Archaeological Resources

Airport Vicinity Development Checklist

Parking Study

Trip Generation Comparison

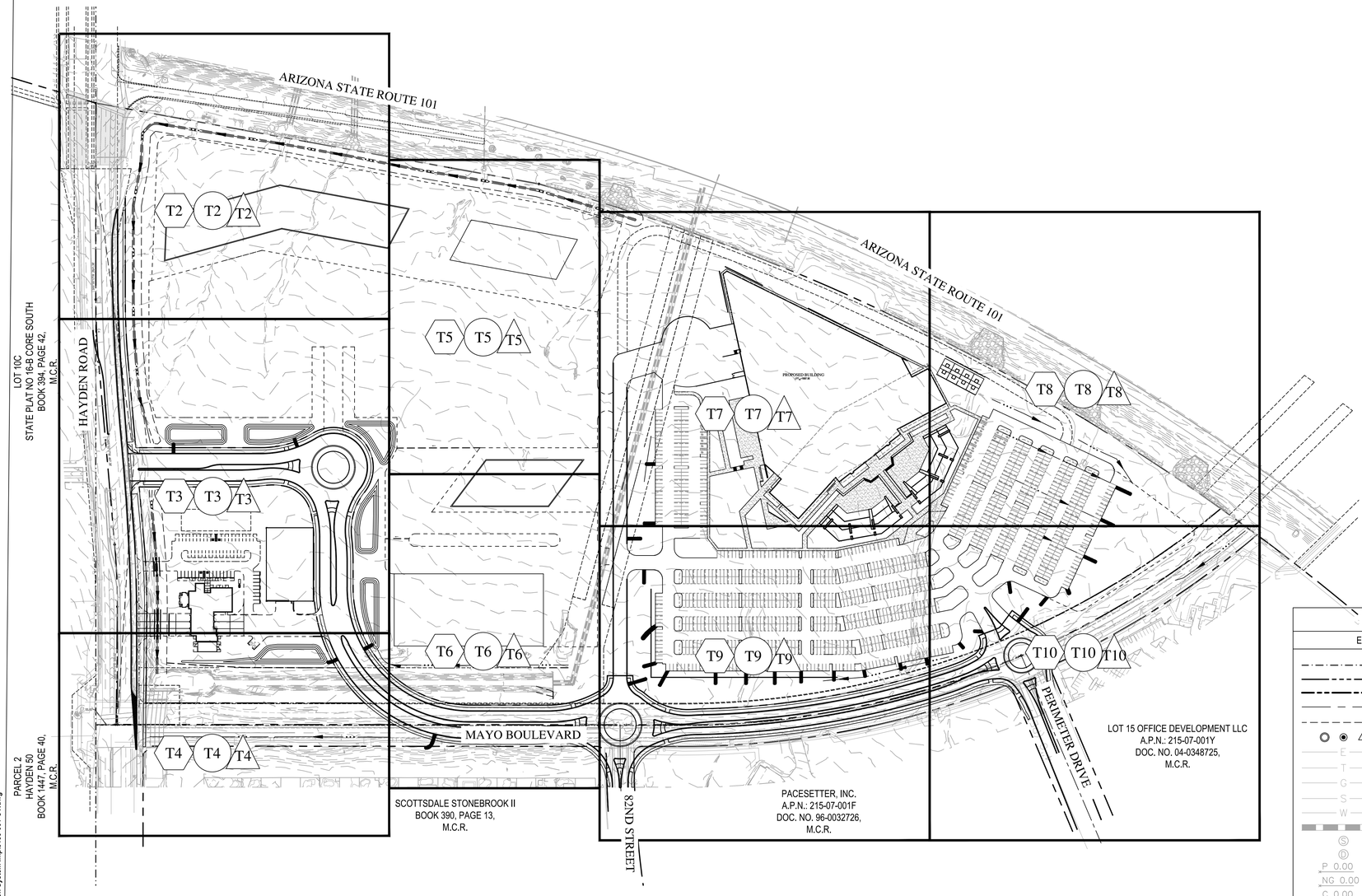
Parking Master Plan

CROSSROADS EAST - PLANNING UNITS X & XI

MASTER TRANSPORTATION PLAN

AT THE N.E. CORNER OF HAYDEN ROAD AND UNION HILLS DR.

A PORTION OF THE NORTH 1/2 OF SECTION 36, TOWNSHIP 4 NORTH, RANGE 4 EAST
OF THE GILA AND SALT RIVER MERIDIAN, MARICOPA COUNTY, ARIZONA



N

0 150 300
Horz. 1 in. = 150 ft.

LEGEND

- TX — TRANSPORTATION IMPROVEMENT PLAN
- TX — CIRCULATION PLAN
- TX — PEDESTRIAN CIRCULATION PLAN
- PROPERTY LINE

LEGEND/ABBREVIATIONS

EXISTING SURVEY	
	SECTION LINE
	RIGHT OF WAY
	PROPERTY LINE
	ROAD CENTERLINE
	EASEMENT
	SURVEY MARKER
E	ELECTRIC
T	TELEPHONE
G	GAS LINE
S	SEWER LINE
W	WATER LINE
	STORM DRAIN PIPE
S	SEWER MANHOLE
D	STORM DRAIN MANHOLE
P 0.00	PAVEMENT ELEVATION
NG 0.00	NATURAL GROUND ELEVATION
C 0.00	CONCRETE ELEVATION
TC 0.00	TOP OF CURB ELEVATION
	JUNCTION BOX/RISER
	FIRE HYDRANT
	WATER VALVE
	STREET/PARKING LIGHT

PROPOSED GRADING, DRAINAGE & PAVING	
	SLOPE ARROW
	WALL
PROPOSED WATER & SEWER	
S	SEWER LNE
12"W	WATER LINE
	PLUG
	SEWER CLEANOUT
	AREA DRAIN
	CATCH BASIN
A.L.	AREA LIGHT
C	CONCRETE ELEVATION
C.B.	CATCH BASIN
DE	DRAINAGE EASEMENT
D.W.	DRYWELL
E.O.L.	EDGE OF LANDSCAPE
J.B.	JUNCTION BOX
FH	FIRE HYDRANT
E.C.B.	ELECTRICAL CABINET BOX
HW	HEAD WALL
INV	INVERT ELEVATION
LFF	LOWEST FINISHED FLOOR ELEVATION
WE	WATER EASEMENT
LF_{88}=	LOWEST FINISH FLOOR ELEVATION
TC 0.00	TOP OF CURB
FG 0.00	FINISH GRADE ELEVATION
C 0.00	CONCRETE ELEVATION
C.A	CROSS ACCESS
E.S.A	EMERGENCY SERVICE ACCESS
P.U.E	PUBLIC UTILITY EASEMENT
U.E	UTILITY EASEMENT
P.A.E	PUBLIC ACCESS EASEMENT

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OWNER / DEVELOPER

AXON
P.O. BOX 1833
TEMPE, AZ 85280
CONTACT: CHARLES HUELLMANTEL
PHONE: (480) 921-2800
E-MAIL: CHARLES@HUELLMANTEL.COM

ENGINEER

WOOD, PATEL & ASSOCIATES, INC.
2051 W NORTHERN AVE. SUITE 100
PHOENIX, AZ 85021
CONTACT: NICHOLAS BROWN, P.E.
PHONE: (602) 335-8503
E-MAIL: NBROWN@WOODPATEL.COM

ARCHITECT

SMITH GROUP
455 NORTH THIRD STREET SUITE 250
PHOENIX, AZ 85004
CONTACT: LYLE STEELY AIA LEED AP
PHONE: (602) 824-5348
EMAIL: WWW.LYLE.STEELY@SMITHGROUP.COM

PROJECT SITE DATA

ASSESSOR PARCEL NUMBER(S):
215-07-210B
PROJECT SITE ADDRESS:
17800 NORTH 85TH STREET
SCOTTSDALE, AZ 85255
PROJECT SITE AREA(S):
NET AREA = 71.07 AC
ZONING:
PCD

SHEET INDEX

NOT FOR CONSTRUCTION

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MT
1
COVER SHEET

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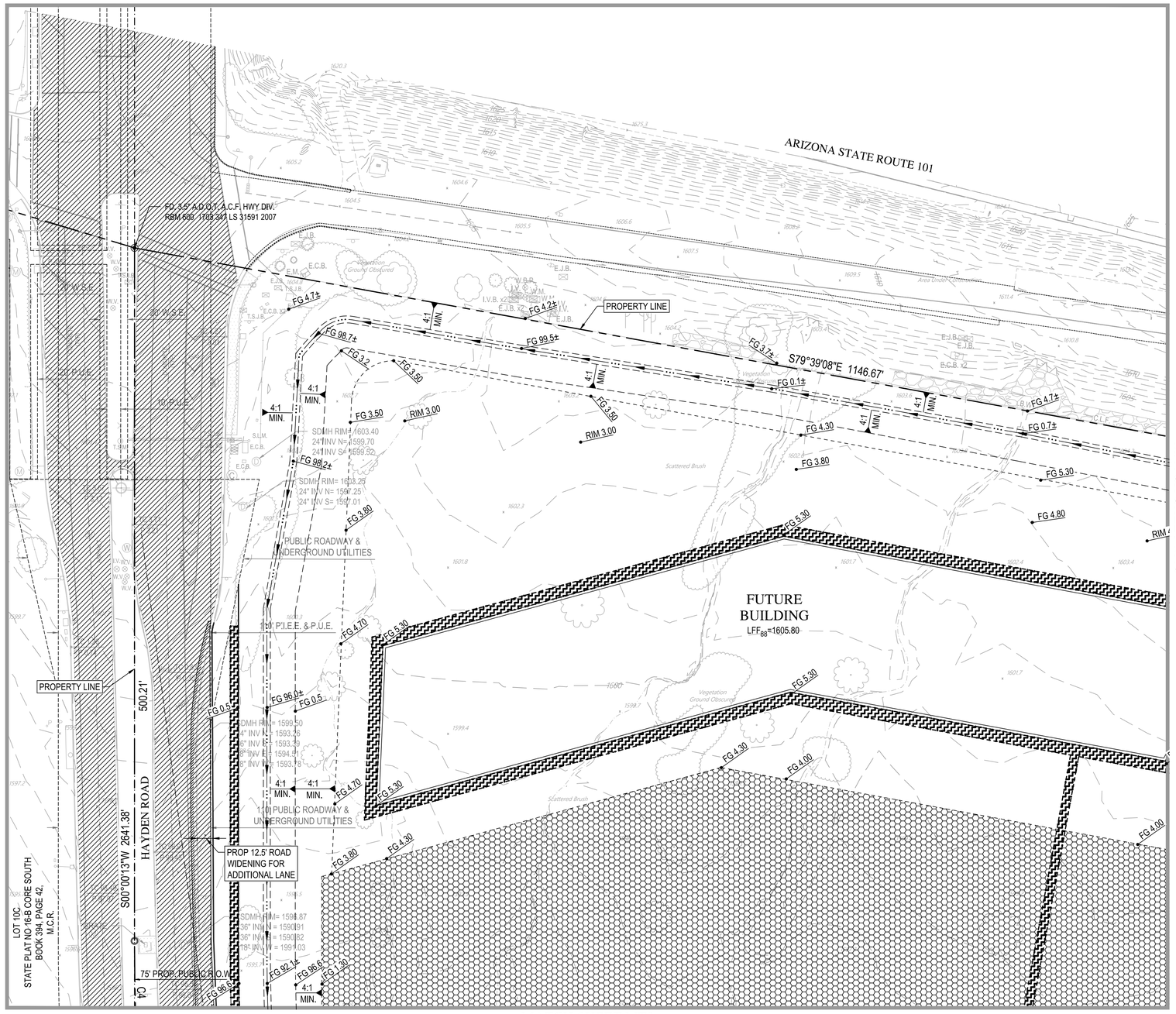

