APPENDIX A: STRUCTURAL

A.1 Combination Loads

Combination Loads

Loads (kips)	
D	
L	
L_r	
S	28.91
W	16.57
E	

Building Dimensions	
Length (ft)	55.33
Width (ft)	52.25
Height (ft)	18.00

Roof Area (ft^2)	
A_r	2891

Wall Area (ft^2)	
A_{north}	996
A_{south}	996
A_{east}	941
A_{west}	941

LRFD		
1.4D	1	0.00
1.2D + 1.6L + 0.5 (L_r or S or R)	2	14.45
1.2D + 1.6(L_r or S or R) + (L or 0.5W)	3	54.54
1.2D + 1.0W + L + 0.5(L_r or S or R)	4	31.02
1.2D + 1.0E + L + 0.2S	5	5.78
0.9D + 1.0W	6	16.57
0.9D + 1.0E	7	0.00

ASD		
D	1	0.00
D + L	2	0.00
D + (L_r or S or R)	3	28.91
D + 0.75L + 0.75(L_r or S or R)	4	21.68
D + (0.6W or 0.7E)	5	9.94
D + 0.75L + 0.75(0.6W) + 0.75(L_r or S or R)	6a	29.14
D + 0.75L + 0.75(0.7E) + 0.75S	6b	21.68
0.6D + 0.6W	7	9.94
0.6D + 0.7E	8	0.00

Symbols	
A_k	Load or load effect arising from extra ordinary event A
D	Dead load
D_i	Weight of ice
E	Earthquake load
F	Load due to fluids with well-defined pressures and max. heights
F_a	flood load
H	Load due to lateral earth pressure, ground water pressure, or pressure of bulk materials
L	Live Load
L_r	Roof Live Load
R	Rain Load
S	Snow Load
T	Self-Straining Load
W	Wind Load
W_i	Wind-on-ice determined in accordance with Chapter 10

A.2 Wind Load

Wind Load

Basic Wind Speed (See Figure 26.5-1A) (Risk Category II. See Snow Loads)		
V	115	mph

Wind Directionality Factor (Section 26.6, Table 26.6-1)		
K_d	0.85	

Exposure Category (See Section 26.7	
Surface Roughness	C
Exposure Category	C

Topographic Factor (See Section 26.8)		
K_{zt}	1.0	

Gust Effect Factor (See Section 26.9)		
G	0.85	

Enclosure Classifcation (See Section 26.10)
Partially Enclosed

Velocity Pressure Exposure (Table 27.3-1)		
$q_z = 0.00256 K_z K_{zt} K_d V^2$		
q_z	24.46	
q_h	26.48	

Internal Pressure Coefficient (See Section 26.11 , Table 26.11-1)		
GC_{pi}	0.55	Towards
GC_{pi}	-0.55	Away

Velocity Pressure Exposure Coefficient (See Table 27.3-1)		
K_z	0.85	
K_h	0.92	

External Pressure Coefficient (Wall) (See Figure 27.4-1)		
C_p	0.8	Windward use q_z
C_p	-0.5	Leeward use q_h
C_p	-0.7	Side use q_h

External Pressure Coefficient (Roof) (See Figure 27.4-1)		
C_p	-0.77	Smaller Windward C_p
C_p	-0.25	Larger Windward C_p
C_p	-0.46	Leeward use q_h

P value roof windward		
p = qGCp-qi(GCpi)		
p	-5.64	Larger C_p
p	-17.29	Smaller C_p

Structure Flexible/Rigid (See Section 29.9.3)		
n_a = 22.2/h^(0.8)		
n_a	1.69	Rigid

Wind Design Pressure			
$p = qGC_p$			psf
Windward (South Wall) use q_z	p	16.63	psf
Leeward (North Wall) use q_h	p	-11.25	psf
Side Walls (East/West Wall) use q	p	-15.75	psf
Windward (South Roof)	p	-5.64	psf
	p	-17.29	psf
Leeward (North Roof)	p	-10.27	psf

Areas			Wind Loads		
$A_{south\ wall}$	996	ft^2	$W_{south\ wall}$	16566	pounds
$A_{north\ wall}$	996	ft^2	$W_{north\ wall}$	-11206	pounds
$A_{east/west\ wa}$	941	ft^2	$W_{east/west\ w}$	-14816	pounds
$A_{south\ roof}$	1445	ft^2	$W_{south\ roof}$	-8145	pounds
$A_{south\ roof}$	1445	ft^2	$W_{south\ roof}$	-24997	pounds
$A_{north\ roof}$	1445	ft_2	$W_{north\ roof}$	-14848	pounds

Symbols	
V	Basic wind speed obtained from Figure. 26.5-1A in mph.
K_d	Wind directionality factor in Table 26.6-1
K_{zt}	Topographic factor as defined in Section 26.8
G	Gust-effect factor
q_z	Velocity pressure evaluated at height z above ground, in psf
q_h	Velocity pressure evaluated at height z=h, in psf.
Gc_{pi}	Product of internal pressure coefficient and gust-effect factor to be used in determination of wind loads for buildings
K_z	Velocity pressure exposure coefficient evaluated at height z.
K_h	Velocity pressure exposure coefficient evaluated at height z=h
C_p	External pressure coefficient to be used in determination of wind loads for buildings.
p	Design pressure to be used in determination of wind loads for buildings, in psf
n_a	Approximate lower bound natural frequency (Hz) from Section 26.9.2

A.3 Snow Load

Snow Load

Ground Snow Load from Fig. 7-1		
P_g	10	psf

Snow Load		
S	28910	pounds

θ	11.1	degrees

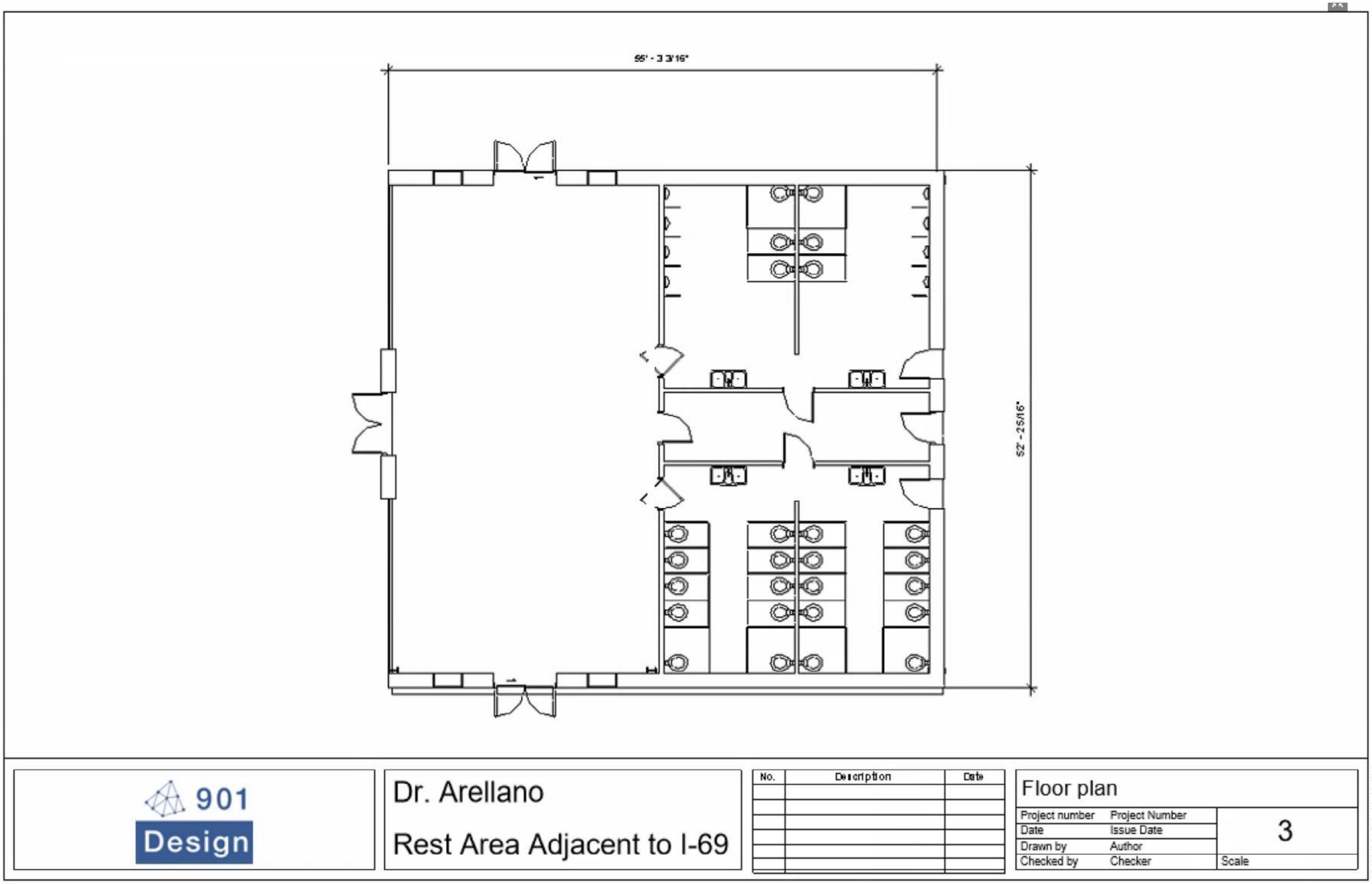
Minimum Snow Load for Low-Slope roofs (θ is less than 15 degrees, and P_g </= 20 psf) $P_m = I_s P_g$		
I_s	1.0	Table 1.5-1 and 1.5-2
P_m	10	psf

