CE 301 - Professor Boyles
Alizer Khowaja
Arwinder Singh
Benjamin Gettig
Elizabeth Chong

Final Report: Dormitory

The University of Texas at Austin

5 December, 2018

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Executive Summary

Tek40 was tasked with the project of designing a dormitory for the University of Texas at Austin including a drainage plan and redesigned traffic signal timing while adhering to the guidelines found in the University's campus Master Plan. The resulting design incorporates modern elements, such as floor to ceiling windows and a green roof, while still remaining true to the University's style in a dormitory that blends well with the existing campus and future plans of development.

The site for the proposed dormitory is a relatively flat plot of land found at the corner of San Jacinto and Dean Keeton. The existing site currently has a sand volleyball court, tables, a few light posts, and a few trees found primarily along Waller Creek on the east side and along the perimeter of the property. The proposed site will retain the existing bridge connecting to the neighboring Creekside dorm as well as the bus stop found at the edge by San Jacinto Blvd. The proposed building will incorporate a diamond shape with three floors of living spaces, four elevators and stairwells, and a green roof with an open garden. A central atrium in the interior of the building will allow for dining options and open seating. Waller Creek will serve as the focal point with features such as the skybridge found on the dormitory floors overlooking the creek. In compliance with the University's Master Plan, the Waller Creek dormitory will integrate will with future plans of development such as a light trail station to be built in the front. The interior of the building will feature spacious sitting areas, a dining hall, and suite style and single room living rooms. Meeting the recommended 250 person capacity, Tek40's dorm encompasses space for 252 in-house residents. The building totals to 72,000 square feet with each suite-style room having 600 square feet and each regular room having 274 feet.

Along with a design for a dormitory building, a site drainage system was designed to provide adequate drainage for the site in the case of a 100-year flood event in Austin which is 13 inches over 24 hours. A gutter system surrounds the roof and skybridge which then feed into four pipes running down the back corners. These then feed into inlets underground and flow through pipes ending at Waller Creek. Runoff from the front side and courtyard areas of the dorm will feed into the San Jacinto and Dean Keeton drainage pipes. The calculations for this drainage system reflect 12-inch concrete pipes flowing at a slope of almost zero with an estimated total of 29,566.0898 cubic feet of water being added to the creek and drainage pipes in a 24 hour period in the event of a 100 year flood.

In addition to a site plan and drainage plan, a transportation access plan takes into the account the increased traffic volume that will result from the influx of new residents. Traffic along San Jacinto Boulevard and Dean Keeton Street will be affected by residents with vehicles as well as the increased traffic travelling towards and out of campus. A redesigned traffic signal was designed assuming all future residents with vehicles will park in the San Jacinto parking garage. The resulting traffic signal consists of four phases. Phase one consists a 29 second green time followed by a 4 second yellow time for traffic flowing north and southbound travelling through and turning right. Phase two uses the same 29 second green time and 4 second yellow time for traffic flowing east and westbound travelling through and straight. Phase three and four accommodate cars turning left and will have a 16 second green time and 5 second yellow time. After four phases, a total 24 second pedestrian cycle consisting of a 3 second green light and 21 second countdown will allow for all foot traffic travelling diagonally in addition to parallel to the streets. This traffic design hopes to accomodate for a perceived volume increase of 20% in traffic travelling northbound and eastbound, of 50% in traffic travelling northbound turning left and eastbound through and right, and of 10% for all other lane groups.

In terms of the structure of the main building, indication of how the building will be constructed and hold itself together is demonstrated by the column design. The total load resulting from live and dead loads will transfer to the ground floor and foundation as well as to horizontal steel beams on the second and third floors. The horizontal beams will transfer loads to vertical columns which will then transfer the load to the concrete foundation. The proposed column design layout incorporates vertical three feet by three feet columns spaced every 12 or 20 feet apart. Each column is 41 feet tall and can support about 529 square feet. Using a factor of safety of 2 when conducting calculations, the proposed load total needed to be sustained by the column design must sustain a compressive failure of 35227.61833 pounds per square feet. Tek40's column design will be able to sustain a maximum load/ capacity of 317048.5649, as this is derived by taking into consideration a safety factor of 2. All of these values were calculated taking all the live and dead loads into consideration. The loads utilized are presented in the table below:

Live Loads (psf)		dead loads (psf)	
Roof	20	clay/tile Roof + soil	40
Attic	10	ceramic tile (floor)	15
Bedroom Areas	30	brick veneer (walls)	45

As a result there will not be any compressive failure which occurs from the column failing to even sustain the demand, *P,* or buckling failure which occurs from the forces applied causing the column to bend or deflect laterally.

The last step in designing Tek40's Waller Creek Dormitory was the design of the foundation which includes the length and breadth of the footing needed to distribute the load of the column onto the soil underneath it. This footing will need to sustain the load of columns without the shear stress exceeding the shear strength of the soil. Using a factor of safety of two, the bearing capacity of the soil was 4863.81 psf with the calculated bearing capacity factor reaching 5.14. An optimized value was calculated in which the footing would be of size 5 by 5 feet and at a depth of 14.71 feet in order to sustain a load of 25,000 pounds. With excavation costs being $20 per cubic foot and the cost of the footing being $1500 with an additional $1000 per square foot, this proposed footing would have a total cost of $51,988.24 and would require 792 cubic feet of surrounding soil to be excavated.

Tek40's Waller Creek Dormitory aims to promote sustainability and comfort while complying will all ethical and professional standards in an attempt to provide the best possible accommodations for all university students and faculty.

Introduction

The area adjacent to the intersection of Dean Keeton and San Jacinto Blvd is currently partially utilized as a sand volleyball court. The section of Waller Creek which borders the land on one side is being neglected as a monument of the University of Texas, and is slightly polluted. In addition, The University of Texas is interested in building a dormitory on the site mentioned. Now, it is the responsibility of TEK40 to conduct experiments, and analyze the landscape along with the surroundings to conclude the type of residency that can be established on the location. The company must also comply with the constraints presented by the university. The constraints are as follows:

1. The new building must provide housing for at least 250 students.

2. It can, but does not need, include a basement and multiple stories. Also, even though not required, the university recommends to use the same floor plan for as many stories as possible.

3. The building must be built in accordance to the plans and design philosophy for this part of campus mentioned in the UT Master Plan.

4. The Waller Creek is considered as one of the“Gems of the University”. So, TEK40 must decide how the design will include the landmark and preserve its value to the campus.

5. Lastly, it must be determine what the company can do to provide access to the convention center, the amount of bike racks to be provided and their location, the bus routes that the students of this dormitory will use, and the access required for deliveries, trash pickup, etc.

This report includes all the experiments and studies conducted by TEK40 regarding the proposed location and includes details on every aspect of the design, elaborating upon some of the concerns that might arise. Each part of the building design and process is split into different sections that showcase the studies conducted.

SECTION 1: SITE DESIGN

OVERVIEW

Tek40's diamond-shaped student living center focuses on the themes of convenience, sustainability, and comfort by integrating modern architecture within the living environment.

FEATURES

1. 3 floors above ground with 2 floors underground garage
2. 4 elevators and stairwells
3. Green Roof
4. Central atrium with cafes and open space
5. Windows in all rooms
6. Porous concrete
7. Creek serves as the main exhibit with parallel gravel path

EXISTING INFRASTRUCTURE

The site is bordered by Dean Keeton St to the north, Waller Creek to the east, and San Jacinto Blvd to the south and west. Currently, the mostly flat plot of land includes a sand volleyball court and tables with a few light poles scattered throughout the perimeter. There is a bridge connecting the existing plot to the Creekside dormitory with a paved sidewalk leading up to it. There is also bus stop currently positioned on the edge of the site by San Jacinto Blvd. According to the UT Master Plan, a light rail station will also be included here in the future.