CURVE TABLE (M)			
CURVE	DELTA	RADIUS	ARC
C2	40°08'46"	2200.00'	1,541.50'
C3	5°02'30"	1800.00'	158.39'
C4	5°02'30"	1800.00'	158.39'

HATCH LEGEND	
	PEDESTRIAN CIRCULATION
	PRIVATE DRIVE
	PUBLIC COLLECTOR STREET
	SURFACE PARKING
	PRIVATE DRIVE / SURFACE PARKING

N

0 40 80

Horz. 1 in. = 40 ft.

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MT 2

MASTER TRANSPORTATION PLAN

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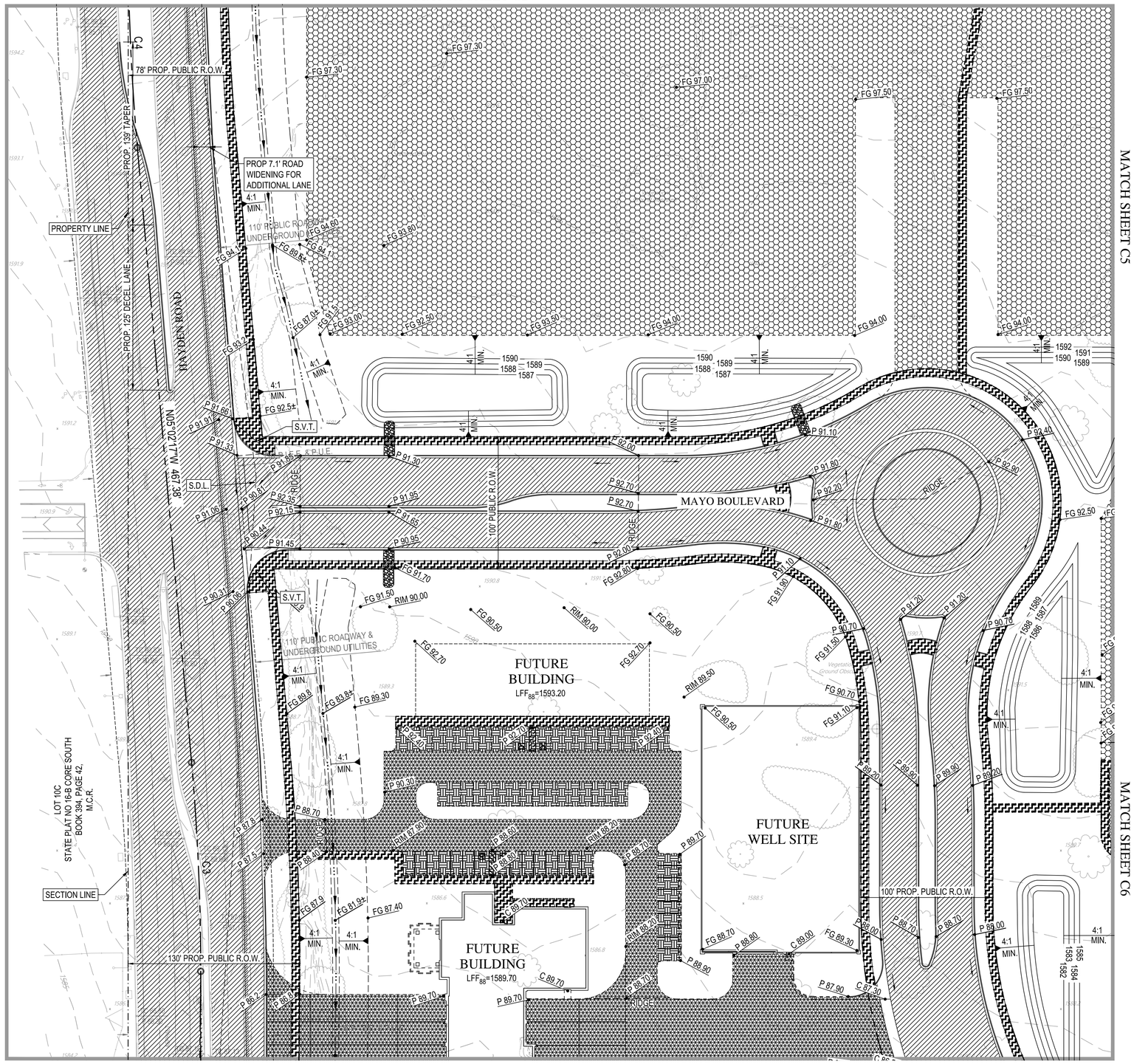
MATCH SHEET C2



MATCH SHEET C5

MATCH SHEET C6

MATCH SHEET C4

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Horz. 1 in. = 40 ft.

CURVE TABLE (M)			
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C4	5°02'30"	1800.00'	158.39'

HATCH LEGEND

- PEDESTRIAN CIRCULATION
- PRIVATE DRIVE
- PUBLIC COLLECTOR STREET
- SURFACE PARKING
- PRIVATE DRIVE / SURFACE PARKING

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MT 3

MASTER TRANSPORTATION PLAN

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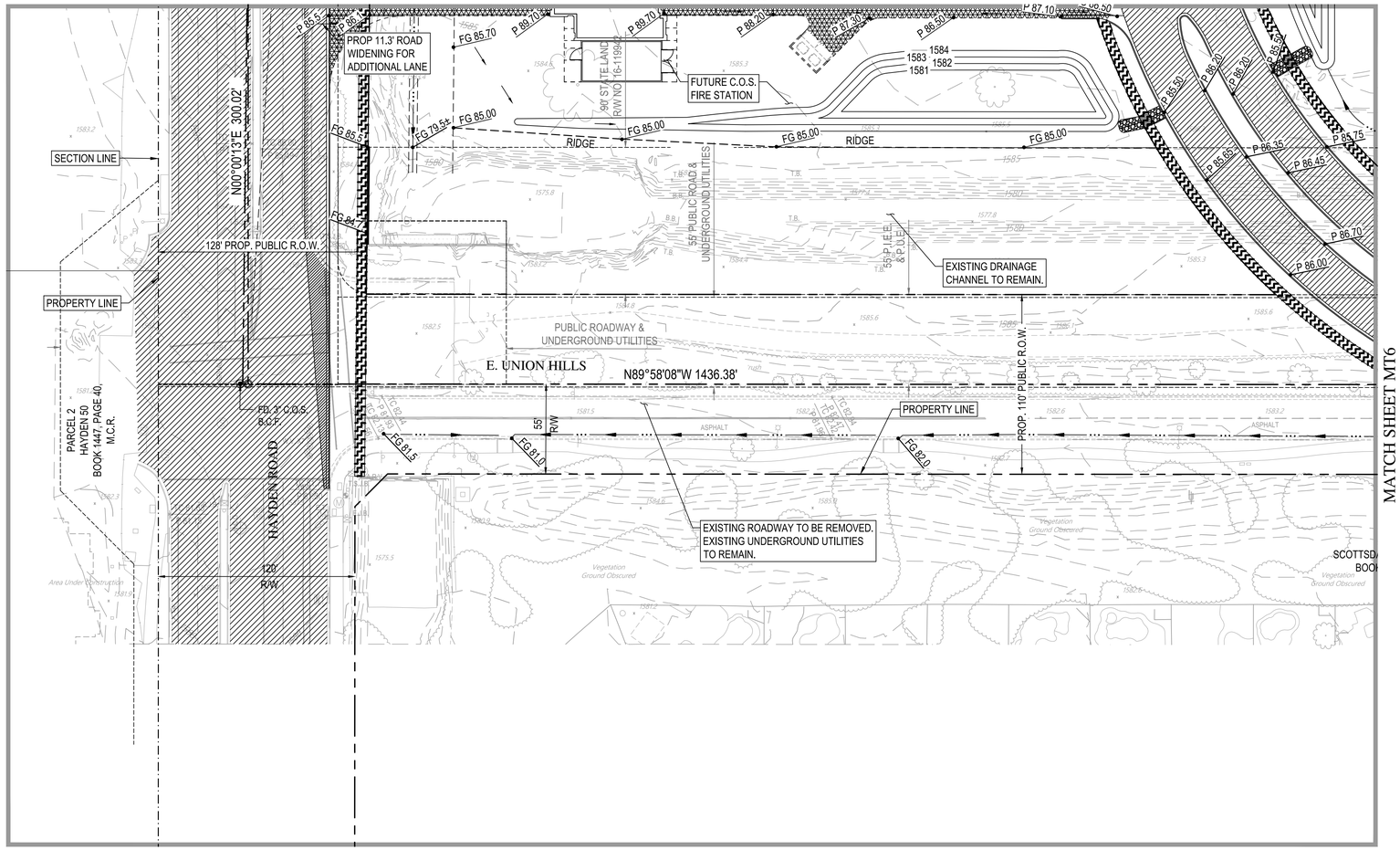
MATCH SHEET MT3



MATCH SHEET MT6

N

0 40 80

Horz. 1 in. = 40 ft.

