Snyder has an area of 227 acres. It is located in Morgan County, Colorado. John Wesley Snyder was a pioneer rancher, and the town was named after him in 1922.
Figure 1. Antelope Springs Church Location (Colorado HomeTownLocator, 2021)

Figure 2. Vicinity Map
1.2 Legal Description

Address: Antelope Springs Church is located at 31948 CO-71, Snyder, Colorado 80750, Morgan County 40°27′52.37″ N, 103°36′0.55″ W

Property Size: 40,272 Square feet

Building Size: 1,207 Square feet

Owner: The Wolever Family

27880 HWY 71, Snyder, CO 80750, USA

1.3 Historical Account of Site and Its Historical Significance

The Antelope Springs Methodist Church was built in 1915 by local farmers and ranchers of the Antelope Springs community. The church was a single story and was approximately five hundred square feet at the time of its construction. In 1932, the church received additional square footage, which included, a second story, an entry area, and a full basement. For decades, the church served as a community gathering place for religious meetings, weddings, baby showers, family reunions, dinners, harvest festivals, and club meetings. Not only does the church serve as a community gathering place, but it also serves as a historical site that carries many memories.

1.4 Timeline of The Antelope Springs Church

- 1889 – Morgan County was founded.
- 1910 – Residents of Antelope Springs were planning to build the church.
- 1915 – The Antelope Springs Church was built by local farmers and ranchers.
- 1932 – A two-story addition with access to a full basement was built.
- 1999 – The Antelope Springs Church closed.
• 2013 – Added to the National Register for Historic Places.
• 2019 – The Antelope Springs Church was set on fire due to an arson event.

2.0 Purpose

The Antelope Springs Church has a significant rule for Snyder’s residents. The church was used for both community and religious purposes. It was used by community members to hold community potluck dinners, weddings, baby showers, harvest festivals, family reunions, and club meetings. Due to an arson event in 2019, the historical church was set on fire and it harshly affected its entire existence.

As part of the University of Colorado Denver senior design project, Mile High Consultants has been tasked to rehabilitate the Antelope Springs Church. Also, to preserve its historical features and aesthetics. The following deliverables are required to achieve the goals of the project:

• Gathering background information of the Antelope Springs Church.
• A historical account of the site and its historical significance.
• A timeline of the development between the discovery of the area to the present day, including the arson event.
• Identify the extent of the fire damage and what fire-related repairs are required.
• Providing building elevations and floor, roof, structural plans, and structural assessment and analysis of the building.
• Calculations of snow and wind loads.
• Suggestions to improve the stabilization of the church while preserving its historic features. The recommendations should follow the 2014 Colorado State guideline titled "Historic Structure Assessment State Historical Fund Annotated Scope of Work."

• Develop two plans for the building as follows:
  o The urgent modifications needed to stabilize the building, and protect it from collapse, vandalism, and moisture intrusion.
  o The required modifications needed to restore the full integrity of the building for historical preservation.

3.0 Jurisdiction Having Authority

The Antelope Springs Methodist Church is privately owned by the Wolever family. As it is located in the unincorporated town of Snyder, jurisdiction falls under Morgan County.

• Morgan County
  218 Kiowa Ave.
  Fort Morgan, CO 80701
  Email: morgancountybcc@co.morgan.co.us
  Phone: 970-542-3500
  www.morgancounty.colorado.gov/
  https://library.municode.com/co/fort_morgan/codes/municipal_code
4.0 Applicable Building Codes

The county of Morgan adopted the 2015 International Building Code standards (referred to as IBC henceforth) on January 1, 2017, according to Ordinance No. 1187. The update to the Morgan County Municipal Code was to match the state standards.

The project was designed using the following guidelines and specifications:

- 2015 International Building Code (IBC)
- 2015 International Residential Code (IRC)
- American Society of Civil Engineers (ASCE) 7-16 “Minimum Design Loads for Buildings and Other Structures”
- American Concrete Institute (ACI) 318 “Building Code Requirements for Reinforced Concrete”
- National Design Standard for Wood Construction, By the American Forest and Paper Association and American Wood Council, 2018
- State Historical Fund (SHF) Historic Structure Assessment (2014)

Design Criteria for the location of the church:

- Risk Category: II
- Wind Speed: 115 miles per hour (mph)
- Ground Snow Load: 30 pounds per square foot (psf)
- Frost Line Depth: 36 inches
- Topographic Effects: No
- Seismic Design Category: A
- 1st Floor Live Load: 100 pounds per square foot (psf) (IBC 2015, Table 1607.1)
- 2nd Floor Live Load: 40 pounds per square foot (psf) (IBC 2015, Table 1607.1)

4.1 Wind Loads

For the main wind force resisting system we determined the wind loads according to Chapter 27 of the American Society of Civil Engineers (ASCE) 7-16 all heights method. This is the amount of load the main structure needs to resist. For the components and cladding, we determined the wind loads according to Chapter 30 of ASCE 7-16 low-rise building. The Morgan County Municipal Code gave some of the design parameters such as the exposure category and the basic wind speed. We assumed the other design parameters according to Chapter 27 of the ASCE 7-16. Here are the design parameters for wind loading:

- Wind Speed: 115 miles per hour (mph)
- Exposure Category: C
- Velocity Pressure Exposure Coefficient $K_z$: 0.85
- Topographic Factor $K_{zt}$: 1.0 (No Hills or Escarpments)
- Directionality Factor $K_d$: 0.85 (Main Wind Force Resisting System (MWFRS), Table 26.6-1
- Gust Factor $G$: 0.85
- “Enclosed” Building: $G_{ci}$: +/- 0.18 (Table 26.13-1)
- Mean Roof Height: 30 feet (Assuming height)

In order to find the wind load we used the ASCE Chapter 26 equation 26.10-1:

$$q_z = 0.00256 \times k_z \times k_{zt} \times k_d \times V^2 = 0.00256 \times k_z \times 1.0 \times 0.85 \times 115^2 = 28.78 \times k_z$$

The wind load calculation will help with the design of the new roof that will need to be replaced. See Exhibit 4 for continued wind load calculation.
4.2 Snow Loads

Snow loading in Colorado can be significant to the design of a structure. The design of snow loads for the project followed Chapter 7 of the American Society of Civil Engineers (ASCE) 7-16. The Morgan County Municipal Code provided the Ground Snow Load. We assumed the other design parameters according to Chapter 7 of the ASCE 7-16. Here are the design parameters for Snow Loading:

- Ground Snow Load: 30 pounds per square foot (psf)
- Importance Factor: 1.0 (Table 1.5-2)
- Exposure Factor $C_e$: 0.9 (Fully Exposed, Table 7.3-1)
- Thermal Factor $C_t$: 1.2 (Unheated Structure, Table 7.3-2)
- Cold Roof Slope Factor $C_s$: 0.5 (Slippery Roof with 45 deg slope)

Unbalanced snow loads are not required to be calculated due to the slope of the roof is greater than 7 on 12. The slope of the church's roof is being called out as 12 on 12. We do need to calculate the drift snow load and the sliding roof load that could be present on the wall of the second floor. Since the roof slope is 1 on 1 then there is a high probability that the snow will accumulate on the side of the second-floor wall. See Exhibit 4 for continued snow load calculation.
5.0 Findings

5.1 Site Visits

There is no doubt that site visits allow visitors an accurate experience of the space and its surroundings. As part of the University of Colorado Denver senior design project, on January 31, 2021, we did a site visit for the Antelope Springs Methodist Church. The site was easy to be found. All the team members arrived on time. We toured the project area with Mr. Kim Grant (Endangered places program director) and the Wolever Family (Property owner). They provided us with background information related to the Antelope Springs Church and its surrounding areas. They talked about the history of the church, its purpose, and the arson event. Also, they answered our questions related to the church. We observed the existing condition of the exterior and interior parts of the church. Including the walls, floors, roof, and foundation. The team was able to have a better understanding of the site, its condition, and its surrounding areas. The team obtained measurements of the whole church. We noticed that the main affected parts are the foundation, roof, and walls. Photos of the site visit can be found in Exhibit 3.

On Saturday, March 6, 2021, the team did a second site visit for the Antelope Springs Methodist Church. The team met Mr. Kim Grant and Mr. Jon Sargent (Deep Roots Craftsmen). The team discussed with them their opinion regarding the church’s foundation, roof, and walls. Our team took all the needed dimensions and measurements of the church. The dimensions were needed for the plans and drawings. The team evaluated each part of the church. The team took enough pictures, videos, and aerial photographs. Photos of the aerial photographs can be found in Exhibit 2.
5.2 Site Facts

- The church has an approximate area of 1,207 square feet.
- The church is at an elevation of 4545 feet (USGS, 2021).
- The Antelope Springs Church is affected by high winds as it is located in an open space in Morgan County.
- The surrounding areas of Antelope Springs Church are mainly farms and ranches.
- The church has two floors with a basement.
- Electricity was provided to the church. However, there is no electricity to the church currently.
- The closest fire station to the church is Hillrose Fire Protection District. It is located 14 miles away from the church.
- The church is a timber structure
- There is no drainage system in the church.
- There is no designated area for parking. The dirt area around the church has been used for guests parking.
- The church does not have any type of insulation.
- There are no bathrooms located in the church or on the property.
- There is no water run to the church.

5.3 First Floor

The first floor of the Antelope Springs Methodist Church is the primary gathering place in the building. It is where the community and religious meetings were held. It was used by
community members to hold, weddings, baby showers, harvest festivals, family reunions, and club meetings. It consists of several rows of benches, an altar, a wood-burning stove, and several windows. The fire was started on this level when a couch and multiple wooden benches were set ablaze. Damage to this floor included the flooring, ceiling, surrounding walls, windows, window trim, lighting, and existing furniture.

The nave area is located on the first floor. This area was constructed in 1915. It is where people who come worship sit. The most affected area by the fire is the first floor. It has dimensions of 30 feet by 30 feet. This floor contains eight windows. The biggest window is located on the east side of the church. It has a width of 68 inches and a height of 83 inches. The rest of the windows have the same dimensions of 33 inches by 60.5 inches. More photos of the first floor can be found in Exhibit 3.

5.3.1 First Floor Plan

![First Floor Plan](image)
5.4 Second Floor

The second floor of the Antelope Springs Church was built in 1932. It is accessed near the front doors of the church. A spiral staircase leads to a small room with a bench and provides a view of the surrounding area. Damage noted in this area included the windows and fire damage to the walls in the staircase. The second floor with an area of 144 square feet. The second floor is mainly used as an extra space or storage. Church supplies, extra chairs, and extra furniture can be stored on this floor. It has two windows, on the south and west sides of the church. The windows on the second floor have the same sizes as the seven windows on the first floor. More photos of the second floor can be found in Exhibit 3.

![Figure 4. Small Room on The Second Floor](image)
5.4.1 Second Floor Plan

![Second Floor Plan](image)

*Figure 5. Second Floor Plan*

5.5 Basement Floor

The basement and the second floor of the Antelope Springs Church were built in 1932. The basement contains a small storage closet under the stairs, a kitchen, and an open dining space. It is where community members used to hold community potluck dinners. Several cracks, varying in size, were found on the structure’s foundation. This is the most significant damage found in the basement. Several walls appeared to be bowing inward. Fire damage was found in the kitchen, as some of the floor beams above had been scorched. The is no water system provided to the kitchen as well as the whole church. There are 7 windows located in the basement with dimensions of 36 inches by 26 inches. The basement has an area of 900 square feet as well as the first floor. There are two columns located in the basement. Those columns are used to resist the lateral loads and to
prevent and bending of the floor above it. The kitchen column has a dimension of 4 inches by 6 inches. The other column located in the dining area has a dimension of 5 inches by 5 inches. Photos of the basement floor can be found in Exhibit 3.

**Figure 6. Basement Dining Area**  
**Figure 7. Basement Kitchen**

### 5.5.1 Basement Floor Plan

![Basement Floor Plan Diagram]

*Figure 8. Basement Floor Plan*
5.6 Roof Rafter System

The most significant damage was found in the roof of the Antelope Springs Church. After the fire, the roof was mainly still intact. Since the fire, part of the roof on the 1932 addition has fallen off and lies beside the structure. This portion of the building is currently open to the elements. The roof over the original church that was built in 1915 has been significantly scorched, however, the main roof rafter support system looks to be undamaged. The roof was constructed with a roof rafter-type system with cedar planks and then covered by metal decking. The current roof looks to have a pitch of 12 on 12. The current roof rafters look to be two by fours, two-foot on center. Currently, there is no ridge beam or ridge board. The ceiling joists are measured as two by sixes that span two feet on center like the rafters. The ceiling joists over the 1932 section of the church are charred and will need to be replaced. The ceiling joists over the 1915 section looked to be scorched, however, they look to be salvageable. More photos of the roof can be found in Exhibit 3.

Figure 9. Damaged Roof of the 1932 Addition
5.6.1 Roof Floor Plan

![Roof Floor Plan](image)

*Figure 10. Roof Floor Plan*

5.7 Framing

Framing of the structure was constructed with two by fours, sixteen inches on center. The majority of the framing in the structure was still intact and not damaged by the fire. The most significant damage was found in the 1932 addition where the fire was started. Framing to the right of the woodstove and staircase were significantly scorched. Check Exhibit 3 for pictures related to framing.
5.7.1 **Sections**

![Typical Wall Sections](image)

*Figure 11. Typical Wall Sections*

5.8 **Flooring**

Flooring throughout the structure was mainly in good condition other than the two fire locations. Kim Grant (Endangered places program director) informed the team that they are looking at doing a cleanup project with volunteers. Greater assessment of all flooring could be done at that time. Significant damage was found in the corner of the 1932 addition, the basement kitchen is visible from the first floor. Check Exhibit 3 for flooring pictures.

5.9 **Windows**

Most of the windows on the Antelope Springs Church are broken out but are covered with plywood. The church has 17 windows. The first floor consists of 8 windows of different sizes. While the second floor has 2 windows of the same size. All windows in the basement are the same size. Some of the plywood is fallen off and it is currently open to the elements. Table 1 represents the locations and sizes of the church windows. Windows photos can be found in Exhibit 3.
<table>
<thead>
<tr>
<th>Location</th>
<th>Count</th>
<th>Size (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Floor</td>
<td>1</td>
<td>68&quot; x 83&quot;</td>
</tr>
<tr>
<td>First Floor</td>
<td>7</td>
<td>33&quot; x 60.5&quot;</td>
</tr>
<tr>
<td>Second Floor</td>
<td>2</td>
<td>33&quot; x 60.5&quot;</td>
</tr>
<tr>
<td>Basement Floor</td>
<td>7</td>
<td>36&quot; x 26&quot;</td>
</tr>
</tbody>
</table>

*Table 1. Antelope Springs Church Windows and Their Sizes*

5.10 Walls

Walls throughout the structure were constructed with two by fours placed sixteen inches on center. Lath and plaster are placed over the framing of walls on both the first and second floors. This technique was common prior to the introduction of drywall in the 1950s. The first-floor interior contains a total of ten walls, the second floor contains a total of four walls, and the basement has a total of twelve walls. Basement walls are constructed with the foundation of the structure and have a coat of paint. Check Exhibit 5 for dimensions of interior walls. Damage to the walls includes the plaster and lath, smoke and water damage, and paint damage. Refer to Exhibit 3 for more wall photos.
Figure 12. East Interior Wall Located on The First Floor

Figure 13. West Interior Wall Covered by Lath and Plaster
5.11 Stairs

The structure contains three total staircases. The first staircase provides access to the building and has a total of five steps and is constructed out of concrete. Metal hand railings are provided on the front steps. The basement staircase located just inside the main entry, has a total of ten steps with a four-foot by four-foot landing. Wooden handrails are provided in the basement staircase. The basement staircase is constructed out of wooden joists and stringers and has wooden treads across the top. The stringers are two by eights and the joists are two by sixes. This staircase was not damaged by either fire started. The staircase connecting to the second floor is a spiral staircase with a total of twelve steps. The staircase is constructed of wood and the underside is curved and covered in lath and plaster. This staircase was not damaged by either fire. Check Exhibit 3 for pictures.

Figure 14. Wooden Staircase
5.12 Doors

The Antelope Springs Church has five different doors of different sizes. The doors are used to separate different interior spaces. All the church doors are wooden doors. They are located on the first and basement floors. Most of the doors need to be painted. The main door gives access to the church. It is located on the east side of the church. The door is affected by smoke damage and it has a rusted handle. There is another door located on the first floor. It gives access to the gathering place and nave area. This door is affected by smoke damage and it needs to be painted. The basement has three doors. Those doors were added in 1932. The kitchen door gives access to the kitchen while the other door gives access to the dining area. The kitchen door is in fair condition while the dining area door needs to be replaced as it has broken parts. The third door is the closet door under the stairs. Table 2 represents the locations and sizes of the church doors. The doors pictures can be found in Exhibit 3.

![Figure 15. Antelope Springs Church Main Door](image-url)
<table>
<thead>
<tr>
<th>Door</th>
<th>Location</th>
<th>Size (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main door</td>
<td>First floor</td>
<td>60&quot; x 78&quot;</td>
</tr>
<tr>
<td>Gathering area door</td>
<td>First floor</td>
<td>59.75&quot; x 79&quot;</td>
</tr>
<tr>
<td>Kitchen door</td>
<td>Basement floor</td>
<td>31.25&quot; x 80&quot;</td>
</tr>
<tr>
<td>Dining area door</td>
<td>Basement floor</td>
<td>35.5&quot; x 77.5&quot;</td>
</tr>
<tr>
<td>Closet door</td>
<td>Basement floor</td>
<td>26.5&quot; x 78&quot;</td>
</tr>
</tbody>
</table>

Table 2. Antelope Springs Church doors and Their Sizes

5.13 **Foundation**

Foundation systems are known as sub-structure. They are used to hold and support the superstructure of a building. Also, they transfer structure loads to the ground. It is very difficult to evaluate existing foundation systems without having a construction plan. The church has continuous concrete footing and a stem wall around its perimeter. Since the church has no construction plans, it is very difficult to say whether an isolated column footing is used under the interior column. The damages we encounter in the foundation system are not fire-related damages. The damages in the foundation system are the damages caused by the age of the structure and the aging of the material. The foundation has many cracks and chipped parts. More pictures of the foundation can be found in Exhibit 3.