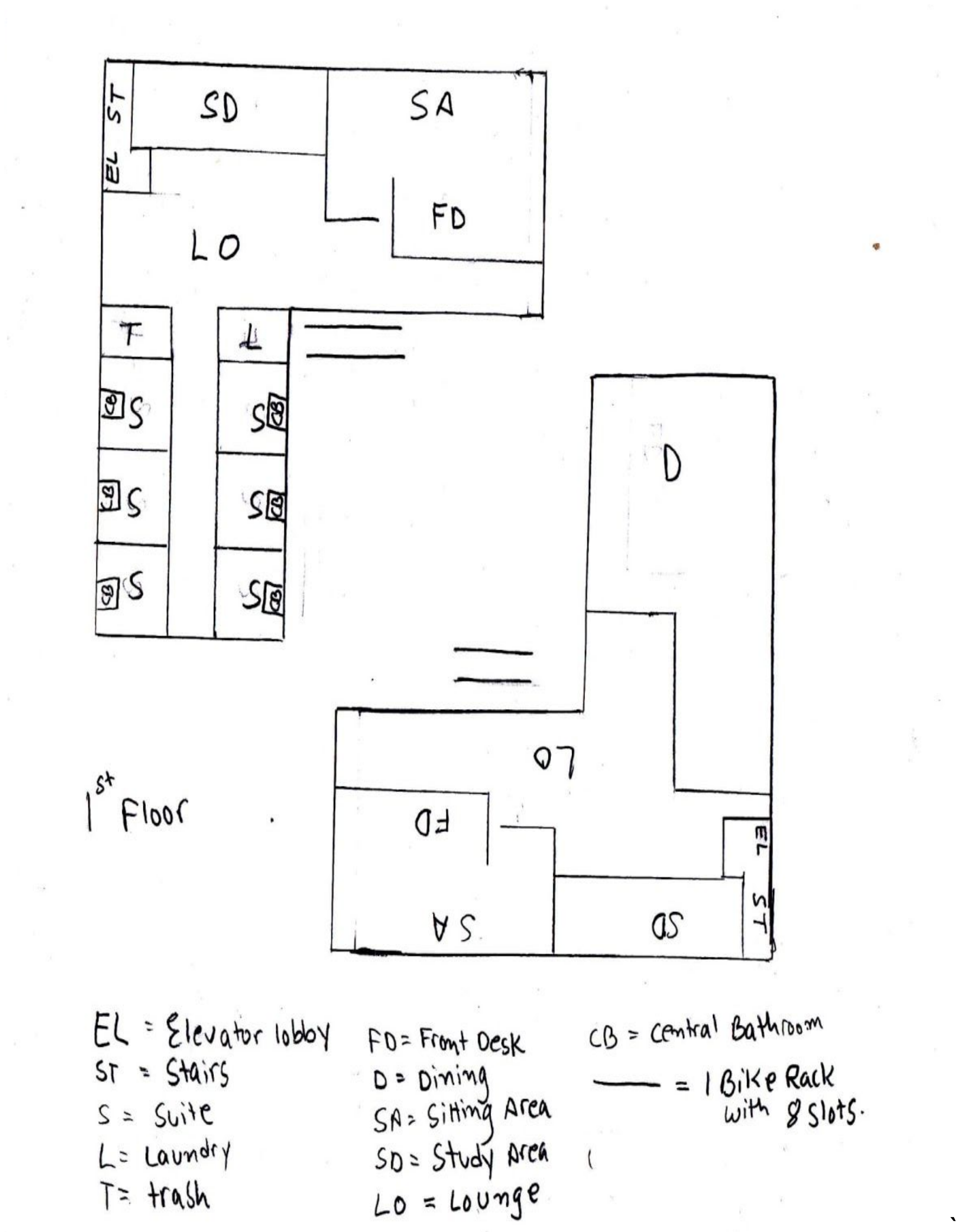
SUMMARY OF UT'S MASTER PLAN

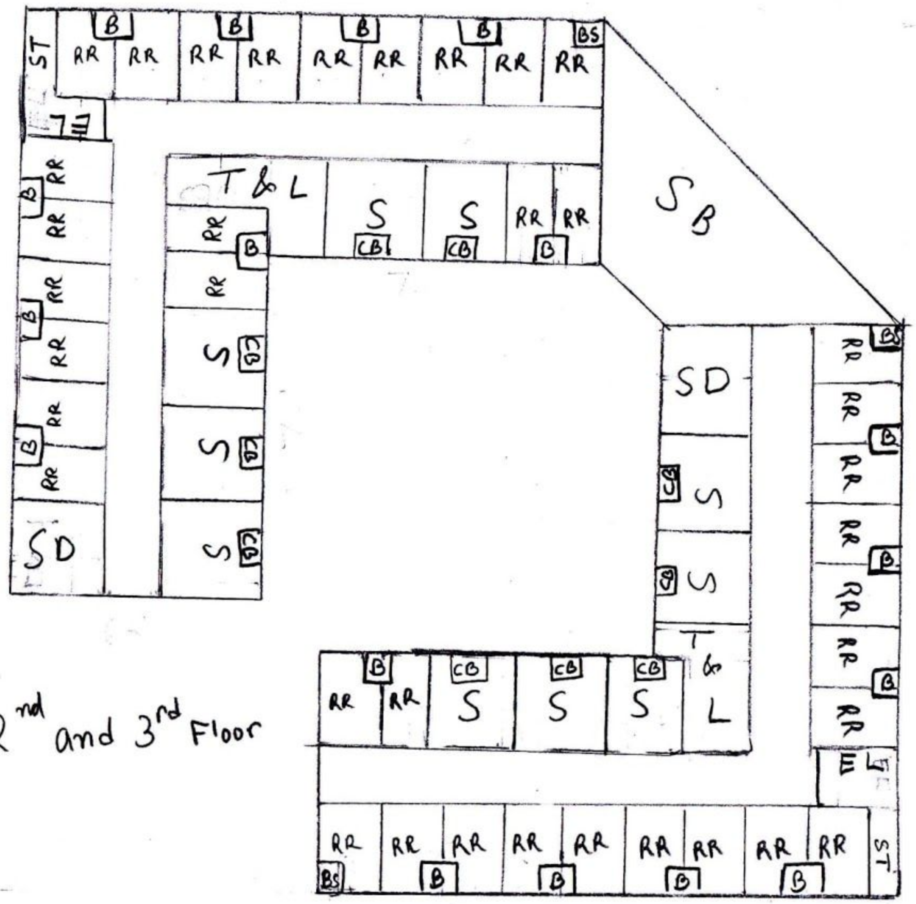
The University master plan views the Waller Creek and San Jacinto Boulevard section as a unified area which balances natural and urban environments. This preexisting balance provides us with the opportunity to integrate academic and residential life into the unique landscape within UT Austin's north campus region. For example, with modern structures such as an open garden on the roof and sky-bridges on the upper floors of our dorm, the beauty of Waller Creek is heavily emphasized without sacrificing its physical state. By strongly considering recommendations advised by the master plan, our cohesive design eradicates the differences between the two distinct corridors and results in a unified, well-functioning atmosphere. Below, you will see few of the ten architectural guidelines (listed on page 210 of the master plan) that we incorporated in our plans.

The extent to which the design of this dorm fits the master plan is as follows:

- ➢ A well designed dormitory will integrate the Core Campus and Central Campus to this corridor.
- ➢ Waller Creek will be glorified as natural resource and will be classified as a desirable feature of the university with structures like the skybridge on the dorm floors that provide a great view of the creek.
- ➢ The structure, as it will be built, will maintain a human scale.
- ➢ The buildings accentuates and makes visible the “vitality and richness of campus life.”
- ➢ The character of this building is responsive to the “need to mitigate the strong sun and [provides] relieving shade in the hot Texas climate.”
- ➢ The building employs a well defined public space as well.
- ➢ The modern architectural design of this dormitory depicts the university as a “progressive and future-oriented institution.”

LINE SKETCHES





2nd and 3rd Floor

EL = Elevator lobby
S = Suite
RR = Regular Room
ST = Stairs
SD = Study

L = Laundry
SB = SKY Bridge
B = Bathroom
CB = Central Bath

BS = Batroom for single room

SITE PLAN


E Dean Keeton St
E Dean Keeton St
130’
60’
130’
60’
70’
70’
135º
30√2’≈ 42.42...’
60’
70’
30’
70’
30’+60√2’
≈ 114.85...’
130’
45º
60’
130’
CREEK

CALCULATIONS

Per Person = 125 ft^2	Elevator Lobby & Stairs= 400 ft^2	Suite = 500 ft^2
Regular Room = 250 ft^2	Study Lounge = 500 ft^2	Suite Central Bath = 100 ft^2
Connecting Bath = 50 ft^2	Single Room Bath = 25 ft^2	Laundry Room = 300 ft^2
Trash Room = 200 ft^2		

10 Suites with Bath	37 Regular Rooms	Single Bath	Connecting Bath
10 x 600 ft^2	37 x 250 ft^2	3 x 25 ft^2	17 x 50ft^2
Total= 16,175 ft^2			
Laundry Room	Trash Room	Elevator Lobby w/ Stairs	Study Lounge
2 x 300 ft^2	2 x 200 ft^2	2 x 400 ft^2	2 x 500 ft^2
Total = 2,800 ft^2			
Total for 2nd floor w/o hallways = 18,975 ft^2	Same Layout for 3rd floor, so same area.		

Suites	Trash Room	Laundry Room
6 x 600 ft^2	300 ft^2	300 ft^2
Total 1st floor (only residence) = 4,200 ft^2		

Students in Suites	Students Regular Rooms
26 suites x 4 students	74 rooms x 2 students
Total = 252 Students	Bike Racks needed = 4 with 8 slots each

Total Building area w/o skybridge = 24,000 ft^2/ floor Total 3 floors= 72,000 ft^2	Calculated area required total for all floors = 42,050 ft^2

SECTION 2: DRAINAGE

OVERVIEW

Develop a drainage system that handles the runoff from the site, and design it to effectively provide adequate drainage incase of a 100-year rainfall event.

DESIGN

To account for a 100 year rain event, we plan to install a gutter system surrounding the roof and skybridge that feed into 4 pipes down the back side corners of the dorm. These will feed into inlets underground where the water will flow through pipes into creek. The runoff from the back side of the dorm will feed into inlets leading to creek. The runoff from the front side of the dorm and courtyard will feed into inlets that run through pipes to the Dean Keeton and San Jacinto drainage system underground.

CALCULATIONS

100 year rain event in Austin, Tx: 13 inches over 24 hrs

Formulas:

$Q = ciA \qquad Q = 1.49\pi^2/128n\ (d^{8/3)})(\sqrt{S})$

Values:	i=13/24 =.54 in/hr	Total plot area: ≈ 50,000 ft^2 =1.1478 acres	Total roof area: =27,072 ft^2 =.6215 acres	Total ground cover area: =22,927 ft^2 =.5263 acres	Total back side ground cover area: =7,666 ft^2 =.1759 acres	Total front side ground cover area: =15,262 ft^2 =.3504 acres	C (roofs) =.75-.95 C (lawns) =.05-.35
Q values:		Q(total) =.3422 ft^3/sec	Q(roof) =.2853 ft^3/sec	Q(lawn) =.0569 ft^3/sec	Q(bs) =.019 ft^3/sec	Q(fs) =.0378 ft^3/sec	
Runoff		To Creek: =26,292.09 ft^3	To street drainage: =3265.92 ft^3				

Pipes:

12 inch, concrete D=12 n=.012

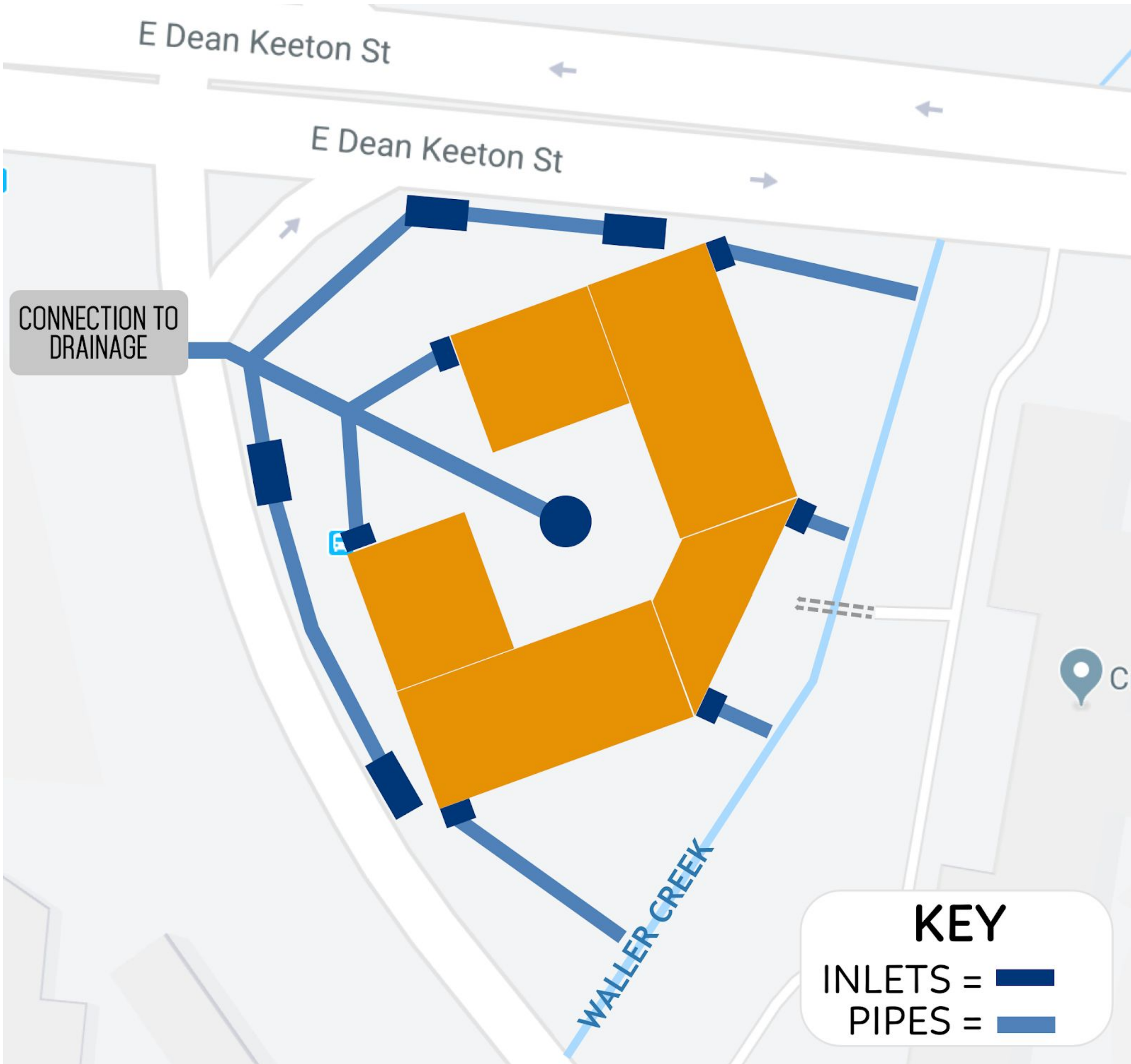
$Q = 1.49\pi^2/128n\ (d^{8/3)})(\sqrt{S})$

$.3422 = 1.49\pi^2/128(.012)\ (12^{8/3)})(\sqrt{S})$

S= $4.03 * 10^{-10}$

This slope shows that our pipes will be running almost completely horizontal at a slope of zero.

SKETCH


E Dean Keeton St
E Dean Keeton St
CONNECTION TO DRAINAGE
WALLER CREEK
KEY
INLETS =
PIPES =

AMOUNT OF WATER ADDED TO THE CREEK

Total Q

= .3422 ft^3/sec *60, *60, *24, = 29,566.08 ft^3 of water runoff in 24 hr period of 100 year flood event

Drainage Plan:

- Runoff from roof will feed into creek.
- Runoff from back side of dorm will feed into creek.
- Runoff from front side and courtyard of dorm will feed into Dean Keeton and San Jacinto drainage pipes.

