Fire Station Addition

60 % Progress Report

Prepared for Mark Lamer

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CENE 486C
4/16/19

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Acknowledgments:

The team would like to express sincere gratitude to Bill Mancini and Mark Lamer for guiding us throughout this project. We are also very thankful to Chief Lee Antonides and Station 82 for their helpful input and for being a pleasure to work with. Also, the team would like to thank Capstone Homes and Western Technologies Inc. for contributing proprietary soil data which was helpful in our analysis and the progression of this project.

1.0 Project Introduction

1.1 Project Purpose

The Ponderosa Fire Station (Station 82) is located in Bellemont, Arizona. The existing station requires additional living quarters for firefighters, a room for hosting community events, more office spaces for staff, and a vehicle bay for storing a battalion chief vehicle or ambulance. Currently the existing fire station can only comfortably house two firefighters, but occasionally the fire station holds up to five firefighters at a time. The client would like to add a community room as community events are currently held in the firetruck bay. Adding a community room is the client's priority for the project. The goal of this project is to design a building addition that flows with the existing station and meets all codes and regulations, as well as meets the client's requests.

1.2 Project Background

Station 82 is in Bellemont, Coconino County, Arizona on 1.4- acre of land. Figure 1 below shows the location of the station in relation to the state of Arizona. The site is located 12 miles west of Flagstaff off Route 66 on Shadow Mountain Drive. Figure 2 and 3 show the street view of the existing station.

Figure 1: Ponderosa Fire Station in Bellemont in relation to Arizona [1]

Figure 2: North Face of the Existing Station

Figure 3: Street View of Existing Station

1.3 Original Site Plan

The original site of the fire station has a parking lot on the west side of the building, an entry and exit driveway east of the building, and driveway located north of the building. The existing structure is 81'-2" x 80'. It is constructed of a prefabricated metal frame. Figure 4 shows a site plan with existing and proposed structure.

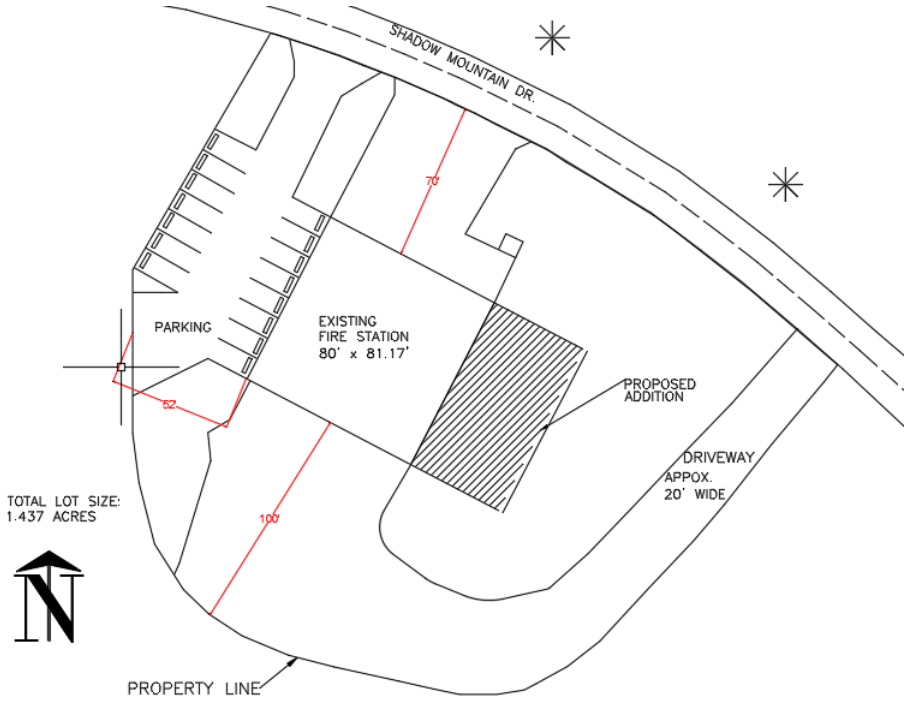


Figure 4: Job Site with Existing and Proposed Stations

1.4 Project Limitations

The team will not design the structural framing of the building. The building frame design will be provided by a steel manufacturer contracted by the client. The team will not be designing and creating an electric plan for the building addition. The team will also not design mechanical components of the building addition such as the HVAC system.

1.5 Project Objectives

The major objectives of the project are to design the floor plan, foundation plan and anchor bolt plans as required to meet the client's requests. Construction costs and a metal frame company will be determined to potentially start construction in the Fall 2019.

2.0 Technical Work

2.1 Site Investigation

A site investigation was conducted to get an understanding of the current state of the station and determine the needs for the new addition. The team walked through the site, measured, and recorded the dimensions of the features in the building such as the size of rooms, hallways, windows, and doors.

2.1.1 Land Survey

As a team, a land survey of the site was conducted using Spectra Precision SP80 GNSS GPS unit with a Spectra Precision Ranger Pro with Survey Pro data program. Specific points including edge of pavement, trees, sign, and building corners were stored under the 1000 numbers. Topo points were stored under the 2000 numbers. When conducting the main topo for the proposed addition on the existing pad, shots were taken in a grid manner at a 5-6ft intervals.

2.1.2 Survey Analysis

Data was uploaded in to AutoDesk Civil 3D and topographic map was created of the site. Figure 5 shows a topographic with the site layout of the existing driveway, parking lot and building.

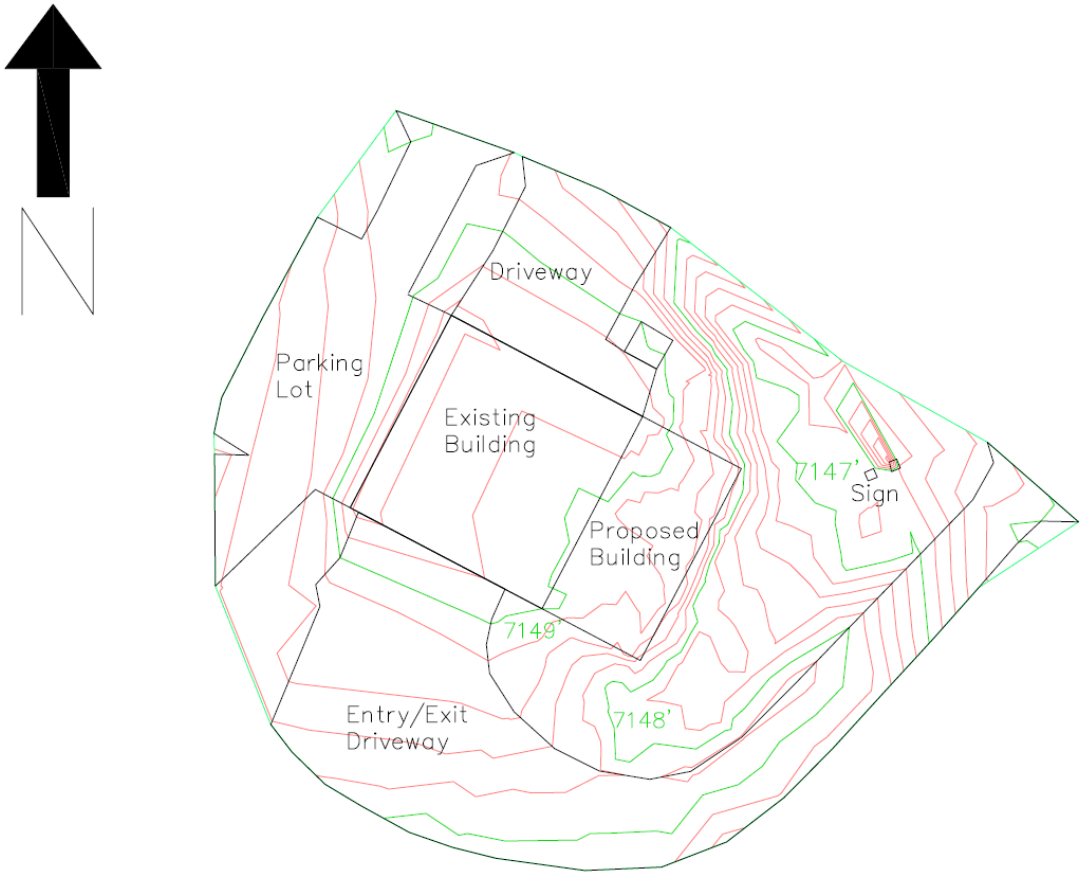


Figure 5: Topographic map and site layout of fire station area.