![Figure 16. Cracks on Foundation System](image.png)
5.14 Overall Church Condition

The condition evaluation is based on the definitions of the 2014 Colorado State guideline titled "Historic Structure Assessment State Historical Fund Annotated Scope of Work."

<table>
<thead>
<tr>
<th>Good Condition</th>
<th>Fair Condition</th>
<th>Poor Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>An element, feature, or space is evaluated in good condition when it is intact, structurally sound, and performing its intended purpose.</td>
<td>An element, feature, or space is evaluated in fair condition when one or more the following are evident: 1. There are early signs of wear, failure, or deterioration, although the feature or element is generally structurally sound and performing its intended purpose. 2. There is failure of a sub-component of the feature or element. 3. Replacement of up to 25% of the feature or element is required. 4. Replacement of a defective sub-component of the feature or element is required.</td>
<td>An element, feature, or space is evaluated in poor condition when the following is evident: 1. It is no longer performing its intended purpose. 2. It is missing. 3. It shows signs of imminent failure or breakdown. 4. Deterioration/damage affects more than 25% of the feature/element and cannot be adjusted or repaired. 5. It requires major repair or replacement.</td>
</tr>
<tr>
<td>1. It needs no repair and only minor or routine maintenance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Condition Evaluation (SHF Historic Structure Assessment Annotated Scope of Work, 2014)

Antelope Springs Church Condition: Poor

The Antelope Springs Church went on fire in the summer of 2019. This resulted in affecting its entire existence. Most parts of the church are either broken or damaged. Interiors and exteriors are affected by smoke, water, and fire damages. The major affected parts are the roof and foundation. Those two parts are essential to make the church stable and safe. They should be fixed in order to provide support to different kinds of loads. The church is in a poor condition. Table 4 represents the condition of all parts of the church. The main elements and spaces of the church can be evaluated as the following:
**First Floor**

**Condition: Poor**

The first floor is the most affected floor by the fire:

- Windows are broken.
- Ceiling is crumbled and fallen apart.
- Walls are burnt and have major smoke and water damages.

**Recommendations:**

- Windows need to be replaced.
- Some interior walls need to be replaced.
- Walls need to be repaired

**Second Floor**

**Condition: Fair**

- Walls having minor smoke and water damages.
- Windows are broken.
- Ceiling is crumbled as the roof rafters can be seen from the second floor.

**Recommendations:**

- Windows need to be replaced
- Walls need to be repaired.
- Ceiling affected parts should be fixed.
**Basement Floor**

Condition: Poor

- Foundation walls are cracked and crumbled.
- Windows are broken.
- Doors are affected by smoke damage and some of them are broken.

**Recommendations:**

- Walls need to be replaced as they are a part of the foundation.
- Cabinet and kitchen doors need to be repaired. While the dining area door needs to be replaced.
- Windows need to be replaced.

**Roof Rafter System**

Condition: Poor

- Significant damage was noted in the structural assessment on the roof rafter system.
  
  Several parts of the rafter system in the 1915 space are fractured and scorched. The rafter system in the 1932 space is no longer a part of the structure.

- The roofing material is significantly damaged in the 1932 space. The original cedar shingles lie beneath the existing sheet metal.

**Recommendations:**

- Demo the entire first-floor roof. The second-floor roof was not damaged during the fire and can remain. We are recommending removing the metal decking over the second-floor roof so when a new metal decking is installed over the first-floor roof, the contractor can
also install the same metal decking over the second-floor roof to create a uniform look over the entire structure.

- Replace the entire roof over the first-floor roof per our designs. Check Exhibit 4 for further calculations on the new roof.
- Install blocking between roof rafters at third points on the rafter beam. The blocking will help stabilize the rafter system.
- Replace all roofing material with new cedar planks and sheet metal. New sheet metal will provide a longer life span for the roof. Ensure all roof elements are sealed to prevent any further weather damage.

**Framing**

**Condition: Poor**

- Significant framing damage was noted in the 1932 space where the fire was started. The fire burned through the lath and plaster material and significantly damaged the framing.

**Recommendations:**

- Replace the framing on the East wall where the fire was started with 2 x 4 studs, spaced 16 inches on-center. Replacing this wall will restore structural support to the second floor.

**Flooring**

**Condition: Fair**

- First-floor significant floor damage was noted where the 1932 fire was started. The fire burned through the flooring up to the floor joists.
- No significant floor damage was noted on the second floor.
• No significant floor damage was noted on the basement floors.

Recommendations:
• Repair flooring in the 1932 addition and refinish all wood floors if possible. Clean up the second floor and basement flooring. Apply sealant paint on the basement flooring. If wood floors cannot be repaired, replace the flooring with the desired material.

Recommendations:
• Repair flooring in the 1932 addition and refinish all wood floors if possible. Clean up the second floor and basement flooring. Apply a sealant paint on the basement flooring. If wood floors cannot be repaired, replace flooring with the desired material.

Windows
Condition: Poor
• First-floor windows broken. The frames are burnt and smoke damaged.
• Second-floor windows are broken.
• Basement floor windows are broken.
• Windows are currently boarded up with plywood and plexiglass.

Recommendations:
• Continue to board windows up with plywood and plexiglass until new windows can be installed.
• Replace all church windows.
Walls

Condition: Poor

- First-floor walls have smoke and paint damage, East and South walls in 1932 space are scorched, significant lath and plaster damage to the 1932 space.
- Second-floor walls have minor smoke damages.
- Basement walls are constructed out of the structure’s foundation. Significant cracking and crumbling were located on the main North wall and the North wall at the bottom of the stairs. Significant cracking was also noted on the main West wall. Foundation cracking was also noted in the kitchen’s South and East walls.
- Repair lath and plaster throughout the structure where needed. Apply paint throughout the entire structure. An Alternative recommendation would be to replace all lath and plaster with drywall throughout the entire structure and apply paint.

Stairs

Condition: Fair

- Cracking and crumbling were noted on the entry stairs. Vegetation has started to grow within the steps.
- No significant damage was noted on the staircase leading to the basement.
- No significant damage was noted on the staircase leading to the second floor.

Recommendations:

- Concrete repair on the entry stairs to prevent further cracking and crumbling damage. If repairs cannot be completed, repour concrete steps to entry. Clean up staircases leading to the basement and second floor. Refinish wood on both staircases.
Doors

Condition: Good

- First floor doors are affected by smoke and water damages.
- Basement doors are affected by smoke and water damages.
- Dining area door is broken.
- Doors are still performing their intended purpose with minor cosmetic flaws.

Recommendations:

- Repair and repaint first-floor doors if possible. If not, first-floor door needs to be replaced.
- Kitchen and cabinet doors located on the basement floor need to be repaired and repainted.
  While the dining area door needs to be replaced.

Exterior Siding

Condition: Fair

- Minor damages were located on all sides of the structure. Some pieces of the siding have broken away or are fractured.
- Minor smoke damages to the siding near roof areas

Recommendations:

- Replace siding that has broken away, is fractured, or has smoke damage. Apply a coat of outdoor paint to the siding on the entire structure.
Foundation

Condition: Poor

- Significant cracking and crumbling were found throughout the entire inspection of the foundation. Major cracking was noted on the main North and West walls of the basement.
- Significant crumbling was found on the North wall at the bottom of the staircase. The crack on the load-bearing wall is due to overload and material aging.
- Inward bowing was observed in the basement East foundation wall. We assume that this phenomenon is related to the increase in lateral pressure over time.
- There is a horizontal crack approximately 5 feet long were found in the south wall of the basement. This crack has emerged due to material aging.
- There is a gap between the window framing and the North foundation wall.
- The concrete slab included in the foundation system has good condition.

Recommendations:

- The crack on the South foundation wall can be repaired with the epoxy injection method.
- In order to prevent lateral load increase in the future, necessary drainage precautions should be taken.
- Steel columns should be placed against the North wall and inner North wall to ensure structural integrity.
- According to the results of future geotechnical studies, reconstruction of the basement North Wall and Inner North wall should be considered.
- If groundwater is encountered during excavations, dewatering, and groundwater cut-off techniques, and associated permitting may be needed.
• Corrosion potential of the soils in the field to concrete and buried metal should be evaluated according to the test results to be made in the laboratory according to American Society for Testing and Materials (ASTM) standards by taking appropriate samples. Our recommendation is to conduct laboratory tests to evaluate the effects of sulfate on concrete and the effects of soil resistivity on the buried metal.

• After the geotechnical studies to be carried out, the compatibility of the filling material of the soil should be evaluated.

• As a result of geotechnical studies, the drainage system should be reconstructed by selecting the appropriate backfill material.

• Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. It is suggested that the owner and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas.
<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
<th>Number of Windows</th>
<th>Number of Doors</th>
<th>Notes (Damage?)</th>
<th>Condition</th>
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<th>Fair</th>
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<tr>
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<td></td>
<td>Cleanup</td>
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<td></td>
<td></td>
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</tr>
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<tr>
<td></td>
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<td>Restore doors and repair minor damages</td>
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</table>

*Table 4. Overall Evaluation*
6.0 **Analysis and Compliance**

6.1 **Hazardous Materials**

From the team’s observations, we did not see any possible hazardous materials. Since the building was constructed in the early 1910s there could be traces of asbestos within the plaster and lead in the current paint on the walls and the exterior of the building.

6.2 **Material Analysis**

The entire structure is built using a timber framing design with concrete used in the foundation. Parts of the structure were set on fire as explained in this report. The roof has the most damage caused by the fire and will need to be repaired or replaced. See roof recommendations for more information on the recommendations for the roof. At this time, the concrete does not look to be reinforced. The foundation is mostly intact however the south load-bearing wall has a crack in the center of the wall and is recommended to be repaired or replaced. See foundation recommendations for more information on the foundation.

6.3 **Zoning Code Compliance**

The property is zoned for Agriculture Production Zone (A). Properties located in Agriculture Production Zones are highly valued resources within Morgan County. The Antelope Springs Church would fall under the 3-175 Agriculture Zone Conditional Uses, Parcels 20 Acres or smaller, section (N Church).
6.4 Building Code Compliance

As stated in section 4.0 Applicable Building Codes, Morgan county has adopted the 2015 International Building Code (IBC) on January 1, 2017. The Fort Morgan Municipal Code has an Amendment (Sec. 21-2-20) on existing structures (IBC 102.6) stating “The legal occupancy of any structure existing on the date of adoption of this code shall be permitted to continue without change, except as is specifically covered in this code, the 1997 Uniform Code for the Abatement of Dangerous Buildings Code, International Existing Building Code or the International Fire Code, or as is deemed necessary by the building official for the general safety and welfare of the occupants and the public.” Currently, with the condition of the building, it is uninhabitable and will need to be repaired to let people occupy the space. Here are provisions from the IBC that are applicable for the repairs of the building:

- **Chapter 15: Roof Assemblies and Rooftop Structures**

  The IBC chapter 15 gives the requirements that shall govern the design, materials, construction, and quality of roof assemblies, and rooftop structures.

- **Chapter 16: Structural Design**

  The IBC chapter 16 gives the requirements that shall govern the structural design of buildings, and structures.

- **Chapter 18: Soils and Foundations**

  The IBC chapter 18 gives the minimum requirements that shall govern the design of foundation systems. Geotechnical investigations shall be conducted in accordance with section 1803.2 and reported in accordance with Section 1803.6.
• Chapter 19: Concrete

The IBC chapter 19 states that structural concrete shall be designed and constructed in accordance with the requirements of this and American Concrete Institute (ACI) 318.

• Chapter 23: Wood

The IBC Chapter 23 gives the minimum requirements for the design of buildings and structures that use wood and wood-based products. The design of structural elements of systems, constructed partially or wholly of wood or wood-based products shall be in accordance with one of the following methods:

1. Allowable stress design in accordance with Sections 2304, 2305, and 2306.2.
2. Load and resistance factor design in accordance with Sections 2304, 2305, and 2307.3.
3. Conventional light-frame construction in accordance with Sections 2304 and 2308.4.
4. American Wood Council (AWC), and Wood Frame Construction Manual (WFCM) in accordance with Section 2309.5. The design and construction of log structures in accordance with the provisions of International Code Council (ICC) 400.

For the design of the new roof rafter system, we followed chapter 8 of the International Residential Code 2015 referred to as IRC from henceforth.

• Chapter 8: Roof-Ceiling Construction

The IRC Chapter 8, Section R802 Wood Roof Framing gives the provisions for wood and wood-based products used for load-supporting purposes.
6.4 **Accessibility Compliance**

Currently, the church is not ADA accessible (ADA: Americans with Disabilities Act). There are 5 steps someone must climb up in order to get into the building. There is room for constructing an ADA-accessible ramp, however, this would change the exterior look of the building. Once up the first flight of stairs and in the building the main room does not require someone to climb or descend stairs. There is a small room upstairs and an unfinished basement which would not be ADA accessible.

7.0 **Recommendations**

The following is a list of recommendations for urgent repairs and to restore the structural integrity of the Antelope Springs Methodist Church. These recommendations will protect the Church from further damage to the Structure, protect the preservation of the historic church, and give the Wolever family and the city of Snyder a community space to use for the foreseeable future. We also split these recommendations into three phases in the next section, based on the importance of each section.

1. Demo of the entire 1st-floor roof that is still present over the first floor of the church. Use extreme caution when removing the roof so the walls are not damaged during demolition. Remove the metal decking over the 2nd-floor roof and replace the cedar shingles, as necessary.

2. Clean up all the debris on the first floor so the construction of the new roof can move forward without problems.

3. Rebuild the new roof rafters over the first floor of the church per our designs. (See Exhibit 4 for roof calculations)
4. Install specified steel column against the basement North Wall and North Wall at the bottom of the stair. (See Exhibit 4 for foundation calculations)

5. According to the results of future geotechnical studies, reconstruction of the basement North Wall and Inner North wall should be considered. (See Exhibit 4 for foundation calculations)

6. Repair cracks found in foundation walls.

7. Patching damaged plaster, trim, and siding.

8. Re-finishing trims, doors, and other smoke-damaged elements.

9. Painting throughout the inside and outside of the building.

8.0 Construction Sequence

8.1 Phase 1 - Urgent Shoring/Modifications

Phase 1 gives the construction sequence that is urgent to prevent further damage to the structure from the weather and prevent future vandalism. The phase of construction will provide a roof over the entire structure.

- Demo the remaining roof over the entire church. Remove the burnt ceiling joists and the section of the burnt roof that is still attached to the 1915 roof section. Use extreme caution when removing the current roof as to not damage the existing walls and floor of the church. Remove the metal decking over the 2nd-floor roof and replace the cedar shingles, as necessary.

- Start cleaning up the main floor so construction can begin on the roof.
- Install 5 ¼ inches x 11 7/8 inches 2.0E Parallam (PSL) flush girder beam that spans across the open section of the 1932 section of the church (see structural plans in Exhibit 5 for more information). This girder beam will be part of the main support beam for the new roof rafter system.

- Build a similar roof rafter system that was present before the fire. Install a 1-inch x 10 inches ridge board between rafters. It is recommended to use 2 x 8 DF.L No. 2 or better spaced at 16 inches on-center. Install wood blocking between rafters at the midspan of rafters to help the stability of the rafter system. Install ceil joists, use 2 x 10’s DF.L No. 2 or better spaced at 16 inches on-center.

- Once the framing is completed on the new roof rafter system, install 7/16 inches Oriented Strand Board (OSB) on top of the rafters.

- Install Grace Ultra Butyl Self-Adhered Underlayment on top of OSB.

- Install new cedar planks on top of the Grace Ultra Butyl membrane.

- Install new metal decking over the entire first-floor roof as well as over the second-floor roof. Having a new metal panel over the entire roof will give a uniform overall look to the church.

8.2 Phase 2 – Restore the Full Structural Integrity

Phase 2 sets the urgent sequence of construction in order to preserve the structural integrity of the building and make it available for safe use in the future.

- The floor slab system should be determined by drilling holes at certain intervals where the floor slab is connected with the load-bearing walls.
- In order to make the connection between steel posts and basement ceiling joists, the basement ceiling cover must be removed.

- Steel posts should be placed on the footings considering the specifications in the project.

- After the steel posts are placed, their connection with the base plate and ceiling joists can be completed.

- The cracks around the stem wall should be repaired using the epoxy method.

**8.3 Phase 3 – Historical Preservation**

Phase 3 sets the urgent sequence of construction in order to restore and repair the historic elements of the structure, and complete detailed work.

- The windowpanes should be replaced with glass similar to the pre-existing, historic glass.

- The original wood trimming throughout the structure must be removed carefully, sanded, painted, finished, and reapplied to the structure.

- The original doors should be refinished as needed.

- The plaster should be patched where it is damaged or missing, and interior paint matched and repainted.

- The exterior sheathing should be fixed and replaced where needed.

- The exterior of the structure should be repainted to the original finish.

- Interior wooden pews should be restored and replaced if the damage is too extensive.