Runoff to Creek

= 24,649.92 ft^3 (from building) + 1,642.17 ft^3 (from back side) = **26,292.09** ft^3

Runoff to DK & SJ drainage

= **3265.92** ft^3 (front side)

SECTION 3: SIGNAL DESIGN

OVERVIEW

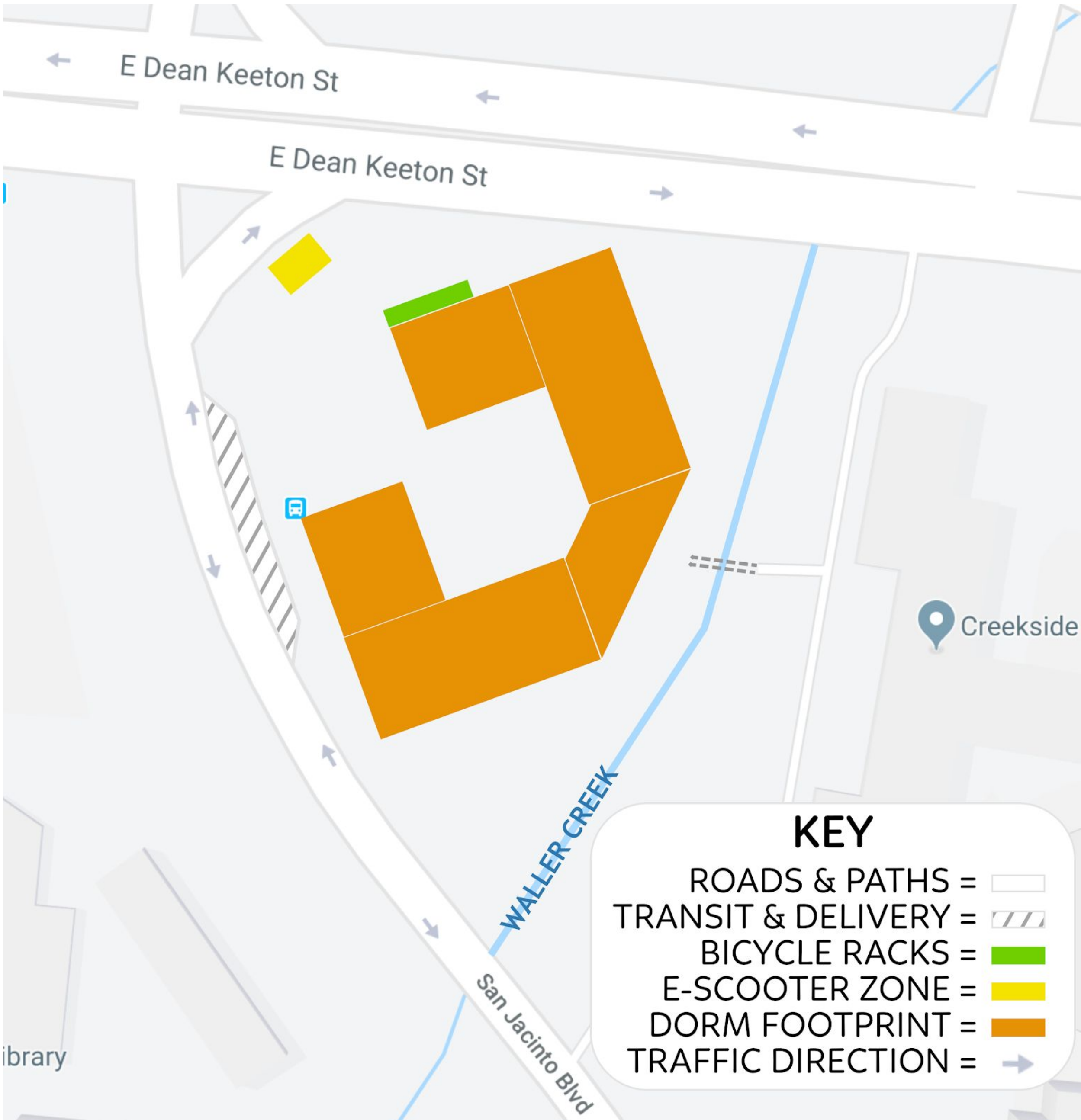
Develop a transportation access plan approved by the University of Texas and the City of Austin.

CHALLENGES

Managing transportation access can be a very difficult task as it entails quite a few logistical challenges; furthermore, some of the major obstacles associated with providing an efficient transportation system to students in this dormitory with the given constraints and location include:

- *Congestion During Peak Traffic Hours* - As a result of more students owning bikes, cars, and e-scooters, traffic conditions for vehicles approaching the Dean Keeton Street and San Jacinto Boulevard intersection will worsen. Although the delay time can be altered, a large volume of automobiles will continue to access routes with limited, static capacity causing delays during peak hours to worsen.
- *"Moov- In and Out" Days* - Moving days already cause a significant increase in traffic. By adding the new dormitory southeast of the Dean Keeton Street and San Jacinto Boulevard intersection, traffic within the area will increase the extent to which vehicles pass through the area due to limited space near the San Jacinto Garage in combination with continuous incoming and outgoing traffic.
- *Congestion on Sidewalks (Public E-Scooters)* - An increase in student population within the area entails a greater demand for publicly available electric scooters, provided by companies such as Lime and Bird, to conveniently reach classes. Populating e-scooters in areas surrounding the new dormitory can inhibit transportation systems from functioning effectively.
- *Access for Students with Disabilities* - Because sidewalks and roads are currently built to primarily support the majority of walking students, disabled individuals will find it difficult to utilize existing infrastructure in the area due to the lack of accessibility features. ADA approved design features will be required to assist in better adapt the space surrounding the dormitory to fit the needs of the student body as a whole.
- *Infrastructural Stress* - Pressure placed on transportation system surrounding the new dorm will dramatically increase as more traffic moves through the area. It is imperative to recognize that more funds must be allocated towards maintenance of existing infrastructure in the long run.

SITE SKETCH


E Dean Keeton St
E Dean Keeton St
WALLER CREEK
San Jacinto Blvd
Creekside
ibrary
KEY
ROADS & PATHS =
TRANSIT & DELIVERY =
BICYCLE RACKS =
E-SCOOTER ZONE =
DORM FOOTPRINT =
TRAFFIC DIRECTION =

CALCULATIONS

Lane group	Base Volume	New Volume	Green Time	Timing plan (green/yellow time)	Saturation Flow	Capacity	*X*	Delay
EB, L	39	47	16	16/5	1718	208.24	0.2247	3.0510
EB, TR	491	737	29	29/4	3436	754.88	0.9757	46.9487
WB, L	59	65	16	16/5	1768	214.30	0.3028	4.1752
WB, TR	457	503	29	29/4	3536	776.85	0.6471	4.7378
NB, L	91	137	16	16/5	1805	218.79	0.6239	13.9215
NB, TR	75	90	29	29/4	1805	396.55	0.2270	2.3366
SB, L	132	145	16	16/5	1212	146.91	0.9884	138.4009
SB, TR	74	81	29	29/4	1212	266.27	0.3057	4.4923

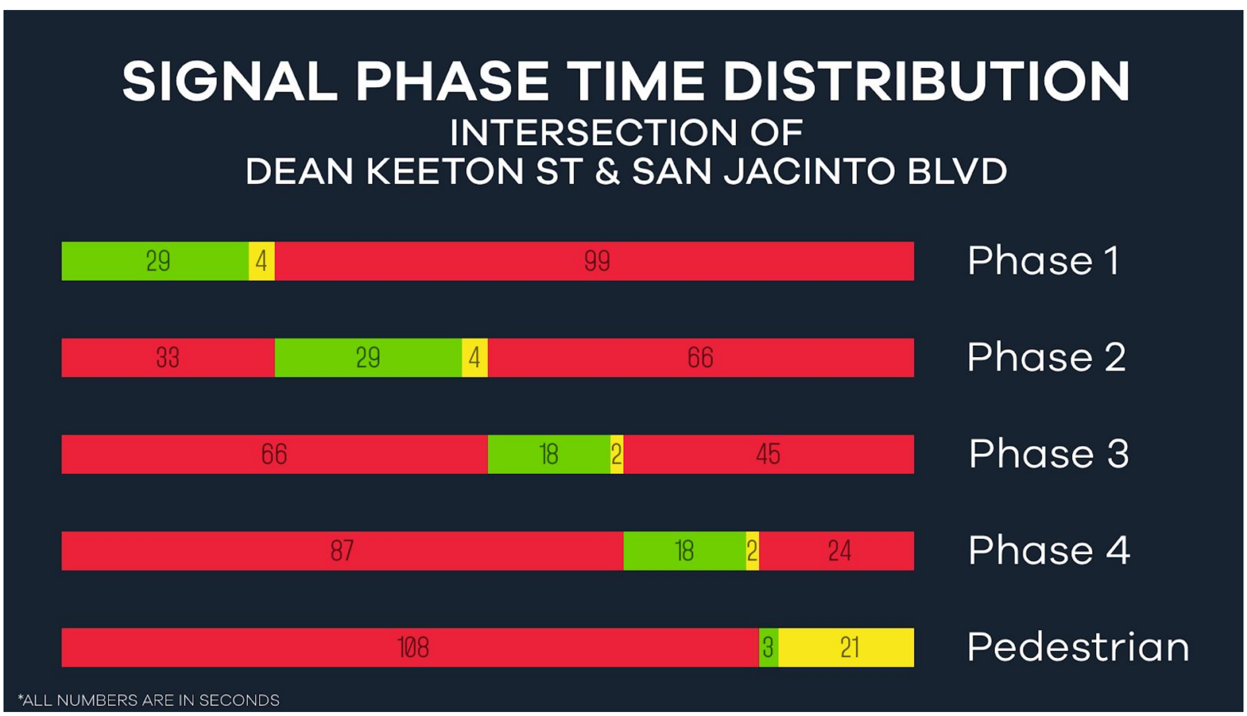
ASSUMPTIONS:

1. Assume since the new dorm is primarily targeted towards upperclassmen, majority of these students will have cars on campus. These students will park their cars at the San Jacinto Garage.
2. The amount of traffic northbound and eastbound will be most directly affected by the increase in drivers from the new dorm. In particular, the traffic northbound turning left and eastbound turning right will increase significantly due to students traveling from the San Jacinto Garage towards campus and from campus back to the garage respectively.
3. The amount of traffic will increase overall for all lane groups as a result of the increased number of drivers in the area.
4. New Volume counts are as follows:
    a. A 50% increase for traffic northbound turning left
    b. A 50% increase for traffic eastbound traveling through and turning right
    c. A 20% increase for remaining traffic northbound and eastbound
    d. A 10% increase for all other turning groups.