Symbols	
C_e	Exposure Factor as determined from Table 7-2
C_s	Slope Factor as determined from Fig. 7-2
C_t	Thermal factor as determined from Table 7-3
h	Vertical separation distance in feet (m) between the edge of a higher roof including any parapet and the edge of a lower adjacent roof excluding any parapet
h_b	height of balanced snow laod determined by dividing p_s, by γ, in ft (m)
h_c	clear height from top of balanced snow load to (1) closest point on adjacent upper roof, (2) top of parapet, or (3) top of a projection on the roof, in ft (m)
h_d	height of snow drift, in ft (m)
h_o	height of bobstruction above the surface of the roof, in ft (m)
I_s	importance factor as prescribed in Section 7.3.3. Tables 1.5-1 and 1.5-2 (Shown below)
l_u	length of the roof upwind of the drift, in ft (m)
P_d	maximum intensity of drift surcharge load, in lb/ft^2
P_f	snow load on flat roofs ("flat"=roof slope </= 5 degrees), in lb/ft^2
P_g	ground snow load as determined from Fig. 7-1 and Table 7-1; or a site-specific analysis, in lb/ft^2
P_m	minimum snow load for low-slope roofs, in lb/ft^2
P_s	sloped roof (balanced) snow load, in lb/ft^2
s	horizontal separation distance in feet between the edges of two adjacent buildings
S	roof slope run for a rise of one
θ	roof slope on the leeward side, in degrees
w	width of snow drift, in ft
W	horizontal distnce from eave to ridge, in ft
γ	snow density, in lb/ft^3 as determined from Eq. 7.7-1

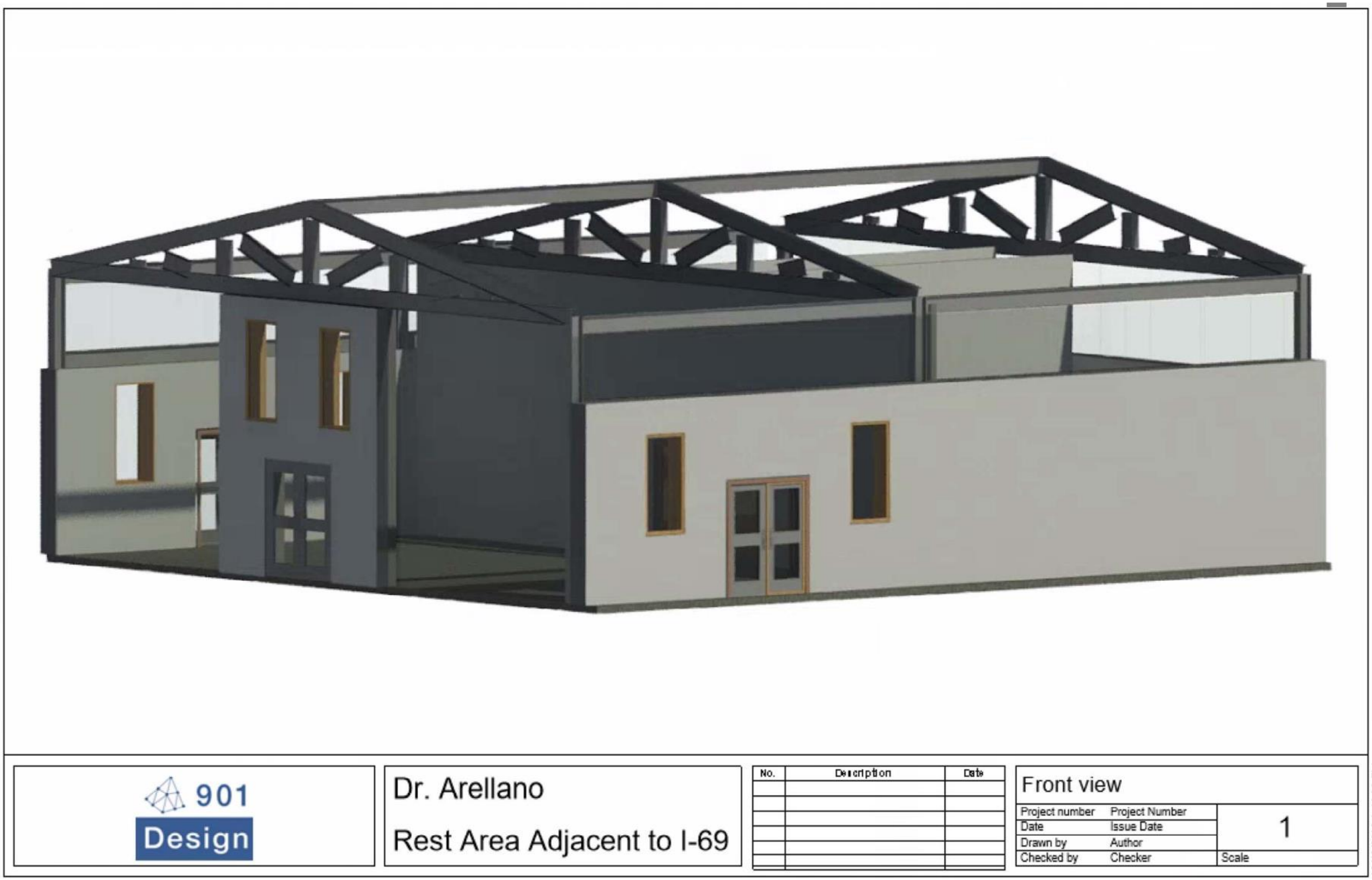
A.4 Rest Room Water Closet Calculation

Restroom Stalls	T_1=A*UV*B*PF*P*UHF	T=Total Toilets	32.90		
		A= 1 way Design Year ADT	17575.00	T_1	
		UV= 1.3 Restroom users per vehicle			
		B= .15= Ratio of Design hourly volume to ADT		T_2	32.90
	or	PF= 1.8= Peak Factor			
		P= Total % of traffic stopping at rest area	0.16	T_3= A*P*.0117	32.90
		UHF= 30= Restroom users per hour per fixture based on 2 min cycle			
	T_2=(S*1.3*1.5*1.8*P)/30				
	W= T * .6	W= Number of women's toilets		W=	19.74
	M= T * .4	M= Total number of men's toilets & urinals		M=	13.16