**9.0 Costs**

Cost estimation for this restoration project was completed for each phase. These phases included urgent modifications, restoring structural integrity, and historical preservation. The
following tables include an itemized list of estimated costs associated with each of the project phases. Costs for each item were selected by choosing the average price within suggested ranges. A fifteen percent increase was taken into consideration due to the remote location of the project site and in the event of further work is discovered throughout restoration.

### Phase 1 Costs

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<th>Item No.</th>
<th>Description</th>
<th>Cost per</th>
<th>Estimated Costs ($)</th>
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<td>Sq. ft.</td>
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<td>Total Square foot of 2nd Floor</td>
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<td>Roofing Permit Application</td>
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<td>4</td>
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<td>Demolition</td>
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<td><strong>Total w/ 15% Increase</strong></td>
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*Table 5. Phase 1 Costs*

### Phase 2 Costs

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<tr>
<td>4</td>
<td>Construction Cost of Steel Columns (40% of Material Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Design Cost (10% of Materials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total w/ 15% Increase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 6. Phase 2 Costs*

### Phase 2 Costs for New Construction of North Exterior and Interior Foundation Walls (Optional)

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Cost per</th>
<th>Estimated Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sq. ft</td>
<td>Sq. ft.</td>
</tr>
<tr>
<td>1</td>
<td>Total Square foot of soil around foundation (9ft wide x 9ft deep)</td>
<td>9720</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Excavation</td>
<td></td>
<td>$12.00</td>
</tr>
<tr>
<td>3</td>
<td>New Foundation Walls ($150 per cubic yard)</td>
<td>184.95</td>
<td>$5.56</td>
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<tr>
<td>4</td>
<td>Geotechnical Investigation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Construction Cost of New Foundation Wall (40% of Material Cost)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Design Cost (10% of Materials)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total w/ 15% Increase</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 7. Phase 2 Costs for New Construction of North Exterior and Interior Foundation Walls (Optional)*
### Phase 3 Costs

<table>
<thead>
<tr>
<th>Item No.</th>
<th>Description</th>
<th>Cost Per Sq. ft.</th>
<th>Estimated Costs Sq. ft.</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cleaning</td>
<td>$6.00</td>
<td>$12,528.00</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Exterior Painting</td>
<td>$3.10</td>
<td>$6,696.00</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Interior Painting</td>
<td>$2.00</td>
<td>$5,568.00</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Windows</td>
<td></td>
<td>$5,900.00</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Basement (7)</td>
<td></td>
<td>$1,400.00</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>First Floor (8)</td>
<td></td>
<td>$3,600.00</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Second Floor (2)</td>
<td></td>
<td>$900.00</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Door Restoration (6 Doors)</td>
<td>$10.00</td>
<td>$400.00</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Refinish Hardwood Floors</td>
<td>$4.00</td>
<td>$4,176.00</td>
<td></td>
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<tr>
<td>10</td>
<td>Remove Current Lath and Plaster (Includes Ceiling)</td>
<td>$20.00</td>
<td>$33,600.00</td>
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<tr>
<td>11</td>
<td>Install New Lath and Plaster (Includes Ceiling)</td>
<td>$15.00</td>
<td>$25,200.00</td>
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<tr>
<td>12</td>
<td>Trim Restoration</td>
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<td>$2,000.00</td>
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<td>13</td>
<td>Platform Restoration</td>
<td>$50.00</td>
<td>$6,000.00</td>
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<tr>
<td></td>
<td><strong>Total w/ 15% Increase</strong></td>
<td></td>
<td><strong>$110,478.20</strong></td>
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</tbody>
</table>

*Table 8. Phase 3 Costs*

### Overall Cost

<table>
<thead>
<tr>
<th>Phase</th>
<th>Description</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phase 1</td>
<td>Urgent Shoring/Modifications</td>
<td>$24,317.90</td>
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<tr>
<td>Phase 2</td>
<td>Restore the Full Structural Integrity</td>
<td>$9,073.50</td>
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<tr>
<td>Phase 3</td>
<td>Historical Preservation</td>
<td>$110,478.20</td>
</tr>
<tr>
<td><strong>Total Cost</strong></td>
<td></td>
<td><strong>$143,869.60</strong></td>
</tr>
</tbody>
</table>

*Table 9. Overall Cost*
10.0 Future Work/Study

Mile High Consultants recommend a review of the assumptions, findings, calculations, and conclusions by a licensed professional engineer licensed in the state of Colorado. We recommend the client perform a soil analysis, to find the exact specifications of soil for the foundation design. We also recommend our client install fire extinguishers throughout the structure. Further investigation should be done to determine the best means of supplying running water and plumbing to the church. Further investigation will need to determine the best form of the sewer system to be installed in the building. If plumbing is added to the structure, we highly recommend adding a sprinkler system, to protect from possible future arson incidents, or incidents when unoccupied. We recommend installing new electrical systems and wiring. If electrical capabilities are improved, we recommend adding security systems to the building to protect against future trespassing. We recommend adding paving around the church as well as a parking lot. Lastly, we recommend adding signage to mark the church as a historical structure, and to display its history.
11.0 References


Google Maps. (2021). Retrieved April 20, 2021, from https://www.google.com/maps/place/Antelope+Springs+Church/@40.464561,-103.6024465,17z/data=!3m1!4b1!4m5!3m4!1s0x876dfe2fe0f7cd5f:0xc97c43017e02a660!8m2!3d40.464561!4d-103.6002578


https://apps.nationalmap.gov/viewer/


12.0 Disclaimer

The assumptions, findings, calculations, and conclusions expressed and described in this report and its exhibits were developed by undergraduate civil engineering students who are not licensed, professional engineers. This report was prepared as an academic exercise as partial fulfillment of the Civil Engineering Senior Design course. Pursuant to C.R.S. §12-25, no part of this report should be used for planning, budgeting, construction, or fiscal related decisions without a complete review and written endorsement from an independent, qualified, and licensed engineer who can assume responsible charge of the project and who is willing and able to become the engineer of record for all aspects of the study, calculations, findings, recommendations, and the project in part and in whole.

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13.0 Conclusion and Summary

The Antelope Springs Church is valuable for the Wolver family and Snyder’s residents. It holds unforgettable memories to the community members who were part of its history. The Antelope Springs Methodist Church is the last standing remnant of the rural community of Antelope Springs. The church was used for both religious purposes and community meetings, showers, family reunions, and harvest festivals. Mile High Consultants were tasked to rehabilitate the church after the arson event in 2019. The main goal of the project is to revive the Antelope Springs Church located in Morgan County.

In this report, Mile High Consultants provide their findings, conclusions, and recommendations. The recommendations are done to preserve the Antelope Springs Church and make it stable to serve the community. Drawings, floor plans, simulations, site photographs, and design calculations can be found in the exhibits section.

Mile High Consultants would like to thank the Wolever family and Mr. Kim Grant of Colorado Preservation Inc. for giving us the opportunity to study and provide recommendations for the revival of the Antelope Springs Church. Please do not hesitate to contact us if you have any questions or concerns.

Sincerely,
The design team
Exhibit 1: Site Map
Figure 1. Antelope Springs Church Map (Google Maps, 2021)

Figure 2. Vicinity Map
Exhibit 2: Aerial Photographs
Figure 1. Antelope Springs Church Aerial Photograph (Google Earth, 2021)

Figure 2. Antelope Springs Church West Facade Aerial Photograph
Figure 3. Antelope Springs Church Northeast Facade Aerial Photograph

Figure 4. Antelope Springs Church Southwest Facade Aerial Photograph
Figure 5. Antelope Springs Church East Facade Aerial Photograph

Figure 6. Antelope Springs Church Roof Aerial Photograph
Exhibit 3: Site Photographs
Figure 1. Antelope Springs Church South Facade

Figure 2. Antelope Springs Church Southwest Corner
Figure 3. Antelope Springs Church West Facade

Figure 4. Antelope Springs Church Northwest Corner
Figure 5. Antelope Springs Church East Façade

Figure 6. Antelope Springs Church Main Door
Figure 7. Antelope Springs Church First Floor

Figure 8. Old Piano Located on The First Floor
Figure 9. First Floor Windows

Figure 10. Interior Walls Affected by Fire
Figure 11. First Floor East Interior Wall Affected by Fire

Figure 12. First Floor Roof Rafter System

Figure 13. First Floor Ceiling
Figure 14. Kitchen Cabinets and Refrigerator Damaged by Fire

Figure 15. Old Kitchen Stove

Figure 16. Basement Kitchen
Figure 17. East Interior Wall View from Stairs

Figure 18. Stairs to The Basement

Figure 19. First Floor Flooring

Figure 20. First Floor Flooring Affected by Fire
Figure 21. Second Floor Flooring

Figure 22. Kitchen Flooring
Figure 23. Dining Area Flooring

Figure 24. Cracked and Chipped Concrete Steps
Figure 25. Concrete Steps

Figure 26. Cracks on Foundation
Figure 27. Exterior Basement Windows

Figure 28. Antelope Springs Church Northeast Corner
Figure 29. Church’s Main Door

Figure 30. Dining Area Door

Figure 31. Basement Closet Door

Figure 32. Kitchen Door
Figure 33. Gathering Area Door

Figure 34. Second Floor
Exhibit 4: Calculations
Design Parameters for Wind Loading

- Wind Load Calculation Follows ASCE 7-16
- Mean Roof Height: 30 feet (Assuming height)
- Wind Speed: 115 mph
- “Enclosed” Building: $G_{pi}$: +/- 0.18 (Table 26.13-1)
- Exposure Category: C
- Velocity Pressure Exposure Coefficient $K_z$: 0.85
- Topographic Factor $K_t$: 1.0 (No Hills or Escarpments)
- Directionality Factor $K_d$: 0.85 (MWFRS, Table 26.6-1)
- Gust Factor $G$: 0.85

**Wind loading Calculations for MWFRS**

Mean Roof Height = 30 ft  
Assumed (Conservative)

Wind Speed = 115 mph  
(Given by Fort Morgan Municipal Code)

$K_d$ = 0.85  
(MWFRS, Table 26.6-1)

$K_t$ = 1.0  
(No Hills)

$q_z \times K_z = 28.78$ psf  
$q_z = 0.00256 \times K_z \times K_t \times K_d \times V^2$

at Mean Roof $K_z = 0.98$, $q_z = 28.20$ psf  
(Table 26.10-1)

### Location on Structure

<table>
<thead>
<tr>
<th>Height (ft)</th>
<th>$K_z$</th>
<th>$q_z$ (psf)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eave Height (15ft)</td>
<td>0-15</td>
<td>0.85</td>
</tr>
<tr>
<td>20</td>
<td>0.9</td>
<td>25.90</td>
</tr>
<tr>
<td>25</td>
<td>0.94</td>
<td>27.05</td>
</tr>
<tr>
<td>Ridge Height (27ft)</td>
<td>30</td>
<td>0.98</td>
</tr>
</tbody>
</table>

$G_{pi}$ = 0.18

Internal Pressure = 5.08 pos/ neg pressure

**Wind Normal to Ridge**

<table>
<thead>
<tr>
<th>Surface</th>
<th>z (ft)</th>
<th>$q$ (psf)</th>
<th>$G$</th>
<th>$C_p$</th>
<th>(+$G_{pi}$)</th>
<th>(-$G_{pi}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windward Wall</td>
<td>0-15</td>
<td>24.46</td>
<td>0.85</td>
<td>0.8</td>
<td>21.71</td>
<td>11.56</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>25.90</td>
<td>0.85</td>
<td>0.8</td>
<td>22.69</td>
<td>12.54</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>27.05</td>
<td>0.85</td>
<td>0.8</td>
<td>23.47</td>
<td>13.32</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>28.20</td>
<td>0.85</td>
<td>0.8</td>
<td>24.25</td>
<td>14.10</td>
</tr>
<tr>
<td>Leeward Wall</td>
<td>all</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.5</td>
<td>-6.91</td>
<td>-17.06</td>
</tr>
<tr>
<td>Sidewalls</td>
<td>all</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.7</td>
<td>-11.70</td>
<td>-21.86</td>
</tr>
<tr>
<td>Windward Roof</td>
<td>28.20</td>
<td>0.85</td>
<td>0.0</td>
<td></td>
<td>5.08</td>
<td>-5.08</td>
</tr>
<tr>
<td>(Assuming angle = 45 deg)</td>
<td>28.20</td>
<td>0.85</td>
<td>0.3</td>
<td>12.27</td>
<td>2.12</td>
<td></td>
</tr>
<tr>
<td>Leeward Roof</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.6</td>
<td></td>
<td>-9.31</td>
<td>-19.46</td>
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</table>

**Wind Parallel to Ridge**

<table>
<thead>
<tr>
<th>Surface</th>
<th>z (ft)</th>
<th>$q$ (psf)</th>
<th>$G$</th>
<th>$C_p$</th>
<th>(+$G_{pi}$)</th>
<th>(-$G_{pi}$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windward Wall</td>
<td>0-15</td>
<td>24.46</td>
<td>0.85</td>
<td>0.8</td>
<td>21.71</td>
<td>11.56</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>25.90</td>
<td>0.85</td>
<td>0.8</td>
<td>22.69</td>
<td>12.54</td>
</tr>
<tr>
<td></td>
<td>25</td>
<td>27.05</td>
<td>0.85</td>
<td>0.8</td>
<td>23.47</td>
<td>13.32</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>28.20</td>
<td>0.85</td>
<td>0.8</td>
<td>24.25</td>
<td>14.10</td>
</tr>
<tr>
<td>Leeward Wall</td>
<td>all</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.5</td>
<td>-6.91</td>
<td>-17.06</td>
</tr>
<tr>
<td>Sidewalls</td>
<td>all</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.7</td>
<td>-11.70</td>
<td>-21.86</td>
</tr>
<tr>
<td>Roof*</td>
<td>0 - h/2</td>
<td>28.20</td>
<td>0.85</td>
<td>-1.3</td>
<td>-26.09</td>
<td>-36.24</td>
</tr>
<tr>
<td></td>
<td>&gt; h/2</td>
<td>28.20</td>
<td>0.85</td>
<td>-0.18</td>
<td>0.76</td>
<td>-9.39</td>
</tr>
<tr>
<td></td>
<td></td>
<td>28.20</td>
<td>0.85</td>
<td>-0.7</td>
<td>-11.70</td>
<td>-21.86</td>
</tr>
</tbody>
</table>

*Distance from windward edge
WIND NORMAL TO RIDGE

INTERIOR PRESSURE
\( \pm 5.08 \) psf

SOUTH ELEVATION

WIND DIRECTION FROM WEST

SIDE WALL WIND LOAD

INTERIOR PRESSURE
\( \pm 5.08 \) psf

EAST ELEVATION
WIND PARALLEL TO RIDGE

WEST ELEVATION

INTERIOR PRESSURE
\( \pm 5.08 \)

24.3 psf

WIND DIRECTION FROM NORTH

SIDE WALL WIND LOAD

NORTH ELEVATION

INTERIOR PRESSURE
\( \pm 5.08 \)

21.9 psf

17.1 psf
Wind loading Calculations for Components & Cladding
at Mean Roof Kz = 0.98, qz = 28.20 psf (Table 26.10-1)

<table>
<thead>
<tr>
<th>Effective Wind Area (ft²)</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Zones +GCp</td>
<td>1</td>
<td>0.95</td>
<td>0.88</td>
<td>0.82</td>
</tr>
<tr>
<td>Zone 1, 2e and 2r -GCp</td>
<td>-1.8</td>
<td>-1.50</td>
<td>-1.10</td>
<td>-0.80</td>
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<tr>
<td>Zone 2n and 3r -GCp</td>
<td>-2</td>
<td>-1.80</td>
<td>-1.45</td>
<td>-1.20</td>
</tr>
<tr>
<td>Zone 3e -GCp</td>
<td>-2.5</td>
<td>-2.20</td>
<td>-1.80</td>
<td>-1.50</td>
</tr>
<tr>
<td>Zone 4 -GCp</td>
<td>-1.1</td>
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<td>-0.98</td>
<td>-0.92</td>
</tr>
<tr>
<td>Zone 5 -GCp</td>
<td>-1.4</td>
<td>-1.29</td>
<td>-1.15</td>
<td>-1.05</td>
</tr>
</tbody>
</table>

Calculated Pressures = qz * GCp (psf)

<table>
<thead>
<tr>
<th>Effective Wind Area (ft²)</th>
<th>10</th>
<th>20</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Zones +GCp</td>
<td>28.20</td>
<td>26.79</td>
<td>24.82</td>
<td>23.13</td>
</tr>
<tr>
<td>Zone 1, 2e and 2r -GCp</td>
<td>-50.76</td>
<td>-42.30</td>
<td>-31.02</td>
<td>-22.56</td>
</tr>
<tr>
<td>Zone 2n and 3r -GCp</td>
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<td>-50.76</td>
<td>-40.89</td>
<td>-33.84</td>
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<tr>
<td>Zone 3e -GCp</td>
<td>-70.51</td>
<td>-62.04</td>
<td>-50.76</td>
<td>-42.30</td>
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<tr>
<td>Zone 4 -GCp</td>
<td>-31.02</td>
<td>-29.61</td>
<td>-27.64</td>
<td>-25.95</td>
</tr>
<tr>
<td>Zone 5 -GCp</td>
<td>-39.48</td>
<td>-36.38</td>
<td>-32.43</td>
<td>-29.61</td>
</tr>
</tbody>
</table>

** Zone 1, 2n, 2r, 2e, 3r, 3e are all roof pressures

* Zone 4 and Zone 5 are wall pressures
Snow Load Calculation

Risk category: II

Ground snow load \( P_g = 30 \text{ psf} \)

Importance factor \( I_s = 1.0 \) (Table 1.5-2)

Exposure factor \( C_e = 0.9 \) (Fully Exposed, Table 7.3-1)