DISCUSSION OF BROADER ISSUES

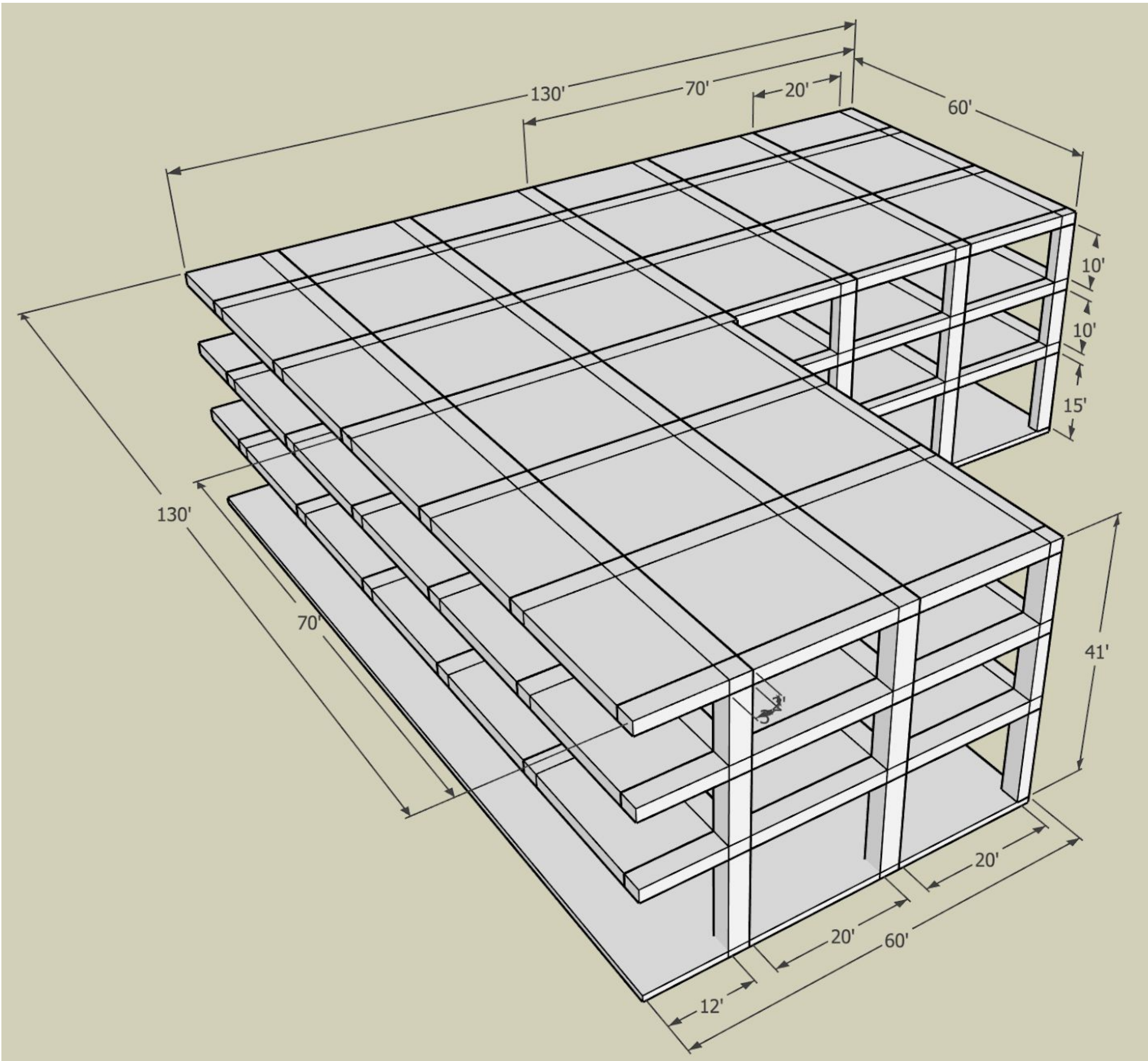
Many issues arise from the implementation of a dormitory causing increased population and congestion in terms of transportation. The addition of 250+ students will increase foot, bike, e-scooter, and vehicle traffic at and around the intersection of Dean Keeton Street and San Jacinto Boulevard. People that currently use sidewalks and intersection will now be affected by an increase in congestion and must accommodate for extra time it takes to travel through and around the dormitory. This effect will be evident across various modes of transportation including vehicles at the intersection, cyclists and e-scooters in bike lanes, and pedestrians on sidewalks.

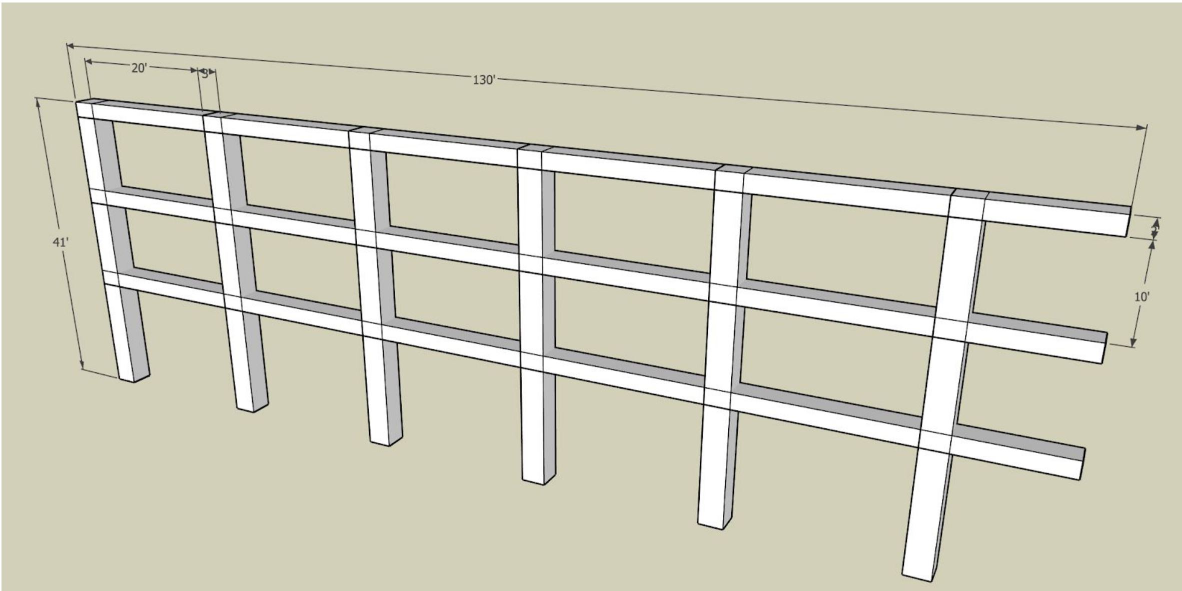
The San Jacinto parking lot will now accommodate the residents of the dorm who brought a car. This sudden growth in the number of vehicles could potentially cause a rise in garage parking price, increase the time it takes to enter and exit the garage, as well as possibly decrease the chances of finding parking in the garage (for students, visitors, and faculty members).

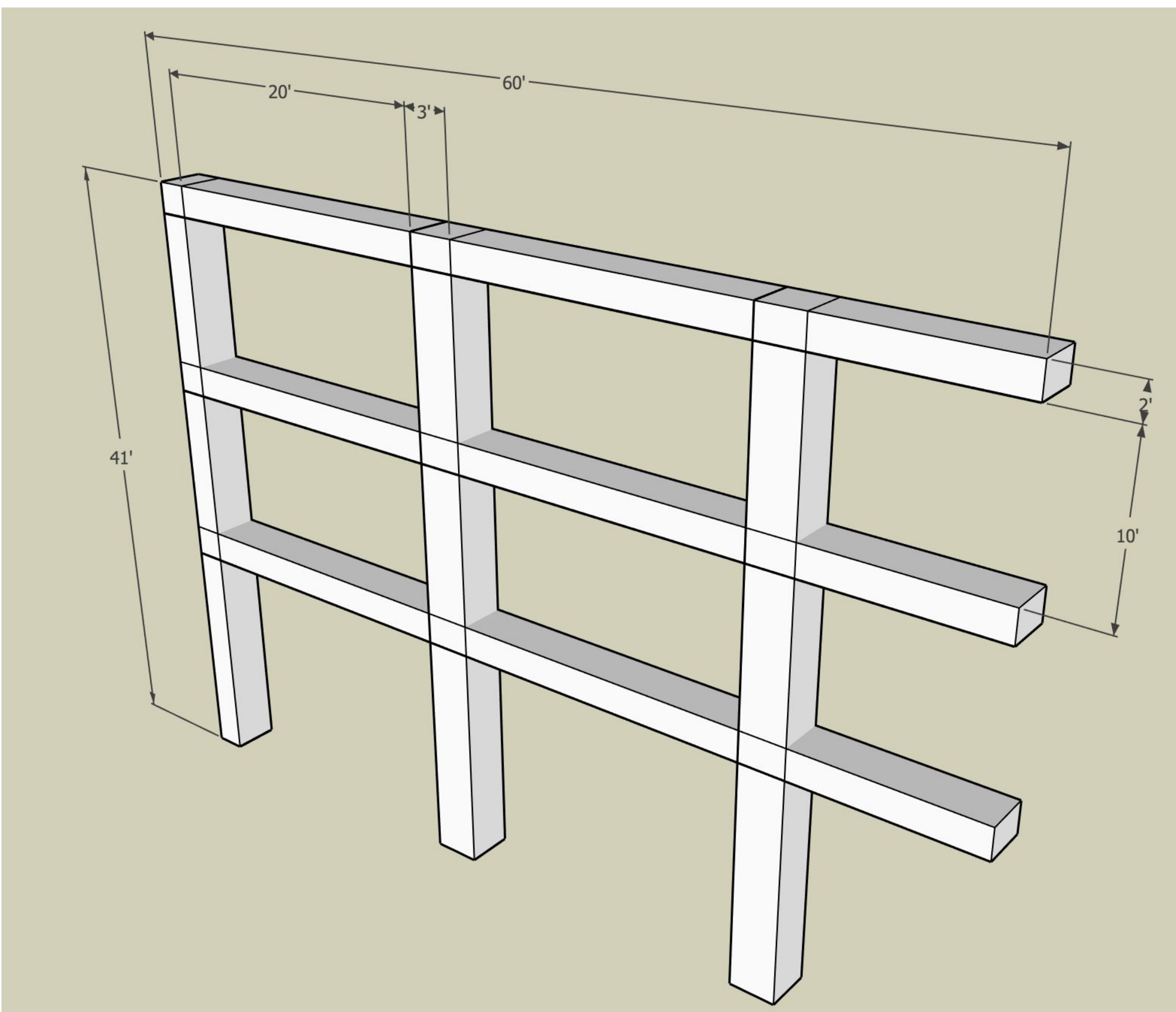


SECTION 4: COLUMN DESIGN

3D MODEL




20'
3'
130'
41'
10'


60'
20'
3'
41'
2'
10'

EXPLANATION

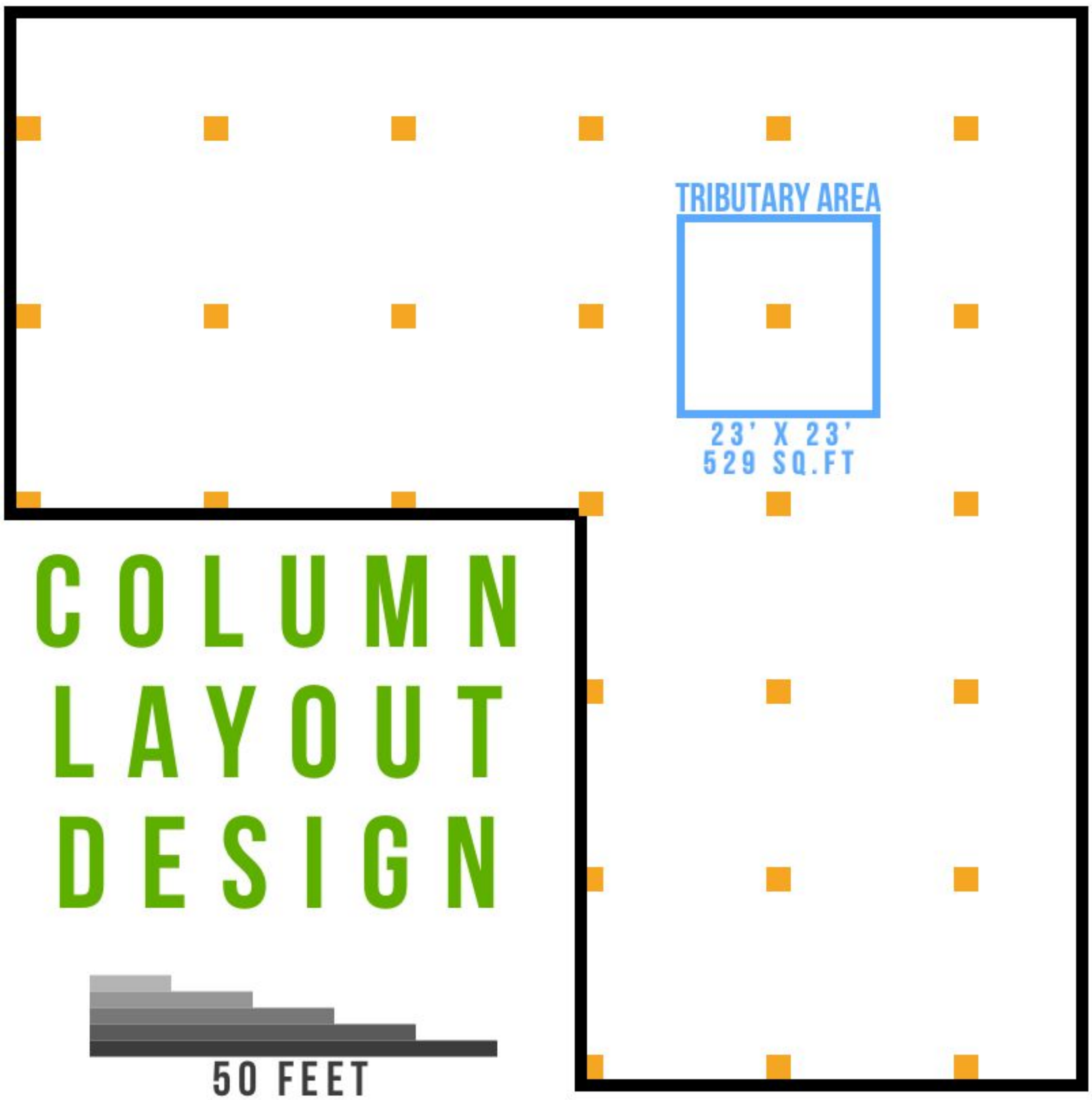
1. All elements of live loads (ex. residents, furniture, etc.) transfer loads directly to the foundation on ground floor and to horizontally placed steel beams on second and third floors
2. Horizontal beams transfer loads to concrete vertical columns (3’x3’) connected by fix-fix joints located 12 or 20 feet apart based on position on floor and frame
3. Vertical columns transfer load to the concrete foundation
4. Foundation exerts load into the ground

DISCUSSION OF FRAME FAILURE

It is possible for the frame to fail due to a number of reasons such as flexure, shear, or buckling

- Flexural failure could occur if the columns are subject to bending stresses. Tension and compression forces can lead to buckling.
- Shear failure could occur in connections between members such as a member to column connection. If the force the connection can withstand is not properly taken into account, failure is more likely to occur.
- Buckling could occur due to the forces applied causing the column to bend or deflect laterally. This will be a problem if the compressive loads reach a certain critical value causing the column to undergo a large lateral deflection.