2.2 Geotechnical Soil Properties

The design of the foundation requires that certain properties of the surrounding soil be found by performing field and laboratory tests on soil samples. The team was able to obtain these soil properties from a geotechnical report provided by Capstone Homes for their Flagstaff Meadows project located directly south of the fire station, hence no assumptions were needed. The team will design the foundation of the fire station addition based on the soil properties determined in

the Flagstaff Meadows geotechnical report since the soil tested in this project is in close proximity to the fire station. The Flagstaff Meadows project consisted of over 30 boring samples over their development site which is located south of the fire station which can be seen below in Figure 6 [2]. The circles around boring samples No.1, 2, 3, 4, 5, 8, 10, 13, and 26 indicate the boring samples that were used to determine the soil properties as these boring samples had laboratory test performed them. The soil properties that are needed for the foundation design are the physical properties of the soil, swelling pressure, expansion index, and the soil bearing capacity. The physical properties of the soil include the sieve analysis of the soil, the liquid limit (LL), and the plasticity index (PI).

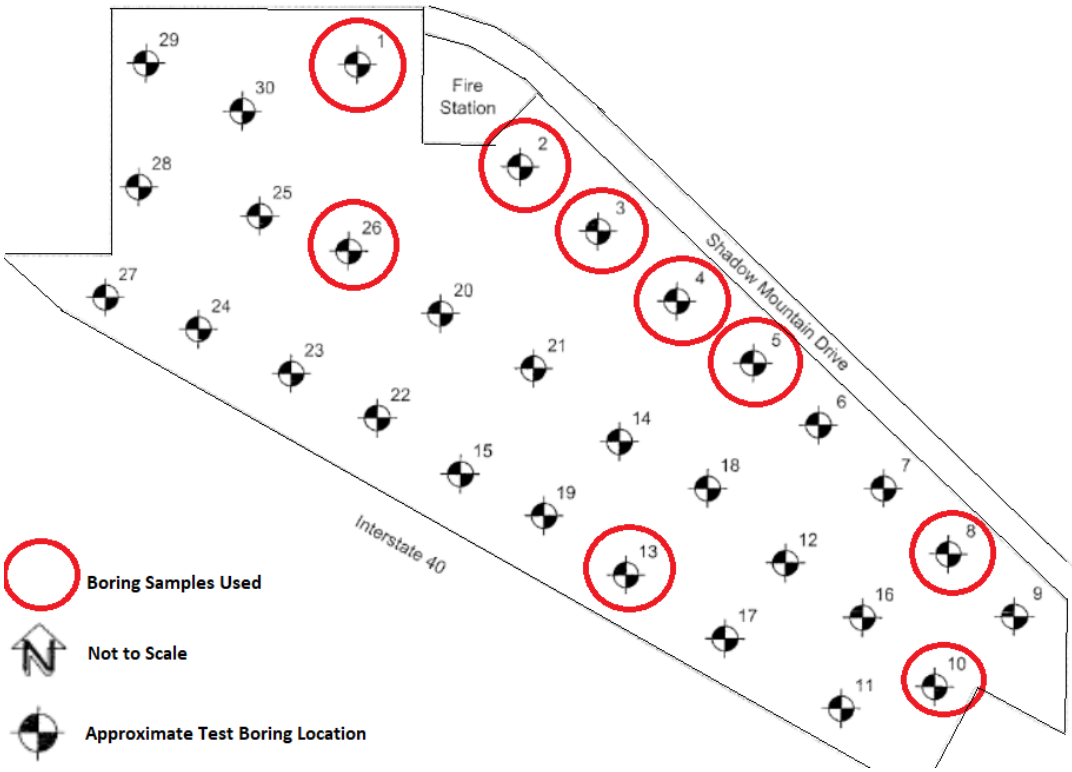


Figure 6: Site map of boring hole locations with fire station labeled for reference [2].

2.2.1 Physical Properties

The physical properties of the soil provided by the Flagstaff Meadows' geotechnical report can be seen below in Table 1. The soil description for the soil classification group symbols can be seen below in Table 2. Table 3 was used to classify the plasticity of the soil based on the plasticity index (PI) found in Table 1. The boring samples that had a sieve analysis and PI test performed can be found in the left column titled "Boring No." The results of the sieve analysis and plasticity index were used to help determine the classification of the soil where each boring sample was taken. The team also looked at the soil description in the boring logs for Boring No. 2 and Boring No. 26 as these boring samples were closest to where the fire station project is located to help determine the type of soil the foundation was to be built on. The Boring logs can be found in Appendix A: Flagstaff Meadows Boring Logs. Based on the physical properties test results in Table 1 for Boring No. 1 and 3 and the soil description in the boring logs for Boring No. 2 and 26, it was

determined that the soil the addition would be built consists of clayey sand and fat clays that have a medium to high plasticity [2]. No groundwater was encountered based on the boring logs found in Appendix A: Flagstaff Meadows Boring Logs [2].

Table 1. Soil properties from testing [2].

PHYSICAL PROPERTIES										
Boring No.	Depth (Feet)	Soil Classification	Particle Size Distribution % Passing By Weight						Atterburg Limits	
			3 In.	No. 4	No. 10	No. 40	No. 200	2μ	LL	PI
1	1-2	SC	100	78	68	56	47		39	21
3	3-5	SC	100	98	94	82	48		43	20
4	4-5	CL	100	96	90	78	50	22	43	21
5	7-8	SC	100	92	86	71	45	24	43	26
8	5-6	SC	100	89	80	66	47		38	20
10	3-4	CH	100	91	85	77	55	22	50	29
13	7-8	CL	100	99	96	89	54	19	42	23

Table 2. Soil description [2].

Soil Description	
Group Symbols	Description
SC	Clayey Sands, Sand-Clay Mixtures, More than 12% Fines
CL	Inorganic Clays of Low to Medium Plasiticity. Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
CH	Inorganic Clays of High Plasticity, Fat Clays

Table 3. Soil plasticity of fine-grained soils [2].

Plasticity of Fine-Grained Soils	
Plasticticity Index (PI)	Term
0	Non-Plastic
1-7	Low
8-25	Medium
Over 25	High

2.2.2 Swelling Pressure

The consolidation test results provided by the Flagstaff Meadows project geotechnical report can be seen below in Table 4. The consolidation test reports from the geotechnical report can be found in Appendix B: Flagstaff Meadows Project Consolidation Test Reports. Consolidation tests were done on Boring samples No. 4, No. 5, and No. 7. The swelling pressures and percent swell values determined by the consolidation test for the Flagstaff Meadows project will be used for the foundation design of the fire station addition to help design against heaving and swelling.

Table 4. Consolidation test results.

Consolidation Test Results				
Boring No.	Depth (Feet)	Soil Classification	Swelling Pressure (kips)	Percent Swell
4	4-5	CL	1	0.4
5	7-8	SC	1.16	0.8
7	3-4	CH	0.16	0.1

2.2.3 Soil Expansion

The soil expansion properties provided by the Flagstaff Meadows project geotechnical report can be seen below in Table 5. The soil properties tables from the geotechnical report can be found in Appendix C: Flagstaff Meadows Project Soil Properties Tables. Soil expansion test were done on Boring samples No. 4, No.5, No. 10, and No.13. The tests concluded that the soil surrounding the fire station had a very low to low potential of expansion [2]. The team will use this information in the foundation design of the fire station addition to help design against heaving and swelling. Heaving and swelling of the soil underneath the foundation is a concern for this project because of the high amounts of clayey soils on the site.

Table 5. Soil expansion properties.

Soil Expension Properties					
Boring No.	Depth (Feet)	Soil Classification	Expansion (%)	Expansion Index	Potential Expansion
4	4-5	CL	7.7	28	21-50 (Low)
5	7-8	SC	3.9	9	0-20 (Very Low)
10	3-4	CH	8.4	39	21-50 (Low)
13	7-8	CL	9.3	43	21-50 (Low)

2.2.4 Soil Bearing Capacity

The soil bearing capacity of the soil was found to be 1500 pounds per square foot (psf) based on the Flagstaff Meadows geotechnical report [2]. This is good because it is consistent with what is expected for soil that is classified as clayey sand [3]. This is the soil bearing capacity the team will use for the foundation design.