HATCH LEGEND

- PEDESTRIAN CIRCULATION
- PRIVATE DRIVE
- PUBLIC COLLECTOR STREET
- SURFACE PARKING
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MT 4

MASTER TRANSPORTATION PLAN

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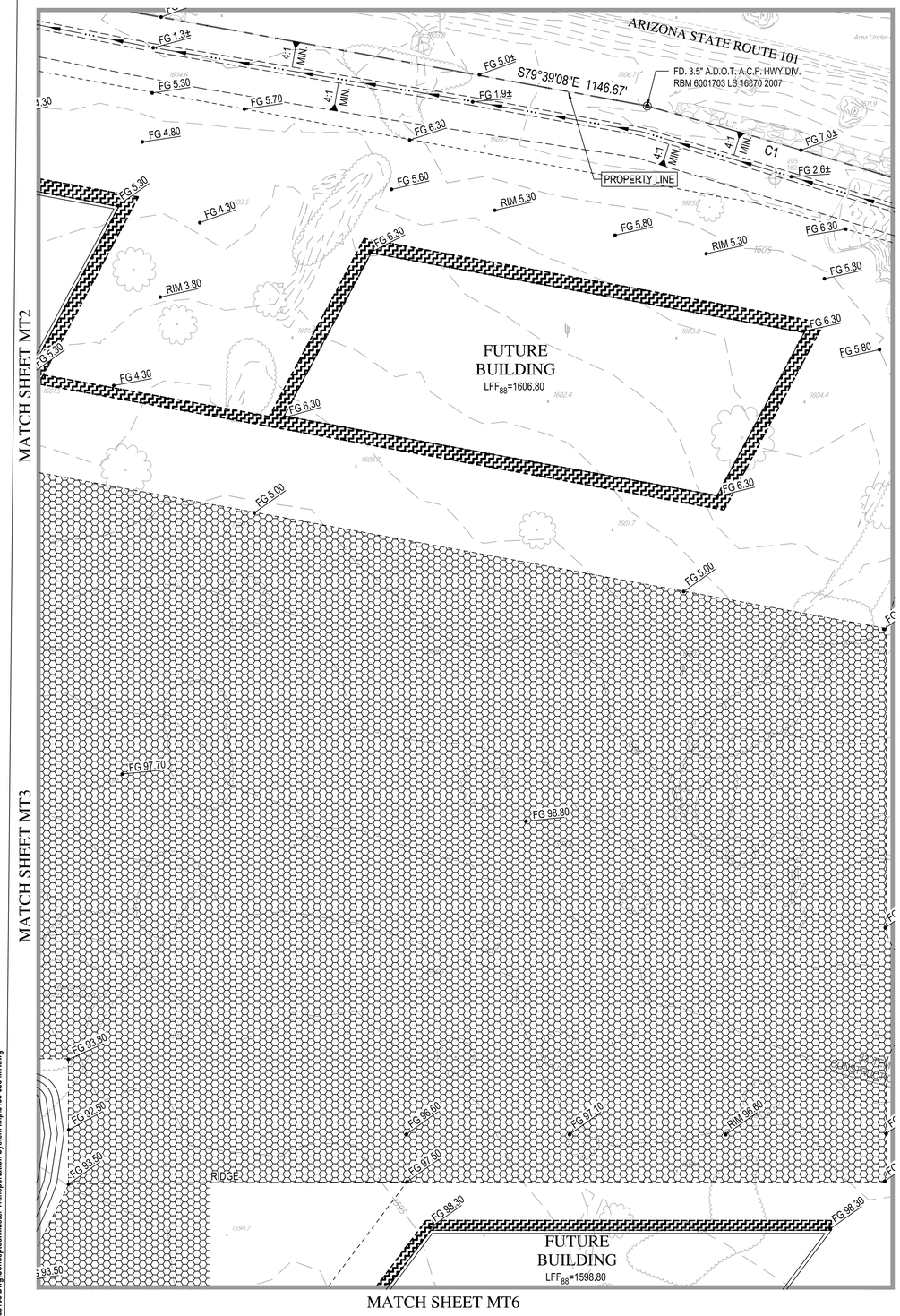

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- SURFACE PARKING
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MT 5

MASTER TRANSPORTATION PLAN

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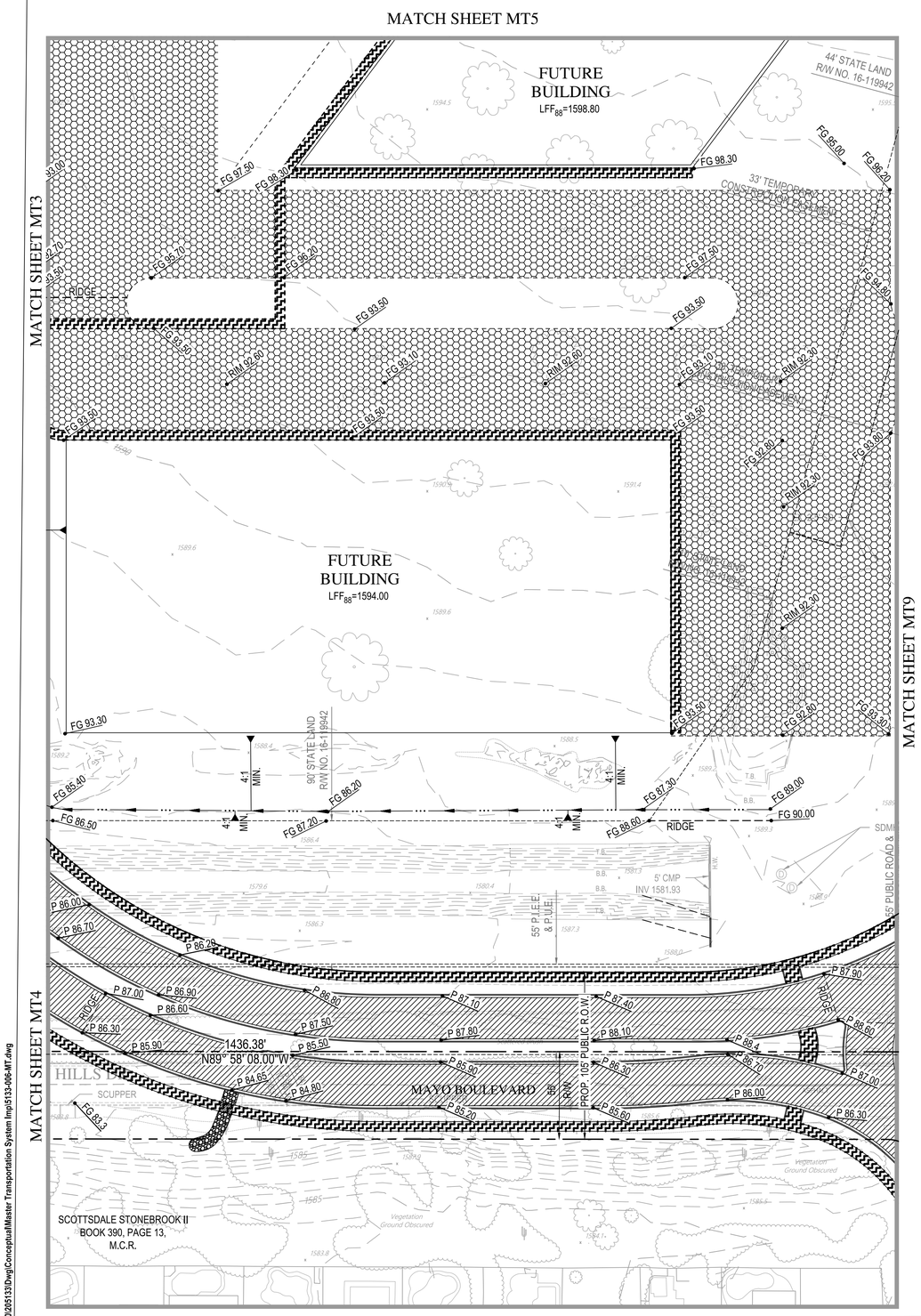

N

0 40 80

Horz. 1 in. = 40 ft.

HATCH LEGEND

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- SURFACE PARKING
- PRIVATE DRIVE / SURFACE PARKING

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MT 6

MASTER TRANSPORTATION PLAN

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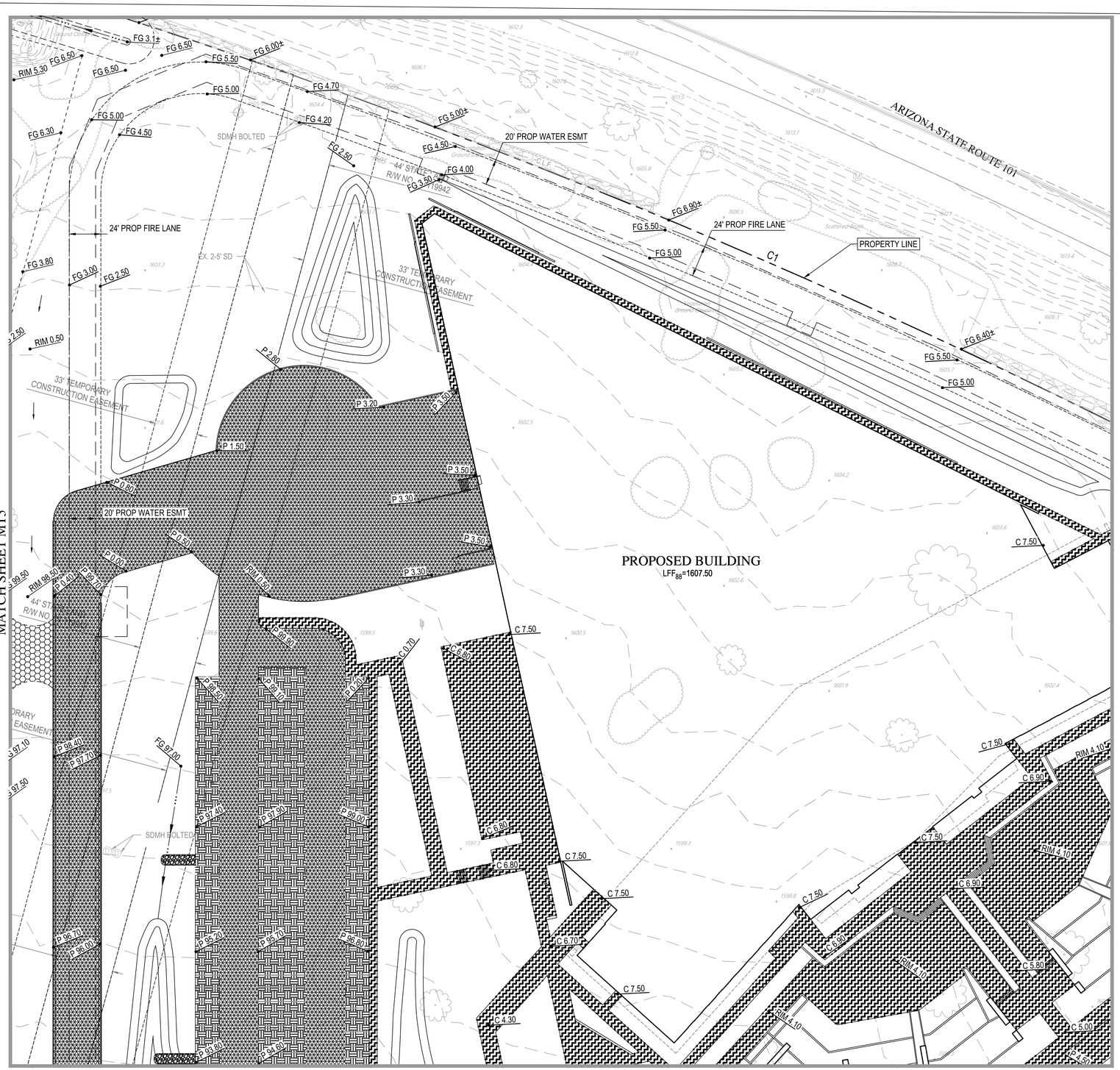