Column Layout Design



SECTION 5: FOUNDATION

Description

Our goal is to determine the size and depth of a footing upon which a column can be placed which can effectively and safely sustain the a total load of 25 kips without failing. The main concern in the design is avoiding the general shear failure of the footing. The pressure placed on the soil must not exceed the bearing capacity of the soil underneath to avoid depression. The construction of the foundation must comply with the given constraints:

1. Assume soil will be backfilled after excavation and placement of the footing
2. Footing must be at least 2 feet below the ground level
3. Footing must be square with no more 8 feet x 8 feet in size
4. The pit to be excavated to place the footing must be at least 1 feet larger on each side compared to the size of the footing
5. The cost of excavation, scaffolding etc. is $20 per cubic foot
6. The cost of the footing is $1500 fixed price plus $1000 per square foot of the footing size
7. Maximum load should be less than the footing's bearing capacity

Approach

The first step in deciding on dimensions and depth of our footing (foundation) was to input 9 different sets of values for length, width, and depth of the footing using $D_f/B \leq 2.5$. The length and width were increased by increments of 1 from 1 to 8 and depth was increased by increments of 2.5 to find the closest whole number solution that was below the capacity factor and satisfied the problem constraints. We began by optimizing the depth to find a set that satisfied the calculated bearing capacity factor to be under 5.14. Then, we optimized the length and width dimensions to bring down the total cost without sacrificing the other numerical and dimensional values. Our primary approach to solve the problem statement was to optimize independent variables to find the strongest, economical formula for our footing.

Calculations

S_u	undrained shear strength (psf)	400		
N_c	bearing capacity factor	5.14		
sc	shape correction factor (= 1.2)	1.2	1.2	1.2
B	shorter dimension of footing (ft)	5	5.89	6
L	longer dimension of footing (ft)	5	5.89	6
d_c	depth correction	3.5	3.94	4
D_f	depth of footing (ft)	12.5	14.71	15
D_f / B	(cannot be > 2.5)	**2.5**	**2.5**	**2.5**
TL	total load carried by columns (25 kips to lbs (force))	25000		
q_{ult}	bearing capacity of the soil (psf) (safety factor of 2)	4317.6	4863.81	4934.4
H	calculated bearing capacity factor	5.8	5.13	5.07
C_f	footing cost ($)	26500	36139.82	37500
C_a	additional cost ($)	10440	15848.43	16660
C_t	total cost ($)	36,940	51,988.25	54,160

Conclusion

Evident from all the activities performed by TEK40, it is feasible to build a dormitory on the site located at the southeast corner of Dean Keeton & San Jacinto that complies with the UT master plan, and is able to follow all the constraints enforced by the university.

It will be able to house 252 students with adequate room for each student, 400 ft^2 suits, and 250 ft^2 regular rooms, will integrate the Core Campus and Central Campus, Waller Creek glorified, will maintain a human scale, the design will make the building seem as a “progressive and future-oriented institution.” The location of the elevator lobbies, trash, laundry, and study rooms is planned in accordance to provide great comfort to the residents.

In the case of a 100-year rain event, the site will effectively handle the runoff. The plan will allow for adequate drainage. Runoff from roof and the back side of dorm will feed into the creek. The water from front side and courtyard of dorm will feed into Dean Keeton and San Jacinto drainage pipes. The amount of water run off to the creek, 24,649.92ft^3 (from building) + 1,642.17ft^3 (from back side) will amount to 26,292.09ft^3. The amount being fed to Dean Keeton and San Jac Blvd will equal 3265.92ft^3 (front side). All four of the pipes installed horizontally with slope $4.03 * 10^{-10}$ will be able to handle these amounts.

The new dormitory will be the cause of increased traffic, but TEK40’s proposed new signal timings resolves such issues without much inconvenience to the general public. Challenges such as, congestion during peak traffic hours, “Moov- In and Out” days, congestion on sidewalks (public e-scooters), access for students with disabilities, and infrastructural stress are resolved with these proposed traffic signal times, as the experiment suggests:

Cycle length - 132 secs

Phase 1 - G: 29 Y: 4 R: 98

Phase 2 - R: 33 G: 29 Y: 4 R: 66

Phase 3 - R: 66 G: 16 Y: 5 R: 45

Phase 4 - R: 87 G: 16 Y: 5 R: 24

Pedestrian- R: 108 G: 3 Y: 21

The proposed structure and frame design accounts for all of the elements of live and dead loads that transfer to the foundation and the beams on the top two floors. The design by TEK40 concrete columns, 3x3 feet, fixed jointed, placed 12 to 20 feet apart have the capacity to bear all such loads without failing, as evident from the studies. They stand no chance of flexure, shear, or buckling due to lateral deflection.

Lastly, the company's plan for the foundation proves it can safely bear the load from a column without failing. The main aspect for foundation design was analyzed extremely carefully, which required calculations for the area required to distribute the load of the column onto the soil underneath it, the size of the footing is adequate to avoid shear failure. All while following these constraints:

The footing needs to be a square that doesn't exceed 8 feet x 8 feet in size.

The pit excavated was at least 1 feet larger on each side compared to the size of the footing.

The excavation cost, scaffolding etc. is $20 per cubic foot.

The cost of the footing is $1500 fixed price plus $1000 per square foot of the footing size

The formula utilized in this experiment consisted of $q_{ult} = S_u N_c \, sc \, d_c$ All of the values derived for the variables are presented in the tables in Section 5, with certain values being optimized to meet the constraints provided.

APPENDIX A

tˇp (reaction time)	0.3 secs
V (vehicle speed)	NB: 15 mph SB: 30 mph EB: 30 mph WB: 30 mph
a (vehicle deceleration rate)	11.15 mps^2
w (intersection width)	75 feet
l (vehicle length)	15 feet
YT (yellow time)@ 15mph	2.377456176 secs
YT (yellow time)@ 30mph	4.318548716 secs
PGT (green time)	17.83296644 secs
PWS (pedestrian walking speed)	4.95 mph

C (cycle length)

132 secs

Cycle Time Distribution by Light				
Phase 1	29	4	98	
Phase 2	33	29	4	66
Phase 3	66	18	2	45
Phase 4	87	18	2	24
Pedestrian	108	3	21	

Buckling			
***F* (maximum load/capacity)**	**317048.5649**	Factor of Safety	2
E (modulus of elasticity)	2000000		
I (moment inertia)	6.75	***P* (demand)**	**169280**
KL (effective length) (ft)	0.5		
L (height of column) (ft)	41	Tributary area (ft^2)	529
A (cross-sectional area) (ft^2)	9		
Compressive failure (psf)	**35227.61833**	Sum of loads (psf)	160

Dead Loads (psf)		Live Loads (psf)	
Brick Veneer (walls)	45	Bedroom areas	30
Clay/tile Roof + Soil	40	Roof	20
Ceramic Tile (floor)	15	Attic	10

S_u	undrained shear strength (psf)	400								
N_c	bearing capacity factor	5.14								
sc	shape correction factor (= 1.2)	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
B	shorter dimension of footing (ft)	1	2	3	4	5	5.89	6	7	8
L	longer dimension of footing (ft)	1	2	3	4	5	5.89	6	7	8
d_c	depth correction	1.5	2	2.5	3	3.5	3.94	4	4.5	5
D_f	depth of footing (ft)	2.5	5	7.5	10	12.5	14.71	15	17.5	20
D_f / B	(cannot be > 2.5)	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**	**2.5**
TL	total load carried by columns (25 kips to lbs (force))	25000								
q_{ult}	bearing capacity of the soil (psf) (safety factor of 2)	1850.4	2467.2	3084	3700.8	4317.6	4863.81	4934.4	5551.2	6168
H	calculated bearing capacity factor	13.5106	10.1329	8.1064	6.7553	5.7935	5.1399	5.0665	4.5035	4.0532
C_f	footing cost ($)	2500	5500	10500	17500	26500	36139.82	37500	50500	65500
C_a	additional cost ($)	360	1260	3040	6000	10440	15848.43	16660	24960	35640
C_t	total cost ($)	2860	6760	13540	23500	36940	51988.25	54160	75460	101140
Adjustable Values		Viable Values			Non-Viable Values			Optimized Footing		

GOALS

- Convenience
- Sustainability
- Comfort
- House 250 students
- Incorporate Waller Creek
- Keep traffic increase to minimum
- Compliance with the UT Master Plan

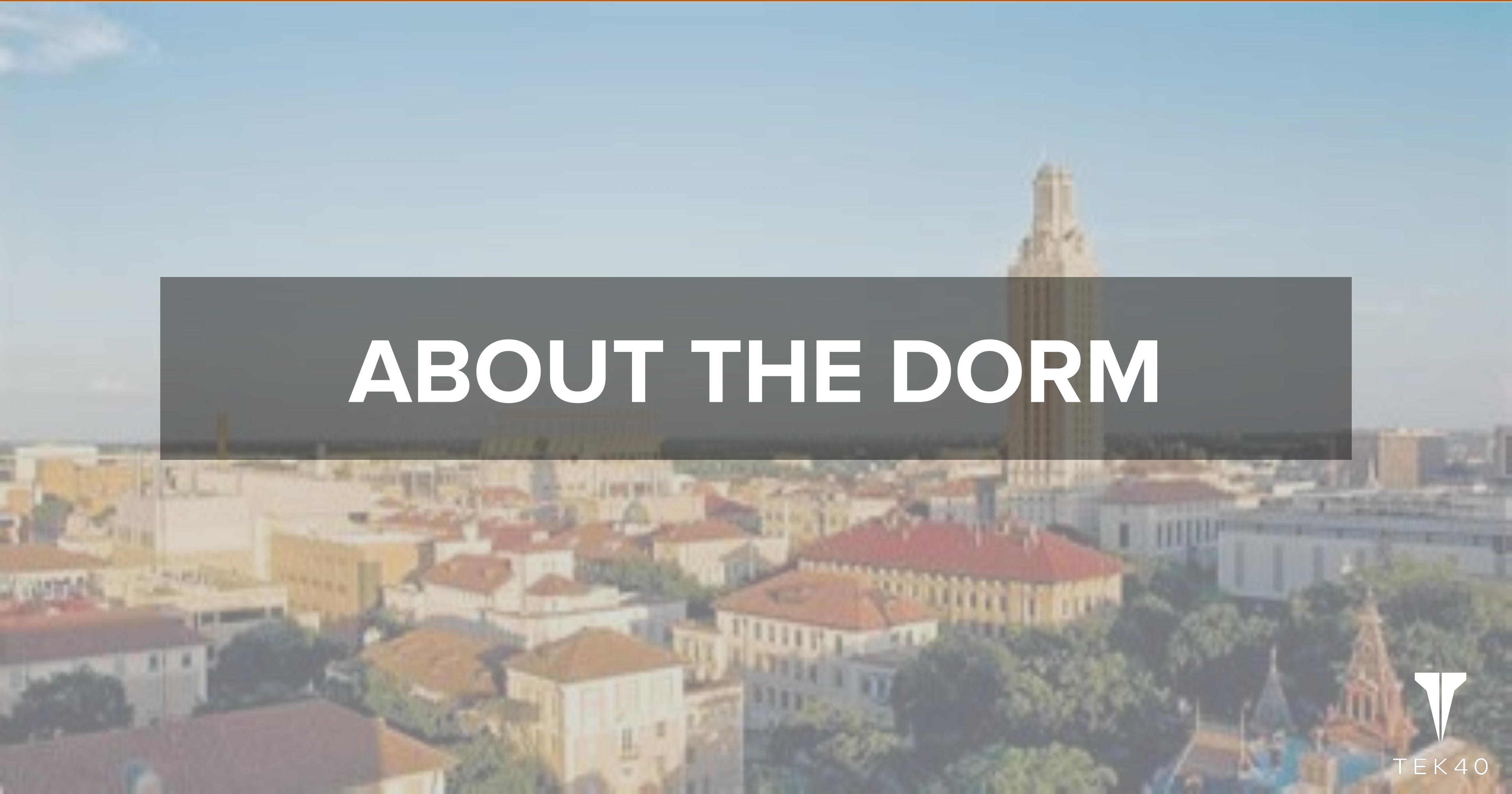
SITE INFO AND ANALYSIS

EXISTING

- Bordered by Dean Keeton, San Jacinto, and Waller Creek
- Plot has volleyball court, few tables, scattered light poles
- Bridge connecting plot and Creekside Dormitory
- Currently bus stop on San Jacinto replaced by light rail station per UT Master Plan