2.3 Structural Design

2.3.1 Design Perimeters

The project design will follow the 2018 International Building Code (IBC 2018), which is the adopted code for Coconino County. According to the code, the snow load for a roof must be designed for 40 pounds per square foot (psf) and 60 psf for ground snow load [4]. The international building code also states that the wind load for any structural building in climate zone 5b (which Bellemont is) must be designed for 120 mile per hour which is 21.7psf [4]. [5]The areas of the beams and column in the existing fire station were used to estimate the dead load of the steel frame building. The areas of the steel beams and columns were then multiplied by the unit weight of steel to calculate the dead load of the steel of 75 plf and 15 psf for the mechanical, plumbing and electrical [5]. The decking dead load is 10psf and 40psf for the floor live load which would include people, chairs, table, firetrucks, etc. [6]. The walls that will be installed for the proposed structure is gypsum board walls which has 4psf as a dead load [5]. For

the girder a 30psf of dead load was used [5]. The team will use the IBC 2018 to figure out the points loads on the concreate slabs. The load combination equation below total load on the foundation was determined from the largest load. It was determined that equation 2 determined the max load of 99.24 kips on the foundation. The tributary areas in figure 10, for the six proposed foundation columns were used to determine the force on each column. For columns 1, 3, 4 and 6 the load was determined to be 29.8 kips. For columns 2 and 5 the load was determined to be 55.1 kips. The shear force from wind for columns 3 and 6 was determined to be 15.2 kips. The max uplift due to wind was determined to be 33.8 psf. A shear force from wind was determined to be 29.2 psf.

Design Loads	
Load	PSF
Dead (D)	15
Live (L)	40
Live Roof (Lr)	20
Snow (S)	40
Wind (W)	30

Equation 1. $W_u = 1.4D$

Equation 2. $W_u = 1.2D + 1.6L + 0.5S$

Equation 3. $W_u = 1.2D + 1.6S + 0.5W$ *(DETERMINNG FACTOR)*

Equation 4. $W_u = 1.2D + 1.0W + L + 0.5S$

Equation 5. $W_u = 1.2D + 1.0E + L + 0.2S$ *(NOT USED)*

Equation 6. $W_u = 0.9D + 1.0W$

Equation 7. $W_u = 0.9D + 1.0E$ *(NOT USED)*

Trib Areas	
Area	S.F.
1	460
2	920
3	460
4	460
5	920
6	460

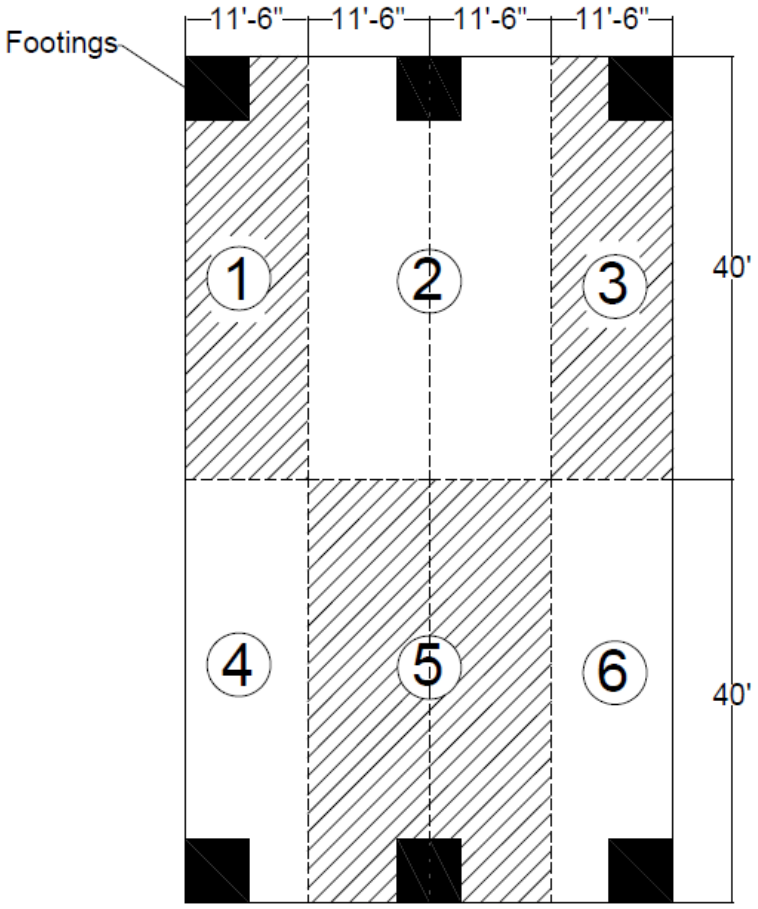


Figure 7. Tributary area of proposed layout

2.3.2 Anchor Bolt Design

Anchor bolts will be used to secure the six metal frame columns to the foundation. 1 inch ASTM F1554-36 steel bolts will be used in accordance to ACI 318-14. The uplift force was calculated to be 22.7 kips and a shear force of 19.6 kips. Figures 9, 10 and 11 show the detail design of the anchor bolt section. The pullout strength, nominal strength and shear strength of the anchor bolts were checked for failure using ACI 318-14 section 17. It was determined that the anchor bolt design is adequate to with stand the uplift and shear force.

2.3.3 Foundation Design

A slab foundation with 6’ x 6’ square footings will be used (see figure 11). Figure 9 and 10 show the foundation specs with rebar locations. Rebar size and spacing was determined using ACI 318-14. 8 #8 rebars with 9” spacing will be used for the footing. #8 rebar with a 16” x 16” mesh spacing will be used for the slab. Concrete specifications are class A C40 which were determined from ACI-318-14. The table below show the different classes of concrete.

Class of concrete	Age	Average of Three Consecutive Specimens	Minimum any One Specimen	Note
A	28 days	4,500 psi	4,000 psi	For all reinforced concrete
B	29 days	3,000 psi	2,500 psi	For pipe cradles, collars, non-reinforced concrete, etc.

2.4 Construction Documents

2.4.1 Floor Plan

The addition will be a 46'x 80' structure. The addition includes two dormitories, a kitchen expansion, a community room, a public restroom, two offices, and a chief bay. The dormitories were designed to replicate the layout of the existing dormitories. The community room is approximately 1066 sf was designed to hold approximately 50 people and complies with the 2018 International Fire Code (IFC). According to the IFC Section 1004, an assembly room without fixed seating must have a minimum of 15sf per occupant [7]. The chief bay was designed considering the dimensions of a TYPE I ambulance which is the largest vehicle that it will store. The 3500 TYPE 1 CHEVY 2018 measures 95"X 105" x 285" and can be seen in Appendix D. Figure 8 shows the existing and proposed floor plan.

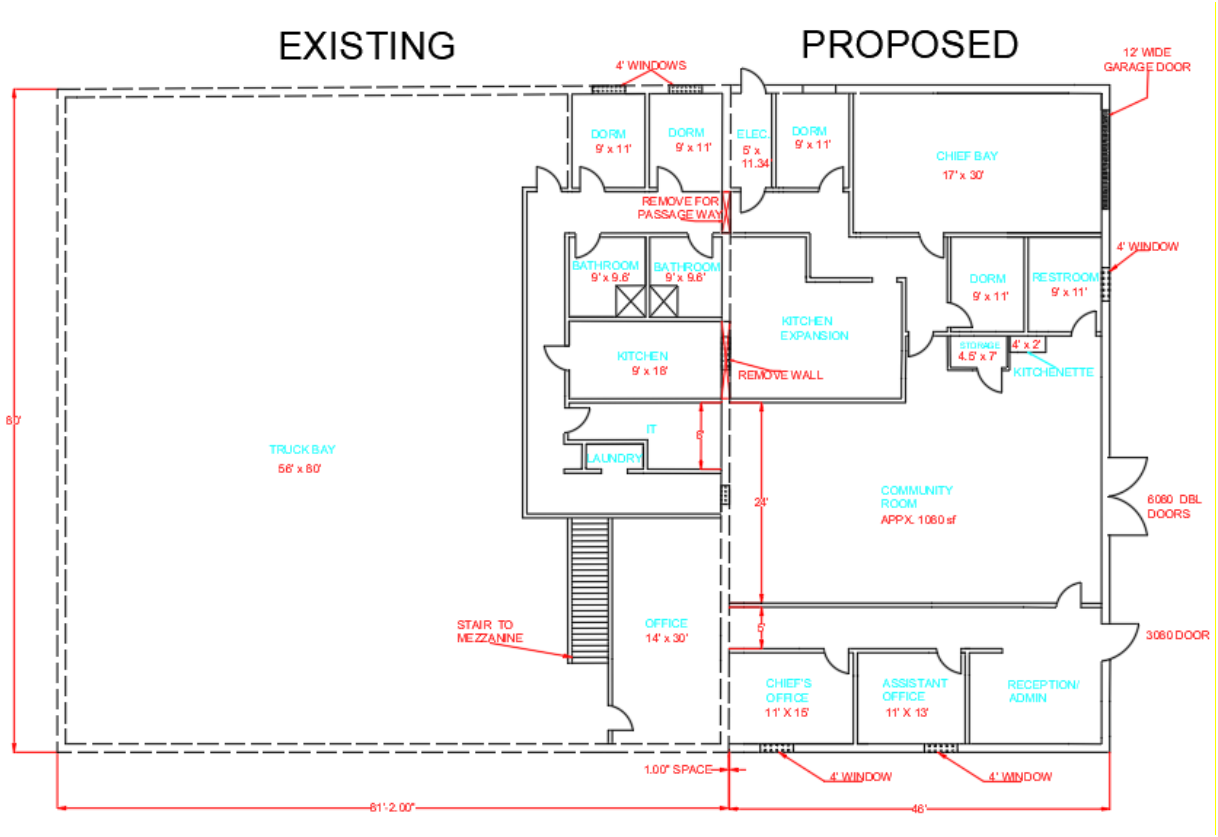


Figure 8: Floor Plan of Existing and Proposed Structures

2.4.2 Site Plan

The site plan in figure 4 depicts the existing and proposed structures, the existing parking lot and driveway, and shows that the minimum setback requirements are met. According to the Coconino Zoning Ordinance, the setbacks for a semi- public use building such as a fire station must be a minimum of 20 feet from all property lines [8].