Thermal factor \( C_t = 1.2 \) (Unheated Structure, Table 7.3-2)

Cold roof slope factor \( C_s = 0.5 \) (15° slope, Fig. 7.4-1b)

Flat Roof Snow Load

\[
P_f = 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot P_g \quad \text{(eq. 7.3-1)}
\]

\[
P_f = 0.7 \cdot (0.9) \cdot (1.2) \cdot (1.0) \cdot (30 \text{ psf}) = 22.7 \text{ psf}
\]

Sloped Roof Snow Load

\[
P_s = C_s \cdot P_f \quad \text{(eq. 7.4-1)}
\]

\[
P_s = 0.5 \cdot (22.7 \text{ psf}) = 11.4 \text{ psf}
\]
Drift snow load

\[ h_w = 20\text{ ft} \quad \text{(min. per ASCE)} \]

Unit weight of snow

\[ \gamma = 0.13 (\rho_g) + 14 = 0.13 (30 \text{ psf}) + 14 = 17.9 \text{ psf} \]

Depth of balanced snow load

\[ h_b = \frac{p_5}{\gamma} = \frac{11.4 \text{ psf}}{17.9 \text{ psf}} = 0.64 \text{ ft} \]

For windward drifts

\[ h_d = 0.43 \sqrt[3]{20\text{ ft} \cdot \sqrt{30 \text{ psf} + 10}} - 1.5 = 1.44 \text{ ft} \]

Drift width = \( w = 4(1.44)\text{ ft} = 5.76 \text{ ft} \)

For leeward drifts

Leeward drifts are 0.75 of \( h_d \) from windward drifts.

\[ h_{d,l} = 0.75 (1.44\text{ ft}) = 1.08 \text{ ft} \]

Since \( h_d = 1.44\text{ ft} > h_{d,l} = 1.08\text{ ft} \)

Windward drifts control.

\[ p_d = \gamma \cdot 1.44\text{ ft} = 17.9 \text{ psf} \cdot 1.44\text{ ft} = 25.7 \text{ psf} \]

Total snow load = \( 11.4 \text{ psf} + 25.7 \text{ psf} = 37.1 \text{ psf} \)
Total snow load in roof between 2nd floor and 1st floor roof is 37.1 psf

**Sliding Snow Load**

\[ S = 9 \text{ ft} \]
\[ W = 6 \text{ ft} \]
\[ P_{se} = 0.4 \times \frac{W (15 - S)}{15} \]

\[ P_{se} = 0.4 \times \frac{11.4 \text{ psf} \times 6 \text{ ft} \times (15 - 9)}{15} = 10.9 \text{ psf} \]

Since drift snow load is higher than sliding snow load. Design of roof and foundation will use 37.1 psf.
Load Combinations for Roof Rafters

\( DL := 15 \text{ psf} \)  \hspace{3cm} \text{Dead Load}

\( LL := 0 \text{ psf} \)  \hspace{3cm} \text{Live Load}

\( LL_r := 20 \text{ psf} \)  \hspace{3cm} \text{Roof Live Load}

\( SL := 37.1 \text{ psf} \)  \hspace{3cm} \text{Snow Load}

\( RL := 0 \text{ psf} \)  \hspace{3cm} \text{Rain Load}

\( WL := 36.24 \text{ psf} \)  \hspace{3cm} \text{Wind Load}

\[ \begin{align*}
U_1 &:= DL \\
U_2 &:= DL + LL \\
U_3 &:= DL + \max(LL_r, SL, RL) \\
U_4 &:= DL + 0.75 \cdot LL + 0.75 \cdot \max(LL_r, SL, RL) \\
U_5 &:= DL + 0.6 \cdot WL \\
U_6 &:= DL + 0.75 \cdot (0.6 \cdot WL) + 0.75 \cdot LL + 0.75 \cdot \max(LL_r, SL, RL) \\
U_7 &:= 0.6 \cdot DL + 0.6 \cdot WL
\end{align*} \]

\[ \begin{align*}
U_1 &= 15 \text{ psf} \hspace{3cm} \text{Load comb 1 from ASCE 7-16} \\
U_2 &= 15 \text{ psf} \hspace{3cm} \text{Load comb 2 from ASCE 7-16} \\
U_3 &= 52 \text{ psf} \hspace{3cm} \text{Load comb 3 from ASCE 7-16} \\
U_4 &= 43 \text{ psf} \hspace{3cm} \text{Load comb 4 from ASCE 7-16} \\
U_5 &= 37 \text{ psf} \hspace{3cm} \text{Load comb 5 from ASCE 7-16} \\
U_6 &= 59 \text{ psf} \hspace{3cm} \text{Load comb 6 from ASCE 7-16} \\
U_7 &= 31 \text{ psf} \hspace{3cm} \text{Load comb 7 from ASCE 7-16}
\end{align*} \]

\( Max_{\text{load}} := \max(U_1, U_2, U_3, U_4, U_5, U_6, U_7) \)

\[ Max_{\text{load}} = 59 \text{ psf} \hspace{3cm} \text{Load comb 6 controls} \]
Antelope Springs Roof Rafter Over 1915 Section

Spacing of Rafters

Horizontal Span of Rafter

Distributed Load

Use DF-L No. 2 for framing

Bending Factor (NDS Table 5A)

Shear parallel to Grain Factor (NDS Table 5A)

Compression Perpendicular to Grain Factor (NDS Table 5A)

Modulus of Elasticity Factor (NDS Table 5A)

Determine Max Moment and Shear from Given Loads

Max Moment on Beam

Max Shear on Beam

Required Sx per load

Try (1) 2 x 8

Section Modulus, Inertia and Area of 2 x 10 Member

Load Duration Factor (NDS Table 2.3.2)

Wet Service Factor (Members are dry)

Temperature Factor (NDS Table 2.3.3)

Beam Stability Factor (Members are Braced)

Size Factor (NDS Table 4A)

Flat Use Factor (NDS Table 4A), Not used in weak axis bending

Incising Factor (NDS Table 4.3.8), Member not incised

Repetitive Member Factor (NDS 4.3.9)

Bearing Area Factor (NDS Table 3.10.4), No overhang
\[ F_b' = F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_r \]  
\[ F_b' = 1035 \text{ psi} \]

\[ F_v' = F_v \cdot C_D \cdot C_M \cdot C_t \cdot C_i \]  
\[ F_v' = 207 \text{ psi} \]

\[ F_{cp}' = F_{cp} \cdot C_D \cdot C_t \cdot C_i \cdot C_b \]  
\[ F_{cp}' = 625 \text{ psi} \]

\[ E' = E \cdot C_M \cdot C_t \cdot C_i \]  
\[ E' = 1600000 \text{ psi} \]

**Flexure Check**

\[ f_b := \frac{M_{max}}{S_x} \]  
\[ f_b = 812.291 \text{ psi} \]  
Max Flexure Pressure on Beam

\[ unity := \frac{f_b}{F_b'} \]  
\[ unity = 0.785 \]  
Flexure Unity < 1; Okay

**Shear Check**

\[ f_v := \frac{1.5 \cdot V_{max}}{A} \]  
\[ f_v = 51.633 \text{ psi} \]  
Max Shear Pressure on Beam

\[ unity := \frac{f_v}{F_v'} \]  
\[ unity = 0.249 \]  
Shear Unity < 1; Okay

**TL Deflection Check**

\[ def := 5 \cdot W_t \cdot L^4 \div \left(384 \cdot E' \cdot I_x\right) \]  
\[ def = 0.19 \text{ in} \]  
Max Deflection on Beam

\[ Def := L \div def \]  
\[ Def = 601.257 \]  
Def > 240; Okay

**LL Deflection Check**

\[ def := 5 \cdot \left((Max_{load} - DL) \cdot W\right) \cdot L^4 \div \left(384 \cdot E' \cdot I_x\right) \]  
\[ def = 0.142 \text{ in} \]  
Max Deflection on Beam

\[ Def := L \div def \]  
\[ Def = 805.613 \]  
Def > 360; Okay

**Crushing Check**

\[ f_{cp} := \frac{V_{max}}{(b \cdot 1.5 \text{ in})} \]  
\[ f_{cp} = 166.448 \text{ psi} \]  
Max Flexure Pressure on Beam

\[ unity := \frac{f_{cp}}{F_{cp}'} \]  
\[ unity = 0.266 \]  
Flexure Unity < 1; Okay

**Use 2 x 8 DFJ No. 2 or Better for Framing of Roof Rafters**
**Antelope Springs Ceiling Joist**

\[ W := 16 \text{ in} \quad \text{Spacing of Ceiling Joists} \]

\[ L := 18.5 \text{ ft} \quad \text{Length of Beam} \]

\[ DL_c := 8 \text{ psf} \quad LL_c := 20 \text{ psf} \quad \text{Dead and Live load of Ceiling} \]

\[ W_I := (DL_c + LL_c) \cdot W \quad W_I = 3.111 \frac{lbf}{in} \quad \text{Distributed Load} \]

**Use DF-L No. 2 for framing**

\[ F_b := 900 \text{ psi} \quad \text{Bending Factor (NDS Table 5A)} \]

\[ F_v := 180 \text{ psi} \quad \text{Shear parallel to Grain Factor (NDS Table 5A)} \]

\[ F_{cp} := 625 \text{ psi} \quad \text{Compression Perpendicular to Grain Factor (NDS Table 5A)} \]

\[ E := 1600000 \text{ psi} \quad \text{Modulus of Elasticity Factor (NDS Table 5A)} \]

**Determine Max Moment and Shear from Given Loads**

\[ M_{max} = W_I \cdot L^2 \div 8 \quad M_{max} = 19166 \text{ in} \cdot lbf \quad \text{Max Moment on Beam} \]

\[ V_{max} = W_I \cdot L \div 2 \quad V_{max} = 345.333 \text{ lbf} \quad \text{Max Shear on Beam} \]

\[ S_{guess} = M_{max} \div F_b \quad S_{guess} = 21.296 \text{ in}^3 \quad \text{Required Sx per load} \]

**Try (1) 2 x 10**

\[ S_x := 21.39 \text{ in}^3 \quad I_x := 98.93 \text{ in}^4 \quad A := 13.88 \text{ in}^2 \quad \text{Section Modulus, Inertia and Area of 2 x 10 Member} \]

\[ b := 1.5 \text{ in} \quad d := 9.25 \text{ in} \]

\[ C_D := 1.0 \quad \text{Load Duration Factor (NDS Table 2.3.2)} \]

\[ C_M := 1.0 \quad \text{Wet Service Factor (Members are dry)} \]

\[ C_1 := 1.0 \quad \text{Temperature Factor (NDS Table 2.3.3)} \]

\[ C_L := 1.0 \quad \text{Beam Stability Factor (Members are Braced)} \]

\[ C_F := 1.0 \quad \text{Size Factor (NDS Table 4A)} \]

\[ C_{fu} := 1.0 \quad \text{Flat Use Factor (NDS Table 4A), Not used in weak axis bending} \]

\[ C_i := 1.0 \quad \text{Incising Factor (NDS Table 4.3.8), Member not incised} \]

\[ C_r := 1.0 \quad \text{Repetitive Member Factor (NDS 4.3.9)} \]
\[ C_b := 1.0 \]

\[ F_b' := F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_{fu} \cdot C_i \cdot C_r \quad F_b' = 900 \text{ psi} \]

\[ F_v' := F_v \cdot C_D \cdot C_M \cdot C_t \cdot C_i \quad F_v' = 180 \text{ psi} \]

\[ F_{cp}' := F_{cp} \cdot C_M \cdot C_t \cdot C_i \cdot C_b \quad F_{cp}' = 625 \text{ psi} \]

\[ E' := E \cdot C_M \cdot C_t \cdot C_i \quad E' = 1600000 \text{ psi} \]

**Flexure Check**

\[ f_b := M_{max} \div S_x \quad f_b = 896.026 \text{ psi} \quad \text{Max Flexure Pressure on Beam} \]

\[ \text{unity} := f_b \div F_b' \quad \text{unity} = 0.996 \quad \text{Flexure Unity < 1 ; Okay} \]

**Shear Check**

\[ f_v := 1.5 \cdot V_{max} \div A \quad f_v = 37.32 \text{ psi} \quad \text{Max Shear Pressure on Beam} \]

\[ \text{unity} := f_v \div F_v' \quad \text{unity} = 0.207 \quad \text{Shear Unity < 1 ; Okay} \]

**TL Deflection Check**

\[ def := 5 \cdot W_l \cdot L^4 \div (384 \cdot E' \cdot I_x) \quad def = 0.622 \text{ in} \quad \text{Max Deflection on Beam} \]

\[ Def := L \div def \quad Def = 357.137 \quad \text{Def > 240 ; Okay} \]

**LL Deflection Check**

\[ def := 5 \cdot (LL_c \cdot W) \cdot L^4 \div (384 \cdot E' \cdot I_x) \quad def = 0.444 \text{ in} \quad \text{Max Deflection on Beam} \]

\[ Def := L \div def \quad Def = 499.992 \quad \text{Def > 360 ; Okay} \]

**Crushing Check**

\[ f_{cp}' := V_{max} \div (b \cdot 3.5 \text{ in}) \quad f_{cp}' = 65.778 \text{ psi} \quad \text{Max Flexure Pressure on Beam} \]

\[ \text{unity} := f_{cp}' \div F_{cp}' \quad \text{unity} = 0.105 \quad \text{Flexure Unity < 1 ; Okay} \]

**Use 2 x 10 DF/L No.2 or Better for Framing of Ceiling Joists**

**Roof Rafter Connection Design**

**Connections for Rafter Beam to Top Plate Followed IRC 2015 Table R602.3**

**Connections for Rafter Beam to Ceiling Joist Followed IRC 2015 Table R802.5.1**

**Connections for Rafter Beam to Ridge Board Followed IRC 2015 Table R602.3**
All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

<table>
<thead>
<tr>
<th>Design Results</th>
<th>Actual @ Location</th>
<th>Allowed</th>
<th>Result</th>
<th>LDF</th>
<th>Load: Combination (Pattern)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Member Reaction (lbs)</td>
<td>4878 @ 2&quot;</td>
<td>11484 (3.50&quot;)</td>
<td>Passed (42%)</td>
<td>--</td>
<td>1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)</td>
</tr>
<tr>
<td>Shear (lbs)</td>
<td>3527 @ 1’ 3 3/8&quot;</td>
<td>13861</td>
<td>Passed (25%)</td>
<td>1.15</td>
<td>1.0 D + 1.0 S (All Spans)</td>
</tr>
<tr>
<td>Moment (ft-lbs)</td>
<td>17899 @ 9’ 1/2&quot;</td>
<td>34332</td>
<td>Passed (52%)</td>
<td>1.15</td>
<td>1.0 D + 1.0 S (All Spans)</td>
</tr>
<tr>
<td>Live Load Defl. (in)</td>
<td>0.599 @ 9’ 1/2&quot;</td>
<td>0.592</td>
<td>Passed (L/356)</td>
<td>--</td>
<td>1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)</td>
</tr>
<tr>
<td>Total Load Defl. (in)</td>
<td>0.862 @ 9’ 1/2&quot;</td>
<td>0.887</td>
<td>Passed (L/247)</td>
<td>--</td>
<td>1.0 D + 0.45 W + 0.75 L + 0.75 S (All Spans)</td>
</tr>
</tbody>
</table>

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

<table>
<thead>
<tr>
<th>Supports</th>
<th>Bearing Length</th>
<th>Loads to Supports (lbs)</th>
<th>Accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Available</td>
<td>Required</td>
</tr>
<tr>
<td>1 - Trimmer - DF</td>
<td>3.50&quot;</td>
<td>3.50&quot;</td>
<td>1.50&quot;</td>
</tr>
<tr>
<td>2 - Trimmer - DF</td>
<td>3.50&quot;</td>
<td>3.50&quot;</td>
<td>1.50&quot;</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Lateral Bracing</th>
<th>Bracing Intervals</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Edge (Lu)</td>
<td>18’ 1” o/c</td>
<td></td>
</tr>
<tr>
<td>Bottom Edge (Lu)</td>
<td>18’ 1” o/c</td>
<td></td>
</tr>
</tbody>
</table>

**Maximum allowable bracing intervals based on applied load.**

<table>
<thead>
<tr>
<th>Vertical Loads</th>
<th>Location (Side)</th>
<th>Tributary Width</th>
<th>Dead (0.90)</th>
<th>Roof Live (non-snow: 1.25)</th>
<th>Snow (1.15)</th>
<th>Wind (1.60)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - Self Weight (PLF)</td>
<td>0 to 18’ 1”</td>
<td>N/A</td>
<td>19.5</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>Default Load</td>
</tr>
<tr>
<td>1 - Uniform (PSF)</td>
<td>0 to 18’ 1”</td>
<td>9’ 8”</td>
<td>15.0</td>
<td>20.0</td>
<td>30.0</td>
<td>36.2</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location Analysis</th>
<th>Shear (lbs)</th>
<th>Moment (ft-lbs)</th>
<th>Deflection (in)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual</td>
<td>Allowed</td>
<td>LDF</td>
<td>Actual</td>
</tr>
<tr>
<td>1 - 0</td>
<td>4034</td>
<td>13861</td>
<td>1.15</td>
<td>0</td>
</tr>
</tbody>
</table>

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

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**ForteWEB Software Operator**

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Antelope Springs Existing Typical Exterior Wall Studs Check