PROPOSED

- Re-timing of intersection light
- Implementation of flood mitigation
- Creekside renovation
- Tree removal



ABOUT THE DORM

Features and Technologies

- Modern architecture
- Diamond shape layout with central atrium (food stands)
- 3 floors with sky bridge on 2nd and 3rd
- 4 elevators and stairwells
- Modern amenities; green roof
- All rooms have windows
- Porous concrete for flood mitigation
- Gravel path, benches, tables, and hammocks around creek

Per Person = 125 ft^2	Elevator Lobby & Stairs= 400 ft^2	Suite = 500 ft^2
Regular Room = 250 ft^2	Study Lounge = 500 ft^2	Suite Central Bath = 100 ft^2
Connecting Bath = 50 ft^2	Single Room Bath = 25 ft^2	Laundry Room = 300 ft^2
Trash Room = 200 ft^2		

10 Suits with Bath	37 Regular Rooms	Single Bath	Connecting Bath
10 x 600	37 x 250	3 x 25	17 x 50
Total= 16,175 ft^2			
Laundry Room	Trash Room	Elevator Lobby w/ Stairs	Study Lounge
2 x 300	2 x 200	2 x 400	2 x 500
Total = 2800 ft^2			
Total for 2nd floor w/o hallways = 18,975 ft^2	Same Layout for 3rd floor, so same area.		

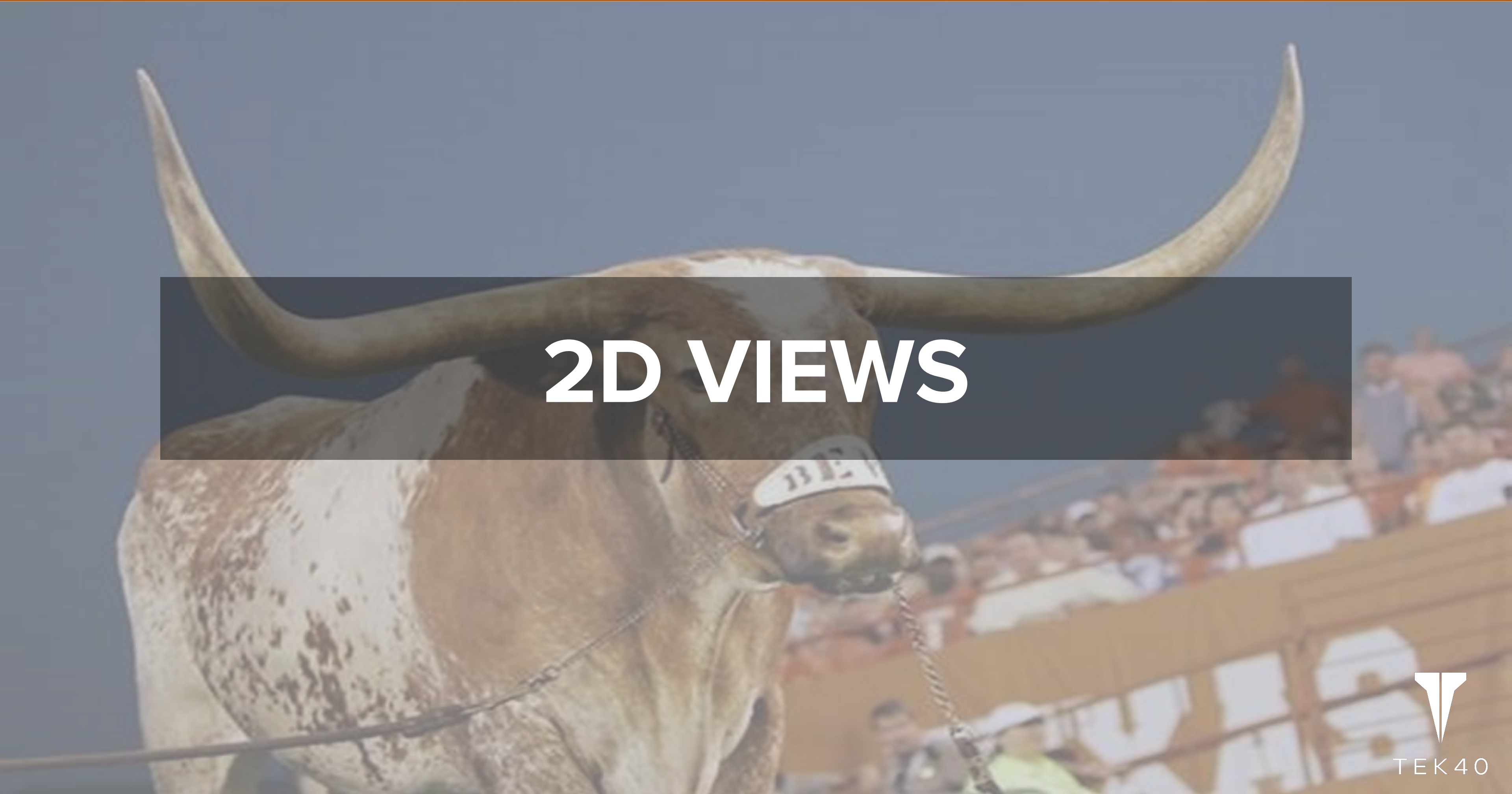
Suites	Trash Room	Laundry Room
6 x 600	300	300
Total 1st floor (only residence) = 4,100 ft^2	Total Building area	

Students in Suites	Students Regular Rooms
26 suites x 4 students	74 rooms x 2 students
Total = 252 Students	Bike Racks needed = 4 with 8 slots each

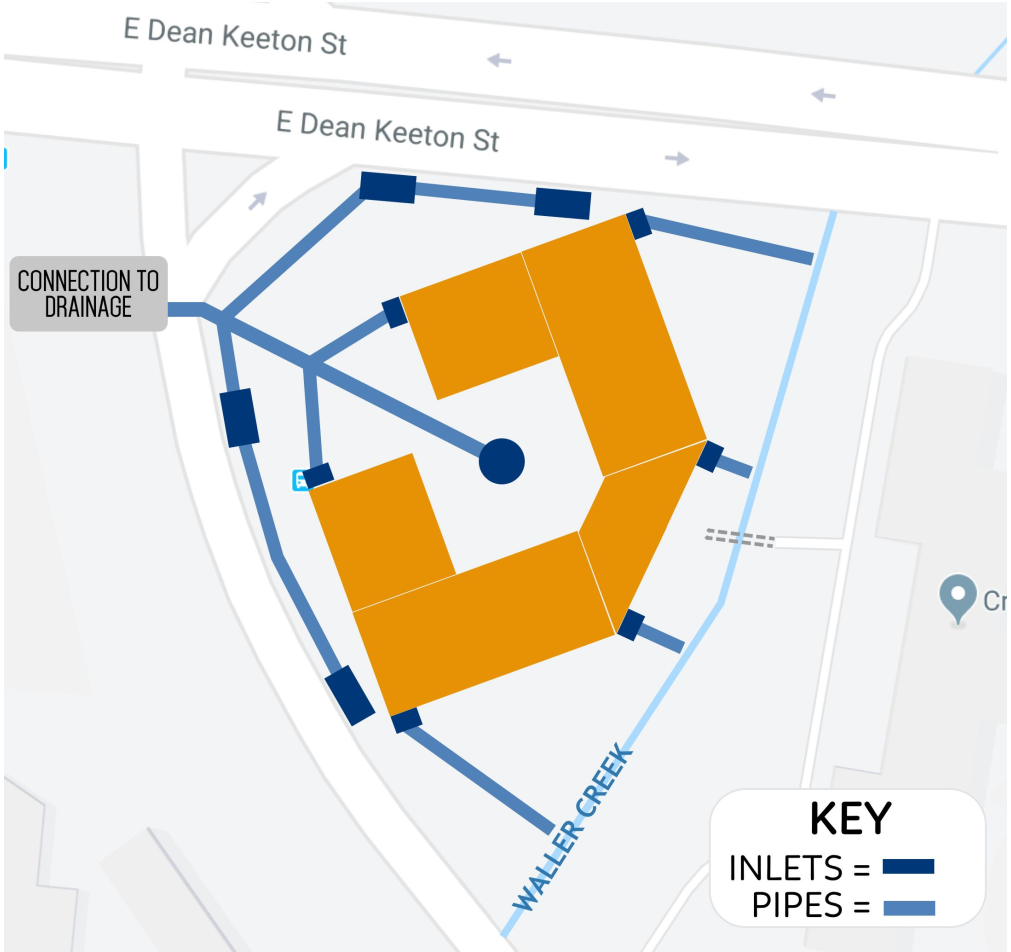
Total Building area w/o skybridge = 24000 ft^2/ floor Total 3 floors= 72,000 ft^2	Calculated area required total for all floors = 42,050 ft^2