2.4.4 Foundation Plan and Details

#8 rebar will be used as reinforcing strength bars according to ACI 318-14 [9]. Table 6 shows the design parameters used for to calculate the foundation size

Table 6. Design parameters for the foundation

Design Parameters		
Name	**Symbol**	**Load**
Yield Strength	fy	40,000 psi
Compressive Strength	f'c	3,00 psi
Soil Bearing Capacity	gamma	1,500 psf
Roof Dead Load	DL	18.3 kips
Roof Live Load	LL	36.8 kips

Figure 9, and 10 below show the foundation specs with rebar location.

Figure 9. Foundation Specs with Rebar Location

Figure 10. Foundation Specs with Rebar Location

Figure 11 below shows the footings that will be used for the design.

Figure 11. Design Footing

2.4.5 Anchor Bolt Plan and Details

Table 7 below shows the design parameters for the anchor bolts. Figure 12 and 13 show more details for the anchor bolts.

Table 7. Design parameters for the anchor bolt.

Design Parameters	
Name	**Load**
Steel Anchor Bolt	ASTM F1554-36
Shear Load	19.6 kips
Uplift Load	22.7 kips

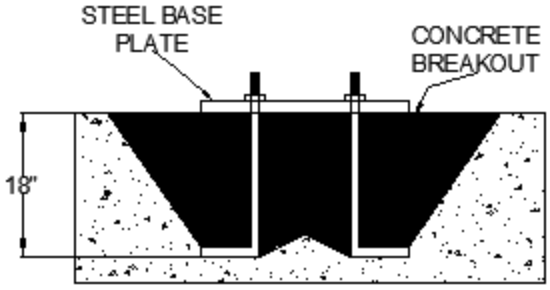


Figure 12. Cone of failure for the anchor bolts.

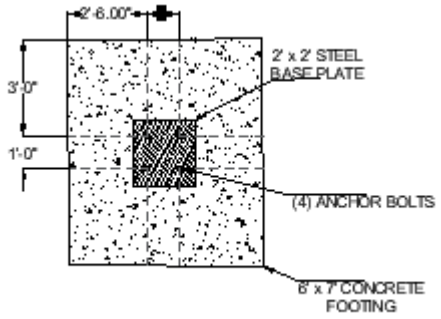
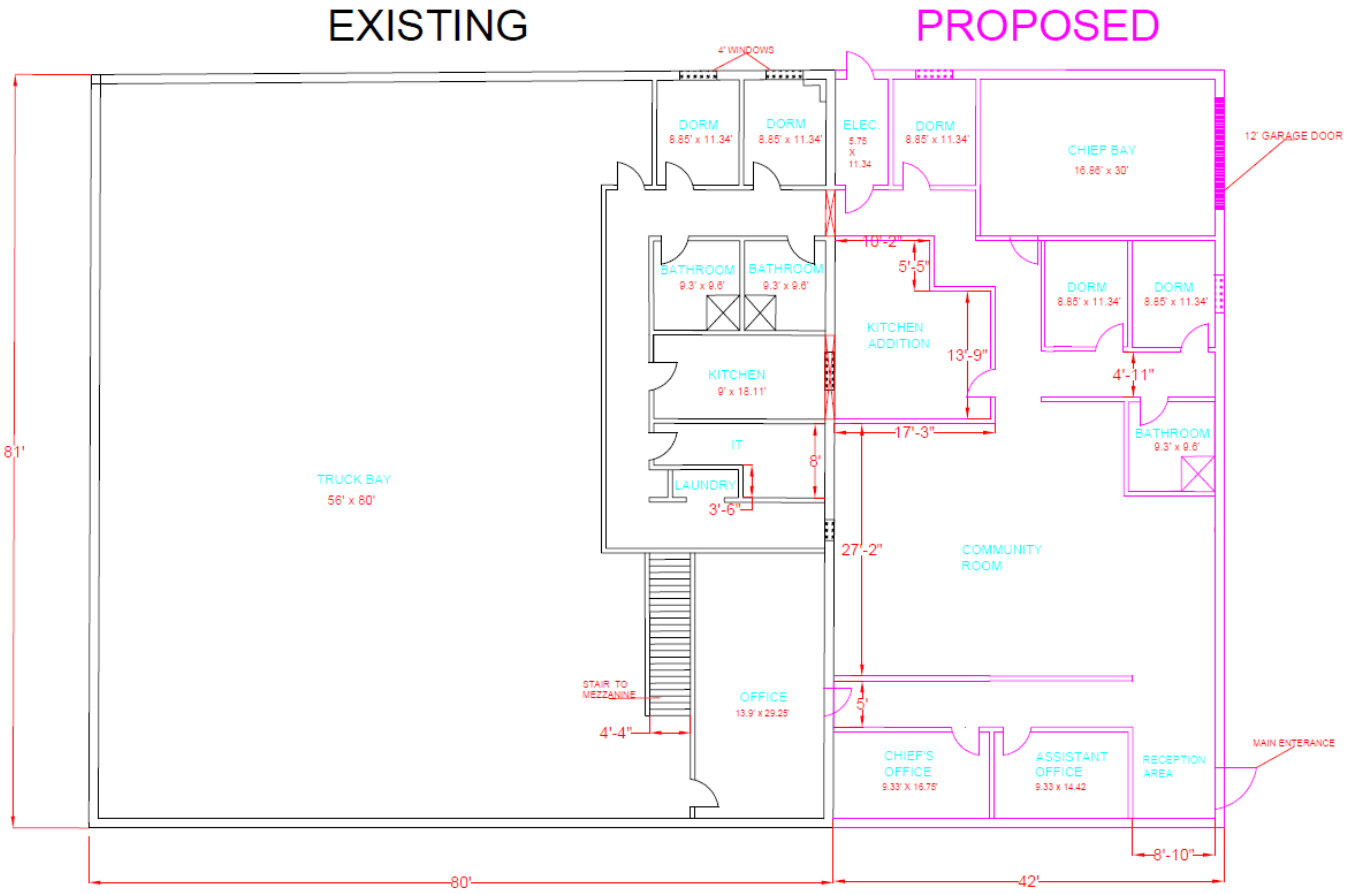