Load Combinations

\[ DL_r := 15 \text{ psf} \]

\[ LL_f := 40 \text{ psf} \]

\[ SL := 30 \text{ psf} \]

\[ WL := 21.86 \text{ psf} \]

\[ DL_f := 12 \text{ psf} \]

\[ DL_w := 100 \text{ plf} \]

\[ L_b := 18 \text{ ft} \]

\[ W_b := 30 \text{ ft} \]

\[ L_2 := 12 \text{ ft} \]

\[ W_2 := 12 \text{ ft} \]

\[ S := 16 \text{ in} \]

\[ R_{DL} := DL_r \cdot \left( L_2 \div 2 + 1 \text{ ft} \right) \cdot S \]

\[ R_{DL} = 140 \text{ lbf} \]

\[ R_{LL} := SL \cdot \left( L_2 \div 2 + 1 \text{ ft} \right) \cdot S \]

\[ R_{LL} = 280 \text{ lbf} \]

\[ R_{DL2} := \left( DL_f \cdot L_2 \div 2 + DL_w \right) \cdot S \]

\[ R_{DL2} = 229 \text{ lbf} \]

\[ R_{LL2} := \left( LL_f \cdot L_2 \div 2 \right) \cdot S \]

\[ R_{LL2} = 320 \text{ lbf} \]

\[ R_{Total.DL} := R_{DL} + R_{DL2} \]

\[ R_{Total.DL} = 369 \text{ lbf} \]

\[ R_{Total.LL} := 0.75 \cdot \left( R_{LL} + R_{LL2} \right) \]

\[ R_{Total.LL} = 450 \text{ lbf} \]

\[ R_{WL} := 0.75 \cdot WL \cdot S \]

\[ R_{WL} = 21.86 \text{ plf} \]

Use DF-L No. 2 for framing

\[ F_b := 900 \text{ psi} \]

Bending Factor (NDS Table 5A)

\[ F_c := 1350 \text{ psi} \]

Shear parallel to Grain Factor (NDS Table 5A)

\[ E_{min} := 580000 \text{ psi} \]

Modulus of Elasticity Factor (NDS Table 5A)

\[ E := 1600000 \text{ psi} \]

Try (1) 2 x 4

\[ S_x := 3.06 \text{ in}^3 \]

\[ I_x := 5.359 \text{ in}^4 \]

\[ A := 5.25 \text{ in}^2 \]

Section Modulus, Inertia and Area of 2 x 4 Member
\[ b = 1.5 \text{ in} \quad \quad d = 3.5 \text{ in} \]

**Determine Max Moment and Compression Stress from Given Loads**

\[ H := 8 \text{ ft} \]

\[ M_{\text{max}} = R_{\text{WL}} \cdot H^2 \div 8 \quad \quad M_{\text{max}} = 2099 \text{ in} \cdot \text{lbf} \]

\[ f_b := M_{\text{max}} \div S_x \quad \quad f_b = 686 \text{ psi} \]

\[ f_c := (R_{\text{Total,DL}} + R_{\text{Total,LL}}) \div A \quad \quad f_c = 156 \text{ psi} \]

\[ C_D := 1.15 \]

\[ C_M := 1.0 \]

\[ C_i := 1.0 \]

\[ C_L := 1.0 \]

\[ C_F := 1.05 \]

\[ C_{fu} := 1.0 \]

\[ C_i := 1.0 \]

\[ C_r := 1.0 \]

**Finding Allowable Compression Stress**

\[ F_c'' := F_c \cdot C_D \cdot C_M \cdot C_i \cdot C_F \cdot C_i \quad \quad F_c'' = 1630.125 \text{ psi} \]

\[ K := 1.0 \]

\[ c := 0.8 \]

\[ l_e := K \cdot H \quad \quad l_e = 8 \text{ ft} \]

\[ F_{cE} := 0.822 \cdot E_{\text{min}} \div (l_e \div d)^2 \quad \quad F_{cE} = 634 \text{ psi} \]

\[ C_p := \frac{1 + (F_{cE} \div F_c'')}{2 \cdot c} - \sqrt{\left( \frac{1 + (F_{cE} \div F_c'')}{2 \cdot c} \right)^2 - \frac{F_{cE} \div F_c''}{c}} = 0.351 \]

\[ F_c' := F_c'' \cdot C_p \quad \quad F_c' = 572 \text{ psi} \]

\[ \text{unity}_c := f_c \div F_c' \quad \quad \text{unity}_c = 0.273 \]

\[ \text{Compression Unity} < 1 \text{ ; Okay} \]

\[ \text{Max Moment on Beam} \]

\[ \text{Max Bending Stress} \]

\[ \text{Max Compression Stress} \]

\[ \text{Load Duration Factor (NDS Table 2.3.2)} \]

\[ \text{Wet Service Factor (Members are dry)} \]

\[ \text{Temperature Factor (NDS Table 2.3.3)} \]

\[ \text{Beam Stability Factor (Members are Braced)} \]

\[ \text{Size Factor, Studs (NDS Table 4A)} \]

\[ \text{Flat Use Factor (NDS Table 4A), Not used in weak axis bending} \]

\[ \text{Incising Factor (NDS Table 4.3.8), Member not incised} \]

\[ \text{Repetitive Member Factor (NDS 4.3.9)} \]

\[ \text{Compression Factor without Cp (NDS Table 5A)} \]

\[ \text{Buckling Length Coefficient (Pin-Pin)} \]

\[ \text{Sawn Lumber} \]

\[ \text{Effective Length} \]

\[ \text{Critical Buckling Stress} \]

\[ \text{Column Stability Factor (NDS 3.7.1, eq-3.7-1)} \]

\[ \text{Allowable Compression} \]

\[ \text{Compression Unity} < 1 \text{ ; Okay} \]
Finding Allowable Bending Stress

\[ F_b' = F_b \cdot \left( C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_r \right) \]

\[ F_b' = 1087 \text{ psi} \]

\[ unity_b = f_b \div F_b' \]

\[ unity_b = 0.631 \]

Bending Unity < 1; Okay

Checking Beam-Column Capacity

\[ unity := \left( \frac{f_c}{F_c'} \right)^2 + \frac{f_b}{F_b' \cdot \left( 1 - \left( f_c \div F_{ce} \right) \right)} \]

\[ unity = 0.912 \]

Combo Unity < 1; Okay

Existing 2 x 4 Studs are Adequate for Exterior Wall Studs

Antelope Springs Existing Typical Interior Wall Studs Check

Load Combinations

\[ DL_r := 15 \text{ psf} \]

Roof Dead Load

\[ LL_f := 40 \text{ psf} \]

2nd Floor Live Load

\[ SL := 30 \text{ psf} \]

\[ SL_1 := 37.1 \text{ psf} \]

Snow Load and Drift Snow Load

\[ WL := 5 \text{ psf} \]

Wind Load

\[ DL_f := 12 \text{ psf} \]

Floor Dead Load

\[ DL_v := 100 \text{ plf} \]

Wall Dead Load

\[ L_1 := 18 \text{ ft} \]

\[ W_1 := 30 \text{ ft} \]

Length and Width of Building

\[ L_2 := 12 \text{ ft} \]

\[ W_2 := 12 \text{ ft} \]

Length and Width of 2nd Floor

\[ S := 16 \text{ in} \]

Spacing of Wall Studs

\[ R_{DL} := DL_r \cdot \left( L_2 \div 2 \right) \cdot S \]

\[ R_{DL} = 120 \text{ lbf} \]

Roof Axial Dead Load on 1st Floor Wall Studs

\[ R_{LL} := \left( SL \cdot 3 \text{ ft} + SL_1 \cdot 6 \text{ ft} \right) \cdot S \]

\[ R_{LL} = 417 \text{ lbf} \]

Roof Axial Live Load on 1st Floor Wall Studs (Drift Length is 6ft)

\[ R_{DL.2} := \left( DL_f \cdot L_2 \div 2 + \left( DL_v + L_2 \right) \right) \cdot S \]

\[ R_{DL.2} = 229 \text{ lbf} \]

2nd Floor Axial Dead Load on 1st Floor Wall Studs

\[ R_{LL.2} := \left( LL_f \cdot L_2 \div 2 \right) \cdot S \]

\[ R_{LL.2} = 320 \text{ lbf} \]

2nd Floor Axial Live Load on 1st Floor Wall Studs

\[ R_{Total.DL} := R_{DL} + R_{DL.2} \]

\[ R_{Total.DL} = 349 \text{ lbf} \]

Total Axial Dead Load on Wall Studs

\[ R_{Total.LL} := 0.75 \left( R_{LL} + R_{LL.2} \right) \]

\[ R_{Total.LL} = 553 \text{ lbf} \]

Total Axial Live Load on Wall Studs

\[ R_{WL} := 0.75 \cdot WL \cdot S \]

\[ R_{WL} = 5 \text{ plf} \]

Total Wind Load on Wall Studs
Use DF-L No. 2 for framing

\[ F_b := 900 \text{ psi} \]  
Bending Factor (NDS Table 5A)

\[ F_c := 1350 \text{ psi} \]  
Shear parallel to Grain Factor (NDS Table 5A)

\[ E_{min} := 580000 \text{ psi} \]  
Modulus of Elasticity Factor (NDS Table 5A)

\[ E := 1600000 \text{ psi} \]  

**Try (1) 2 x 4**

\[ S_x := 3.06 \text{ in}^3 \quad I_x := 5.359 \text{ in}^4 \quad A := 5.25 \text{ in}^2 \]  
Section Modulus, Inertia and Area

\[ b := 1.5 \text{ in} \quad d := 3.5 \text{ in} \]

**Max Moment and Compression Stress from Given Loads**

\[ H := 8 \text{ ft} \]  
Height of Wall

\[ M_{max} := R_{WL} \cdot H^2 \div 8 \quad M_{max} := 480 \text{ in} \cdot \text{lbf} \]  
Max Moment on Beam

\[ f_b := M_{max} \div S_x \quad f_b := 157 \text{ psi} \]  
Max Bending Stress

\[ f_c := (R_{Total\_DL} + R_{Total\_LL}) \div A \quad f_c := 172 \text{ psi} \]  
Max Compression Stress

\[ C_D := 1.15 \]

\[ C_M := 1.0 \]

\[ C_t := 1.0 \]

\[ C_L := 1.0 \]

\[ C_F := 1.05 \]

\[ C_{fu} := 1.0 \]

\[ C_i := 1.0 \]

\[ C_r := 1.0 \]

**Finding Allowable Compression Stress**

\[ F_c^{''} := F_c \cdot C_D \cdot C_M \cdot C_t \cdot C_F \cdot C_i \quad F_c^{''} := 1630.125 \text{ psi} \]  
Compression Factor without Cp (NDS Table 5A)

\[ K := 1.0 \]

\[ c := 0.8 \]  
Buckling Length Coefficient (Pin-Pin)

Sawn Lumber
$l_e := KH$ \hspace{1cm} $l_e = 8 \text{ ft}$ \hspace{1cm} Effective Length

$F_{cE} := 0.822 \cdot \frac{E_{\text{min}}}{(l_e / d)^2}$ \hspace{1cm} $F_{cE} = 634 \text{ psi}$ \hspace{1cm} Critical Buckling Stress

$C_p := \frac{1 + (F_{cE} / F_{c'}^n)}{2 \cdot c} - \sqrt{\left(\frac{1 + (F_{cE} / F_{c''}^n)}{2 \cdot c}\right)^2 - \frac{F_{cE} / F_{c''}^n}{c}} = 0.351$ \hspace{1cm} Column Stability Factor (NDS 3.7.1, eq-3.7-1)

$F'_c := F''_c \cdot C_p$ \hspace{1cm} $F'_c = 572 \text{ psi}$ \hspace{1cm} Allowable Compression

$unity_c := f_c / F'_c$ \hspace{1cm} $unity_c = 0.3$ \hspace{1cm} Compression Unity $< 1$; Okay

**Finding Allowable Bending Stress**

$F'_b := F_b \cdot C_D \cdot C_M \cdot C_I \cdot C_L \cdot C_F \cdot C_{fu} \cdot C_r$ \hspace{1cm} $F'_b = 1087 \text{ psi}$ \hspace{1cm} Allowable Bending Stress

$unity_b := f_b / F'_b$ \hspace{1cm} $unity_b = 0.144$ \hspace{1cm} Bending Unity $< 1$; Okay

**Checking Beam-Column Capacity**

$unity := \left(\frac{f_c}{F'_c}\right)^2 + \frac{f_b}{F'_b \cdot (1 - (f_c / F_{cE}))} = 0.288$ \hspace{1cm} Combo Unity $< 1$; Okay

**Existing 2 x 4 Studs are Adequate for Interior Wall Studs**

**For the East Interior Wall Where Fire was Started Replace with 2 x 4 DF.L No.2 or Better Studs**
**Load Tracking Analysis**

**Design Criteria**

- **Roof Dead Load**: 15 psf
- **Floor Dead Load**: 12 psf
- **Wall Dead Load**: 100 plf
- **Floor Live Load**: 100 psf
- **Snow Load**: 30 psf
- **Wind Load**: 115 mph
- **Ps wall**: 24 psf
- **Roof**: 36.24 psf
- **Wall**: 24 psf

**2nd Floor Dimensions**

- Trusses spaced at 2': 1.3 ft
- Length of 2nd Floor: 12 ft
- Width of 2nd Floor: 12 ft
- Eave length: 1 ft
- Floor joist spaced at 16": 1.3 ft

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Dead Load on Wall R2a</td>
<td>105</td>
<td>plf</td>
</tr>
<tr>
<td>Roof Dead Load on Wall R2b</td>
<td>105</td>
<td>plf</td>
</tr>
<tr>
<td>Roof Live Load on Wall R2a</td>
<td>210</td>
<td>plf</td>
</tr>
<tr>
<td>Roof Live Load on Wall R2b</td>
<td>210</td>
<td>plf</td>
</tr>
<tr>
<td>Roof Total Load on Wall R2a</td>
<td>315</td>
<td>plf</td>
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<tr>
<td>Roof Total Load on Wall R2b</td>
<td>315</td>
<td>plf</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>2nd Floor + Wall Dead Load F2a</td>
<td>108</td>
<td>plf</td>
</tr>
<tr>
<td>2nd Floor + Wall Dead Load F2b</td>
<td>172</td>
<td>plf</td>
</tr>
<tr>
<td>2nd Floor Live Load on Wall F2a</td>
<td>66.67</td>
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<tr>
<td>2nd Floor Live Load on Wall F2b</td>
<td>600</td>
<td>plf</td>
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<tr>
<td>2nd Floor Total Load on Wall F2a</td>
<td>174.67</td>
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</tr>
<tr>
<td>2nd Floor Total Load on Wall F2b</td>
<td>772.00</td>
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<thead>
<tr>
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<tbody>
<tr>
<td>F2a = R2a + F2a</td>
<td>489.67</td>
<td>plf</td>
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<tr>
<td>F2b = R2b + F2b</td>
<td>1087.00</td>
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1st Floor Dimensions

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top Length of Building</td>
<td>18 ft</td>
</tr>
<tr>
<td>Top Width of Building</td>
<td>30 ft</td>
</tr>
<tr>
<td>Bottom Length of Building</td>
<td>12 ft</td>
</tr>
<tr>
<td>Bottom Width of Building</td>
<td>18 ft</td>
</tr>
<tr>
<td>Trusses spaced at 2'</td>
<td>2.0 ft</td>
</tr>
<tr>
<td>Floor joist spaced at 16&quot;</td>
<td>1.3 ft</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof Dead Load Wall R1</td>
<td>150 plf</td>
</tr>
<tr>
<td>Roof Dead Load Wall R2</td>
<td>30 plf</td>
</tr>
<tr>
<td>Roof Dead Load Girder</td>
<td>150 plf</td>
</tr>
<tr>
<td>Roof Live Load Wall R1</td>
<td>300 plf</td>
</tr>
<tr>
<td>Roof Live Load Wall R2</td>
<td>60 plf</td>
</tr>
<tr>
<td>Roof Live Load Girder</td>
<td>300 plf</td>
</tr>
<tr>
<td>Roof Total Load Wall R1</td>
<td>450 plf</td>
</tr>
<tr>
<td>Roof Total Load Wall R2</td>
<td>90 plf</td>
</tr>
<tr>
<td>Roof Total Load Girder</td>
<td>450 plf</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Floor + Wall Dead Load on F1</td>
<td>208 plf</td>
</tr>
<tr>
<td>1st Floor + Wall Dead Load on F2</td>
<td>107.8 plf</td>
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<td>1st Floor + Wall Dead Load on F3</td>
<td>280 plf</td>
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<tr>
<td>1st Floor + Wall Dead Load on F4</td>
<td>215.8 plf</td>
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<td>1st Floor + Wall Dead Load on F5</td>
<td>172 plf</td>
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<tr>
<td>1st Floor + Wall Dead Load on F6</td>
<td>107.8 plf</td>
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<table>
<thead>
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<tbody>
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<td>1st Floor Live Load Wall F1</td>
<td>900 plf</td>
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<tr>
<td>1st Floor Live Load Wall F2</td>
<td>65 plf</td>
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<tr>
<td>1st Floor Live Load Wall F3</td>
<td>1500 plf</td>
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<tr>
<td>1st Floor Live Load Wall F4</td>
<td>965 plf</td>
</tr>
<tr>
<td>1st Floor Live Load Wall F5</td>
<td>600 plf</td>
</tr>
<tr>
<td>1st Floor Live Load Wall F6</td>
<td>65 plf</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st Floor Total Load Wall F1</td>
<td>1108 plf</td>
</tr>
<tr>
<td>1st Floor Total Load Wall F2</td>
<td>172.8 plf</td>
</tr>
<tr>
<td>1st Floor Total Load Wall F3</td>
<td>1780 plf</td>
</tr>
<tr>
<td>1st Floor Total Load Wall F4</td>
<td>1180.8 plf</td>
</tr>
<tr>
<td>1st Floor Total Load Wall F5</td>
<td>772 plf</td>
</tr>
<tr>
<td>1st Floor Total Load Wall F6</td>
<td>172.8 plf</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ASD Loads on Each Wall</td>
<td></td>
</tr>
<tr>
<td>$F_1 = R_1 + F_1$</td>
<td>1558.00 plf</td>
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<tr>
<td>$F_2 = R_2 + F_2$</td>
<td>262.80 plf</td>
</tr>
<tr>
<td>$F_3 = R_1 + F_3 + F_2b$</td>
<td>3317.00 plf</td>
</tr>
<tr>
<td>$F_4 = R_1 + F_4 + F_2a$</td>
<td>2120.47 plf</td>
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<tr>
<td>$F_5 = F_5 + F_2b$</td>
<td>1859.00 plf</td>
</tr>
<tr>
<td>$F_6 = F_6 + F_2a$</td>
<td>662.47 plf</td>
</tr>
</tbody>
</table>
Structural steel Bracing:

Dead load = 707.1 lb \times 6\text{ ft} = 4242.6 lb

Live load = 2610 \times 6\text{ ft} = 15660 lb

\[ P_0 = 1.2D + 1.6L = 3014.6 \text{ lb} \geq 30.14 \text{ kips} \]

Steel Manual Table 4-1 \( k_2 \): Assume \( L = 7.6 \text{ ft} \); \( K = 0.65 \)

AISC Table 4-14 \( k_2 \): Assume \( L = 50 \text{ in} \), \( \sigma_{\text{fcr}} = 28.4 \text{ ksi} \) for \( y = 36 \text{ ksi} \)

Area required = \( 30.14 \text{ kips} / 28.4 \text{ ksi} \) = 1.06 in²

Use W6\times16; \( A = 4.74 \text{ in}^2 \); 2.6 in cy; 0.967 in

\[ \left( \frac{kL}{r} \right)_x = \frac{59.28}{2.6} = 22.8 \]

\[ \left( \frac{kL}{r} \right)_y = \frac{59.28}{0.967} = 61.3 \geq \text{ controls} \]

AISC Table 4-14 \( \sigma_{\text{fcr}} = 26.6 \)

\[ \sigma_{\text{fcr}} = 26.6 \times 4.74 = 126.0 \text{ kips} > 30.14 \Rightarrow \text{OK!} \]

Use 3 \( \times \) W6\times16

Anchor rod size can be determined based on OSHA requirements and practical consideration.
w 6 x 16  

\( F_y = 36 \text{ ksi}; F_j = 50 \text{ ksi} \)

\( A = 4.74 \text{ in}^2 \)  
\( t_f = 0.40 \text{ in} \)  
\( b_f = 4.03 \text{ in} \)

\( a = 2.60 \text{ in} \)  
\( t_w = 0.260 \text{ in} \)  
\( d = 6.28 \text{ in} \)

\( I = 32.1 \text{ in}^4 \)  
\( k = 0.655 \text{ in} \)

**Flanges:**  
\[ \frac{b}{t} = \frac{4.03}{0.40} = 10.07 \]  
\[ \frac{b}{t_f} = \frac{4.03}{0.40} = 10.07 \]  
\[ 0.56 \sqrt{\frac{E}{F_y}} = 0.56 \sqrt{\frac{29,000}{36}} = 15.89 \]  
\[ 9.95 < 15.89 \rightarrow \text{OK!} \]

**Webs:**  
\[ \frac{b}{t} = \frac{19.1}{4.4} = 4.35 \]  
\[ 1.49 \sqrt{\frac{E}{F_j}} = 1.49 \sqrt{\frac{29,000}{36}} = 42.28 > 19.1 \rightarrow \text{Non slender member} \]

w 6 x 16 \( \rightarrow \text{OK!} \)
Base plate Design:

Column: w6 x 16  Fy = 36 ksi  

Pu = 30.14 k  

Assume concrete strength = 3000 psi

Assume footing dimension = 4 ft x 4 ft

A2 = Footing Area = (4.8 in x 4.5 in) = 2.304 in²

Required Base Plate Area: 

\[ A = \frac{P_{u}}{0.85 f'c' \frac{A_{2}}{A_{1}}} \] 

\[ = \frac{30.14}{0.85 \times 3 \times \sqrt{2}} \] 

\[ \approx 12.88 \text{ in}^2 \]

Base plate needs to be at least as large as the column: 16 in²

bf = 4.03 x 6.25 = 25.3 in² > 16 in²  

Optimize Base plate dimension.

\[ A = \frac{0.95d - 0.855c}{2} = \frac{0.95 \times 6.25 - 0.85 \times 4.03}{2} = 1.37 \text{ in} \]

\[ N = \sqrt{A_{1}} + A = \sqrt{15 \text{ in}^2} + 1.37 = 5.24 \text{ in} \approx 6 \text{ in} \]

\[ B = \frac{A_{1}}{N} = \frac{15 \text{ in}^2}{6 \text{ in}} = 2.5 \text{ in} \]

Therefore base plate area; 6 in x 6 in = 36 in²

Check Bearing strength of concrete:

\[ \phi P_{u} + \phi (0.85 f'c') \left( \sqrt{\frac{A_{1}}{A_{2}}} \right) \]  

\[ = 0.65 \times 0.85 \times 3 \times (6 \times 6) \times 2 \]

\[ = 119.34 \text{ k} > 35.17 \text{ k} \rightarrow \text{OK!} \]

Required Base plate thickness:

\[ t_{req} = \frac{\sqrt{2 P_{u}}}{0.9 f_{c} B N} \]  

\[ = 1.38 \sqrt{\frac{2 \times 35.17}{0.9 \times 36 \times (6 \times 6)}} = 0.33 \text{ in} \]

Use PL 1/2 x 6 x 6 in A36
Base Plate connection;
use E70 electrodes, small fillet welds.

\[ R_n = F_M \times I \left( \frac{1}{2} \times 6 \right) = 108k \]

\[ LF = \phi = 0.90 \Rightarrow 0.9 \times 108 = 97.2k \]

Tensile rupture strength = \( 1 \times 6 = 3n^2 \)

1. \( R_n = F_u \times A_e = 50 \times 3 = 150k \)
2. \( LF = \phi = 0.75 \)
   (Structural Steel Design by Jack C.)

\[ \frac{2}{3} R_n = 0.75 \times 112.5 = 84k \]

Design of weld connection: max weld size = \( \frac{5}{16} \)

min weld size = \( \frac{3}{16} \)
( ) ( ) Structural Steel Design by Jack C.

\[ R_n \text{ of weld per in} = F_u A_w = (0.6 \times 30) \left( \frac{5}{16} \times 0.707 \right) = 9.28 k/ln \]

\[ LF = \phi = 0.75 \Rightarrow 0.75 \times 9.28 = 6.96 k/ln \]

Weld length required = \( \frac{97.2}{6.96} = 13.96 \) in \( \Rightarrow \) use 7 in each side
Bolt Connection Design:

\[ P_u = 5154 \text{ k} \]
\[ F_y = 36 \text{ k} \]
\[ F_u = 58 \text{ k} \]

Bearing strength of 1 bolt:

\[ R_n = 1.21c + F_u \leq 2.4d + F_u \]

\[ C = 2 - \frac{1}{2} \left( \frac{1}{2} + \frac{1}{8} \right) = 1.6875 \]

\[ R_n = 1.21c + F_u \leq 2.4d + F_u \]

\[ = 58.46 \leq 34.8 \Rightarrow \text{Bearing strength} = 34.8 \text{ k} \]

\[ R_n = 0.75 \times 34.8 = 26.1 \text{ k} \]

Shear strength of 1 bolt:

\[ R_n = F_{nw} A_b = F_{nw} \times \left( \frac{\pi}{4} \times d^2 \right) \]

\[ R_n = 68 \times \left( \frac{\pi}{4} \times \frac{1}{2} \right) = 13.35 \text{ k} \]

\[ R'_n = 0.75 \times 13.35 = 10.01 \text{ k} \]

Number of bolts:

\[ \frac{51.54}{10.01} \approx 5 \text{.04} \approx 6 \text{ bolt} \]

Use 6 bolts (A490 - 1 in) for bearing type connection.
Continuous Strip Footings for F4
1. Floor 1. R.oof 2. Floor 2. R.oof

Dead load: 2800 lb + 17000 lb + 1720 lb + 1050 lb = 3077 lb
Live Load: 1500 lb + 3000 lb + 6000 lb + 2100 lb = 3010 lb
Wind Load: 36.24 psf x 12 ft
Snow Load: 39.1 psf x (12/2 + 1)

Net Bearing Capacity: 1500 psf

Required Frost Depth: 36 inches

Unit weight of Soil: \( \gamma_s = 100 \text{ psf} \)

Concrete Strength: 4000 psi

Yield strength of rebars: 60 ksi

Design code ACI-318-14

Depth of footing: (Rankine's Formula)

\[ D_{min} = \frac{1}{(1 - \sin \theta)} \left( \frac{1 - \sin \theta}{1 - \sin \theta} \right)^2 \]

\[ = \left( \frac{1500}{100} \right) \left( \frac{1 - \sin 22}{1 + \sin 22} \right)^2 \]

\[ = 3.1 \text{ ft} \times 1 \text{ ft} \] (Assume 6" overburden soil)

Net soil bearing capacity = 1500 psf

(ACI 13.3.1.1)

Area required: \( \frac{4012 \text{ lb/ft}}{1500 \text{ psf}} = 2.67 \text{ ft}^2 \) \( \times \) min. footing width for each 1 ft strip

Factored Load: ASCE 7-16: \( 1.2D + 1.6L + 0.5C \text{ or } S \text{ or } E \) - 3.3 kips

Factored net pressure: \( \frac{5153.9}{2.67} = 1930.2 \text{ psf} \times 1.93 \text{ ksi} \)
Shear capacity check:

\[ d = (f - \text{cover} - db/2) \]

\[ = 8\text{in} - 3\text{in} - \frac{1}{2} = 4.5\text{in} \]

\[ V_u = q_u \times b \times (k - d) \]

\[ = 14.8 \times 0.66 \left( \frac{3.5}{12} \right) = 4.65 \text{ kip-ft}\]

ACI 318-11 (22.5.5.1) \[ \Phi V_c = 2 \times \frac{f'_c}{f_c} \times b_w \times d \]

\[ = 2 \times 1 \times \sqrt{4000} \times 8 \times 4.5 / 1000 = 2.27 \text{ kips} \]

\[ \Phi V_c = 0.75 \quad \text{ACI 318-11 Table 21.2.1} \]

\[ \Phi V_c = 1.70 \text{ kips} \]

\[ V_u < \Phi V_c \Rightarrow \text{OK!} \]
Flexural Reinforcement Design:

Design moment: \( M_u = \frac{9.0 \times 12^2}{2} = \frac{4.0 \times 12 \times (18)^2}{2} = 4.5 \text{ kip-ft/ft} \)

\[ A_s = \frac{M_u}{\varphi f_y (d - 0.5)} \]

\[ a = \frac{A_s f_y}{0.85 f_c' b} = \frac{A_s \times 60}{0.85 \times 4 \times 12} = a = 1.47 A_s \]

\[ A_s = \frac{4.5 \text{ kip-ft/ft} \times 12 \text{ in/ft}}{0.9 \times 60 (4.5 - 1.47 A_s)} = A_s = 0.23 \text{ in}^2 \]

\[ \Rightarrow \text{min. reinforcement ACI 7.6.1.1} = A_{smin} = 0.0018 b h \]

\[ A_{smin} = 0.216 \text{ in}^2 \geq 0.22 \text{ in}^2 \]

\[ m_n = \Phi A_s f_y (d - 0.5) = 26.25 \text{ kip-in/ft} \]

\[ M_n > M_u \rightarrow \text{OK!} \]
Bar Spacing, Placement:

\[ \text{Main bar spacing} = \frac{Ax}{A_J} \text{ in} \]

Use #5 bar -> \[ \frac{0.31 \text{ in}^2 \times 12}{0.23} = 16.1 \approx 16 \text{ in O.C.} \]

\[ \text{Footing width} = 36 \text{ in} \]

Cover = \[ \frac{3 + 3 \text{ in}}{2 \text{ in}} \text{ total both side} \]

Spacing = 16 in O.C. \[ \times \frac{30}{16} = 1.875 \rightarrow \text{use two #5 bars 15 in O.C.} \]

\[ \text{#5 rebar; 15 in O.C.} \]

3" clear

3" clear

36 inches
**Isolated Column Design:**

**Floor Live Load:**

\[ 8 \times 100 = 300 \times 18 = 5,400 \text{ lb} \]

**Floor Dead Load:**

\[ 3 \times 12 \times 18 = 648 \text{ lb} \]

**Point Load on Column:** 604.8 lb

**Column Size:** \( 6 \times 4 = 24 \text{ in}^2 \)

**Design Load:** \( 1.20 + 1.60 = 3,417.6 \text{ lb} \)

**Assume thickness of footing = 12 in**

\[ d_{ow} = h - \text{ clear - one bar diameter.} \]

\[ 12 - 3 - 0.5 = 8.5 \text{ in} \]

**Over burden pressure; Depth of footing = 4'**

\[ W = 8.5 (2 - h) + 8.5 h = 100 (4 - 1) + 150 \times 1 \]

\[ = 450 \text{ psf} = 0.451 \text{ sf} \]

**Effective Bearing capacity:**

\[ 1500 - 450 = 1050 \text{ psf} = 1.05 \text{ sf} \]

**Required Bearing area:**

\[ \frac{9.417}{1050} = 8.96 = 9 \text{ ft}^2 \]
Isolated Column (cont.)

**Critical Shear:** \( b_0 = 4 \times (c + d_{lay}) = 4 \times (6 + 8.5) = 58 \text{ in} \)

**Design Pressure:** Factored load \( A_{req} = 9.4 \text{ lb/ft}^2 \)

**Punching Shear:** \( V_{up} = 9.4 \times (8^2 - (c + d_{lay})^2) \) \( \Rightarrow \text{ACI 11.11.12} \)

\[ V_{up} = 1.046 \times (3^2 - (6 + 8.5)^2) = 22.62 \text{ kip} \]

**Punching shear capacity:** \( V_c = 4 \times \sqrt{12} \times b_0.d = 4 \times \sqrt{12} \times 580 \times 85 = 124.7 \text{ kip} \)

\[ V_c = 124.7 \times 0.75 = 93.5 \text{ kip} \]

\( V_c > V_{up} \Rightarrow \text{OK!} \)

**Maximum moment:** \( M_u = 0.8 \times L^2 \)

\[ k = \frac{(B-C)}{2} = \frac{(3 \times 12) - 6}{2} = 15 \text{ in.} \]

\[ M_u = 3 \times 1.046 \times (1.25)^2 = 2.45 \text{ ft-kip} \]
Isolated Column Design:

\[ m_u = 25.56 \text{ kip} \in \text{in} \]

\[ a = 0.2 \text{dav} = 0.2 \times 8.5 = 1.7 \]

\[ A_0 = \frac{m_u}{f_y (dav - a/2)} = \frac{25.56}{0.9 \times 60 \times (8.5 - 1.7/2)} = \frac{25.56}{413.1} = 0.06 \text{ in}^2 \]

\[ a = \frac{A_{fy}}{0.85 B} = \frac{0.06 \times 60}{0.85 \times 4 \times 3 \times 12} = \frac{3.6}{122.4} = 0.029 \]

\[ A_{min} = 0.005 \times B \times \text{dav} = 0.005 \times 3 \times 8.5 \times 12 = 1.53 \text{ in}^2 \]

\[ A_{min} \text{ governs.} \]

Bars placement:

Using #5 bars; Number of bars = \( \frac{1.53}{0.31} = 4.95 \approx 5 \) rebars

Spacing = \( (3 - 0.5) = 2.5 \times 12/5 = 6 \text{ in} \frac{1}{4} \)
**Structural Steel Columns:**

- Use three W6X16 for inner North Wall.
- Use four W6X16 for basement North Wall.
- Use PL ½ x 7 x 7 A36 steel base plate.
- Use E70 electrodes 7 in. each side for baseplate to steel column connection.
- Use specified Simpson Column Cap for steel post to floor joist connection.
- Use ½ in diameter bolt for column cap connection.

**Continuous Strip Footing:**

- Use 36 in. wide, 10 in. thick footing along the perimeter.
- Use 8 in. thick stem wall.
- Use No. 5 three rebars for reinforcement of footing.
- Use No. 5 two rebars for reinforcement of stem wall.
- Use 3 in. cover for footing reinforcement for both sides.
- Place No.5 rebars 15 in c/c for footing.