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HATCH LEGEND

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- SURFACE PARKING
- PRIVATE DRIVE / SURFACE PARKING

N

0 40 80

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MT 7

MASTER TRANSPORTATION PLAN

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MATCH SHEET MT7

MATCH SHEET MT10

CURVE TABLE (M)			
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C2	40°08'46"	2200.00'	1,541.50'
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MT 8

MASTER TRANSPORTATION PLAN

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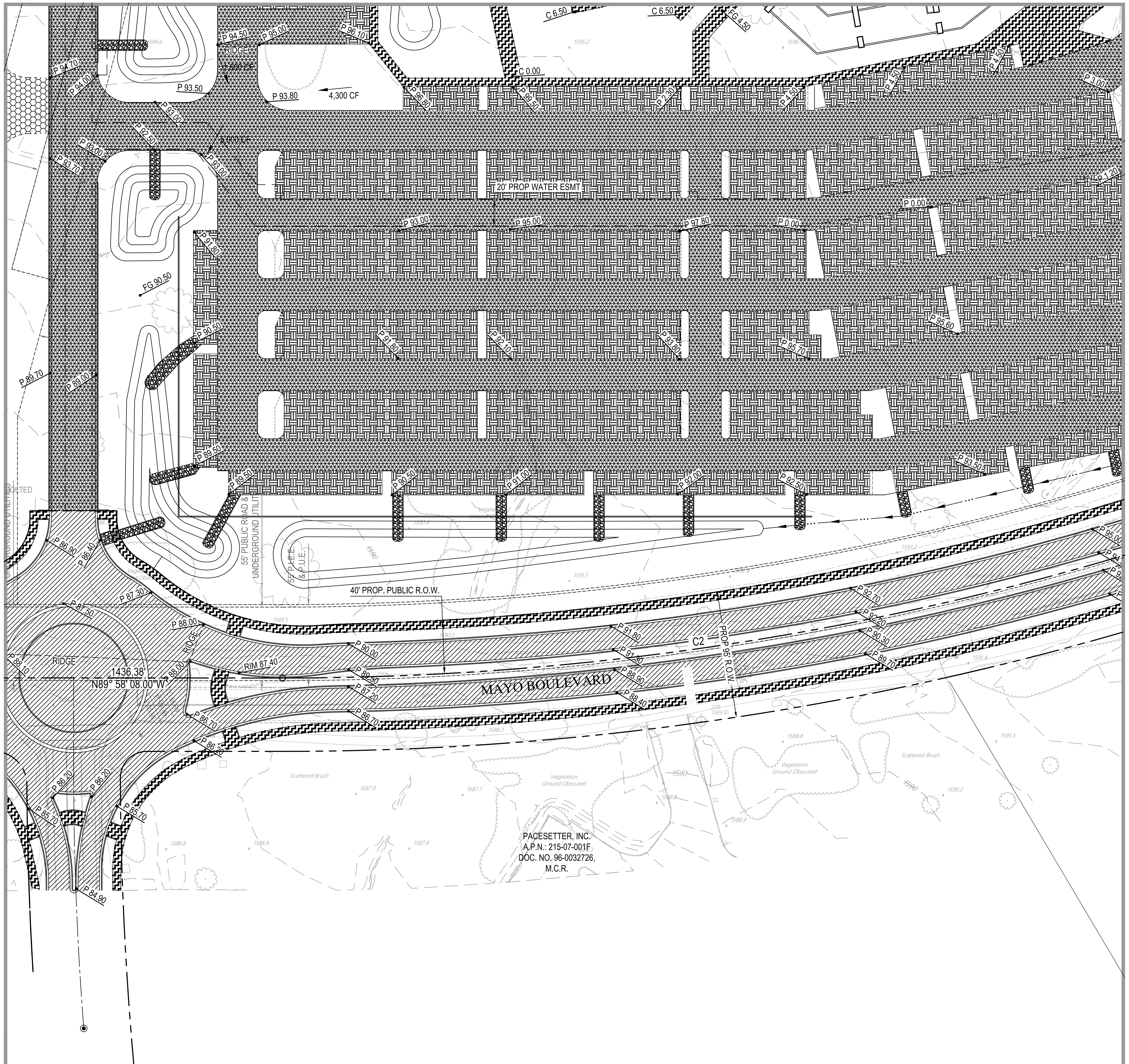

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CURVE TABLE (M)

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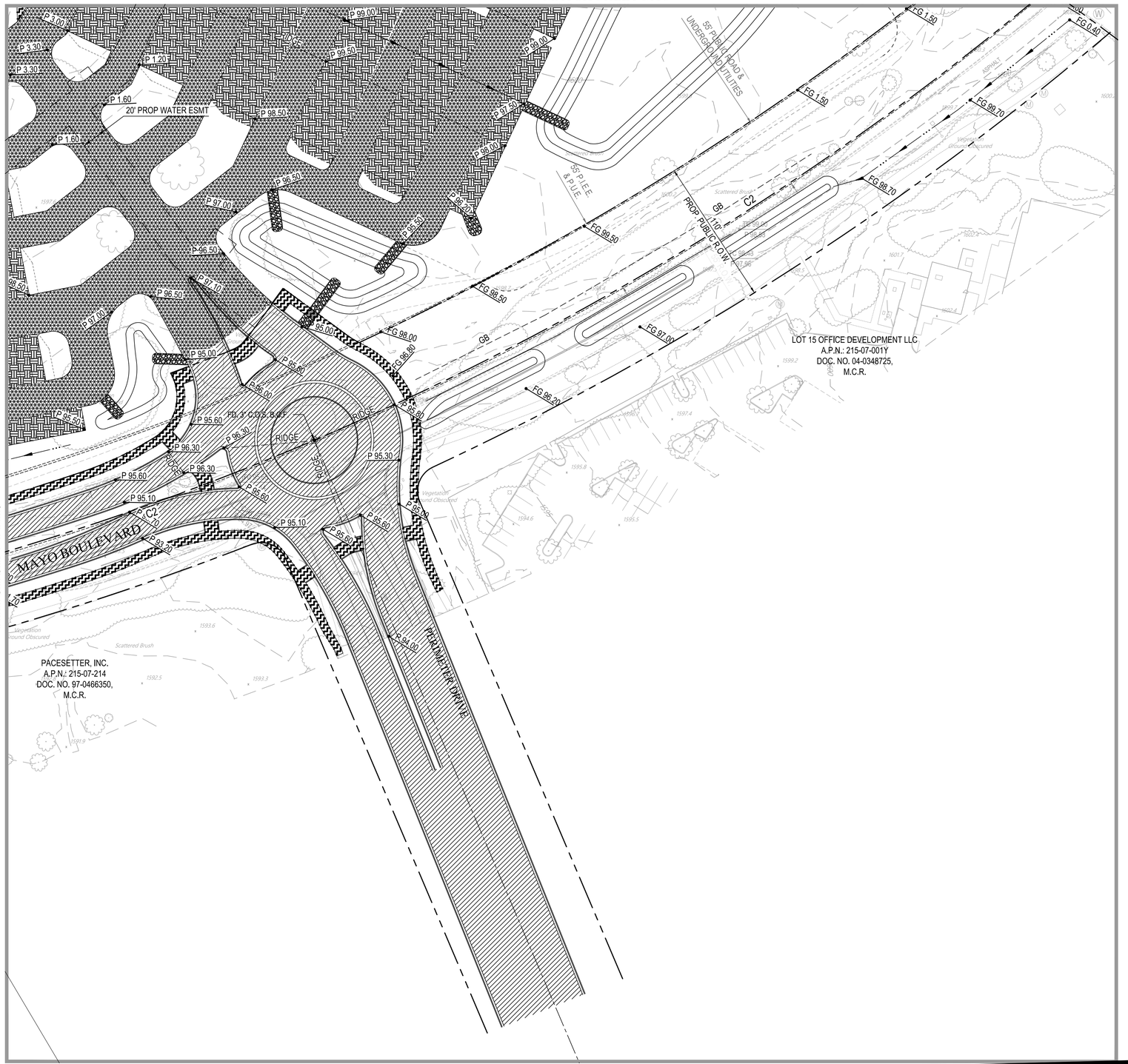
MATCH SHEET MT8



MATCH SHEET MT9

CURVE TABLE (M)			
CURVE	DELTA	RADIUS	ARC
C2	40°08'46"	2200.00'	1,541.50'
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- SURFACE PARKING
- PRIVATE DRIVE / SURFACE PARKING

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MT
10

MASTER TRANSPORTATION PLAN

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SCOTTSDALE AIRPORT VICINITY DEVELOPMENT **SHORT FORM**

For development projects within 20,000 feet of Scottsdale Airport NOT located on an Airpark taxilane or adjacent to airport property

The owner of developments within the Airport Influence Area shall complete forms required by the City and Scottsdale Airport to comply with the Scottsdale Revised Code, Chapter 5 – Aviation and the Airpark Rules and Regulations; and submit the completed forms with final plans to the assigned city project manager.

Project Name: Axon Campus	Plan#: 716-PA-2020
Site Address: Southeast corner of Hayden Road and Loop 101	
Contact name: Charles Huellmantel, Huellmantel & Affiliates	Phone: (480) 921-2800

1. HEIGHT ANALYSIS, CH. 5, SEC. 5-354. GENERAL REQUIREMENTS

☒ Applicants must conduct a height analysis for all projects located within 20,000 feet of Scottsdale Airport.