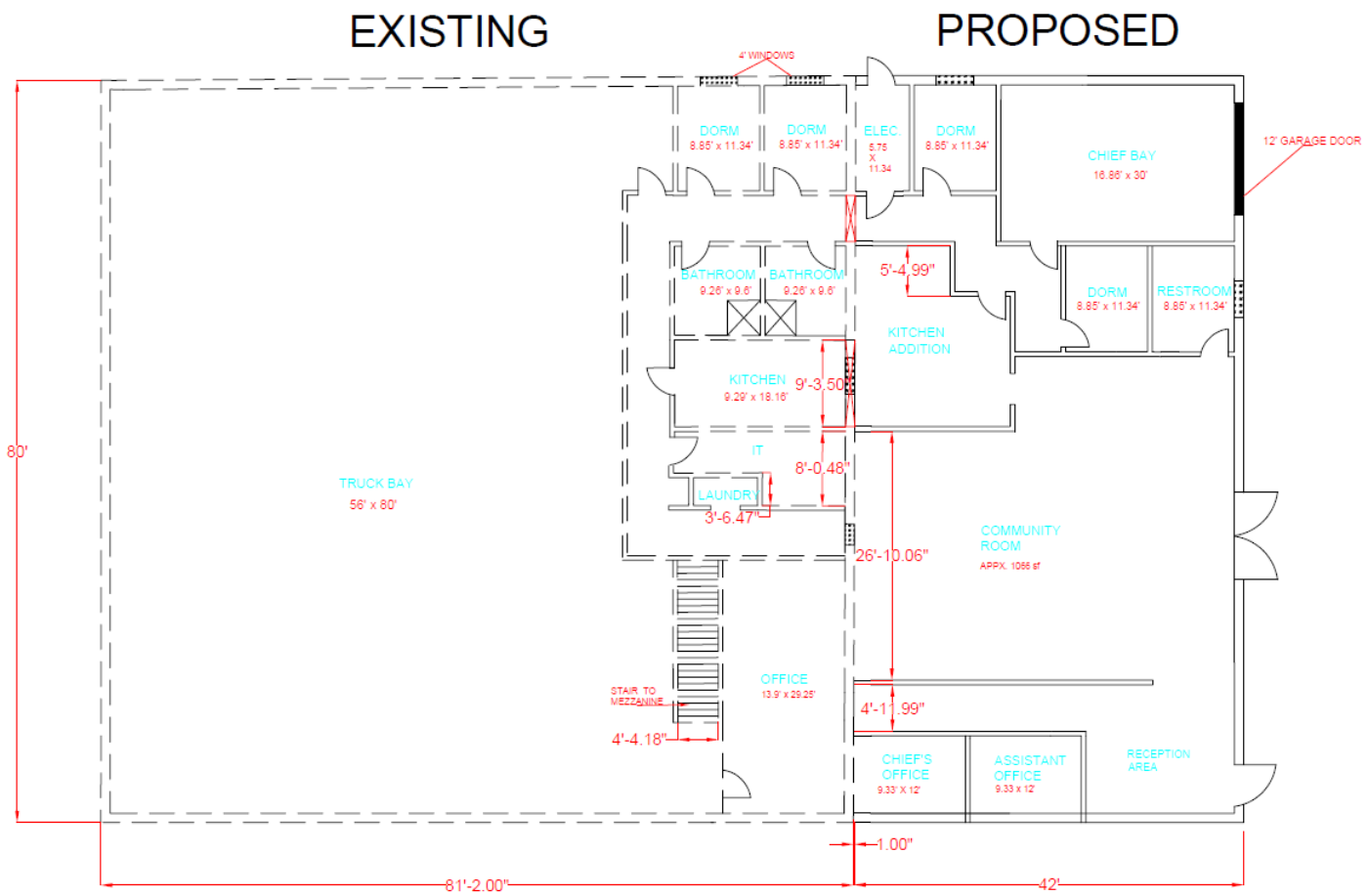
Figure 13. Detailed layout of the anchor bolt plate on the footing column.

2.5 Design Alternatives

Two design alternatives were developed for the layout of the building addition. Figure # below displays Alternative 1 for the proposed building addition. Alternative 1 consisted of three additional dorm rooms, a hallway that connects the community room to the dorm living quarters, an additional restroom, the chief's vehicle bay, an electrical room, and a smaller community room and reception area. Figure # below displays Alternative 2 for the proposed building addition. Alternative 2 consisted of two additional dorm rooms, a wall that separates

the community room from the dorm living quarters, an additional restroom, the chief's vehicle bay, an electrical room, and a larger community room and reception area.





2.6 Final Design Recommendations

Alternative 2 was chosen as the final design. Alternative 2 was chosen as the client preferred this design alternative. This was due to the wall adding more privacy for the firefighters as opposed to having a hallway that connects the community room and the dorm living quarters. This design also has a larger community room and reception area which was a priority for the client. This design also allows easier access to the restroom for the community members.

3.0 Summary of Engineering Work

3.1 Scope

The scope of work changed from the initial proposal phase. The original scope order was site investigation, metal frame company research, structural design, construction documents, and project deliverables. Upon further research, the metal frame company research was removed due to the lack of feedback and communication from the different companies contacted. In the initial proposal, a section for conducting a soils analysis of the site was removed because a previous soils reports of the surrounding area was obtained from the client. The new scope

order changed to site investigation, structural design, construction documents and project deliverables.

3.2 Schedule

The original Gantt Chart in Appendix # had to be adjusted with the changes in the scope of work. The new Gantt Chart can be reference in Appendix #. The new changes do not change the original critical path. However, a major difference in the schedule is the start of construction documents that were expected to be started later. As the scope of the project unfolded, the site plan, cover page and floor plan could be started earlier than expected. Tasks that were with the foundation plans took longer than expected due to the complexity and accuracy needed.

4.0 Summary of Engineering Costs

4.1 Cost of Implementation

To determine the cost of implementation the team used resources from ADOT construction bids. The cost was broken down in three categories, the excavation and fill, reinforced concrete with rebar and anchor bolts, and proposed metal frame cost. Table # below shows a breakdown of the construction costs. The cost for excavation, backfill and concrete work includes labor. The total cost comes to $89,932. This does not include the interior walls, interior furnishings or M.P.E.

Item Description	Quantity	Unit	Material ($/unit)	Subtotal
Excavation	340	CY	$9	$3,060
Backfill	240	CY	$7	$1,680
Reinforced Concrete	100	CY	$400	$40,000
Anchor Bolts	24	EA	$8	$192
Metal Frame	1	EA	$45,000	$45,000
			Total Cost:	$89,932

4.2 Cost of Engineering Services

The scope of work required five positions, a senior engineer, engineer, field technician, drafter and an intern. Table # below shows the expected engineering costs associated with the project. The previous cost of services was estimated at $69,494. The new actual cost was determined to be $58,833. The difference in cost was due to the removal of the lab testing and metal frame research tasks. Surveying task took alt less time than previously estimated due to previous experience and usage of new technology. The construction documents and design processes took longer than expected due. In the end there was a saving of $10,661 in engineering services

	Senior Engineer	Engineer	Field Tech	Drafter	Intern	Estimated	Actual Total	Estimated	Actual Cost
Billing Rate	$255/hr	$115/hr	$51/hr	$69/hr	$21/hr	Total Hours	Hours	Cost Per Task	Per Task
1.0 Site Investigation	2	3	6	0	10	64	21	$2,870	$1,371
2.0 Lab Testing/Soil Properties	4	0	0	0	0	25	4	$759	$1,020
3.0 Metal Frame Co Research	0	0	0	0	0	60	0	$9,460	$0
4.0 Structural Design	16	26	2	0	18	120	62	$13,416	$7,550
5.0 Construction Documents	12	13	0	83	61	213	169	$12,421	$11,563
6.0 Project Deliverables	30	35	5	7	19	70	96	$11,138	$12,812
7.0 Project Management	43	43	27	27	27	120	167	$14,630	$19,717
Hours per Position	107	120	40	117	135	672	519	$64,694	$54,033
							Total Cost:	$69,494	$58,833

5.0 Conclusion

The design of the Ponderosa Fire Station building addition required the team to devise a solution that addressed the existing station's current limitations and the client's needs as well as meet all codes and regulations. The final layout of the building addition met the client's needs by adding additional living quarters for the firefighters, a community room for events, offices for the staff and the fire chief, expending the kitchen area, and adding a vehicle bay. The designs of the anchor bolts and foundation were done following the codes and design parameters given by the IBC 2018, Coconino County, and ACI 318-14 Code which meant all codes and regulations were met.

References

[1] Google Maps, "Google Maps," 2018. [Online]. Available: https://www.google.com/maps/place/Ponderosa+Fire+District/@35.2375028,-111.8175314,1916m/data=!3m1!1e3!4m5!3m4!1s0x0:0x9a3f129a0b7c9664!8m2!3d35.2372423!4d-111.8164742. [Accessed 22 September 2018].

[2] C. Wiedeman, "Flagstaff Meadows Unit III West Shadow Mountain Drive," Flagstaff, 2006.

[3] [Online]. Available: https://www.law.cornell.edu/cfr/text/24/3285.202 . [Accessed 10 Feb 2019].

[4] [Online]. Available: http://www.coconino.az.gov/Faq.aspx?TID=51,49,50,53,52. [Accessed 10 Feb 2019].

[5] [Online]. Available: http://web.engr.uky.edu/~gebland/CE%20382/CE%20382%20Four%20Slides%20per%20Page/L2%20-%20%20Loads.pdf. [Accessed 10 Feb 2019].

[6] [Online]. Available: https://www.decksgo.com/deck-post-load.html. [Accessed 10 Feb 2019].