**Isolated Spread Footing:**

- Use a 3ft x 3 ft x 1 ft thick footing underneath interior columns.
- Use No. 5 five rebars each way for reinforcement of footing.
- Use NO. 5 four dowels
- Place No.5 rebars 6 in c/c

- Per standard practice in Colorado, foundation walls should be designed to span 10 feet horizontally.
- Per ACI 318, 14.3.5, horizontal and vertical steel should not be spaced more than 18 in. O.C. vertically or horizontally.
- Per ACI 318, 14.3.2, the minimum ratio of vertical reinforcement per wall area is 0.0012.
- Per ACI 318, 14.3.3, the minimum ratio of horizontal reinforcement per wall area is 0.0020.
- Per ACI 318, 7.7.1, the minimum cover for rebar where the concrete is cast against earth is 3 inches.
- Per ACI 318, 7.7.1, No. 5 and smaller bars cast in walls but exposed to soil/weather shall have a minimum cover of 1-1/2 inches.
Exhibit 5: Plans and Drawings
Antelope Springs Methodist Church Revival

Contacts
Mr. Kim Grant, Endangered Places Program Director
Email: kgrant@coloradopreservation.org
Phone: 303-893-4260 Ext. 222
Colorado Preservation, Inc.
1420 Ogden Street, Suite 103, Denver, CO 80218
www.ColoradoPreservation.org

The Wolever Family, Ms. Sharon Wolever, Property Owner
Email: hatcreek18@gmail.com
Phone: 970-842-2170

Jurisdictional Authority
Morgan County
218 Kowa Ave.
Fort Morgan, CO 80701
Email: morgancountybcc@co.morgan.co.us
Phone: 970-542-3500
www.morgancounty.colorado.gov/

Sheet Index

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Antelope Springs Methodist Church

Project Location Map

Site Map

CU Denver Civil Engineering Dept.
1200 Larimer St, Denver, CO 80204

Drawn By: Nicholas Bass
Cover Page

Checked by: Dirk Dykson S-0
DETAIL G IS FOR OUR RECOMMENDATION TO REPLACE THE NORTH EXTERIOR AND INTERIOR FOUNDATION WALLS. SEE FOUNDATION DETAIL 2 ON S.8.

DETAIL H IS FOR OUR RECOMMENDATION TO REPLACE THE ISOLATED COLUMN AND FOOTING IN THE KITCHEN AREA. SEE FOUNDATION DETAIL 2 ON S.8.
EXISTING 2 X 8 FLOOR JOIST SPACED 16" O.C.
SISTER EXISTING 2 X 8 FLOOR JOIST WHERE HOLE IS PRESENT.
REPLACE AS NEEDED
2 X 4 WALL STUDS SPACED 16" O.C.

Antelope Springs Methodist Episcopal Church
Submittal: 5/1/2021
Checked by:
Drawn By:
Abdulahab Alhamaidan, Nicholas Bass E.I., Dirk Dykson, Ryker McDaniel, Fatih Tekin
Revisions:
Rev:
Description:
By:
Date:

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204
Senior Design - CVEN 4067
Dirk Dykson
Nicholas Bass
Antelope Springs Methodist Episcopal Church
Abdulahab Alhamaidan, Nicholas Bass E.I., Dirk Dykson, Ryker Mcdaniel, Fatih Tekin
Senior Design - CVEN 4067 Submittal: 5/1/2021

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Dirk Dykson
Checked by: Nicholas Bass

Second Floor Plan

Revisions:

<table>
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<th>Description</th>
<th>By</th>
<th>Date</th>
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Antelope Springs Methodist Episcopal Church
Abdulahab Alhamaidan, Nicholas Bass E.I., Dirk Dykson,
Ryker Mcdaniel, Fatih Tekin
Senior Design - CVEN 4067 Submittal: 5/1/2021

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Dirk Dykson
Checked by: Nicholas Bass

Revisions:

1. X 12 RIDGE BOARD
2. 2 X 8 ROOF RAFTER
3. EXISTING CEILING JOIST
4. VALLEY FRAMING
EXISTING (2) 2 X 4 TOP PLATE

2 X 8 ROOF RAFTERS

LUS28 FACE MOUNT HANGER

EXISTING TYP 2 X 4 WALL STUDS

EXISTING TYP 2 X 4 WALL STUDS

5 3/4" X 11 7/8" 2.0E PSL GIRDER

USE (4) 10D BOX NAILS FOR GIRDER TO TOP PLATE

1/2" PLASTER FINISH

1/2" WOOD LATH

(4) 2 X 4 TRIMMER STUDS

1/2" WOOD LATH

1/2" PLASTER FINISH

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Nicholas Bass
Checked By: Dirk Dykson

Roof Detail 1
2 X 8 ROOF RAFTERS

1 X 12 RIDGE BOARD

USE (4) 10D BOX NAILS FOR RAFTER TO RIDGE

2 X 8 ROOF RAFTERS

2 X 10 CEILING JOIST

USE (4) 10D BOX NAILS PER CEILING JOIST/RAFTER TO TOP PLATE

CUT BIRDS MOUTH INTO RAFTERS

EXISTING (2) 2 X 4 TOP PLATE

USE (3) 16D COMMON NAILS PER HEEL JOIST SPLICES

EXISTING TYP 2 X 4 WALL STUDS

2" WOOD LATH

3/4" PLASTER FINISH

NOTCH CEILING JOIST AS NEC.

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Nicholas Bass

Roof Detail 2

Revised By: Nicholas Bass

Checked By: Dirk Dykson
EXISTING TYP 2 X 4 WALL STUDS

EXISTING 2 X 8 FLOOR JOIST

SHIM AS REQ'D

SIMPSON HANGER CCQ46SDS2.5

$\frac{1}{4}'' \times 2\frac{1}{2}''$ SDS SCREWS PER SIMPSON

$\frac{3}{4}'' \times 2''$ SDS SCREWS PER SIMPSON

W 6 X 16 STEEL COLUMN SUPPORT

EXISTING 6'' FOUNDATION STEM WALL

W 6 X 16 STEEL COLUMN SUPPORT

1'' = 1' - 0''

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Nicholas Bass
Checked by: Dirk Dykson

Foundation Detail 1

Mile High Consultants

Antelope Springs Methodist Episcopal Church
Abdulahab Alhamaidan, Nicholas Bass E.I., Dirk Dykson, Ryker Mcdaniel, Fatih Tekin
Senior Design - CVEN 4067 Submittal: 5/1/2021
DETAIL G IS FOR OUR RECOMMENDATION TO REPLACE THE NORTH EXTERIOR AND INTERIOR FOUNDATION WALLS.

DETAIL H IS FOR OUR RECOMMENDATION TO REPLACE THE ISOLATED COLUMN AND FOOTING IN THE KITCHEN AREA.

CONCRETE STEM WALL

CONTINUOUS FOOTING

#5 REBAR

3'

8'

ISOLATED FOOTING

#5 REBAR

3'

3'

#5 REBAR

3'

3'

CONCRETE COLUMN

Assuming existing 4" S.O.F

A S S I M I L A T I N G  4" S.O.F

4" S.O.

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Fatih Tekin

Checked by: Nicholas Bass

CU Denver Civil Engineering Dept.
1200 Larimer St. Denver, CO 80204

Drawn By: Fatih Tekin

Checked by: Nicholas Bass

Fatih Tekin

Nicholas Bass

Ryker McDaniel, Fatih Tekin

Senior Design - CVEN 4067  Submitall: 5/1/2021
Exhibit 6: Photo Simulation
Figure 1. Revit Model of Antelope Springs Church Sky View of Southeast Corner

Figure 2. Revit Model of Antelope Springs Church Northwest Corner
Figure 3. Revit Model of Antelope Springs Church Southeast Corner

Figure 4. Revit Model of Antelope Springs Church Northeast Corner
Exhibit 7: List of Uses in The Zone District
Agriculture Production Zone (A)

3-165 Zone Purpose

Agriculture is considered to be a highly valued resource in Morgan County. Conservation of agricultural resources and land is paramount and such land and resources must be protected from adverse impacts resulting from uncontrolled and undirected business, commercial, industrial and residential uses. The A zone is established to maintain and promote agriculture as an essential industry of Morgan County. The A zone is established to provide areas for the conduct of agriculture activities and activities related to agriculture and agricultural production without the interference of other incompatible uses. Morgan County recognizes that non-agriculture uses, such as residences, occur in the Agriculture Zone, but that these uses are subordinate to agricultural uses.

3-170 Agriculture Zone Uses-By-Right

Parcels Larger Than 20 Acres

(A) Farming, ranching, and gardening for personal and commercial production purposes.
(B) One (1) single-family residence (site built or manufactured home on a permanent and engineered foundation, but not a mobile home) per parcel.
(C) Cultivation, storage, sale of crops, vegetables, plants, flowers and nursery stock.
(D) Grazing of livestock.
(E) Truck and sod farms, nursery stock and greenhouses.
(F) Sales offices for truck and sod farms (commercial), greenhouses, and nurseries.
(G) Accessory uses.6
   (1) Two ham radio and/or television towers and satellite TV dishes exceeding three feet in diameter.
   (2) One (1) additional single-family residence (site built or manufactured home on a permanent and engineered foundation, but not a mobile home) per parcel used only for employees of the property owner (farm hands) or family members of the property owner in addition to the primary residence allowed by paragraph (B) of this section.
   (3) Farm office.
   (4) Roadside stands for sale of personally grown vegetables, fruits and farm products.
   (5) Home occupations.
   (6) Seed sales.

1Amended 2007 BCC 61; 12-4-07
2Amended 2008 BCC 2; 1-8-08
3Amened 2008 BCC 50; 12-9-08
4Amended 2009 BCC 19; 5-5-09
5Amended 2009 BCC 27; 9-1-09
6Amended 2011 BCC 19; 7-12-11
7Amended 2013 BCC 19; 7-30-13
8Amended 2014 BCC 05; 1-21-14
(H) A major facility of a public utility for which a development permit has been issued.
(I) Water reservoirs of less than 10 acres maximum surface area or 65 acre feet maximum capacity.
(J) Garages, parking, other equipment storage buildings for personal use.6
(K) Farm buildings, storage sheds, and silos for storage of farm products.6
(L) Buildings and sheds for protection of livestock.6
(M) Fertilizer and chemical storage for personal and on-farm use.6
(N) Pipelines, and accessory structures, that transport water and wastewater for domestic, agricultural, commercial and/or industrial use, except for pipelines transporting wastewater produced as a result from oil and gas operations to a commercial disposal well facility or wastewater designated as hazardous waste.17
(O) Oil and gas wells.22
(P) Injection wells, except commercial disposal injection wells.23

Parcels 20 Acres and Smaller

(A) Farming, ranching, and gardening for personal and commercial production purposes.
(B) One (1) single family residence (site built or manufactured home on a permanent and engineered foundation, but not a mobile home) per parcel.
(C) Grazing of livestock not to exceed the animal densities of Section 3-730.
(D) Accessory uses:6
   (1) Two ham radio and/or television towers and satellite T.V. dishes exceeding three feet in diameter.
   (2) Home occupations.
(E) Garages, parking, other equipment storage buildings for personal use.6
(F) Buildings and sheds for protection of livestock.6
(G) Farm buildings, storage sheds, and silos for storage of farm products.6
(H) A parcel of 20 acres or smaller which is being actively used as a headquarters or base of operations for bona fide farming or ranching operation shall be considered to consist of more than 20 acres for purposes of this section.
(I) Water reservoirs of less than 10 acres maximum surface area or 65 acre feet maximum capacity.
(J) Pipelines, and accessory structures, that transport water and wastewater for domestic, agricultural, commercial and/or industrial use, except for pipelines transporting wastewater produced as a result from oil and gas operations to a commercial disposal well facility or wastewater designated as hazardous waste.17
(K) Oil and gas wells.22
(L) Injection wells, except commercial disposal injection wells.23

1Amended 2007 BCC 61; 12-4-07
2Amended 2008 BCC 2; 1-8-08
3Amended 2008 BCC 50; 12-9-08
4Amended 2009 BCC 19; 5-5-09
5Amended 2009 BCC 19; 5-5-09
6Amended 2009 BCC 27; 9-1-09
7Amended 2011 BCC 19; 7-12-11
8Amended 2013 BCC 19; 7-30-13
9Amended 2013 BCC 19; 7-30-13
10Amended 2017 BCC 49; 7-30-17
11Amended 2017 BCC 54; 12-19-17
12Amended 2014 BCC 05; 1-21-14
3-175 Agriculture Zone Conditional Uses

Parcels Larger Than 20 Acres

(A) Group homes, foster family care homes.
(B) Animal training, breeding and boarding facilities.
(C) Golf courses.
(D) Commercial disposal injection wells.\(^1\)
(E) Meeting places.
(F) Utility service facilities.
(G) Veterinary clinics, hospitals, small animal kennels.
(H) Additional living units on permanent and engineered foundations not allowed as uses-by-right. Not to exceed four (4) per parcel.\(^2\)
(I) Synthetic fuel production not exceeding 10,000 gallons per year and provided the fuel is used on the property farmed.
(J) Small wind energy conversion systems.
(K) Schools.
(L) Public recreation facilities.
(M) Churches.
(N) Communication facilities.
(O) Mobile homes used for any purpose including primary or accessory residences (one mobile home per parcel).\(^3\)
   (1) Replacement of existing mobile homes on the same location (able to connect to existing utilities)\(^4\) with a newer mobile home, within 90 days of removal of the older unit, is exempt from the requirement of obtaining a Conditional Use Permit. A Mobile Home Placement Permit must be obtained in all cases.
(P) Livestock confinement operations confining more than the allowed animal unit densities but fewer than 200 animal units in a confinement area of two (2) or more acres or fewer than 90 animal units in a confinement area of one-half (1/2) acre or more or 15 animal units of fowl, game birds or other small animals in a confined area of 1500 square feet or more.
(Q) Commercial trucking and heavy equipment parking and maintenance.
(R) Extraction of sand, gravel, or dirt for a single public road project provided all requirements of the Colorado Mined Land Reclamation Board have been met.
(S) Hunting and/or fishing preserves and hunting parks.
(T) Keeping of alternative livestock.
(U) Agriculture related businesses if associated with owner occupied housing.
(V) Additional antennas for radio or television transmission.\(^5\)
(W) Cemeteries.
(X) Routine or minor expansions of livestock confinement facilities.
(Y) Home occupations conducted in an accessory building.

\(^{1}\)Amended 2007 BCC 61; 12-4-07
\(^{2}\)Amended 2008 BCC 2; 1-8-08
\(^{3}\)Amended 2008 BCC 50; 12-9-08
\(^{4}\)Amended 2008 BCC 19; 5-5-09
\(^{5}\)Amended 2009 BCC 27; 9-1-09
\(^{6}\)Amended 2009 BCC 19; 12-9-08
\(^{7}\)Amended 2011 BCC 19; 7-12-11
\(^{8}\)Amended 2013 BCC 19; 7-30-13
\(^{9}\)Amended 2014 BCC 05; 1-21-14
(Z) Asphalt or concrete batch plants for a single road project provided all other federal, state, and local laws and regulations are complied with.

(AA) Storage of mobile homes in excess of 14 days from notice to the planning administrator.

(BB) Commercial boat and recreation vehicle storage.

(CC) Water storage reservoirs of 10 acres and greater and less than 20 acres maximum surface area or 65 acre feet and greater and less than 130 acre feet maximum capacity.

(DD) Hospitals

(EE) Fire Stations

(FF) Flowlines and Gathering lines. 22

Parcels 20 Acres or Smaller

(A) Group homes, foster family care homes.

(B) Animal training, breeding and boarding facilities.

(C) Golf courses.

(D) Commercial injection wells. 22

(E) Meeting places.

(F) Utility service facilities.

(G) Sales offices for truck and sod farms (commercial), greenhouses, and nurseries.

(H) Veterinary clinics, hospitals, small animal kennels.

(I) Hospitals.

(J) Additional living units on permanent and engineered foundations not to exceed one (1) per parcel. 2

(K) Small wind energy conversion systems.

(L) Schools.

(M) Public recreation facilities.

(N) Churches.

(O) Communication facilities.

(P) Mobile homes used for any purpose including primary or accessory residences (one mobile home per parcel). 6

(1) Replacement of existing mobile homes on the same location (able to connect to existing utilities) 6 with a newer mobile home, within 90 days of removal of the older unit, is exempt from the requirement of obtaining a Conditional Use Permit. A Mobile Home Placement Permit must be obtained in all cases.

(Q) Livestock confinement operations confining more than the allowed animal unit densities but fewer than 200 animal units in a confinement area of two (2) or more acres or fewer than 90 animal units in a confinement area of one-half (1/2) acre or more or 15 animal units of fowl, game birds or other small animals in a confined area of 1500 square feet or more.

(R) Commercial trucking and heavy equipment parking and maintenance.

1 Amended 2007 BCC 61; 12-4-07

2 Amended 2008 BCC 2; 1-8-08

3 Amended 2008 BCC 50; 12-9-08

4 Amended 2009 BCC 19; 5-5-09

5 Amended 2009 BCC 27; 9-1-09

6 Amended 2009 BCC 19; 7-12-11

7 Amended 2011 BCC 19; 7-30-13

8 Amended 2013 BCC 19; 7-30-13

3-12

9 Amended 2013 BCC 55; 12-19-13

10 Amended 2014 BCC 05; 1-21-14
(S) Extraction of sand, gravel, or dirt for a single public road project provided all requirements of the Colorado Mined Land Reclamation Board have been met.

(T) Hunting and/or fishing preserves and hunting parks.

(U) Keeping of alternative livestock.

(V) Agriculture related businesses if associated with owner occupied housing.

(W) Additional antennas for radio or television transmission.\(^6\)

(X) Cemeteries.

(Y) Routine or minor expansions of livestock confinement facilities.

(Z) Home occupations conducted in an accessory building.

(AA) Asphalt or concrete batch plants for a single road project provided all other federal, state, and local laws and regulations are complied with.

(BB) Storage of mobile homes in excess of 14 days from notice to the planning administrator.

(CC) Commercial boat and recreation vehicle storage.

(DD) Roadside stands for sale of personally grown vegetables, fruits and farm products.

(EE) Seed sales.

(FF) Water storage reservoirs of 10 acres and greater and less than 20 acres maximum surface area or 65 acre foot and greater and less than 130 acre foot maximum capacity.

(GG) Fire Stations.

(HH) Flowlines and Gathering lines.\(^22\)

3-180 **Agriculture Zone Special Review Uses**\(^26\)

(A) Single-family dwellings located less than 1,320 feet from an existing animal confinement operation, packing plant, slaughter house, or rendering plant.