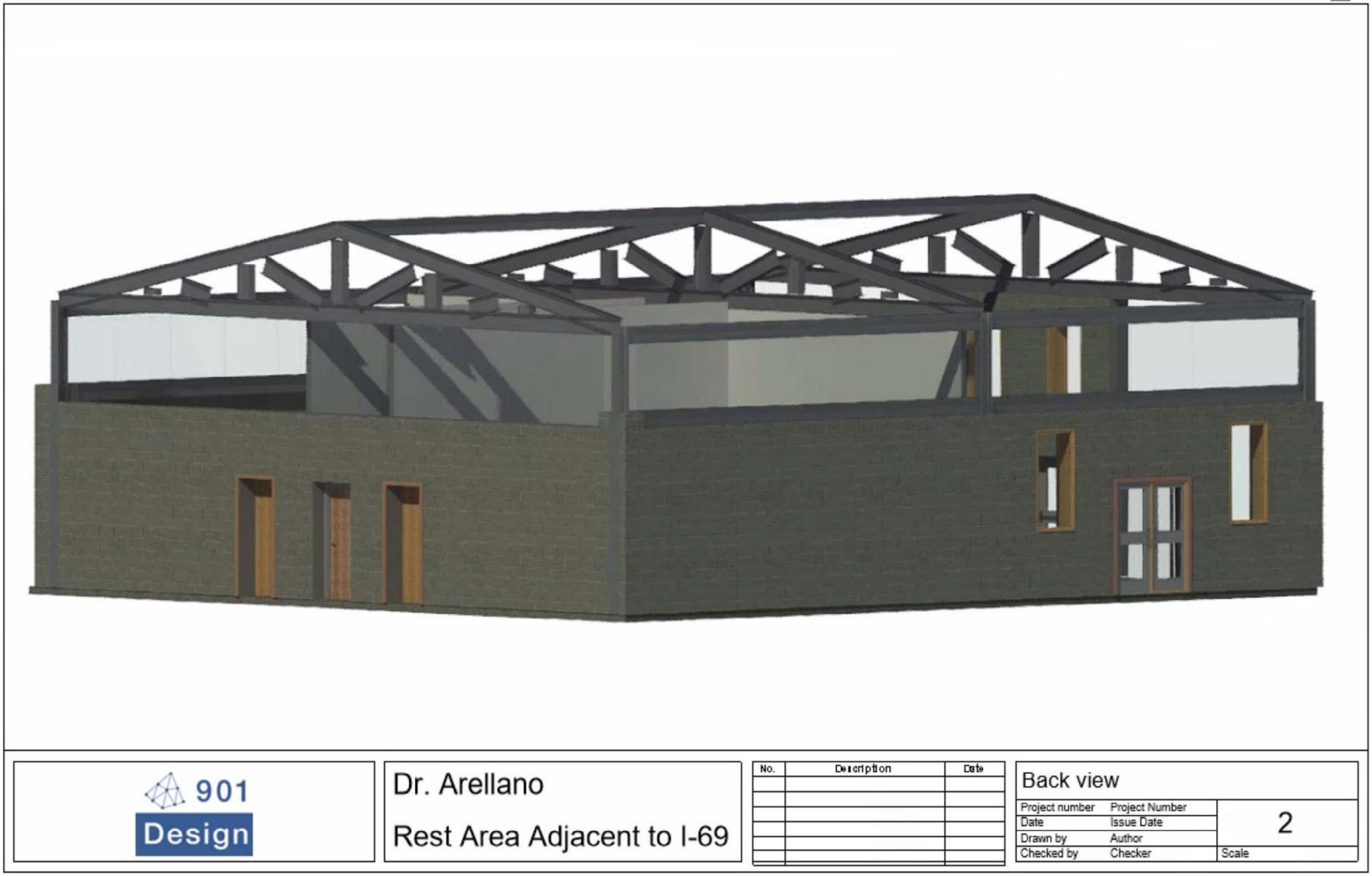
A.5 Building Floor Plan



A.6 Building Front Façade



A.7 Building Back façade



APPENDIX B: BOREHOLE PLAN

THE UNIVERSITY OF MEMPHIS

CIVL 4199 – CIVIL ENGINEERING SENIOR DESIGN

Geotechnical Investigation Boring Plan:

I-69 Proposed Rest Area

901 Design

Date Submitted: October 19, 2018

Prepared by:

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Available Subsurface Information

A site visit was made on September 17, 2018. The information collected from the site visit is that the location is existing farm land and has minimal elevation change. The site is private property, so observations could only be made from the shoulder of Wilkinsville Road. Information on the Soil surface was available on the Tennessee Virtual Archive (TeVA). TeVA's website displays a Shelby County Tennessee soil map of 1916. The map specifies the primary surface soils that are present around the proposed construction site location. These soils are shown to be predominately silt loam and Memphis silt loam. Additional information pertaining to the subsurface soil was found on the Web Soil Survey website. The data displayed below corresponds to the proposed construction site location.

Table 1. Soil Typical Profile

Typical Subsoil Profile	
Depth	**Soil Type**
0 to 7 inches	Silt Loam
7 to 28 inches	Silt Loam
28 to 50 inches	Silt Loam
50 to 60 inches	Silt Loam

Preliminary Model of Subsurface

The subsurface model displayed below (Figure 1.) corresponds to the information gathered from Web Soil Survey. The first 5 ft. of soil consist of silt loam. The location has an annually fluctuating ground water level that varies between 1 ft. to 2 ft 4 in. in depth. Silt soils are not ideal for shallow foundations and will most likely need to be cut and filled with more stable material. Silt soil has a tendency to retain moisture and drains poorly. The retention of water causes the silty soil to expand, pushing against a foundation and weakening it, making it not ideal for support. However, Loam is the ideal soil type. Typically, it's a combination of sand, silt and clay. Loam is great for supporting foundations because of its evenly balanced properties, especially how it maintains water at a balanced rate. Loam is a good soil for supporting a foundation and should allow the engineer to design a shallow foundation. The laboratory testing results will determine if the silt loam near the surface will need to be cut and filled with new soil.

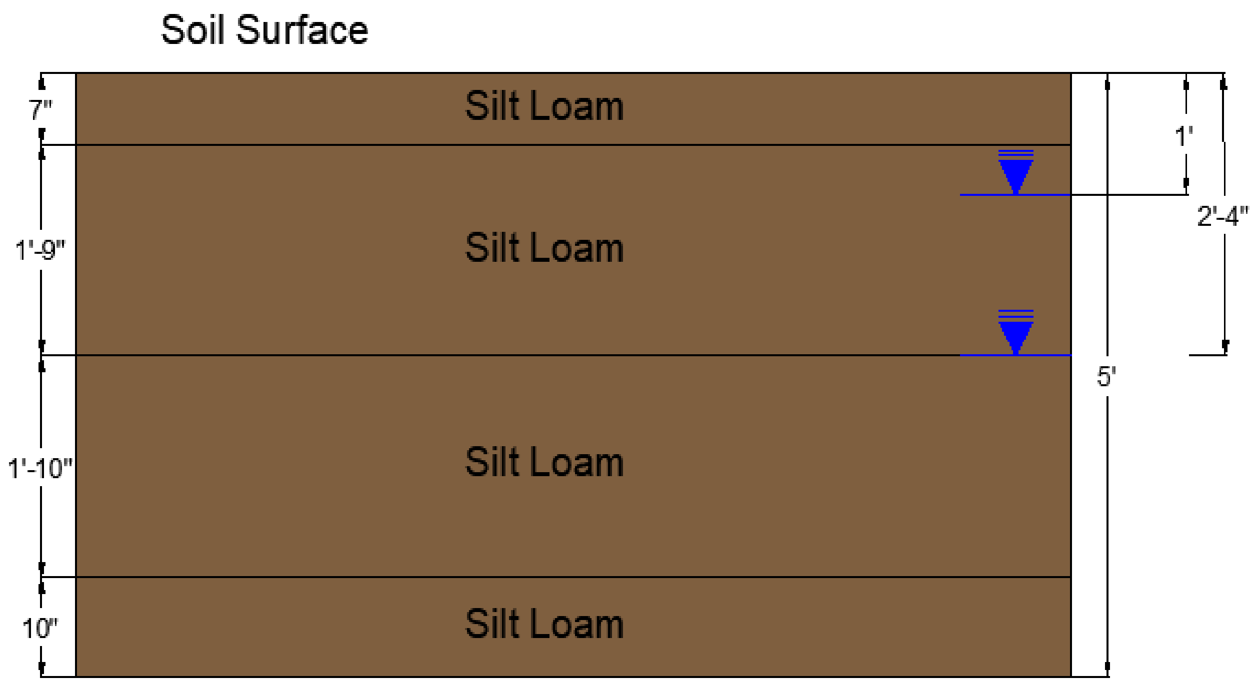


Figure 1. Interpreted Soil Profile

<u>Required Soils Needed for Design and Construction</u>

With the proposed site being in Shelby County Tennessee, sand's, silt's, and clays are all possible subgrade soils. A slab or continuous wall foundation was originally planned for this building. This plan is possible if lab tests conclude the existing soil is capable of supporting a shallow foundation. If the lab tests conclude the soil is not capable of supporting the shallow foundation, the location must undergo preliminary earth work before the foundation could be constructed. Preliminary earth work would involve removing the undesirable soil and replacing it with the appropriate soil type necessary to meet the foundations needs. If the silt loam soil is shown through laboratory testing to be a unstable soil and earth work/cut and fill is greater than a depth of 10 ft., the excessive preparation work may make a shallow foundation unappealing. If the situation occurs, where the sub soil is inferior in bearing capacity and settlement, a deep foundation will need to be considered. Firm clays, loam, or sand near the soil surface would be ideal for a shallow/continuous wall foundation.

Proposed Boring Location Plan

The construction site for the proposed I69 rest area has been chosen. However, the layout for the building and parking lot has not been finalized. For this reason, the boreholes for this project will be laid out in a grid pattern that extends 200 meters (656 ft. 2 in.) by 400 meters (1312 ft. 4 in.). The proposed rest area layout is approximately 180 meters (590 ft. 6 in.) by 300 meters (984 ft. 3 in.). The larger borehole grid pattern will allow the engineers to change the layout of the rest area and may alleviate the need for drilling more boreholes. The grid spacing was chose based off the Table 2. shown below.

Table 12.2 Approximate Spacing of Boreholes (Das)	
Type of project	**Spacing (m)**
Multistory building	**10 – 30**
One-story industrial plants	**20 – 60**
Highways	**250 – 500**
Residential subdivisions	**250 – 500**
Dams and dikes	**40 – 80**

Table 2. Borehole Spacing

The type of construction for the I-69 rest area is similar to a residential subdivision, but if a spacing of 250 meters (820 ft. 3 in.) was chosen there would only be one borehole within the proposed site layout, and most of the soil borings would be on the outer bounds of the proposed layout. For those reasons, a grid spacing between the boreholes will be 100 meters (328 ft. 1 in.). This spacing will result in a more detailed subsurface investigation, see the attached map (Figure 2.) for borehole locations. The number of boreholes confined to the grid will be 14. The center of the grid will overlap with the center of the proposed site layout maximizing the subsurface soil sampling for the available building area. There will be 4 additional boreholes for the building that will be placed 5 ft. away from the corners of the proposed building location. There is a total of 18 boreholes that will complete the subsoil investigation. After all soil sample are recovered, the boreholes confined to the grid will be backfilled with bentonite pellets. The 4 boreholes for the proposed building subsoil investigation will be backfilled with grout. Prior to soil investigation boring, surveyors will be hired to locate and stake the proposed borehole locations.