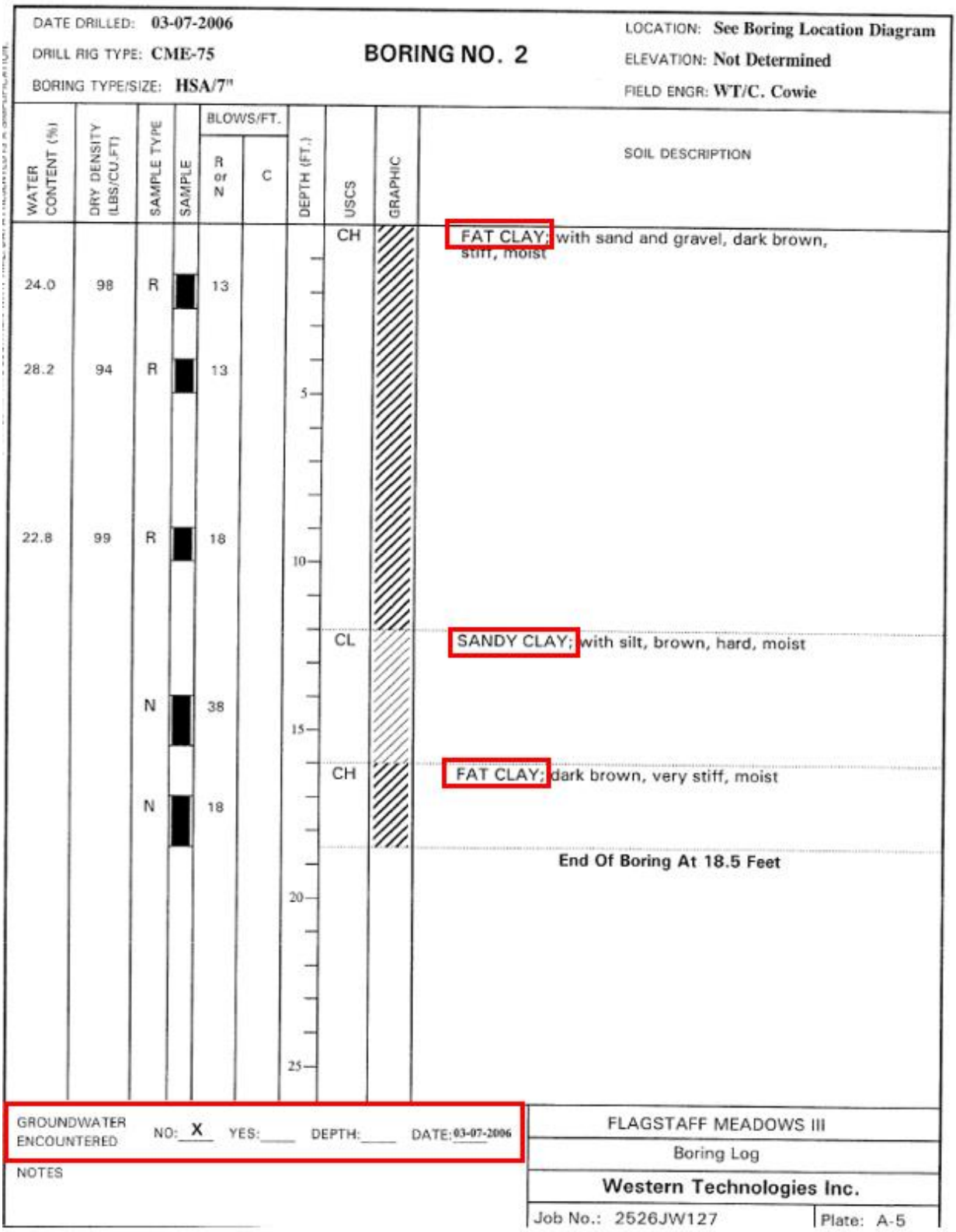
[7] International Code Council, "International Fire Code," Country Club Hills, 2018.

[8] Coconino County, "Coconino County Zoning Ordinance," 2017.

[9] A. C. 318, Building Code Requirement for Structural Concrete (ACI 318-14), 2014.

Appendix

Appendix A: Flagstaff Meadows Project Boring Logs



DATE DRILLED: 03-07-2006
DRILL RIG TYPE: CME-75
BORING TYPE/SIZE: HSA/7"

BORING NO. 2

LOCATION: See Boring Location Diagram
ELEVATION: Not Determined
FIELD ENGR: WT/C. Cowie

WATER CONTENT (%)	DRY DENSITY (LBS/CU.FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT. R or N	BLOWS/FT. C	DEPTH (FT.)	USCS	GRAPHIC	SOIL DESCRIPTION
							CH		FAT CLAY; with sand and gravel, dark brown, stiff, moist
24.0	98	R		13					
28.2	94	R		13		5			
22.8	99	R		18					
						10	CL		SANDY CLAY; with silt, brown, hard, moist
		N		38		15			
							CH		FAT CLAY; dark brown, very stiff, moist
		N		18					
									End Of Boring At 18.5 Feet
						20			
						25			

GROUNDWATER ENCOUNTERED NO: X YES: ____ DEPTH: ____ DATE: 03-07-2006

NOTES

FLAGSTAFF MEADOWS III
Boring Log
Western Technologies Inc.
Job No.: 2526JW127 Plate: A-5

DATE DRILLED: 03-09-2006

DRILL RIG TYPE: CME-75

BORING TYPE/SIZE: HSA/7"

BORING NO. 26

LOCATION: See Boring Location Diagram

ELEVATION: Not Determined

FIELD ENGR: WT/E. Guerrero

WATER CONTENT (%)	DRY DENSITY (LBS/CU.FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT. R e c	BLOWS/FT. C	DEPTH (FT.)	USCS	GRAPHIC	SOIL DESCRIPTION
							CH		FAT CLAY; brown, firm, damp
									BASALT; black, porphyritic, hard
									Auger Refusal At 2 Feet

GROUNDWATER ENCOUNTERED NO: X YES: ____ DEPTH: ____ DATE: 03-09-2006

NOTES

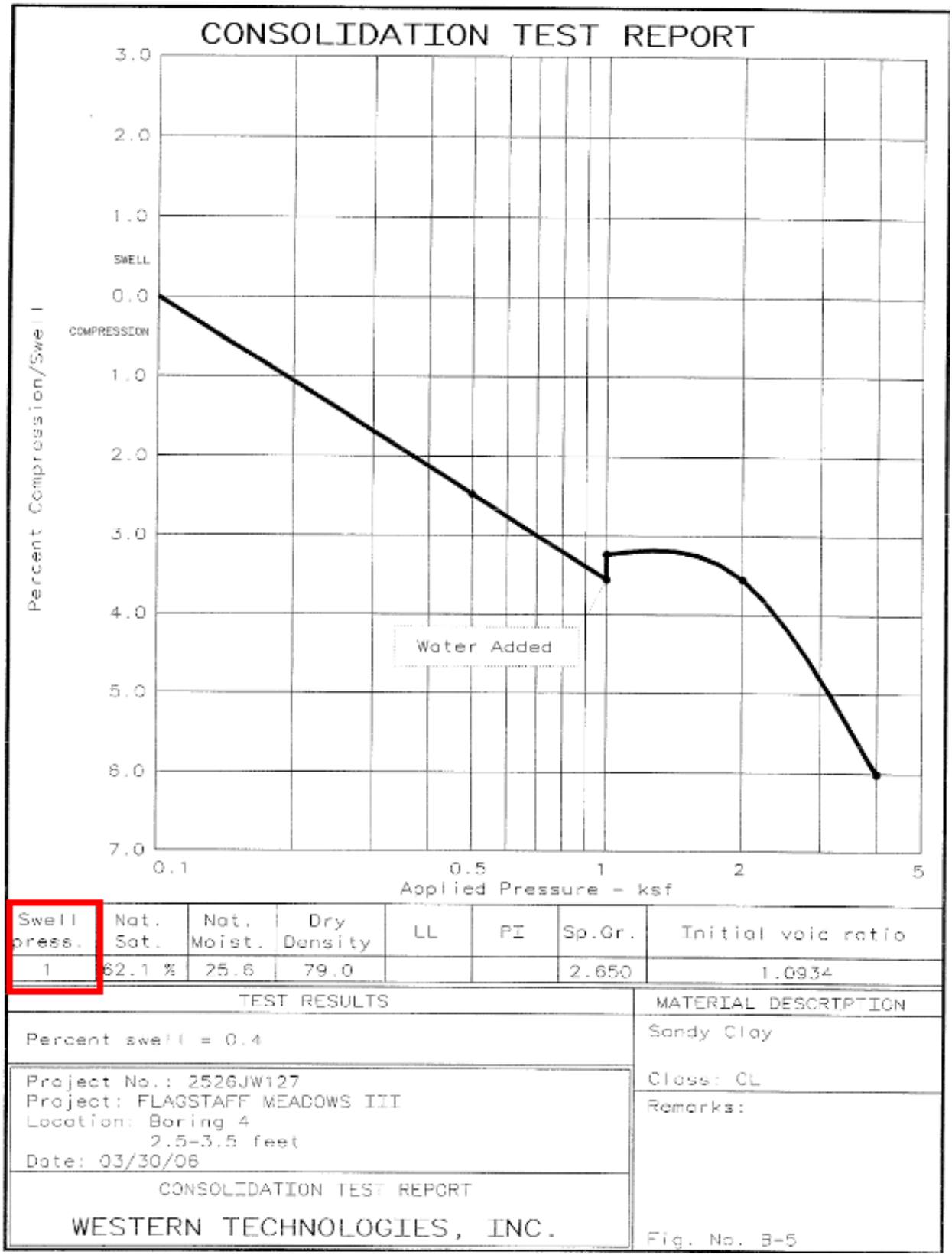
FLAGSTAFF MEADOWS III

Boring Log

Western Technologies Inc.