(B) Boarding, raising or otherwise keeping exotic animals.

(C) Campgrounds and recreational vehicle (RV) parks.

(D) Commercial and private airports, airstrips and heliports.

(E) Asphalt and concrete batch plants.

(F) Feed mills

(G) Commercial grain elevators.

(H) Communication facilities exceeding height limits.

(I) Storage and sale of commercial fertilizer and farm chemicals.

(J) Crop dusting operations.

(K) Solid waste management, such as but not limited to sanitary landfills, waste treatment and storage facilities, including manure storage and composting facilities.

(L) Utility service facilities exceeding height limits.

(M) Water and sewer treatment facilities, storage facilities.

(N) Outdoor shooting ranges.

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\(^1\)Amended 2007 BCC 61; 12-4-07

\(^2\)Amended 2008 BCC 2; 1-8-08

\(^3\)Amended 2009 BCC 19; 5-5-09

\(^4\)Amended 2011 BCC 19; 7-12-11

\(^5\)Amended 2013 BCC 19; 7-30-13

\(^6\)Amended 2008 BCC 50; 12-9-08

\(^7\)Amended 2014 BCC 05; 1-21-14
(O) Livestock confinement operations in excess of the allowed animal unit densities or conditional use permit allowances.
(P) Water storage reservoirs of 20 acres and greater maximum surface area or 130 acre feet and greater maximum capacity.
(Q) Cattle truck washing and cleaning.
(R) Junk, scrap metal, auto wrecking and farm and other equipment storage and salvage yards.
(S) Commercial synthetic fuel production.
(T) Slaughter houses.
(U) Packing plants.
(V) Rendering plants.
(W) Recreational facilities for use by either the landowner and guests or permit holders or open to the public which involve significant physical improvements to the property or significant increases in traffic on County roads. The Planning Administrator shall make the determination of whether an improvement or an increase in traffic is significant.
(X) Bed and breakfast facilities.
(Y) Two-family dwelling, as the only residential structure, site built or manufactured on a permanent and engineered foundation (one per parcel). Each unit must be served by its own septic and water supply unless under common ownership.\(^2\)

\(^1\)Amended 2007 BCC 61; 12-4-07
\(^2\)Amended 2008 BCC 2; 1-8-08
\(^3\)Amended 2008 BCC 50; 12-9-08
\(^4\)Amended 2009 BCC 19; 5-5-09
\(^5\)Amended 2009 BCC 27; 9-1-09
\(^6\)Amended 2011 BCC 19; 7-12-11
\(^7\)Amended 2013 BCC 19; 7-30-13
\(^8\)Amended 2014 BCC 05; 1-21-14
Exhibit 8: Team Resumes
ABDULWAHAB ALHAMAIDAN
1776 Broadway Denver, CO 80202 | +1 (303)478-2307 | abdulwahabalhamaidan@gmail.com

EDUCATION
Bachelor of Science: Civil Engineering
University of Colorado Denver - Denver, CO


ACADEMIC PROJECTS
- Steel design of a two-story moment frame for an office building in Denver, CO.
  - The columns, girders and beams were designed per AISC specifications.
- Portable water supply and distribution design to Castle Oaks Estates community in Castle Rock, CO
  - Analysis of water use by area served storage tanks, pumps, transmission, and treatment.

AWARDS AND CERTIFICATIONS
- Dean’s list at the University of Colorado Denver (06/2017 – 12/2020)
- Kuwait Cultural Office LA Academic Outstanding Award (2017 – 2019)
- ESL Academy at the University of Colorado Denver certificate (03/2017)
- Certificate of perfect attendance at ESL Academy (12/2016)
- Prince of Kuwait Award for Excellence and Creativity (2009)

PROFESSIONAL ASSOCIATIONS
- Tau Beta Bi, Member (Initiated May 2020 – Present)
  - The Engineering Honor Society
- The American Institute of Steel Construction (AISC), Member (Initiated Nov 2020 – Present)
- The National Society of Leadership and Success, Inducted Member (Initiated Dec 2020 – Present)
  - Selected by campus administration to participate among top students in a leadership program including:
    - Leadership Training Day: Trained in leadership and success skills via an introspective and interactive training session.
    - Speaker Events: Participated in seminars led by celebrities and best-selling authors on topics such as leadership, time management, and goal setting.
    - Success Networking Teams:
      - Participated in peer based leadership development teams
      - Experience in setting and achieving goals, receiving coaching, coaching others, and holding others accountable to commitments.

COMPUTER SKILLS
- MS Office, AutoCAD, Revit, RISA 2D & 3D, and MATLAB.
**Nicholas Bass E.I.**  
1833 Williams St, Denver CO 80218, 970-531-4939, nickbass92@gmail.com

**PROFILE**

I am looking for a structural firm that will give me the experience to sit for the Professional Engineering Exam

- Team player, ambitious, and self-motivated
- Excellent leadership, organizational, and communication skills
- Manages time and priorities appropriately and able to adjust with short notice
- Effective problem-solving skills with the ability to stay calm in times of stress and high activity
- Proficient with Microsoft Office, Bluebeam, and AutoCAD

**EDUCATION**

Completed Fundamentals Engineering Exam  
June 2020

**University of Colorado Denver**  
Expected Completion Spring 2021
Pursuing Bachelor of Science, Civil Engineering

**Community College of Denver**  
Fall 2016 - Spring 2018
Pursued: Associate of Science, Engineering

**RELEVANT COURSES**

- Structural Analysis
- Masonry Design
- Structural Design Loads
- Timber Design
- Structural Steel Design
- AutoCAD/ Revit/ AutoCAD Civil 3D
- Reinforce Concrete Design
- Geotechnical Engineering

**PROFESSIONAL EXPERIENCE**

**LTS Drafting & Engineering – Structural Project Coordinator, Centennial, Colorado**  
January 2021 - Present

- Provided structural calculations for a variety of interior and exterior components including:
  - Curtain Wall and Storefront systems
  - Glass and Glazing
  - Skylights
  - Connection Analysis into substrates including wood, concrete, steel, and post-tension concrete
- Worked with Structural and Architectural Construction Documents
- Systems used on the job include AutoCAD, Cbeam, RISA 3D and custom made excel spreadsheets for analysis

**LTS Drafting & Engineering – Civil Engineering Intern, Centennial, Colorado**  
March 2019- August 2020

- Provided structural calculations for a variety of interior and exterior components including:
  - Curtain Wall and Storefront systems
  - Glass and Glazing
  - Skylights
  - Connection Analysis into substrates including wood, concrete, steel, and post-tension concrete
- Worked with Structural and Architectural Construction Documents
- Systems used on the job include AutoCAD, Cbeam, RISA 3D and custom made excel spreadsheets for analysis

**Brookfield Office Properties – Engineer Level 1, Denver, Colorado**  
January 2016- March 2017

- Monitored the Building Automation System
- Worked on Carrier Chillers (800 ton to 1100 ton) and diesel fire pumps
- Managed the day to day operations of the building
- Testing of emergency generator and fire system
DIRK J. DYKSON  
Denver, CO 80227  
dirkj@dykson.com  
(970) 218-7700

SUMMARY
Dedicated, persistent, passionate student leader pursuing a career in commercial architecture.

EDUCATION
University of Colorado Denver, Denver, CO  
Double Major: Architecture and Civil Engineering; Minor: Mathematics; GPA: 3.54  
Aug ’16 – Present

Fort Collins High School, Fort Collins, CO  
GPA: 3.99, Class Rank: 34 of 370  
Aug ’12 – May ’16

Honors: National Honor Society, Honor Roll, Math Honor Society, National Technical Honor Society, Student Athlete Honors, Varsity Tennis Captain, National Society of High School Scholars  
Athletics: Basketball, Football, Baseball, Tennis  
2016: Lead role musical–Into the Woods  
2015: Cast member school musical Shrek, male understudy–Fools, lead role–The Glass Menagerie

TECHNICAL SKILLS
Tech Shop: 1,000+ hours experience  
Sep ’13 – May ’16

- Proficient with CNC plasma cutters, lathe, welding, laser engraving/cutting, drill press  
- Materials: wood, aluminum, iron, steel, sheet metal, stone, dyes, urethanes

SolidWorks expert; CSWP – Certified SolidWorks Professional Core –  
CSWA – Certified SolidWorks Associate  
Revit and AutoCAD proficient  
Blender proficient  
Corel Draw proficient  
Adobe Photoshop, Gimp, MS: Excel, Powerpoint, Word – proficient

Intermediate skills in Microsoft Office, Google SketchUp, and ULS Touch 1  
Intermediate skills in orthography, basic blueprints, sketching/drafting, drawing, illustrations

EXPERIENCE  
overlapping part-time positions

WE GOTTA GUY, LLC, Fort Collins, CO  
Craftsman – Contractor  
Jul ’17 – Aug ’17 / May ’19 – Oct ’19

Renovated, remodeled, demolished, framed, dry walled, painted, finished basements/bathrooms.

DOUG’S MACHINE AND CUSTOM GRINDING, Fort Collins, CO  
Apprentice  
Feb ’16 – Aug ’16

Training in all shop areas, including reseating, glass beading, grinding, planing. Part-time during school, full-time during summer.

DGM STUDIOS, Fort Collins, CO  
Math Tutor  
Sep ’13 – Aug ’16

Teach middle and high school students key math concepts in Pre-Calculus, Algebra 1-2, and Geometry to maximize comprehension and classroom success. 2 hours weekly.

Guitar Teacher  
Sep ’12 – Aug ’16

Teach and develop students to guitar proficiency. 1 hour weekly.
**FAITH CHURCH** Student Ministries, Fort Collins, CO  
**Student Ministries Worship Leader** Aug '13 – Aug '16

Plan, coordinate, and lead music sessions for weekly high school student ministry gatherings and annual retreats. Coordinate music selection, staff instrument and vocal assignments, team meetings and weekly practice sessions.

- Manage volunteer staff of 10 students, including sound team.
- Evaluate and make decisions on potential musicians/singers.
- Coach and mentor team members and developing musicians.

**High School Worship Team Member** Aug '12 – Jul '13

Participated in weekly music sessions for high school student ministry gatherings and annual retreats. Managed sound booth monthly, verifying microphones, testing instruments, adjusting sound monitors and managing sound levels. 4 hours weekly.

**Middle School Youth Group Student Leader** Aug '12 – Jul '13

Lead games for 45 middle school students, including weekly planning, coordination, and emcee responsibilities. Middle school small group leader. 2-3 hours weekly.

**Middle School Worship Co-Leader** Aug '10 – Jul '12

Co-lead weekly music sessions for middle school student ministry gatherings and annual retreats – vocals, electric/acoustic guitar. 3 hours weekly

**FORT COLLINS HIGH SCHOOL**, Fort Collins, CO  
**Tech Teacher's Aide** Jan '14 – Aug '16

Assisted teacher by instructing and working with students, teaching tech concepts, and helping students obtain technical experience/knowledge in overall shop, computers, software and tech shop machines. Project leader/manager on 10 projects during the year. 5 hours weekly.

**FORT COLLINS RECREATION DEPARTMENT**, Fort Collins, CO  
**Head Basketball Coach** Oct '14 – Dec ‘15

Coached 8th grade recreational basketball team with 10 players. Planned and executed practice sessions, game strategy and player assignments. Managed parent volunteer assistant coaches. Sportsmanship of the Year Award 2014 and 2015. 5 hours weekly.

**FORT COLLINS RECREATION DEPARTMENT**, Fort Collins, CO  
**Assistant Basketball Coach** Oct '10 – Mar '14

Coached 4th – 7th grade basketball teams with 10 –12 players over 4 seasons. 5 hours weekly.

**ACTIVITIES**  
**KEY CLUB**, Treasurer, President Sep '13 – May ‘16

Collect/track dues, manage/forecast budgets including revenue, expenses/reserves. Volunteer for monthly community service projects such as hiking trail repair and cleanup. 3 hours weekly.

- Nominated for and attended Nov 2014 Key Leader annual leadership training retreat.

**MATH HONOR SOCIETY**, Member Oct '13 – May ‘16

Participate in multiple activities to further math comprehension across Poudre School District. Key contributor in creating 3 math videos to help students understand difficult math concepts.

**FCA: FELLOWSHIP OF CHRISTIAN ATHLETES**, Captain Sep '12 – May ‘16

Prepare and present weekly message to 30 students. Sophomore leader and Freshman member. 4 hours weekly.
RYKER MCDANIEL

PROFESSIONAL SUMMARY

College student working towards a Bachelor of Science in Civil Engineering with experience in facility inspections, State regulations and requirements, issuance of letters of violations, and sampling.

SKILLS

- Problem solving
- Ownership
- Team player
- Dependable
- Fast learner
- Time management
- Excel
- Word
- Outlook

WORK HISTORY

Industrial Pretreatment Technician, November 2020 to Current
South Adams County Water & Sanitation District (SACWSD)—Commerce City, CO
- Collect samples to ensure compliance with state requirements
- Collect samples from industrial users
- Conduct facility inspections of industrial facilities
- Provide operations guidance to industrial users

Internship, May 2019 to November 2020
South Adams County Water & Sanitation District – Commerce City, CO
- Collected GIS location data of the District’s Pretreatment sand, oil, and grease interceptors
- Comprehend District and State backflow regulations and requirements
- Conducted facility inspections and identified cross-connections
- Issued letters of violation for facilities and provided follow-up guidance
- Ensured compliance with all District and State backflow regulations and requirements
- Developed and updated guidance documents for the District’s Backflow Program

Internship, May 2017 to August 2017
Summit Engineering Services – Englewood, CO
- Assisted both Civil and Mechanical engineers on oil and gas projects
- Studied oil and gas P&ID’s
- Generated P&ID’s for projects using Cadworks

EDUCATION

- Colorado State University-Fort Collins, CO: August 2016 – May 2019
- University of Colorado-Denver, CO: August 2019 – May 2021

HONORS

SACWSD- District Recognition of Outstanding Performance Award - 2019
Fatih D. Tekin (BS)

SUMMARY

I am looking for a challenging role that offers me the opportunity to develop new skills while strengthening those I already possess.

EDUCATION

University of Colorado, Denver, Denver, CO
BS Civil Engineering
Anticipated May 2021

Eskisehir Osmangazi University, Eskisehir TURKEY
BS Geological Engineering
2008 - 2013

TECHNICAL SKILLS

Developed through professional and academic experience.

- AutCAD, NetCAD
- Corel Draw
- RISA
- Primavera P6
- Rockscience
- MS Project, Excel, PowerPoint
- Windows, Mac OS

EXPERIENCE

Laboratory & Field Technician
Ninyo & Moore Geotechnical & Environmental Sciences Consultants
Denver, COLORADO
April 2019 - Present

Working as a laboratory and field technician mainly focusing on running soil tests in the laboratory according to ASTM standards. Monitoring of the samples from the beginning of the process, cooperate with the project managers, delivering the necessary test and documentation of test data into the information system. Ensured daily basis report and performing basic maintenance on work equipment. Tracking the calibration date of the equipment, and keeping the inventory updated. Assists in training and orientation of new technicians.

Geological Engineer
Gur & Geoteknik Engineering, Ankara - TURKEY
December 2013 – May 2017

Worked as Geological Engineer on the projects in Turkey. My responsibility on these projects included providing technical expertise by supervising geological and geotechnical investigations on-site, assessing the test results, and providing input to technical reports, ensuring the coordination between different parties. Focused expertise in these projects, soft-soil/rock mechanics, consolidation and ground modification, management of field team, description of soil, prepare the geological map.
Major Projects:

**Development Zoning Project**
- Gerede, Bolu, Turkey - Micro-Development Zoning - Geological and Geotechnical Investigations and Paleoseismic research - 7,000m Drilling
- Dortyol, Erzin, Payas, Hatay, Turkey - Micro-Development Zoning - Geological and Geotechnical Investigations and Paleoseismic research - 7,000m Drilling
- Gemlik, Bursa, Turkey - Micro-Development Zoning - Geological and Geotechnical Investigations and Paleoseismic research - 7,000m Drilling
- Kaynaşı, Düzce, Turkey - Development Zoning & Paleoseismic about KAF - Geological and Geotechnical Investigations - 3,000m Drilling
- Kemah, Erzincan - Development Zoning - Geological and Geotechnical Investigations - 3,500m Drilling
- Mollakoy, Erzincan, Turkey - Development Zoning - Geological and Geotechnical Investigations - 500m Drilling
- Yenimühacı, Tekirdağ - Development Zoning - Geological and Geotechnical Investigations - 500m Drilling

**Soil Investigation of Various plots for Building**
- Corum-Ardahan, Turkey - Soil Survey - 500m Drilling
- Aksaray - Soil Survey - 500m Drilling
- Filyos, Zonguldak, Turkey - Soil Survey - 500m Drilling
- Karabük, Turkey - Aktas Dam Project - Soil Survey - 1,500m Drilling

**Sewerage and water infrastructure ground survey project**
- Kutahya-Gediz, Turkey - Drinking Water Route of Ground Survey Project
- Bursa, Keles-Orhangazi, Turkey - Drinking Water Route of Ground Survey Project
- Adıyaman- Şanlıurfa, Turkey - Solar Energy Farm Soil Investigations
- Aksaray Agacoren, Turkey - Ground Survey Route Sewerage Project - Soil Survey
- Foca, İzmir - Ground Survey Route Sewerage Project - Soil Survey

**CERTIFICATE & COURSES**
- Occupational Health and Safety Courses – 40 hours
- NETCAD Courses
- Construction Careers Now Certificate
- Oracle Advanced Project Management in Primavera P6 Certificate
- OSHA 10-hour Construction Safety and Health

**REFERENCES**
- Available upon request