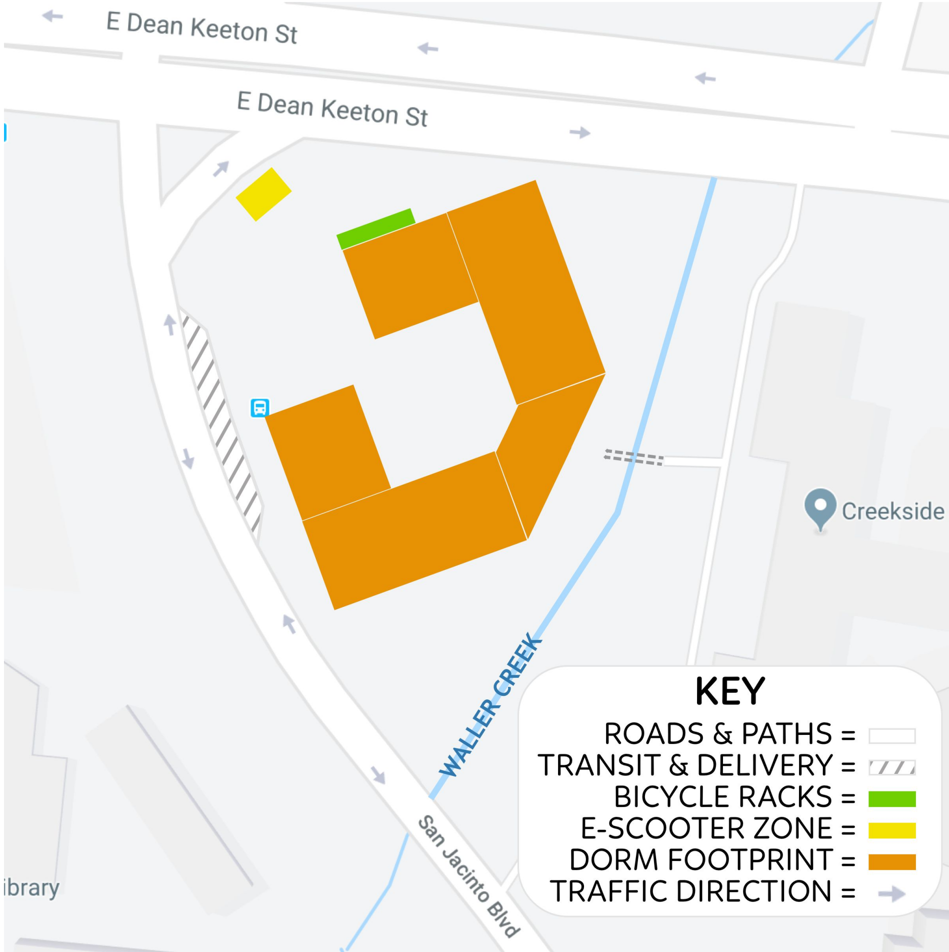
TEK40

2D VIEWS

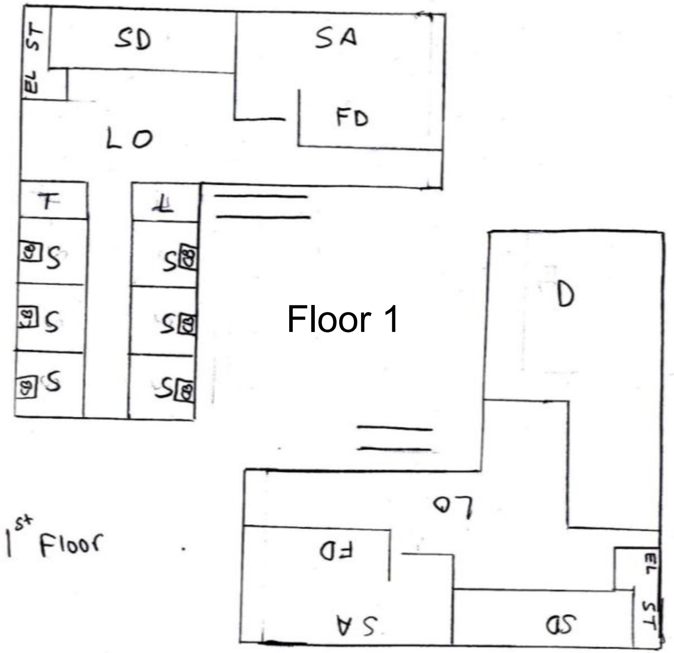


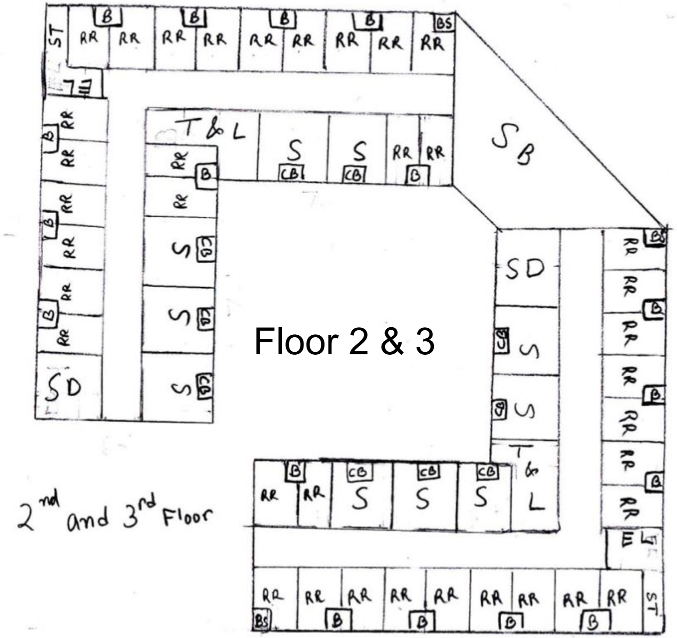

E Dean Keeton St
E Dean Keeton St
130’
60’
130’
60’
70’
70’
135°
30√2’ ≈ 42.42…’
30’
60’
70’
70’
30’+60√2’
≈ 114.85…’
45°
130’
60’
130’
Creekside
WALLER CREEK


E Dean Keeton St
E Dean Keeton St
CONNECTION TO DRAINAGE
WALLER CREEK
KEY
INLETS =
PIPES =


E Dean Keeton St
E Dean Keeton St
Creekside
WALLER CREEK
San Jacinto Blvd
ibrary
KEY
ROADS & PATHS =
TRANSIT & DELIVERY =
BICYCLE RACKS =
E-SCOOTER ZONE =
DORM FOOTPRINT =
TRAFFIC DIRECTION =

TEK40





EL = Elevator lobby
ST = Stairs
S = Suite
L = Laundry
T = trash

FD = Front Desk
D = Dining
SA = Sitting Area
SD = Study Area
LO = Lounge

CB = Central Bathroom
—— = 1 Bike Rack with 8 slots.

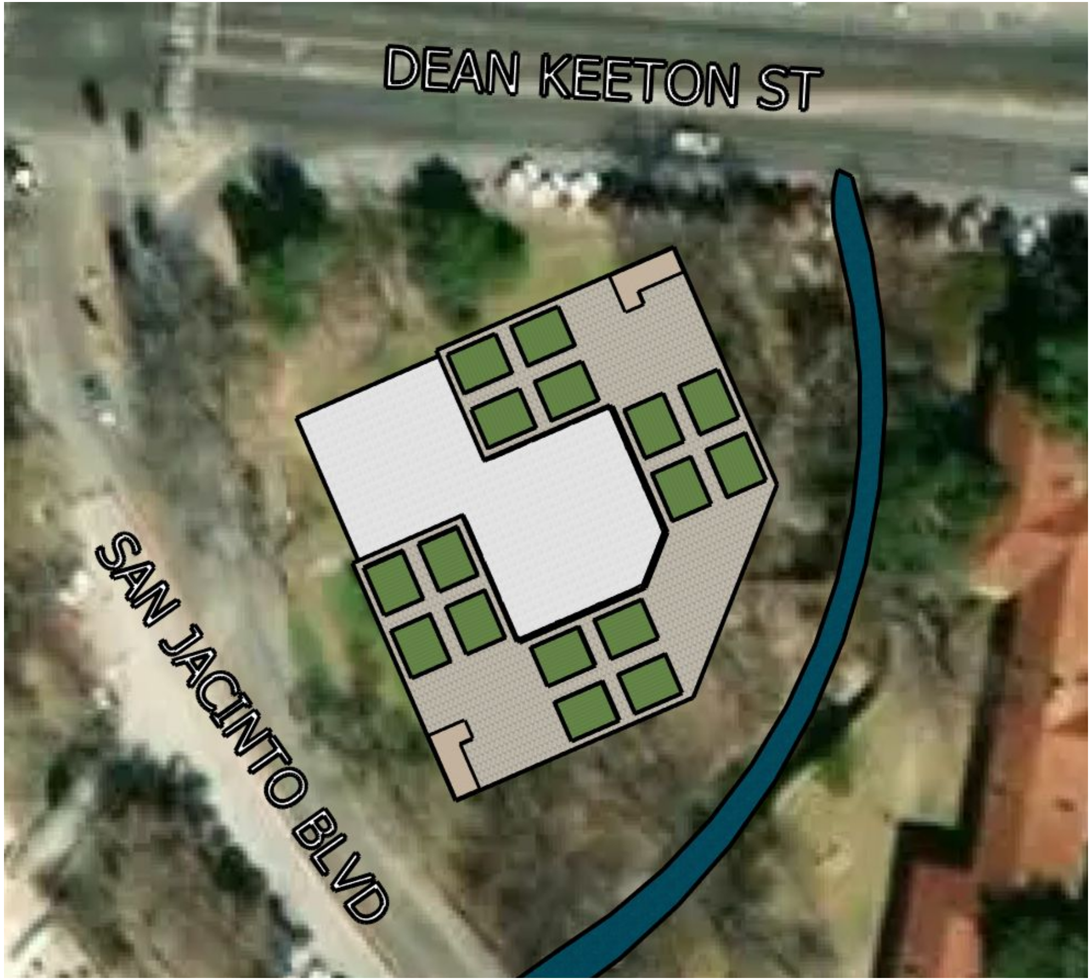
EL = Elevator lobby
S = Suite
RR = Regular Room
ST = Stairs
SD = Study

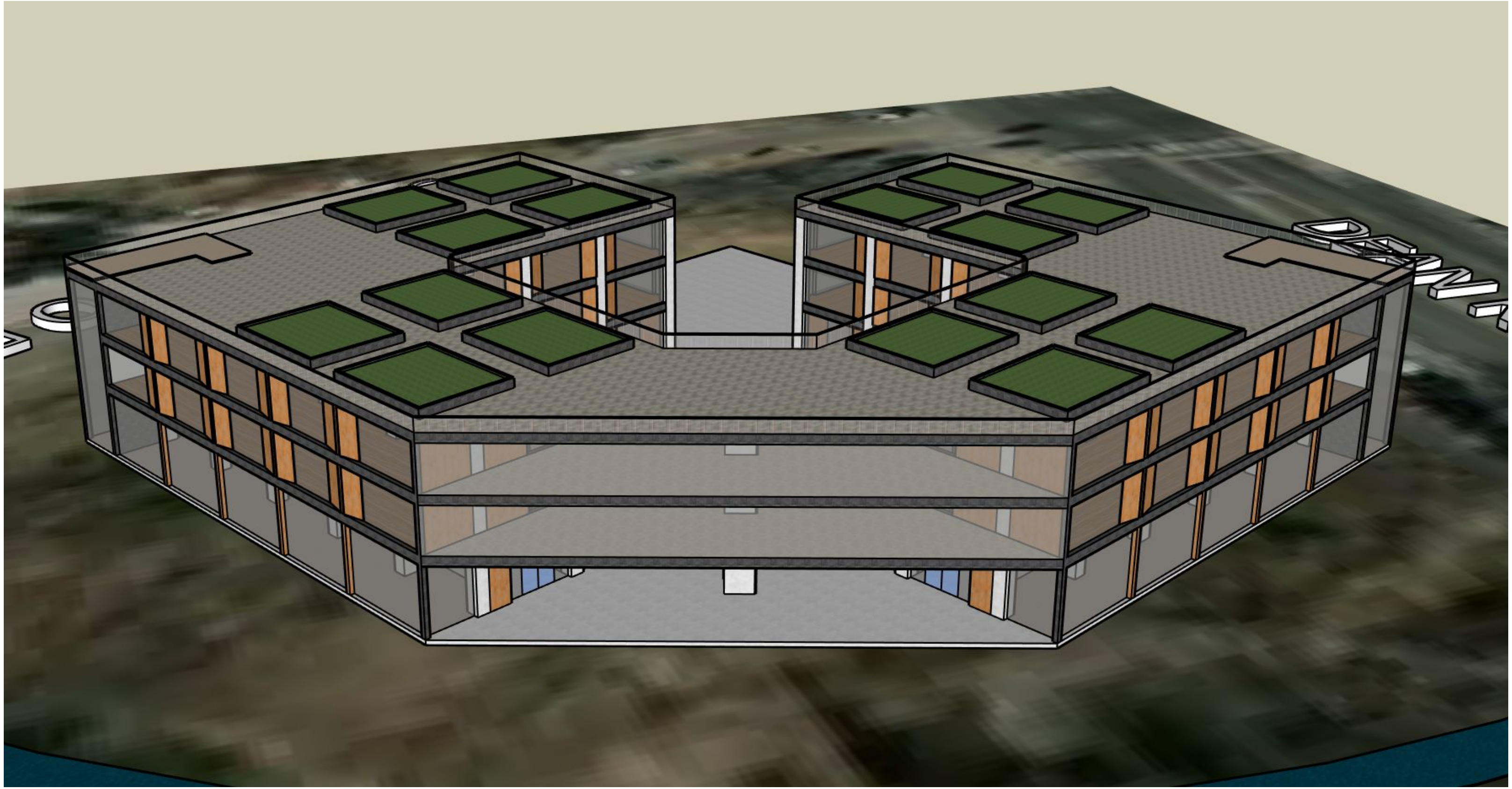
L = Laundry
SB = Sky Bridge
B = Bathroom
CB = Central Bath