Job No.: 2526JW127 Plate: A-29

Appendix B: Flagstaff Meadows Project Consolidation Test Reports



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Initial void ratio
1	62.1 %	25.6	79.0			2.650	1.0934

TEST RESULTS

Percent swell = 0.4

MATERIAL DESCRIPTION

Sandy Clay

Class: CL

Project No.: 2526JW127
Project: FLAGSTAFF MEADOWS III
Location: Boring 4
2.5-3.5 feet
Date: 03/30/06

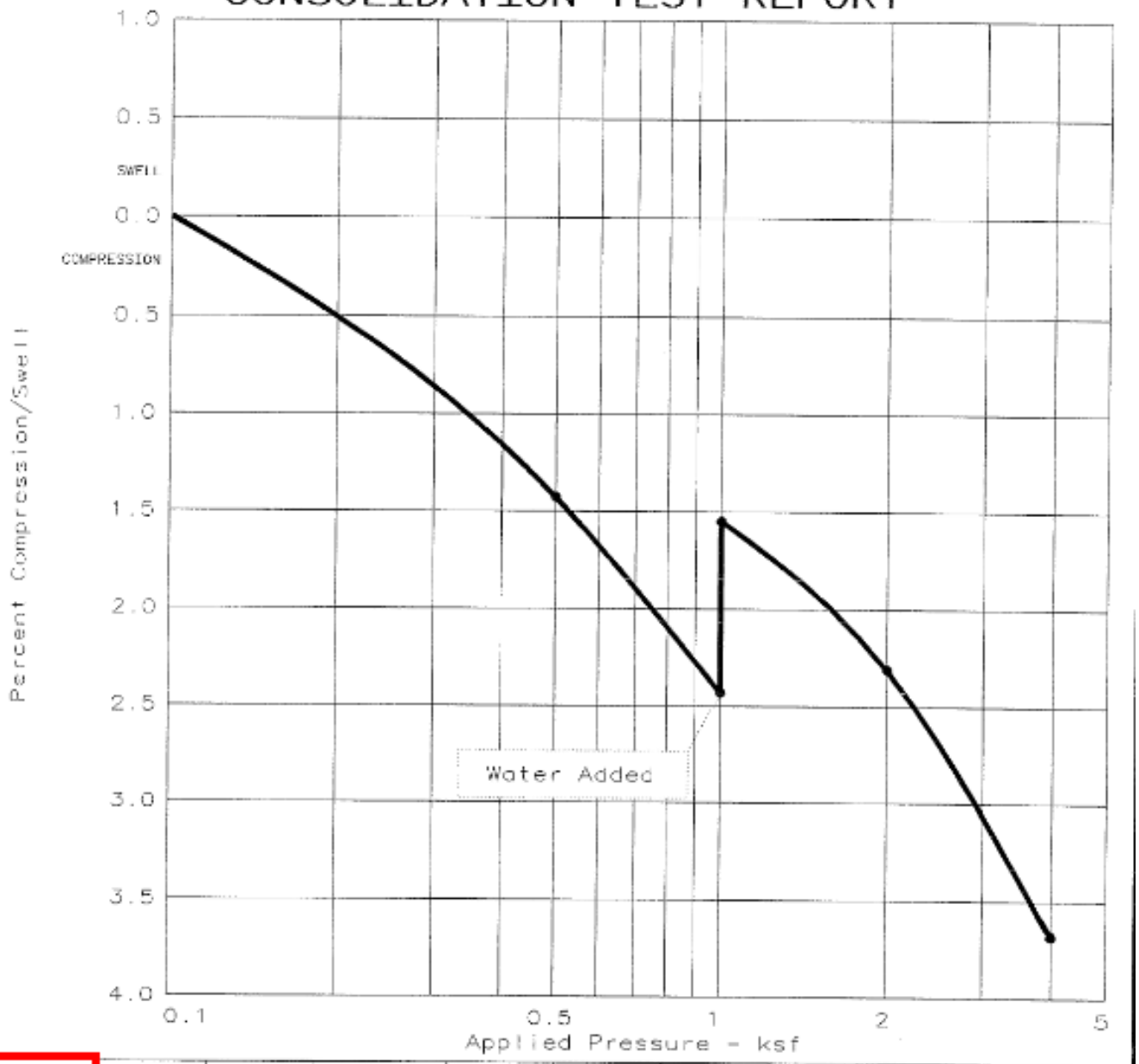
Remarks:

CONSOLIDATION TEST REPORT

WESTERN TECHNOLOGIES, INC.

Fig. No. B-5

CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Initial void ratio
1.16	86.4 %	31.2	84.6			2.650	0.9560

TEST RESULTS

Percent swell = 0.8

MATERIAL DESCRIPTION

Clayey Sand

Class: SC

Project No.: 2526JW127
Project: FLAGSTAFF MEADOWS III
Location: Broring 5
10-11 feet
Date: 03/30/06

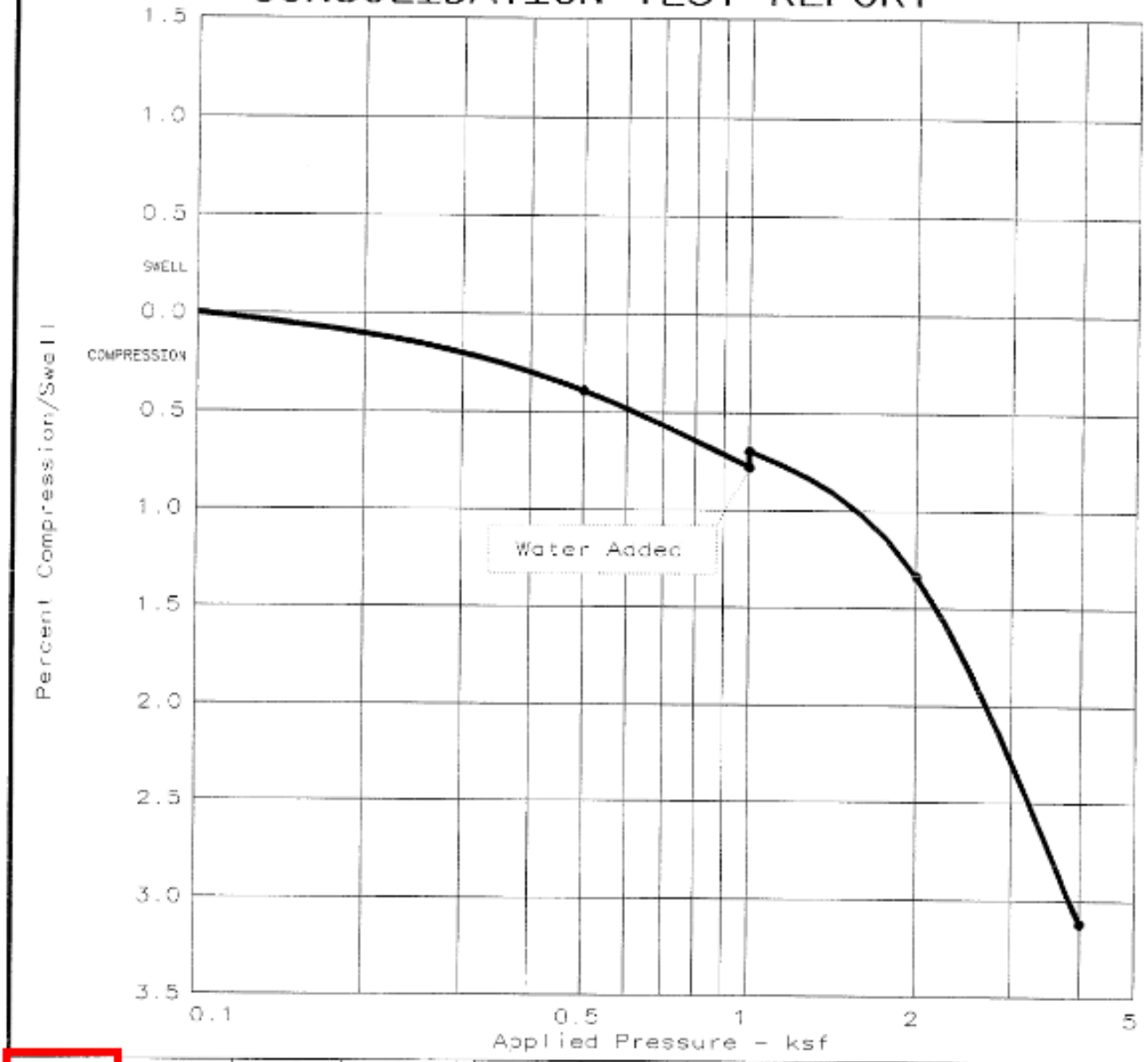
Remarks:

CONSOLIDATION TEST REPORT

WESTERN TECHNOLOGIES, INC.