Boring Depths

The depth of boreholes will be calculated according to Sowers and Sowers (1970). The calculations in the table below represent two types of buildings. Both calculations will be examined, and the most practical borehole depth will be chosen.

$Db=3S^{0.7}$	(for light steel or narrow concrete buildings)	Equation (12.1) Das
$Db= 6S^{0.7}$	(for heavy steel or wide concrete buildings)	Equation (12.2) Das

Table 2. Boring Depth Equations

Where:

Db = depth of boring (m)

S = number of stories

The borehole depth for light steel buildings results in a depth of 3 meters (9.84 ft.). The borehole depth for heavy steel buildings results in a depth of 6 meter (19.69 ft.). If the light steel calculation was chosen for the borehole depth, assuming Web Soil Survey's data is correct, the engineer would only gain information on the next 5 ft. of subsoil. There will be large stresses placed on the soil from the building and the tractor trailer parking lot. For this reason, the borehole depth for the grid will comply with the heavy steel building calculation. The depth of the boreholes confined to the grid will be 20 ft. in depth. The boreholes that are placed for the building will have locations that diverge from the grid and will go down to deeper depths. The building boreholes will have a minimum depth of 20 ft. If firm soil is not found in the first 20 ft., the borings shall continue until firm ground is reached. The deeper depth of the building boreholes is meant to protect the building from any unexpected soil layers that could increase the settlement.

Field Tests

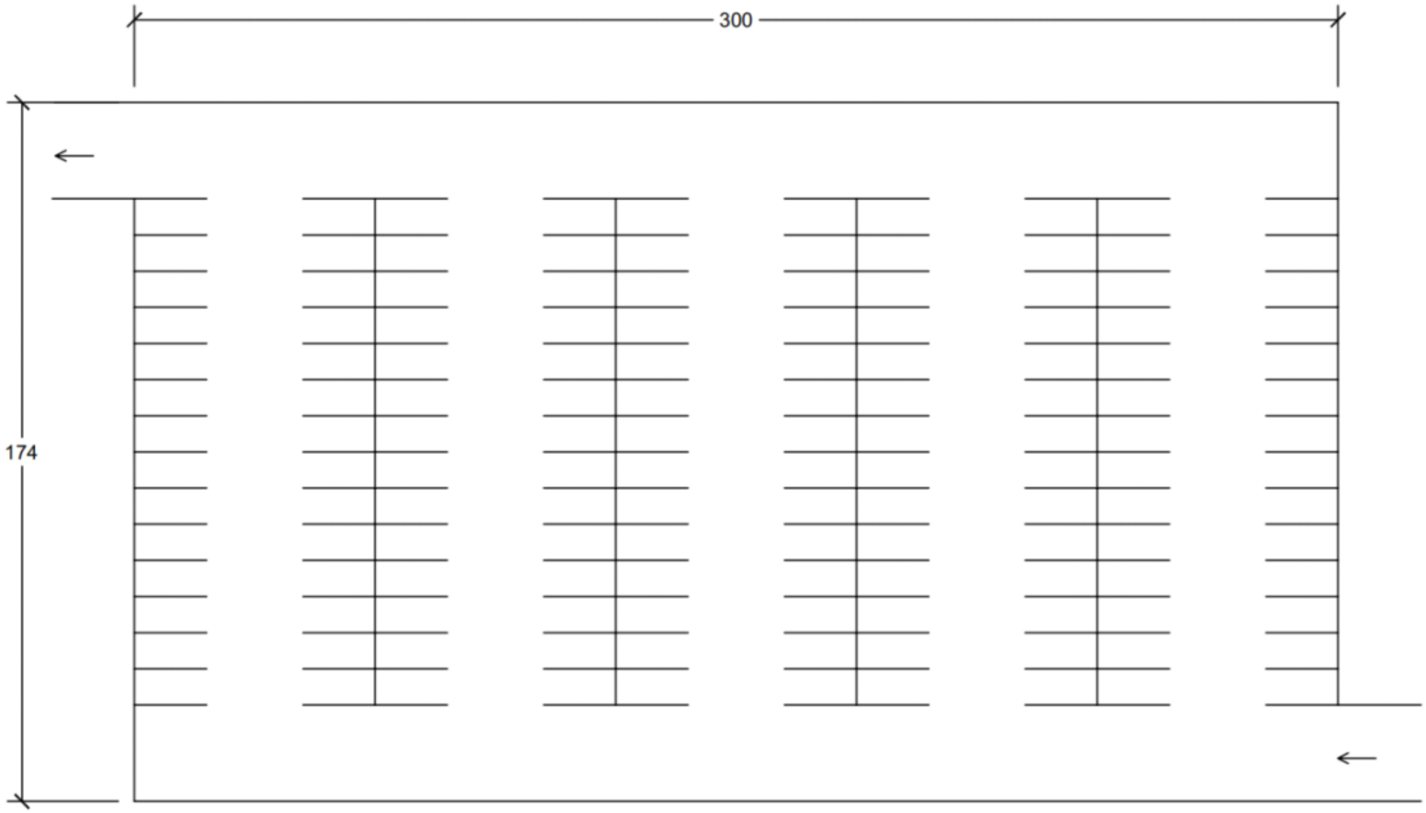
Field testing will be performed to gain information on the subsoil's friction angle (ø'), unit weight (γ), and ground water level. The test that will be completed in the field is the Standard Penetration Test (SPT). The SPT samples will be recovered every 1.5 meters (5 ft.). If soil sample recovery is unsuccessful due to a granular type of soil, it is advised that a spring core catcher be placed inside the split spoon sampler. The results of the SPT will give the soils N-value that will allow the engineer to determine the soils unit weight (γ), and friction angle ($\o'$). When cohesive soil is encountered, Soil samples will be recovered using thin walled tubes/Shelby tubes. Like the SPT, the Shelby tube samples will be recovered every 1.5 meters (5 ft.) when applicable. The unit weight of the soil and the ground water level are necessary for calculating the effective stress (σ'_o) of the soil. The Shelby tubes will allow the lab to receive undisturbed soil samples for testing consolidation, and undrained shear strength.

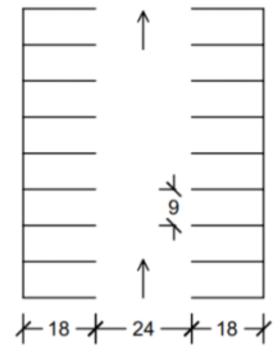
Laboratory Tests

The lab tests will allow the engineer to obtain the remaining soil parameters that are necessary to size the building foundation based on settlement and bearing capacity. The tests to be performed in the laboratory will include the in-situ water content test, sieve analysis, Atterberg limits, consolidation test, and the unconfined compressive test. All tests will be executed in compliance with ASTM specifications. The in-situ water content test is necessary for the engineer to understand the natural subsoil conditions that will influence the soils strength, settlement, and bearing capacity. A sieve analysis will also be completed to attain information on the subsoil particle gradation. The soil samples will also be tested for Atterberg Limits. The Atterberg limits test will allow the computation of the subsoils Liquid Limit (LL), Plastic Limit (PL), and Plasticity Index (PI). With Sieve Analysis and Atterberg Limits tests completed, the recovered subsoil samples will then be assigned the appropriate soil classification. Disturbed soil samples recovered from the SPT will suffice for in-situ water content, sieve analysis, and Atterberg Limit tests. The one-dimensional consolidation test, and the unconfined compressive strength test will both be performed using the soil samples recovered by Shelby tubes. The consolidation test will quantify both the ultimate amount of settlement and the time rate of settlement in the soil layers. Using laboratory derived parameters, field settlement behavior of the soil layer can be predicted. The results from the consolidation test will allow the calculation of the compression index (C_c), recompression index (C_r), and void ratio (e_o). The Unconfined compressive strength test will be performed to measure the unconfined compressive strength (qu) and undrained shear strength (su) of normally consolidated and slightly over consolidated cylindrical specimens of cohesive soil. The information attained from the unconfined compressive test is used to estimate the bearing capacity of spread footings and other structures when placed on deposits of cohesive soil. The completion of the previously described tests will allow the engineer to size a foundation based on bearing capacity and settlement.