BS = Batroom for Single room

TEK40

3D MODEL


DEAN KEETON ST
SAN JACINTO BLVD



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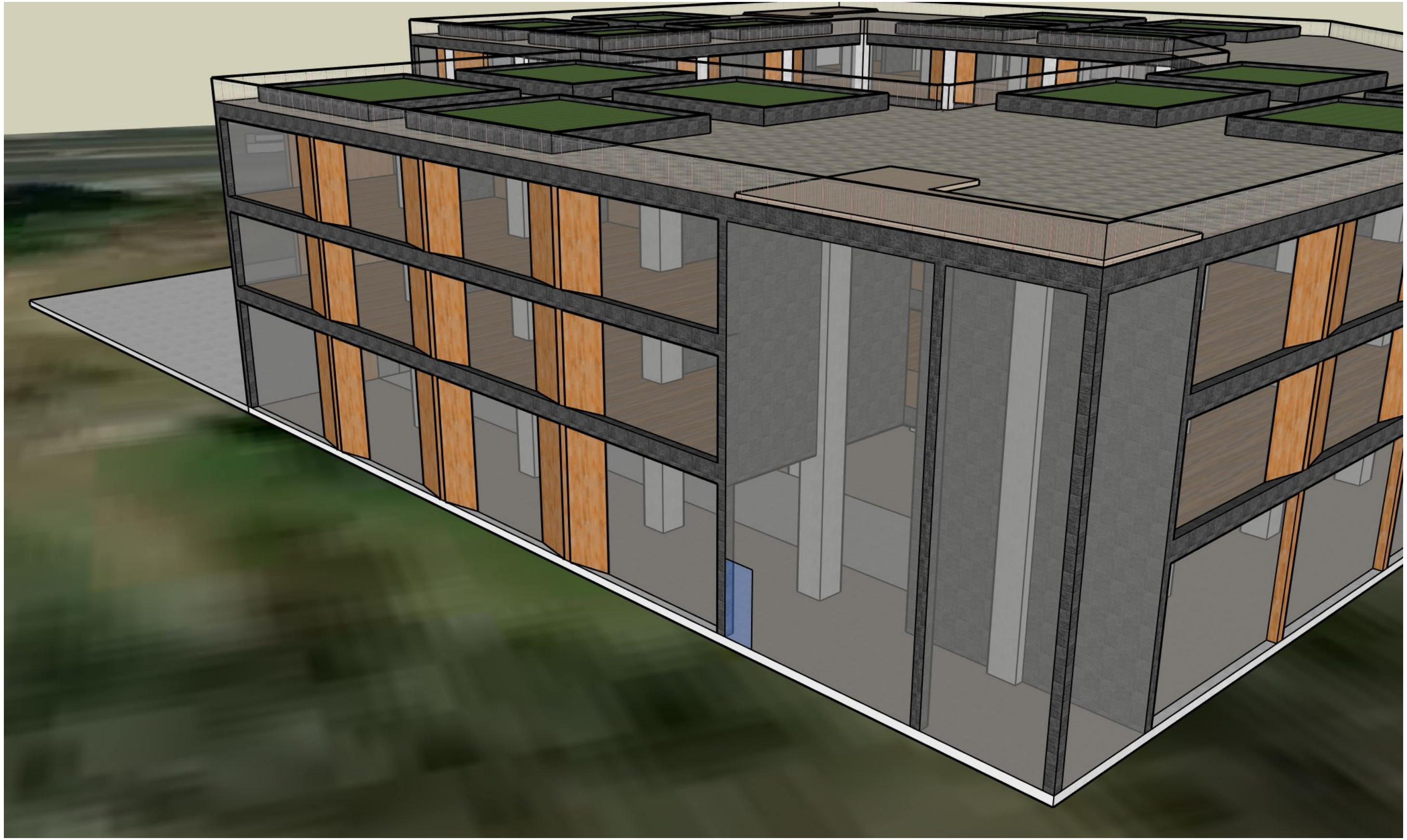
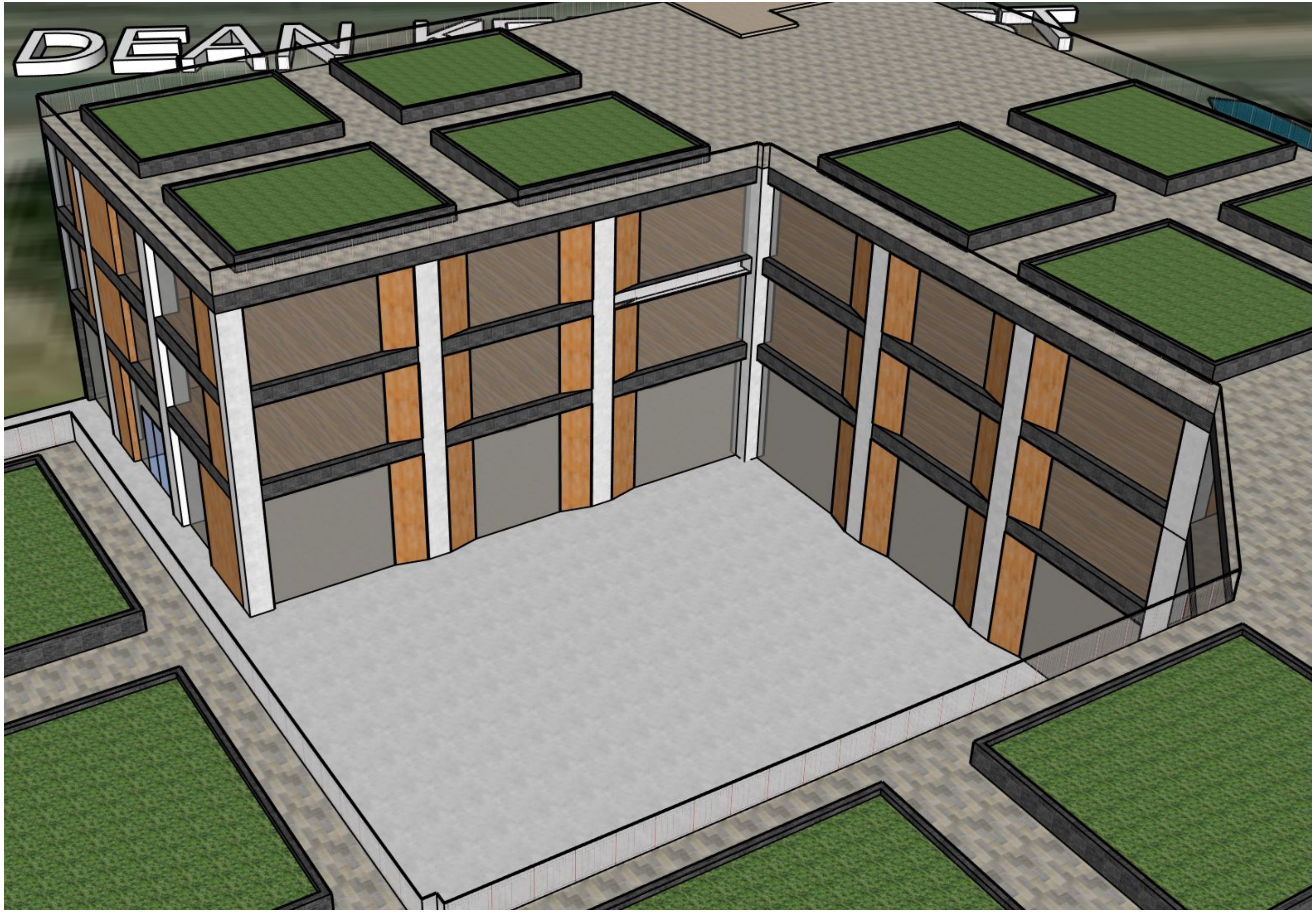
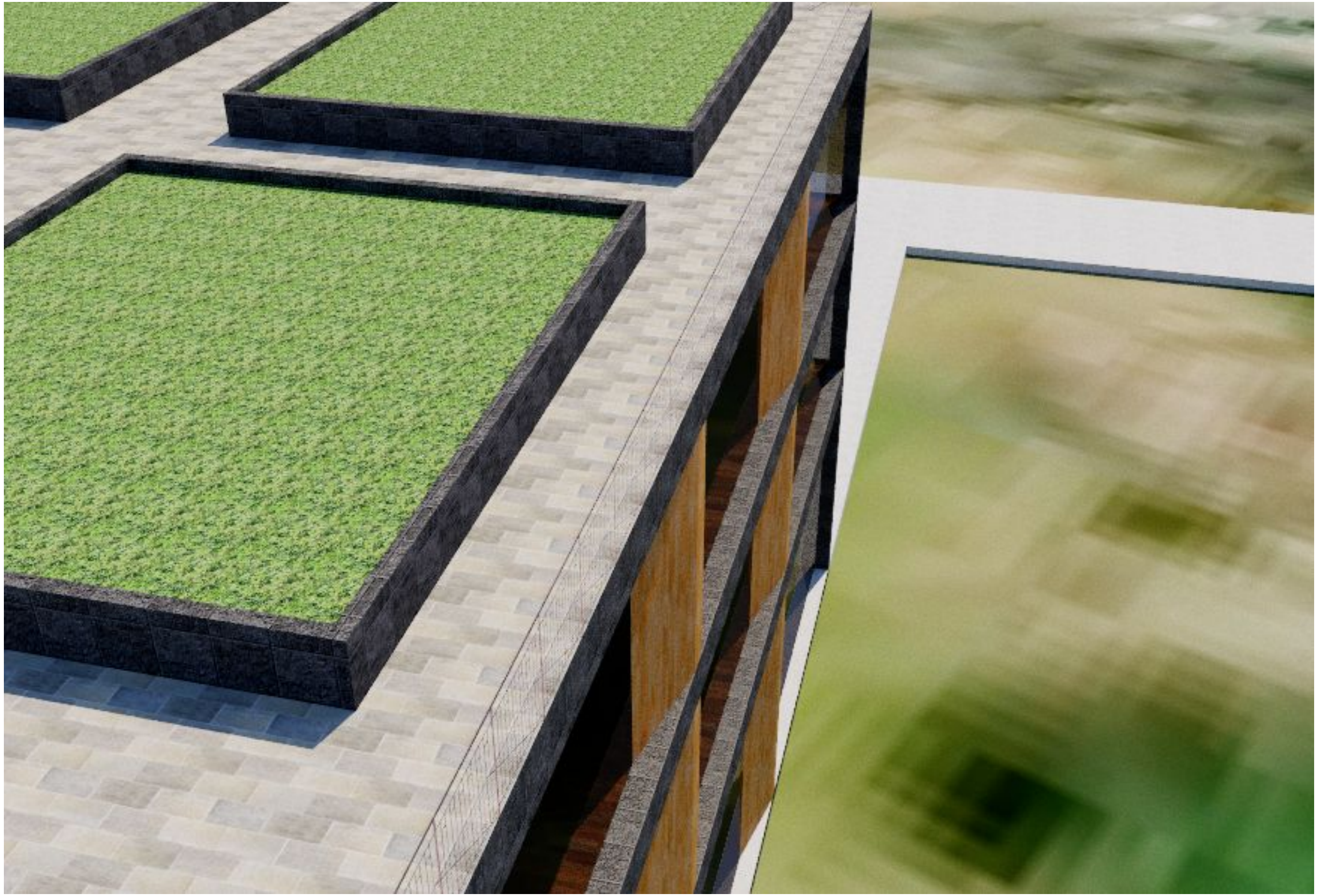



DEAN

RENDERED IMAGES

TEK40


DEAN KEETON ST
SAN JACINTO BLVD



ETHICS AND STAKEHOLDERS

- Compliance with the Engineering Code of Ethics.
  - **Safety, health, and welfare of the public**
  - **Focus on the principles of sustainable development**
- Who are the stakeholders?
  - The University of Texas
  - Public that utilizes the roads involved
  - Students
  - Texas government
  - Other dormitories

CHALLENGES

- Elevation leveling
- Removing trees surrounding property
- Room type selection to effectively house at least 250 students
- Placement of flood pipes
- Exclusion of the underground garage
- Consideration of increased vehicle and pedestrian traffic
- Beam size and design
- Foundation and footing design