Fig. No. B-6

CONSOLIDATION TEST REPORT



Swell press.	Nat. Sat.	Nat. Moist.	Dry Density	LL	PI	Sp.Gr.	Initial void ratio
0.16	89.1 %	33.7	82.6			2.650	1.0017

TEST RESULTS

Percent swell = 0.1

Project No.: 2526JW127
Project: FLAGSTAFF MEADOWS III
Location: Boring 7
5-6 feet
Date: 03/30/06

CONSOLIDATION TEST REPORT

WESTERN TECHNOLOGIES, INC.

MATERIAL DESCRIPTION

Fat Clay

Class: CH

Remarks:

Fig. No. B-7

Appendix C: Flagstaff Meadows Project Soil Properties Tables

SOIL PROPERTIES

BORING NO.	DEPTH (FEET)	SOIL CLASSIFICATION	SOIL PROPERTY		COMPRESSION / CONSOLIDATION		EXPANSION			REMARKS
			INITIAL DRY DENSITY (PCF)	INITIAL WATER CONTENT (%)	SURCHARGE (KSF)	TOTAL COMPRESSION (%)	SURCHARGE (KSF)	EXPANSION (%)	MAXIMUM SWELL PRESSURE (KSF)	
4	4-5	CL	108	14.0			0.1	7.7		1,2
5	7-8	SC	106	14.7			0.1	3.9		1,2
10	3-4	CH	106	14.7			0.1	8.4		1,2
13	7-8	CL	9.3	15.4			0.1	9.3		1,2

NOTE: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.

REMARKS:
1. Compacted Density (approximately 95% of ASTM C698 maximum density at moisture content slightly below optimum).
2. Submerged to approximate saturation.
3. Dry Density determined from one ring of a multi-ring sample.
4. Visual Classification.

FLAGSTAFF MEADOWS III

Soil Properties

Western Technologies Inc.

Job No.: 2526JW127 | Plate: B-2

SOIL PROPERTIES

BORING NO.	DEPTH (FEET)	SOIL CLASSIFICATION	SOIL PROPERTY			EXPANSION INDEX		REMARKS
			INITIAL DRY DENSITY (PCF)	MOLD NO WATER CONTENT (%)	FINAL WATER CONTENT (%)	SATURATION (%)	EXPANSION INDEX	
4	4-5	CL	83	18.4	37.4	48	28	1,3,5
5	7-8	SC	86	17.7	30.5	50	9	1,2,5
10	3-4	CH	83	18.9	38.6	50	39	1,2,5
13	7-8	CL	89	18.1	32.7	54	43	1,3,5

NOTE: ASTM D4829

REMARKS:

1. Submerged to approximate saturation.
2. $EI_{measured} = (\Delta H/H_i) \times 1000$
3. $EI_{50} = EI_{measured} \times 150 - S_{measured} \times (65 + EI_{measured} / 220 - S_{measured})$
4. Ring Weight = 200.7 grams
5. Ring Weight = 397.0 grams

FLAGSTAFF MEADOWS III

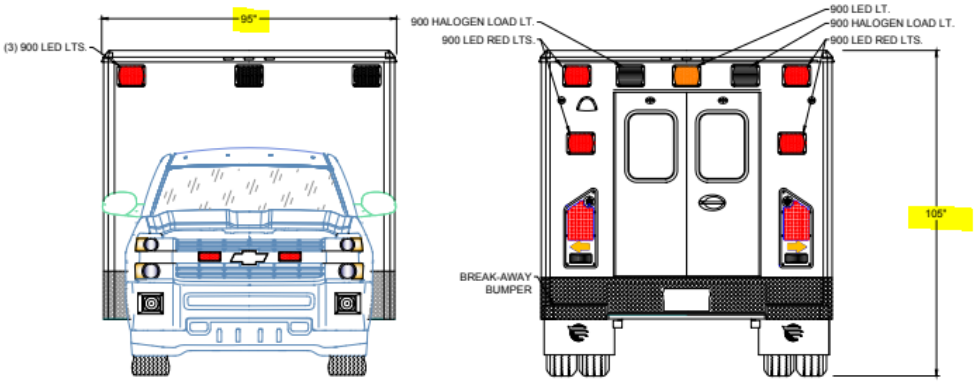
Soil Properties

Western Technologies Inc.

Job No.: 2526JW127 | Plate: B-3

Appendix D: 3500 Type I Chevy 2018 Ambulance Specifications

CA101740 MODEL 1153C 153 x 95 x 67



EXTERIOR COMPARTMENT DIMENSIONS IN INCHES

INTERIOR DIMENSIONS				PASS THRU		INTERIOR DIMENSIONS				JAMB OPENING	
COMPT.	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	COMPT.	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH

50" AISLE

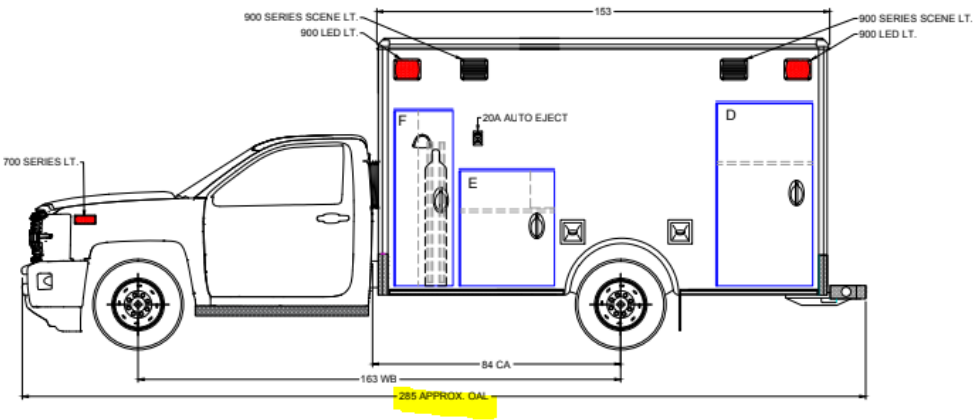
BE ADVISED THAT THESE ARE PRELIMINARY LAYOUTS INTENDED TO ILLUSTRATE DESIGN INTENT AND DIMENSIONS ARE FOR REFERENCE ONLY PRIOR TO FINAL ENGINEERING

Wheeled Coach

3500 TYPE 1 CHEVY 2018
FRONT / REAR
EXTERIOR VIEWS

DATE: 03/21/18 SCALE:
DWN BY: SG DWG NO: 1 / 9

CA101740 MODEL 1153C 153 x 95 x 67



BE ADVISED THAT THESE ARE PRELIMINARY LAYOUTS INTENDED TO ILLUSTRATE DESIGN INTENT AND DIMENSIONS ARE FOR REFERENCE ONLY PRIOR TO FINAL ENGINEERING

EXTERIOR COMPARTMENT DIMENSIONS IN INCHES

INTERIOR DIMENSIONS				JAMB OPENING		INTERIOR DIMENSIONS				JAMB OPENING	
COMPT.	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH	COMPT.	HEIGHT	WIDTH	DEPTH	HEIGHT	WIDTH
D	61.75	32.75	17.00	58.50	29.25						
E	39.00	32.25	17.00	37.00	30.00						
F	59.00	20.00	17.00	58.50	16.75						

50" AISLE

Wheeled Coach

3500 TYPE 1 CHEVY 2018
LEFT EXT. VIEW

DATE: 03/21/18 SCALE:
DRAWN BY: SG DWG NO: 2 / 9