1. Complete a height analysis for all structures, appurtenances or construction equipment through the FAA at: https://oeaaa.faa.gov/oeaaa/external/portal.jsp, click on the Notice Criteria Tool (left side). If you do not exceed criteria, submit this FAA response from the website with your packet or you must complete step 2.

IF required by FAA, complete Step 2

2. Submit an FAA form 7460-1 Notice of Proposed Construction or Alteration for review and determination. Please allow about 45 days for this process. A copy of the FAA's response will be required prior to final plan approval.

2. AIRCRAFT NOISE AND OVERFLIGHT DISCLOSURE, CH. 5, SEC. 5-356 & SECT. 5-357

☐ Incorporate the Airport Disclosure for Development around Scottsdale Airport language into the CC&Rs or other procedural documents and provide a copy. *Exhibit A*

☐ An avigation easement will need to be granted to the city. If not already recorded for property, submit a notarized Avigation Easement form with packet to your project manager. *Exhibit B*

For questions regarding this form or aviation-related requirements, contact Scottsdale Airport at 480-312-2321.

SCOTTSDALE AIRPORT SDL

CivTech

September 10, 2020

Charles Huellmantel
Huellmantell & Affiliates
605 South Ash Avenue
Tempe, Arizona 85281
Telephone: (480) 921-2800
Email: charles@huellmantel.com

RE: ENHANCED TRAFFIC STATEMENT FOR THE AXON CAMPUS – SCOTTSDALE, ARIZONA

Dear Mr. Huellmantel:

CivTech is pleased to present this enhanced traffic statement for the proposed Axon Campus (`project site') located in on the south and west side of Loop 101, north of the Mayo Boulevard/Union Hills alignment and east of Hayden Road in Scottsdale, Arizona. The proposed project would develop one (1) parcel on approximately 70 acres that was previously proposed as a part of the Crossroads East PCD (Parcel 13). The previous assumptions for this parcel included industrial, manufacturing and warehousing uses totaling approximately 1.5 million square feet. The Axon Campus is an allowable use for Parcel 13 with the PCD. The proposed trip generation assumptions utilized during the Crossroads East TIA prepared for the PCD zoning process with the Arizona State Land Department (ASLD) were similar in scale. The proposed site plan can be found in **Attachment A**.

PURPOSE AND SCOPE

The purpose of this traffic statement is to determine if the relocated Mayo Boulevard, which is now proposed in a different location than originally shown within the Crossroads East TIA, can utilize roundabouts to help realign the roadway and provide more developable land for the Axon Campus. The location and potential size of roundabouts used in the relocation will be reviewed to determine if adequate spacing is provided from the arterial street network to avoid queueing through the roundabout. The typical section required for Mayo Boulevard east of Hayden Road with the Axon Campus is also being reviewed as part of this statement.

The Crossroads east TIA was approved by the City of Scottsdale on September 23, 2011 with a stipulation that the developer provide an additional lane in the northbound direction on Hayden Road fronting the project. This lane has been considered within the analysis. A trip generation comparison will be conducted as well as a capacity analysis to determine if there are additional changes to the surrounding roadway network that are needed due to the development of this parcel.

13-ZN-2020
9/11/2020

EXISTING CONDITIONS

SURROUNDING LAND USES

The project site is currently undeveloped land. Directly north of the site is the Pima (Loop 101) Freeway, and the City of Scottsdale water treatment plant. Directly to the south of the site is the Scottsdale Stonebrook single-family detached housing, Pacesetter Business complex, Hilton Garden Inn, Scottsdale Sports Complex, Sonoran Corporate Center Condominium, Hartford Place Condominium, Scottsdale Liberty Hospital, and other business buildings. Directly to the east of the site is the Pima (Loop 101) Freeway, DC Ranch Crossing Shopping Center, DC Ranch Crossing Apartment complex, Corporate Center at DC Ranch, and single-family detached housing. Directly to the west of the site is currently undeveloped land.

EXISTING ROADWAY NETWORK

The existing roadway network within the study area includes Mayo Boulevard and Hayden Road. The study roadways are discussed in further detail as follows:

Mayo Boulevard is an east-west collector roadway with one (1) lane in each direction within the vicinity of the proposed site. Mayo Boulevard begins at the southwest corner of the site at Hayden Road and continues for approximately half a mile where it turns into Union Hills Drive at Perimeter Drive. The posted speed limit is 35 miles per hour (mph) within the vicinity of the site.

Hayden Road is a north-west minor arterial roadway with two (2) lanes and a bike lane in each direction with a raised center median within the vicinity of the proposed site. Hayden Road begins southwest of the site at Scottsdale Road and continues north of the site to Deer Valley Road where it turns into Miller Road. Hayden Road provides direct access to the Loop 101 Freeway. The posted speed limit is 40 miles per hour (mph) within the vicinity of the site.

EXISTING INTERSECTION CONFIGURATION

The intersection of **Hayden Road & Mayo Boulevard** operates as an unsignalized "T" intersection with stop control in the westbound approach. The northbound approach consists of two (2) through lanes, one (1) dedicated right-turn lane, and a bike lane. The southbound approach consists of two (2) through lanes, one (1) left-turn lane, and a bike lane. The westbound approach consists of one (1) shared left-turn/through/right-turn lane. Designated pedestrian crosswalks are provided along all legs of the intersection.

EXISTING CAPACITY ANALYSIS

Peak hour capacity analyses have been conducted for the study intersections based on existing intersection configurations and traffic volumes. All intersections have been analyzed using the methodologies presented in the *Highway Capacity Manual (HCM), Special Report 209,* and Updated 2016 and using Synchro software, version 10.0 under the HCM 6th edition methodology.

The concept of level of service (LOS) uses qualitative measures that characterize operational conditions within the traffic stream. The individual levels of service are described by factors that

include speed, travel time, freedom to maneuver, traffic interruptions, and comfort and convenience. Six levels of service are defined for each type of facility for which analysis procedures are available. They are given letter designations A through F, with LOS A representing the best operating conditions and LOS F the worst. Each level of service represents a range of operating conditions. Levels of service for intersections are defined in terms of delay ranges. **Table 3** lists the level of service criteria for signalized and unsignalized intersections, respectively.

Table 3 – Level of Service Criteria for Controlled Intersections

Level-of-Service	Signalized Control Delay (sec/veh)	Unsignalized Control Delay (sec/veh)
A	≤ 10	≤ 10
B	> 10-20	> 10-15
C	> 20-35	> 15-25
D	> 35-55	> 25-35
E	> 55-80	> 35-50
F	> 80 (or v/c > 1)	> 50 (or v/c > 1)

Source: Exhibits 19-8, 20-2, 21-8, and 22-8, Highway Capacity Manual 2017

Synchro 10.0 software calculates the LOS per the HCM 2016 methodology. The 2016 HCM documents the signalized LOS calculation methodology which takes into account lane geometry, traffic volumes and cycle length/phasing to compute LOS. Synchro analysis worksheets report individual movement delay/LOS and overall delay/LOS for signalized intersections; unsignalized intersection worksheets report the worst-case delay/LOS and the average overall intersection delay. Results of the existing level of service analyses are shown in **Table 4** for both AM and PM peak hours. The existing conditions analysis worksheets have been included in **Attachment B**.

Existing volumes for this analysis were determined by using traffic counts previously conducted at this intersection from June of 2018. These counts were grown by a factor of 2.1% per year from 2018 to 2020 in order to represent traffic as it would be today.

Table 4 – Existing Peak Hour Levels of Service

ID	Intersection	Intersection Control	Approach/ Movement	Existing LOS AM (PM)
1	Hayden Road & Mayo Boulevard	1-way stop (WB)	SB left WB Shared	A (B) A (C)

The results of the existing conditions analysis summarized in Table 4 indicate that the intersection of Hayden Road & Mayo Boulevard operates with acceptable levels of service (LOS D or better).

FUTURE ROADWAY CONDITIONS

Upon buildout of this project, the Mayo Boulevard alignment will be reconstructed approximately 760 feet, center to center, north of the existing alignment. Mayo Boulevard west of Hayden Road is also currently under construction so that it connects to the existing alignment east of Scottsdale Road.

The City of Scottsdale will assist with constructing Mayo Boulevard east of Hayden Road to Perimeter Drive, no access to the Loop 101 freeway will be constructed. Mayo Boulevard could provide up to a four lane section with two lanes of travel in each direction of travel. The proposed cross-section will be determined as part of this traffic analysis and to accommodate the needs of the Axon Campus.

SITE ACCESS

Access to the site will be via one main access point along Mayo Boulevard. Future development could also provide a second access from Mayo Boulevard. Both access points will utilize the proposed roundabouts to connect to private driveways. The primary access, located at 82nd Street will be a four-legged roundabout with two eastbound approach lanes and two westbound departure lanes. All other approach and departure lanes have been assumed with one lane in each direction.

TRIP GENERATION

The potential trip generation for the Axon Campus was estimated utilizing the Institute of Transportation Engineers (ITE) *Trip Generation Manual, 10th Edition* and *Trip Generation Handbook, 3rd Edition*. The ITE *Trip Generation Manual* contains data collected by various transportation professionals for a wide range of different land uses. The data are summarized in the report and average rates and equations have been established that correlate the relationship between an independent variable that describes the development size and generated trips for each categorized land use. The anticipated trip generation comparison for the project site is provided in **Table 1**.