APPENDIX C: TRANSPORTATION

C.1 Car Parking Alternative 1: Conventional Parking





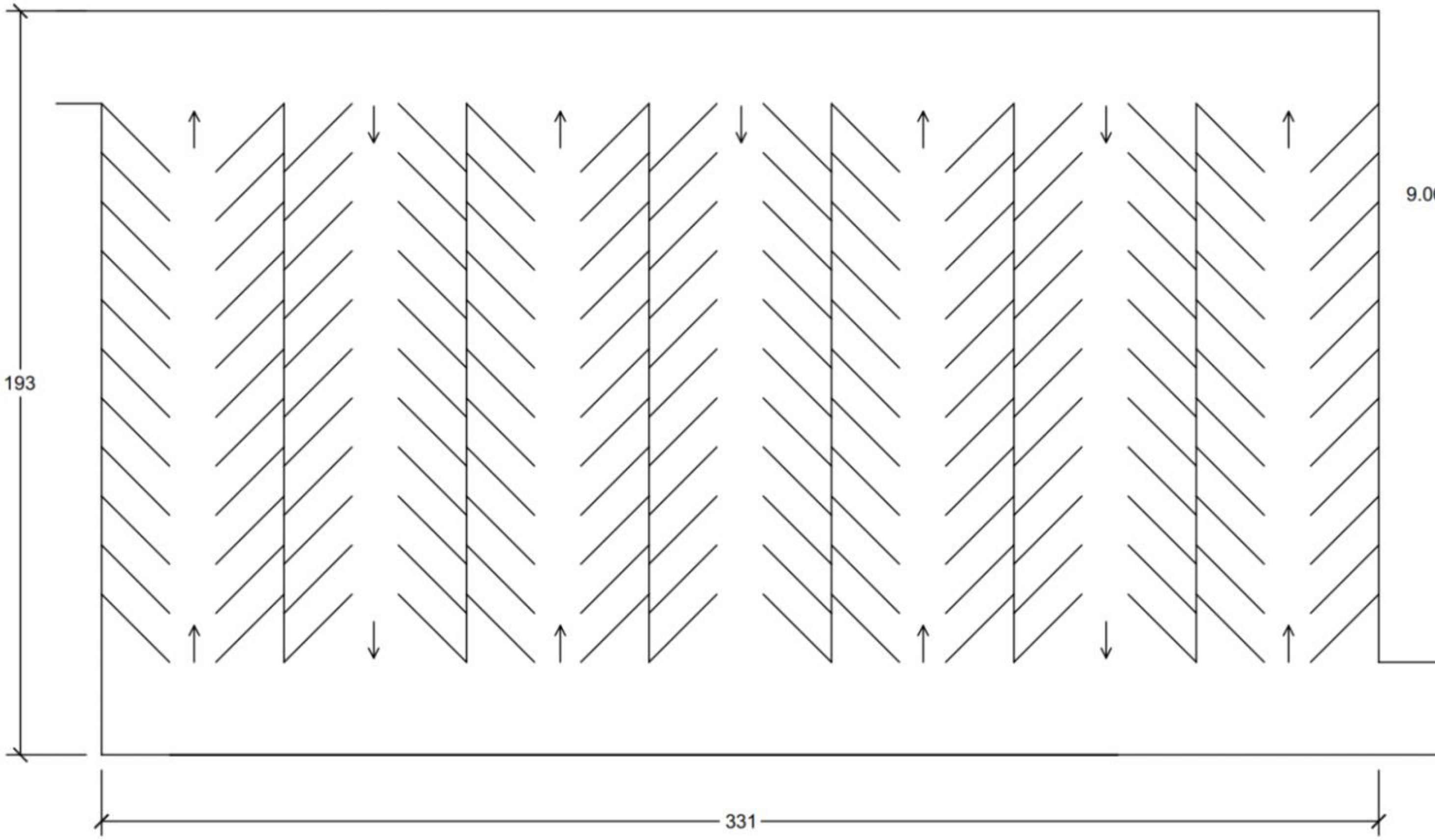
Parking Stall Geometry:

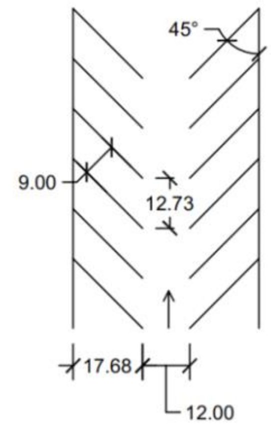
- Parking Angle: 90 Degree
- Parking Stall Width: 9'
- Aisle Width: 24'
- Vehicle Projection: 18'
- Stall Width Projection: 9'

Parking Layout Features:

- 140 Parking Spaces
- 4+1/2+1/2 parking columns of 14 parking space per column
- Area: 52,200 squarefeet
- Parking Efficiency: 373 sqft per space
- Pedestrian Parking lot walking distance:
- Mean: 88ft Standard Deviation: 36.41
- Number of stop sign required: 10

C.2 Car Parking Alternative 2: Angular Parking





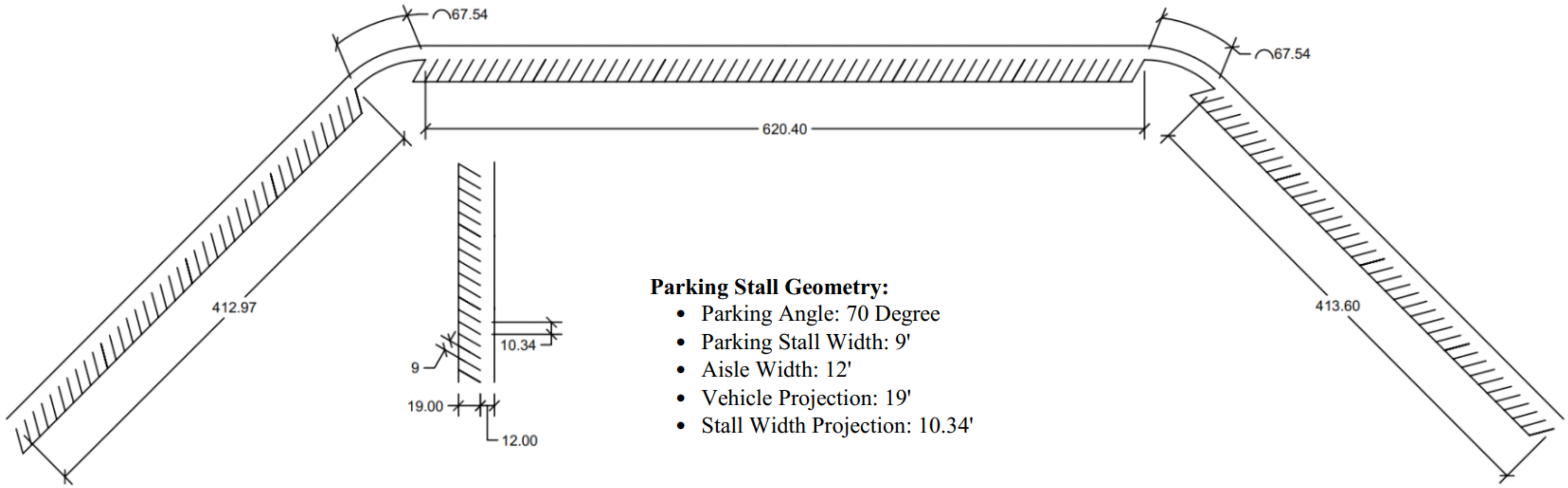
Parking Stall Geometry:

- Parking Angle: 45 Degree
- Parking Stall Width: 9'
- Aisle Width: 12'
  (one-way traffic)
- Vehicle Projection: 17.68'
- Stall Width Projection: 12.73'

Parking Layout Features:

- 140 Parking Spaces
- 6+1/2+1/2 parking columns of 10 parking space per column
- Area: 68,883 square feet
- Parking Efficiency: 456 sqft per space
- Pedestrian Parking lot walking distance:
  Mean: 96 ft Standard Deviation: 36.69
- Number of stop sign required: 7
- One-Way Traffic within the aisle
- Two-Way traffic in the top and bottom road alignment

C.3 Car Parking Alternative 3: Angular Parking Along the Curb



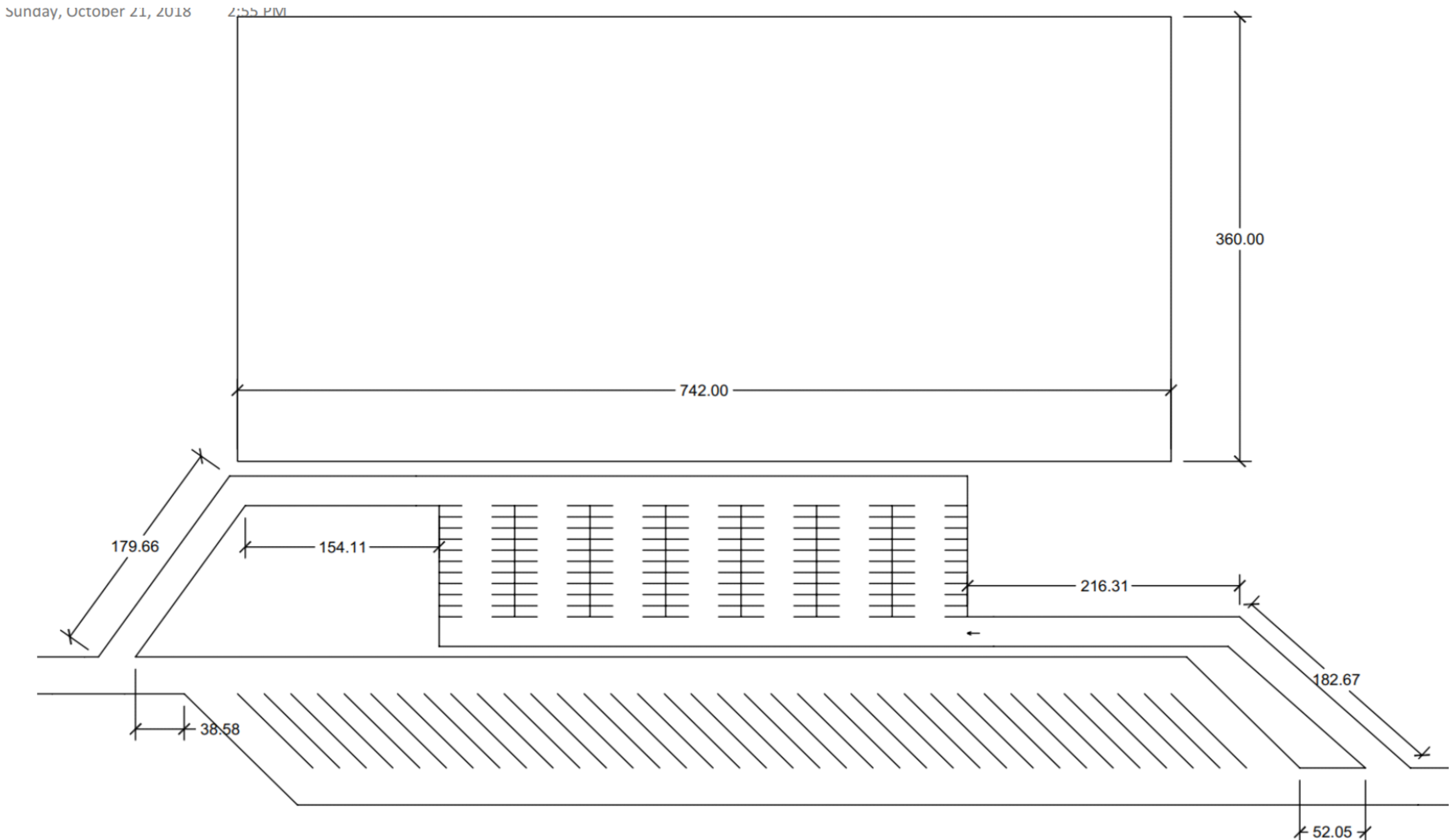
Parking Stall Geometry:

- Parking Angle: 70 Degree
- Parking Stall Width: 9'
- Aisle Width: 12'
- Vehicle Projection: 19'
- Stall Width Projection: 10.34'

Parking Layout Features:

- 140 Parking Spaces
- 60 Parking Lots on the left and right alignment; 80 parking lots in the center alignment
- Area: 44,874 squarefeet
- Parking Efficiency: 321 sqft per space
- Pedestrian Parking lot walking distance:
  Mean: 12ft Standard Deviation:0
- Number of yield sign required: 3

C.4 Site Layout Alternative 1: Outward-Oriented Design

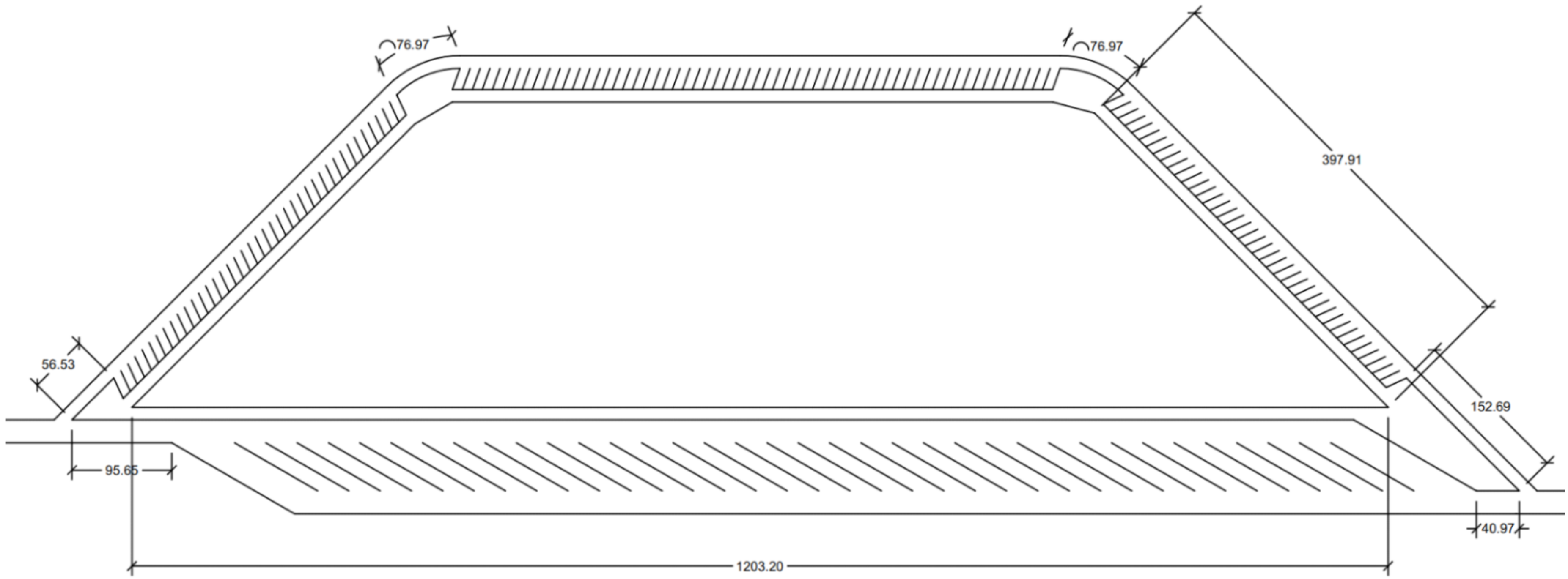


Parking Layout Features:

- Car Parking Alternative 1 for 140 Car Parking Stalls
- 45 Degree Parking Pull in and through for 35 Truck Parking Stalls
- A Total of 267,120 square feet of main area of usage (larger than 6 acres)

- A total of 824 ft road alignment
- Distance from Car Parking Lot to Main Area: 261
- Distance from Truck Parking Lot to Main Area: 399
- Two traffic in Car Parking Lot

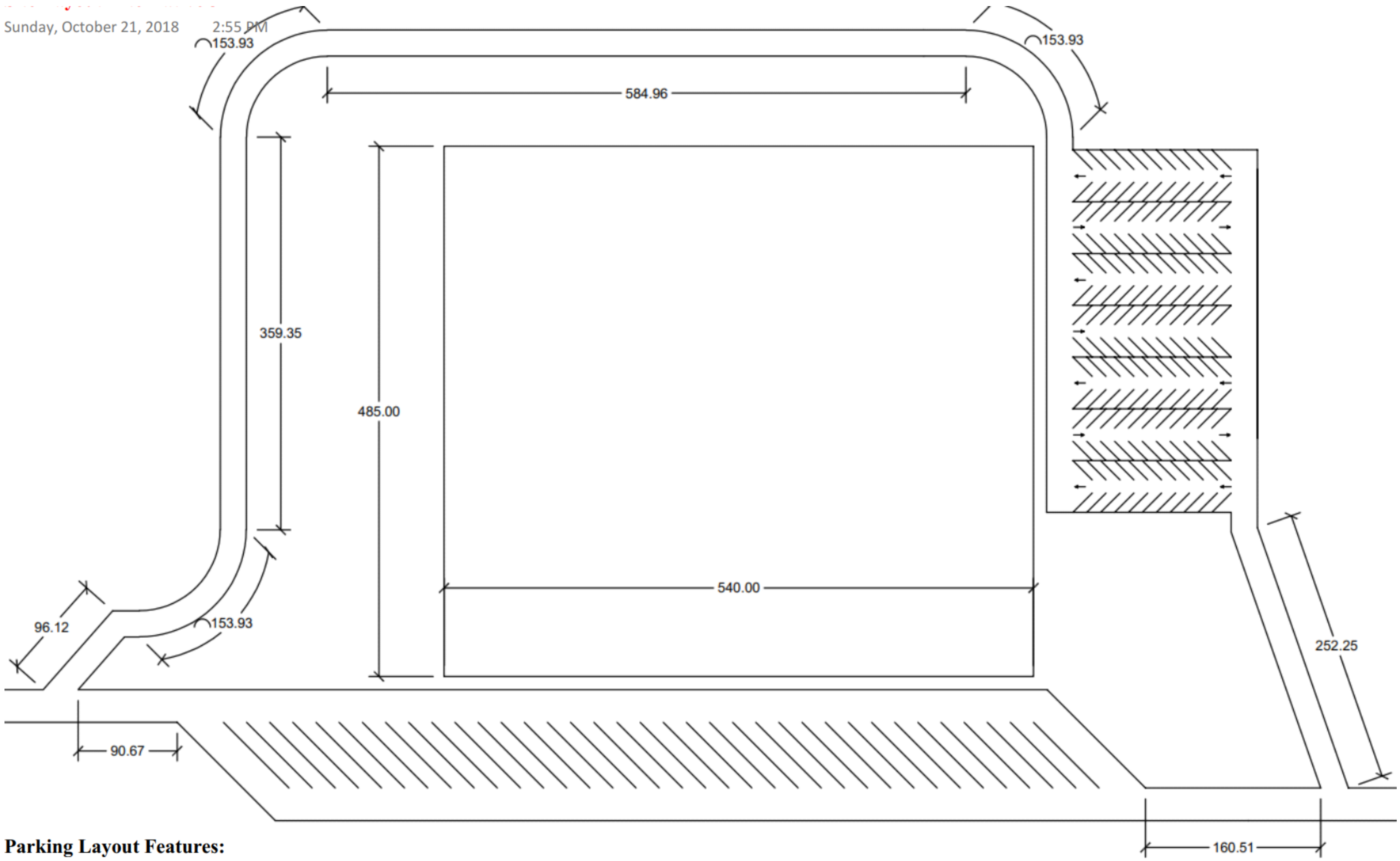
C.5 Site Layout Alternative 2: Inward-Oriented Design