Table 1 - Trip Generation Summary

Land Use	ITE Code	Land Use Name	Quantity Units+	AM Distribution		PM Distribution	
				In	Out	In	Out
Previous Assumption (Crossroads East)							
Industrial Park	130	Industrial Park	490.766 KSF	82%	18%	21%	79%
Manufacturing	140	Manufacturing	490.766 KSF	78%	22%	36%	64%
Warehousing	150	Warehousing	490.766 KSF	79%	21%	25%	75%
Proposed							
General Office Building	710	General Office building	780.000 KSF	86%	14%	16%	84%
Warehousing	150	Warehousing	130.000 KSF	77%	23%	27%	73%

Land Use	ADT		AM Peak Hour				PM Peak Hour			
	Avg. Rate*	Total	Avg. Rate*	In	Out	Total	Avg. Rate*	In	Out	Total
Previous Assumption (Crossroads East)										
Industrial Park	5.25	2,576	0.49	196	43	239	0.79	81	305	386
Manufacturing	3.87	1,900	0.82	313	88	402	0.77	137	243	380
Warehousing	3.13	1,534	0.19	74	20	94	0.18	23	68	91
Total		**6,010**		**583**	**151**	**732**		**241**	**616**	**857**
Proposed										
General Office Building	9.98	7,782	0.97	654	106	760	1.03	128	673	801
Warehousing	1.93	250	0.31	32	9	41	0.33	12	31	43
Total		**8,032**		**686**	**115**	**801**		**140**	**704**	**844**
Difference (Proposed-Previous Assumption)		**1,797**		**103**	**-36**	**66**		**-101**	**88**	**-13**
Difference (%)		**30%**		**18%**	**-24%**	**9%**		**42%**	**14%**	**-2%**

Notes: *All average rates were calculated by dividing total trips generated using regression equation by the number of dwelling units. (See below.)
+ KSF = 1,000 square feet

CALCULATIONS (Equations shown only where applicable)			
Land Use [Units]	*Daily*	*AM Peak Hour*	*PM Peak Hour*
General Office Building [X = 780 SF]	FC: LN(T)=0.97*LN(X)+2.5 [9.98]	FC: T=0.94*X+26.49 [0.97]	FC: LN(T)=0.95*LN(X)+0.36 [1.03]
Warehousing [X = 130 SF]	FC: T=1.58*X+45.54 [1.93]	FC: T=0.12*X+25.32 [0.31]	FC: T=0.12*X+27.82 [0.33]

The proposed Axon Campus development could generate up to 8,032 weekday daily trips with 801 trips occurring during the AM peak hour (686 in/115 out) and 844 trips occurring during the PM peak hour (140 in/704 out)

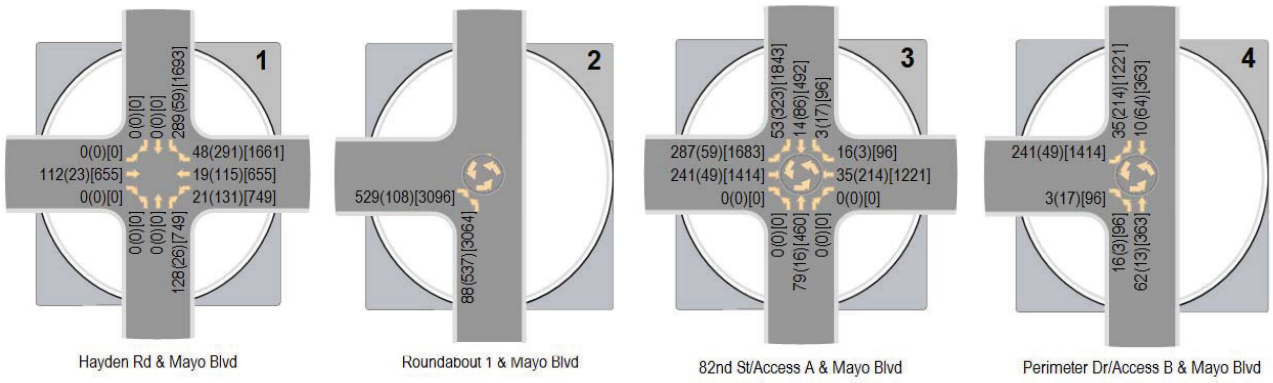
The Axon Campus is expected to generate 1,797 additional external daily trips as compared to the original Crossroads East TIA, with 66 additional trips generated during the AM peak hour (103 trips in/-36 trips out) and 13 fewer trips generated during the PM peak hour (-101 trips in/88 trips out).

TRIP DISTRIBUTION AND ASSIGNMENT

A single trip distribution pattern was taken from the previously approved Crossroads East TIA. It is expected that the development will generate trips based on future population within a 10-mile radius of the site. Future total population within a 10-mile radius of the site, as predicted by the 2030 socio-economic data compiled by the Maricopa Association of Governments (MAG), was used in that study as a basis to estimate trip distribution for the development.

Based on this information and the local street network, distribution percentages were assigned to the study roadway network. The resulting trip distribution percentages were applied to the generated trips to determine the AM and PM peak hour site traffic at the intersections within the study area and are illustrated in **Figure 1**.

Figure 1 – Site Trip Distribution



BACKGROUND TRAFFIC GROWTH PROJECTIONS

Background traffic along Hayden Road was determined by growing the existing 2020 traffic volumes by 2.1% per year to the opening year 2035. This gives a growth factor of 1.366 applied to the existing Hayden Road volumes.

CivTech recently conducted a traffic study for the Cavasson development, located on the southwest corner of Hayden Road and Legacy Boulevard. This development is anticipated to produce additional traffic on Hayden Road by the horizon year 2035. This anticipated additional traffic was added to the grown existing volumes to represent future traffic on the surrounding roadway network.

Along with the Cavasson development, Mayo Boulevard is currently being constructed so that it connects west to Scottsdale Road. The original Crossroads East TIA projected volumes for this portion of Mayo Boulevard between Hayden Road and Scottsdale Road. In order to have a more conservative estimate of approach traffic volumes, the eastbound and westbound volumes from Crossroads East for this portion of Mayo Boulevard were included in place of the existing volumes since the roadway is not yet completed and existing traffic that was present is likely construction vehicles. The horizon year for Crossroads East TIA was 2030, so the volumes used in the Axon Campus background traffic were grown by 2.1% per year for 5 years in order to represent the 2035 horizon year as projected for the Cavasson development.

Background traffic calculations as well as the Cavasson and Crossroads East volumes referenced above are located within **Attachment C**.

TRAFFIC AND IMPROVEMENT ANALYSIS

The overall intersection and approach levels of service are summarized in **Table 5** for the 2035 background and total traffic conditions. Detailed analysis worksheets for the 2035 analyses can be found in **Attachment D**.

Table 5 – Peak Hour Levels of Service

ID	Intersection	Intersection Control	Approach/ Movement	2035	
				No Build	Build
				AM (PM)	AM(PM)
1	Hayden Road & Mayo Boulevard	Signalized	NB	C(C)	D(D)
			SB	C(C)	D(D)
			EB	D(D)	D(D)
			WB	D(D)	D(D)
			Overall	**C(C)**	**D(D)**
2	Roundabout 1 & Mayo Boulevard	Roundabout	NB	NA	A(B)
			EB		A(A)
			WB		A(A)
			Overall		A(A)
3	82nd Street & Mayo Boulevard	Roundabout	NB	NA	A(A)
			SB		A(A)
			EB		A(A)
			WB		A(A)
			Overall		A(A)
4	Perimeter Drive & Mayo Boulevard	Roundabout	NB	NA	A(A)
			SB		A(A)
			EB		A(A)
			Overall		A(A)

The results of the Synchro analysis summarized in **Table 5** indicate that all study intersections operate with overall acceptable levels of service D or better.

QUEUE STORAGE ANALYSIS

Adequate turn storage should be supplied on any approach where turn lanes are permitted and/or warranted. A queuing analysis was performed for all warranted/recommended and existing intersection turn lanes where site traffic is expected as well as left turn lanes adjacent to the site. According to the methodology documented in *A Policy on Geometric Design of Highways and Streets* (the AASHTO "Green Book"*)*, the storage length for a turn lane is typically estimated as the length required to hold the average number of arriving vehicles per two minutes, where unsignalized, or per

one-and-a half signal cycles, where signalized.[1] The formulas used for the calculations are shown below.

For signalized intersections, the storage length is determined by the following formula:

Storage Length = [1.5 x (veh/hr)/(cycles/hr)] x 25 feet

For unsignalized intersections, the storage length is determined by the following formula:

Storage Length = [(veh/hr)/(30 periods/hr)] x 25 feet

The total projected traffic volumes were utilized for the calculations. From this, the resulting turn lane storage for turn movements using AASHTO guidelines were calculated and are summarized in **Table** . Calculations for the AASHTO queue storage length recommendations and the 50th percentile HCM 2016 queue storage length recommendations are provided in **Appendix E**. The 50th percentile HCM 2016 queue storage lengths are given in vehicles and multiplied by 25 feet per vehicle to determine the storage length.

Table 6 – Queue Storage Lengths

ID	Intersection	Intersection Control	Movement	Queue Storage		
				AASHTO	HCM(2)	Recommended
1	Hayden Road & Mayo Boulevard	Signalized	NB Left	50′	35′	150′
			SB Left	900′	45′	(1)300′
			EB Left	50′	225′	150′
			WB Left	225′	85′	150′
			SB Right	75′	160′	200′
			WB Right	1025′	390′	(3)

(1) A minimum of 150-feet of queue storage is recommended at all signalized intersections.
(2) HCM 50th percentile queue reported in vehicles/lane, assuming 1 vehicle ~ 25 feet.
(3) Westbound right-turn lane is a through trap lane that will provide more then the calculated queue storage.

The recommended storage lengths in **Table 6** is provided for study horizon year 2035 using the total traffic projections.

[1] *The American Association of Highway and Transportation Officials on pages 714-715 of its publication,* Geometric Design of Highways and Streets *("AASHTO Green Book"), indicates that storage length for a turn lane, exclusive of taper, "should usually be based on one and one-half to two times the average number of vehicles that would store per cycle" at a signalized intersection.*

Conclusions

The following conclusions and recommendations have been documented in this statement:

- The proposed Axon Campus development could generate up to 8,032 weekday daily trips with 801 trips occurring during the AM peak hour (686 in/115 out) and 844 trips occurring during the PM peak hour (140 in/704 out).
- The Axon Campus is expected to generate 1,797 additional external daily trips as compared to the original Crossroads East TIA, with 66 additional trips generated during the AM peak hour (103 trips in/-36 trips out) and 13 fewer trips generated during the PM peak hour (-101 trips in/88 trips out).
- All proposed intersections are anticipated to operate at acceptable levels of service.
- All intersections are anticipated to operate at acceptable levels of service with the proposed intersection lane configuration and the following roadway typical sections:
    - Mayo Boulevard should be constructed with a four-lane section, two lanes in each direction of travel between Hayden Road and 82nd Street. This will require the construction of a two-lane roundabout approximately 400 feet east of the Hayden Road alignment.
    - Mayo Boulevard could be reduced to provide a two-lane section, one lane in each direction of travel from 82nd Street to Perimeter Drive.
- Queue storage recommendations and proposed lane configuration recommendation have been provided in **Attachment E**.

Thank you for allowing CivTech to assist you on this project. We wish you the best as you proceed with the development. Please call me if you have any questions about this statement and/or if we can be of further assistance.

Sincerely,

CivTech

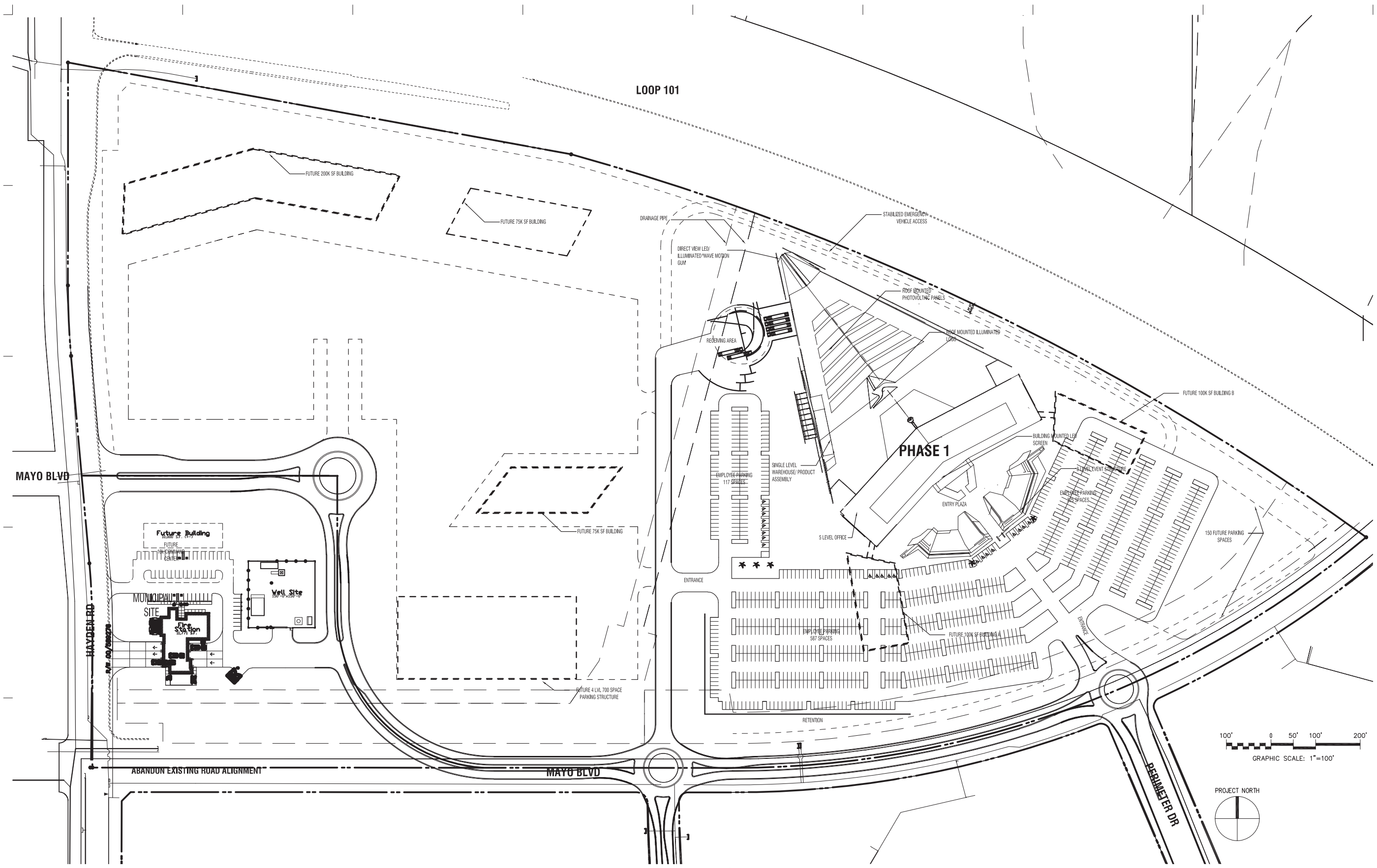
Dawn D Cartier, P.E., PTOE
Project Manager/President

Attachments:

A. Site Plan
B. Existing Conditions Analysis
C. Background Growth Calculations
D. 2035 Analysis Worksheets
E. Queue Storage Analysis

SMITHGROUP
455 NORTH THIRD STREET
SUITE 250
PHOENIX, AZ 85004
602.265.2200
www.smithgroup.com

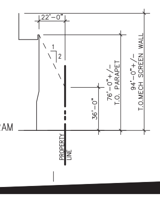
AXON



ISSUED FOR | YR | DATE

AXON HEADQUARTERS CONCEPTUAL SITE PLAN 08052020

1"=100'



BUILDING SETBACK DIAGRAM

01/13/2020

AXON CORPORATE HEADQUARTERS: FUTURE BLDG's PROPOSED

BLDG HEIGHT		76'-0" +/- TO PARAPET
ZONING:		PCD
OFFICE (B OCC)	275,000SF +/- @1;300	825 Spaces
PARKING REQUIRED		2677 Spaces
ADA REQUIRED 4%		109 Spaces

AXON CORPORATE HEADQUARTERS: FUTURE BLDG

BLDG HEIGHT		76'-0" +/- TO PARAPET
ZONING:		PCD
OFFICE (B OCC)	75,000SF +/- @1;300	225 Spaces
PARKING REQUIRED		1852 Spaces
ADA REQUIRED 4%		76 Spaces

AXON CORPORATE HEADQUARTERS: BLDG B PROPOSED

BLDG HEIGHT		76'-0" +/- TO PARAPET
ZONING:		PCD
OFFICE (B OCC)	100,000SF +/- @1;300	300 Spaces
PARKING REQUIRED		1627 Spaces
ADA REQUIRED 4%		66 Spaces

AXON CORPORATE HEADQUARTERS: BLDG A PROPOSED

BLDG HEIGHT		76'-0" +/- TO PARAPET
ZONING:		PCD
OFFICE (B OCC)	100,000SF +/- @1;300	300 Spaces
PARKING REQUIRED		1327 Spaces
ADA REQUIRED 4%		54 Spaces

AXON CORPORATE HEADQUARTERS: PHASE 1

BLDG HEIGHT		76'-0" +/- TO PARAPET
ZONING:		PCD
OFFICE (B OCC)	230,000SF +/- @1;300	767 Spaces
ASSEMBLY/ WAREHOUSE (F-1)	130,000SF +/- @1:500	260 Spaces
PARKING REQUIRED		1027 Spaces
ADA REQUIRED 4%		42 Spaces
PARKING PROVIDED		1027 Spaces
ADA PROVIDED		21 Spaces*

*Reduction to 2% (26 spaces) will be requested per Sec 9.105.c.2.a of C.O. Scottsdale Zoning code for Phase I.

ASP05

13-ZN-2020
9/11/2020

Intersection	
Int Delay, s/veh	1.7

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	0	41	307	9	176	568
Future Vol, veh/h	0	41	307	9	176	568
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	145	365	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	46	341	10	196	631

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1049	171	0	0	351	0
Stage 1	341	-	-	-	-	-
Stage 2	708	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	223	843	-	-	1204	-
Stage 1	692	-	-	-	-	-
Stage 2	449	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	187	843	-	-	1204	-
Mov Cap-2 Maneuver	187	-	-	-	-	-
Stage 1	692	-	-	-	-	-
Stage 2	376	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9.5	0	2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	843	1204	-
HCM Lane V/C Ratio	-	-	0.054	0.162	-
HCM Control Delay (s)	-	-	9.5	8.6	-
HCM Lane LOS	-	-	A	A	-
HCM 95th %tile Q(veh)	-	-	0.2	0.6	-

Intersection	
Int Delay, s/veh	3.2

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	3	237	819	5	32	352
Future Vol, veh/h	3	237	819	5	32	352
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	145	365	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	90	90	90	90	90	90
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	3	263	910	6	36	391

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	1178	455	0	0	916	0
Stage 1	910	-	-	-	-	-
Stage 2	268	-	-	-	-	-
Critical Hdwy	6.84	6.94	-	-	4.14	-
Critical Hdwy Stg 1	5.84	-	-	-	-	-
Critical Hdwy Stg 2	5.84	-	-	-	-	-
Follow-up Hdwy	3.52	3.32	-	-	2.22	-
Pot Cap-1 Maneuver	184	552	-	-	740	-
Stage 1	353	-	-	-	-	-
Stage 2	753	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	175	552	-	-	740	-
Mov Cap-2 Maneuver	175	-	-	-	-	-
Stage 1	353	-	-	-	-	-
Stage 2	716	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	18.1	0	0.8
HCM LOS	C		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	538	740	-
HCM Lane V/C Ratio	-	-	0.496	0.048	-
HCM Control Delay (s)	-	-	18.1	10.1	-
HCM Lane LOS	-	-	C	B	-
HCM 95th %tile Q(veh)	-	-	2.7	0.2	-

Location of counts: Hayden Road south of Loop 101

Source(s): https://www.scottsdaleaz.gov/transportation/studies-reports/traffic-volume

	Year	Volume
Start	2014	12,100
End	2016	12,600
AAGR		2.0%
Exp Factor		1.041

Growth Rate Used	2.1%
Per-Year Multiplier	1.021

Year	Expansion Factor(s)	
2018	1.000	
2019	1.021	
2020	**1.042**	**Opening**
2021	1.064	
2022	1.087	
2023	1.110	
2024	1.133	
2025	1.157	
2026	1.181	
2027	1.206	
2028	1.231	
2029	1.257	
2030	1.283	
2031	1.310	
2032	1.338	
2033	1.366	
2034	1.394	
2035	1.424	
2036	1.454	
2037	1.484	
2038	1.515	
2039	1.547	
2040	1.580	
2041	1.613	
2042	1.647	
2043	1.681	
2044	1.717	
2045	1.753	
2046	1.789	
2047	1.827	
2048	1.865	
2049	1.905	
2050	1.945	