Parking Layout Features:

- Car Parking Alternative 3 for 140 Car Parking Stalls
- 30 Degree Parking Pull in and through for 35 Truck Parking Stalls
- A Total of 265,708 square feet of main area of usage (larger than 6 acres)
- A total of 501 ft road alignment
- Distance from Car Parking Lot to Main Area: 100
- Distance from Truck Parking Lot to Main Area: 199
- One way traffic throughout

C.6 Site Layout Alternative 3: Mixed Design



Parking Layout Features:

- Car Parking Alternative 2 for 140 Car Parking Stalls
- 45 Degree Parking Pull in and through for 35 Truck Parking Stalls
- A Total of 261,900 square feet of main area of usage (larger than 6 acres)
- A total of 2,006ft road alignment
- Distance from Car Parking Lot to Main Area: 385 ft
- Distance from Truck Parking Lot to Main Area: 322ft

C.7 User Comfort Guidelines

*Adopt from

Guidelines: By comparing the design of the car parking lot versus the User Comfort Factor Grading Requirement shown in Table 2, One can determine the user comfort factor of it. User Comfort Factor relates to the ease of pulling into and out of the parking stall. The parameter is one of the performance measurement for car parking lot, which is equivalent to the analogy of Level of Service and Roadway performance measurement

Note: The aisle width as represented in Figure 1 and Table 2 refers to two-way traffic. If in the case the design is based on one-way traffic, the aisle width dimension can be reduced by half.

User Comfort Factor (UCF)	Level of Service	Easeness of Parking
4	A	Excellent
3	B	Good
2	C	Acceptable

Table 1. User Comfort Factor Definition

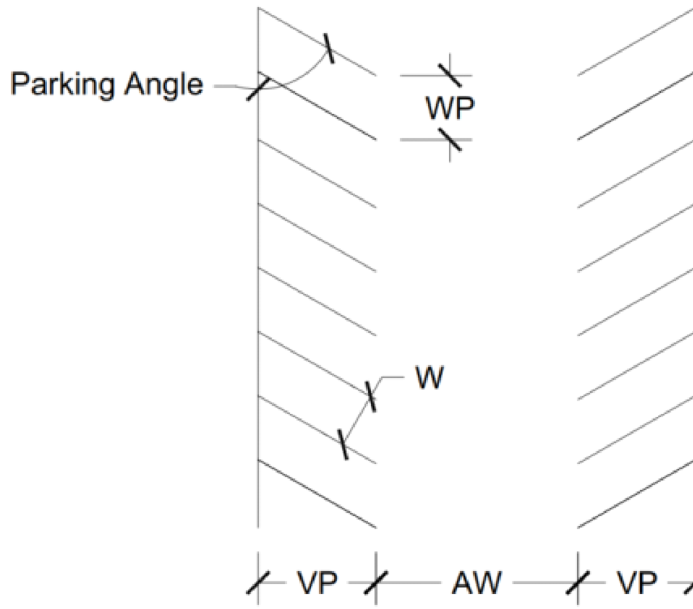


Figure 1. Geometry of Parking Stall

Table 2. User Comfort Factor Requirement

Parking Angle	Stall Width Projection (WP)	Vehicle Projection (VP)	Aisle Width (AW)	Stall Width Projection (WP)	Vehicle Projection (VP)	Aisle Width (AW)	Stall Width Projection (WP)	Vehicle Projection (VP)	Aisle Width (AW)
	User Comfort Factor 4 :w = 9'-0"			**User Comfort Factor 3: w = 8'-9"**			**User Comfort Factor 2: w = 8'-6"**		
45	12'-9"	17'-7"	14'-8"	12'-4"	17'-7"	13'-8"	12'-0"	17'-7"	12'-8"
50	11'-9"	18'-2"	15'-3"	11'-5"	18'-2"	14'-3"	11'-1"	18'-2"	13'-3"
55	11'-0"	18'-8"	15'-8"	10'-8"	18'-8"	14'-8"	10'-5"	18'-8"	13'-8"
60	10'-5"	19'-0"	16'-6"	10'-1"	19'-0"	15'-6"	9'-10"	19'-0"	14'-6"
65	9'-11"	19'-2"	17'-5"	9'-8"	19'-2"	16'-5"	9'-5"	19'-2"	15'-5"
70	9'-7"	19'-3"	18'-6"	9'-4"	19'-3"	17'-6"	9'-1"	19'-3"	16'-6"
75	9'-4"	19'-1"	19'-10"	9'-1"	19'-1"	18'-10"	8'-10"	19'-1"	17'-10"
90	9'-0"	18'-0"	26'-0"	8'-9"	18'-0"	25'-0"	8'-6"	18'-0"	24'-0"

C.8 Optimum Parking Stall Analysis

Optimum Parking Stall

Sunday, October 21, 2018 2:30 PM

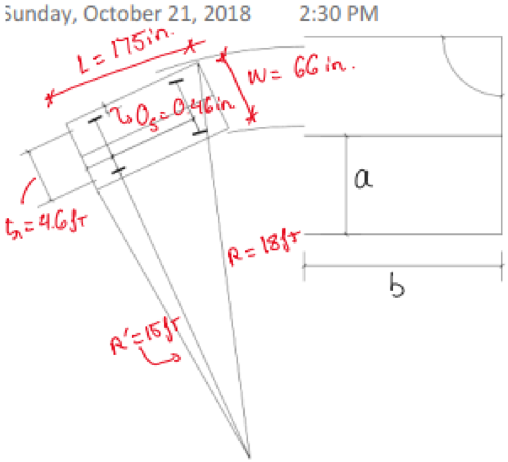


Figure. Minimum Turning Paths Into Stall

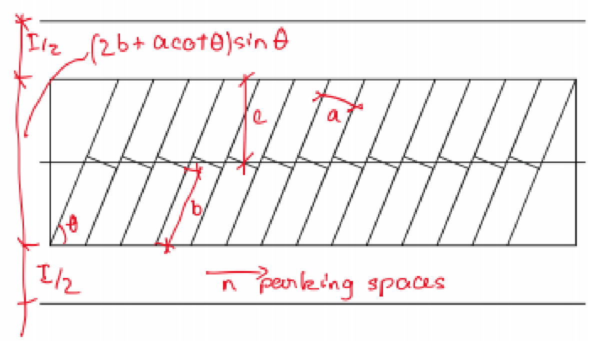
- The assumption for small vehicles dimension are given in the picture on the left. The data is extracted from a study of Weant (1984)
- Ricker (1948) computed aisle width as a function of parking angle θ:

$$I = R' + C + \sin\theta\sqrt{R^2 - (r + t_n + O_s + i - c)^2} - \cos\theta(r + t_n + O_s + a) \quad (1)$$

Which:
- C: clearance between cars = 1 ft
- i: intercar distances = $a - 2O_s - t_n$ = 23ft

Plug in the number

$$I = 2.04a + 1.15a\sin\theta - 1.7a\cos\theta \quad (2)$$



Overall area:

$$A = \frac{an}{\sin\theta}\left(\sin\theta(2b + a\cot\theta) + I_\theta\right)$$

There are 2n parking stall

=> Unit area:

$$A' = \frac{A}{2n} = \frac{a}{2\sin\theta}\left(\sin\theta(2b + a\cot\theta) + I_\theta\right)$$

Assume b = 1.8a

$$A = f(\theta) = a^2\left(\frac{1.02}{\sin\theta} - 0.35\cot\theta + 2.375\right)$$

In this project:

Stall Width = a = 9'

- Alternative 1:

$A_1 = f(90) = 274.99\ ft^2$

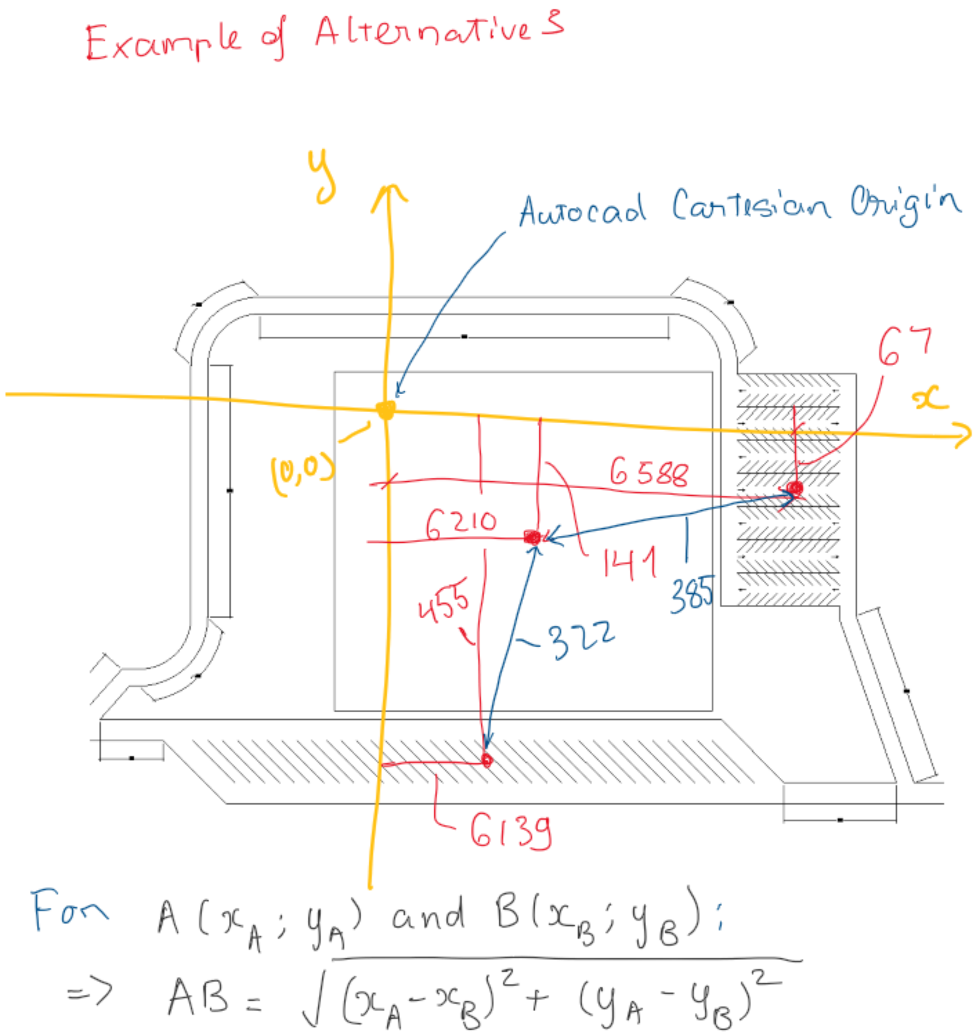
- Alternative 2:

$A_2 = f(45) = 280.87\ ft^2$

- Alternative 3:

$A_3 = f(70) = 269.98\ ft^2$

C.9 Distances Between Area Analysis



	Alternative 1		
	Car parking lot centroid	Truck parking lot centroid	Main area of usage of centroid
X (ft)	7471.1265	7501.8304	7471.8304
Y (ft)	314.3169	177.0102	575.3169
Distance from car parking to main area	261.0009492		
Distance from truck parking to main area	399.4348849		

	Alternative 2		
	Car parking lot centroid	Truck parking lot centroid	Main area of usage of centroid
X (ft)	5834.2752	5897.4696	5836.1337
Y (ft)	807.224	518.2629	707.4529
Distance from car parking to main area	99.78840823		
Distance from truck parking to main area	198.8842596		

	Alternative 3		
	Car parking lot centroid	Truck parking lot centroid	Main area of usage of centroid
X (ft)	6588.6545	6139.1757	6210.1757
Y (ft)	-67.5232	-455.3977	-140.8977
Distance from car parking to main area	385.5256403		
Distance from truck parking to main area	322.4147174		

*Figure is not to scale

C.10 Horizontal and Vertical Alignment of Entrance and Exit Ramp

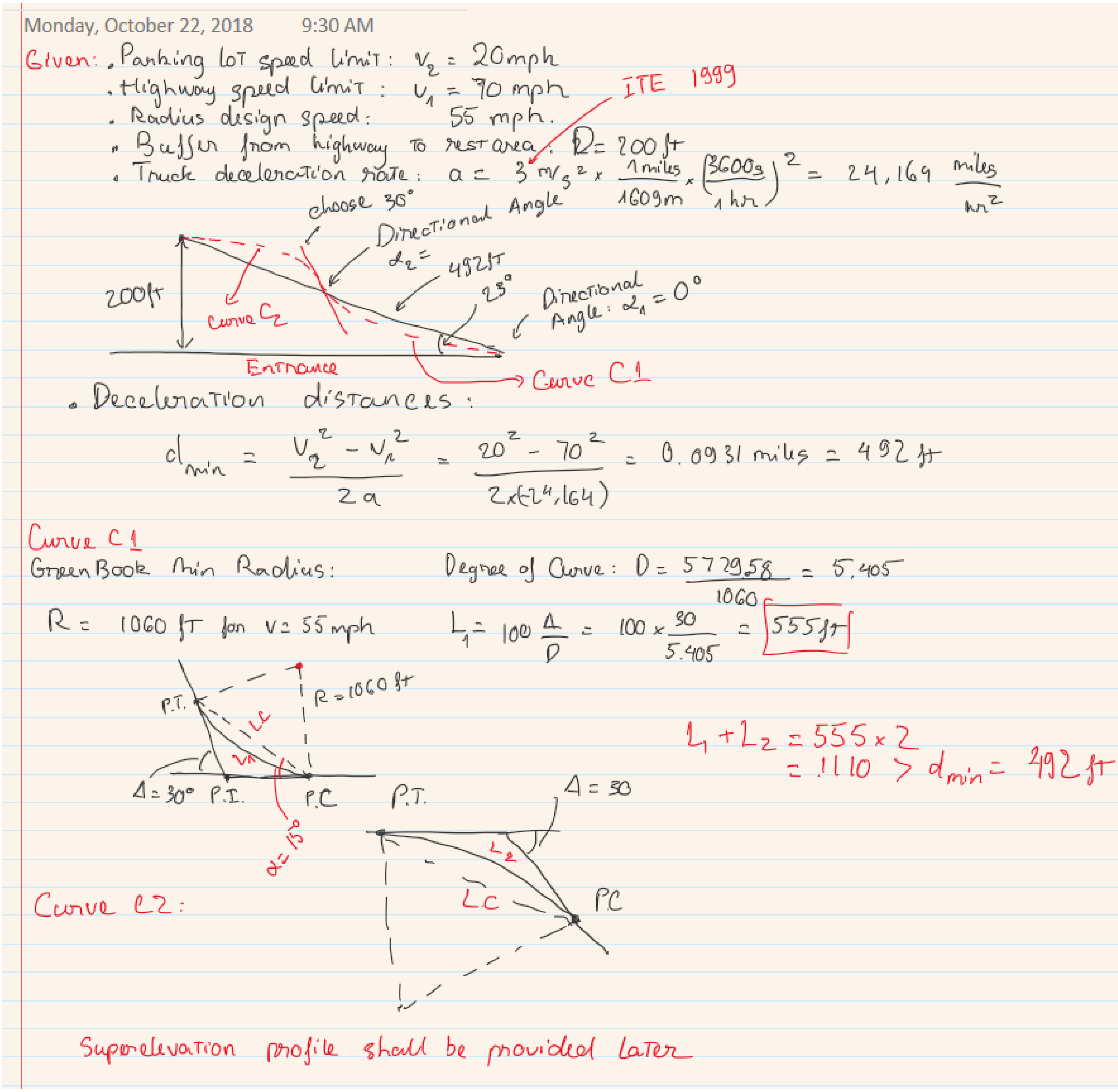


*Figure Not To Scale

C.11 Parking Capacity Calculation

Parking capacity

Publication BM (DM-2)

Monday, October 22, 2018 11:50 AM

Given:

Parameter	Definition	Value
ADT	Average daily Traffic (30 year projection)	35,150 (Collected From TDOT)
K	Ratio of Design hour Volume	0.12 (Rural Area)
D	Directional Distribution	0.6 (Common Value)
P_{stop}	% of vehicle stop at rest area	9% (Rural Area)
P_{car}	Percentage of cars	
P_{truck}	Percentage of Trucks	
T_{stay}	length of Stay	0.5 (30min)

Output

N_{car}	Number of car parking spaces	0.8
N_{truck}	Number of truck parking spaces	0.2

Calculations:

Peak Hour Directional Traffic: $PHD = ADT \times K \times D = 35{,}150 \times 0.12 \times 0.6 = 2530.8$

Number of Parking spaces: $N = PHD \times P_{stop} \times T_{stay} = 35{,}150 \times 9\% \times 0.5 = 113.8 \rightarrow 114$

↳ Number of car parking: $N_{car} = 114 \times 0.8 = 91$ spaces

Truck parking: $N_{truck} = 114 - 91 = 23$ spaces

Owner's objectives: $N_{car} = 140$; $N_{truck} = 35$

→ $N_{car} = 140$

$N_{truck} = 35$