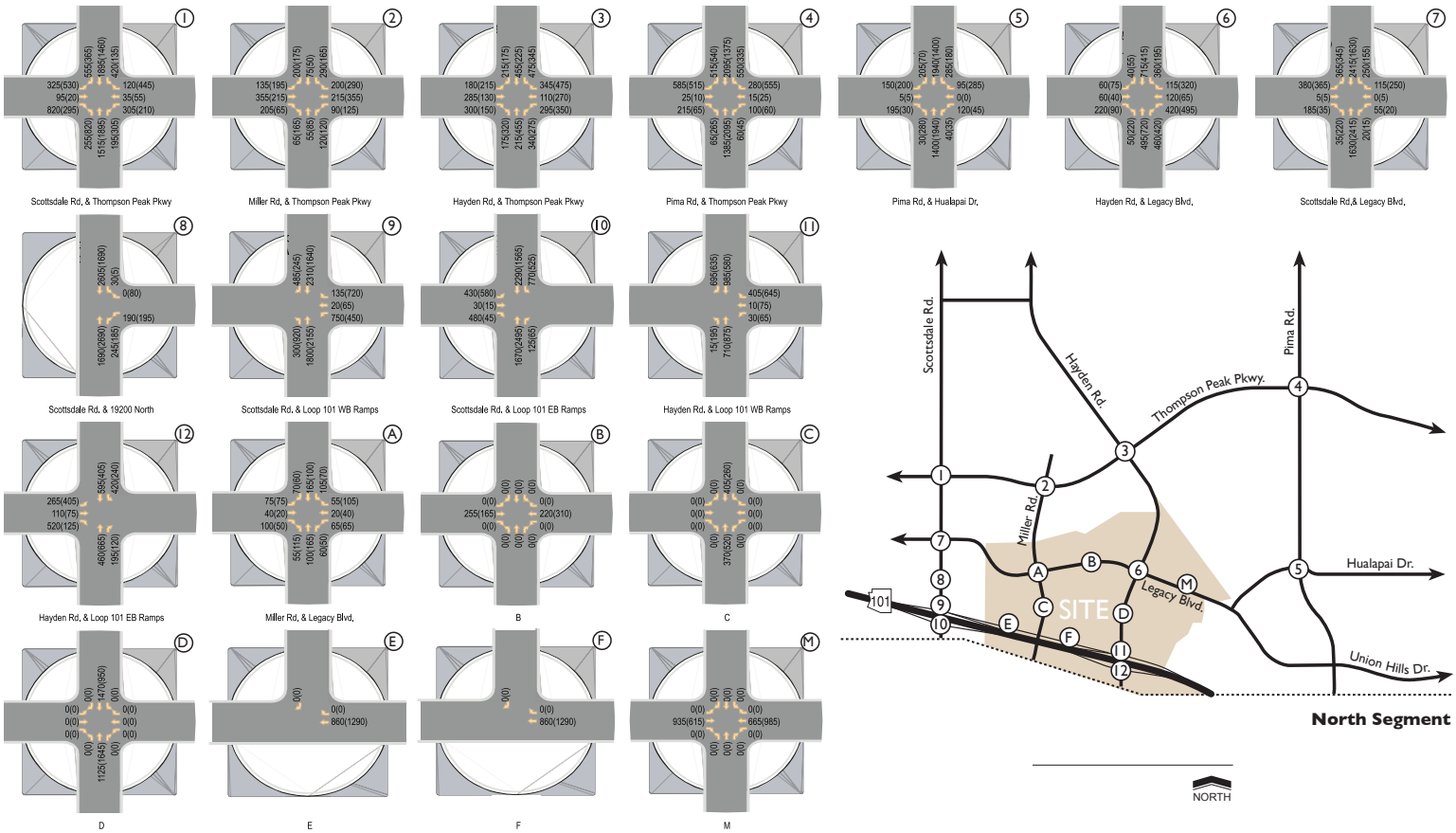


Figure 12: 2030 Peak Hour Background Traffic - North

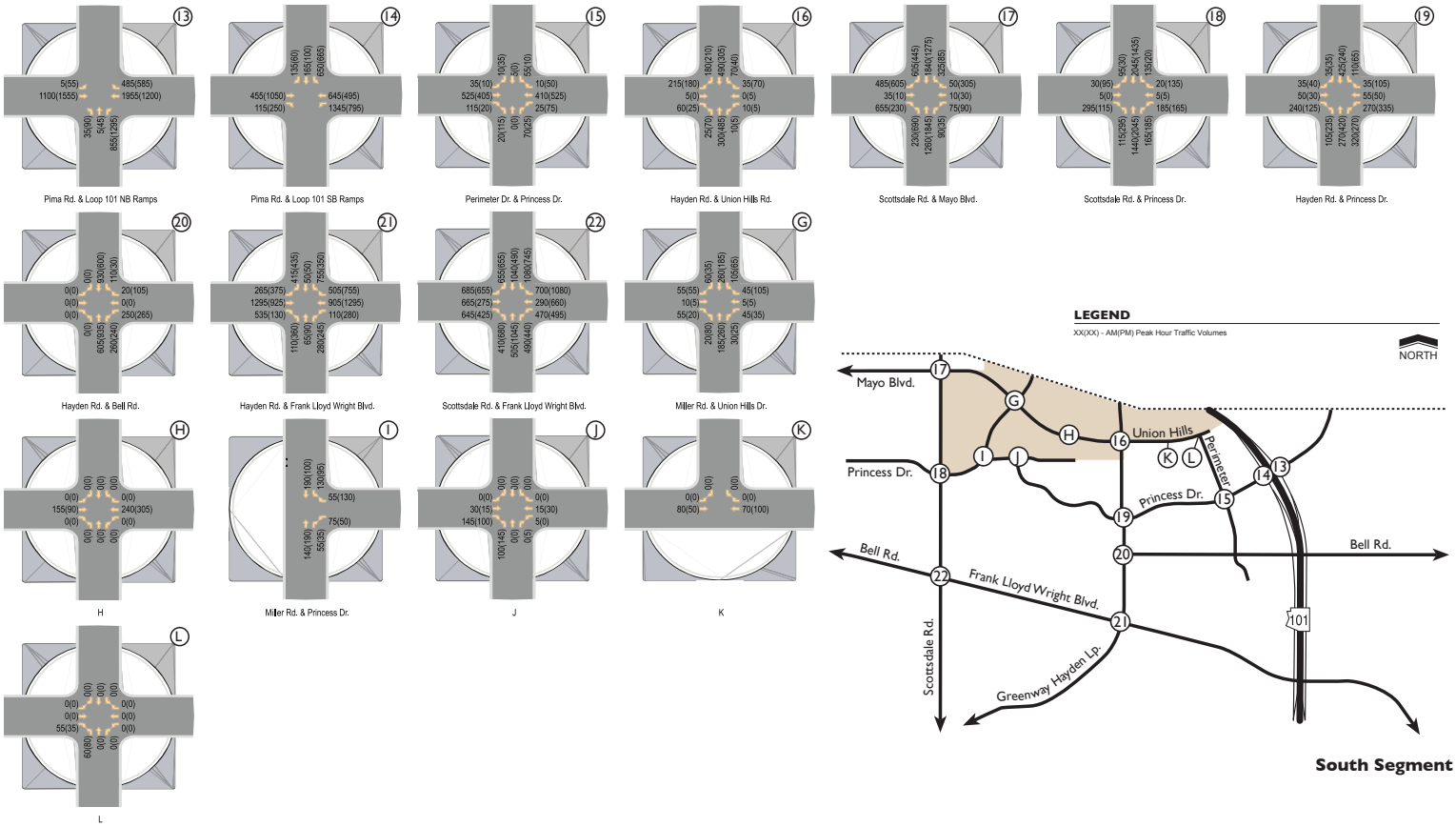


Figure 13: 2030 Peak Hour Background Traffic - South

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	257	6	76	11	0	56	46	667	12	240	860	215
Future Volume (veh/h)	257	6	76	11	0	56	46	667	12	240	860	215
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	286	7	51	12	0	1	51	741	13	267	956	239
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	411	37	271	135	71	60	297	2025	36	474	2172	969
Arrive On Green	0.17	0.19	0.19	0.01	0.00	0.04	0.01	0.19	0.19	0.03	0.20	0.20
Sat Flow, veh/h	1781	195	1420	1781	1870	1585	1781	3573	63	1781	3554	1585
Grp Volume(v), veh/h	286	0	58	12	0	1	51	368	386	267	956	239
Grp Sat Flow(s),veh/h/ln	1781	0	1615	1781	1870	1585	1781	1777	1859	1781	1777	1585
Q Serve(g_s), s	17.9	0.0	3.6	0.8	0.0	0.1	1.4	21.7	21.7	6.8	28.3	15.2
Cycle Q Clear(g_c), s	17.9	0.0	3.6	0.8	0.0	0.1	1.4	21.7	21.7	6.8	28.3	15.2
Prop In Lane	1.00		0.88	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	411	0	308	135	71	60	297	1007	1054	474	2172	969
V/C Ratio(X)	0.70	0.00	0.19	0.09	0.00	0.02	0.17	0.37	0.37	0.56	0.44	0.25
Avail Cap(c_a), veh/h	433	0	464	192	288	244	318	1007	1054	683	2172	969
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Uniform Delay (d), s/veh	43.4	0.0	40.7	54.3	0.0	55.6	12.6	30.0	30.0	12.6	29.9	24.7
Incr Delay (d2), s/veh	4.6	0.0	0.3	0.3	0.0	0.1	0.3	1.0	1.0	1.0	0.6	0.6
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.4	0.0	1.5	0.4	0.0	0.0	0.6	10.6	11.1	2.9	13.7	6.6
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	47.9	0.0	41.0	54.6	0.0	55.7	12.9	31.0	30.9	13.6	30.5	25.3
LnGrp LOS	D	A	D	D	A	E	B	C	C	B	C	C
Approach Vol, veh/h		344			13			805			1462	
Approach Delay, s/veh		46.8			54.7			29.8			26.6	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	13.9	72.5	6.1	27.4	8.6	77.9	24.5	9.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	23.5	38.5	5.5	34.5	5.5	56.5	21.5	18.5
Max Q Clear Time (g_c+I1), s	8.8	23.7	2.8	5.6	3.4	30.3	19.9	2.1
Green Ext Time (p_c), s	0.7	4.2	0.0	0.3	0.0	8.8	0.2	0.0

Intersection Summary	
HCM 6th Ctrl Delay	30.3
HCM 6th LOS	C

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	0	57	6	6	324	87	1287	7	44	672	271
Future Volume (veh/h)	215	0	57	6	6	324	87	1287	7	44	672	271
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	239	0	63	7	7	27	97	1430	8	49	747	301
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	341	0	255	129	75	117	380	2344	13	227	2276	1015
Arrive On Green	0.13	0.00	0.16	0.01	0.04	0.04	0.01	0.21	0.21	0.01	0.21	0.21
Sat Flow, veh/h	1781	0	1585	1781	1870	1585	1781	3623	20	1781	3554	1585
Grp Volume(v), veh/h	239	0	63	7	7	27	97	701	737	49	747	301
Grp Sat Flow(s),veh/h/ln	1781	0	1585	1781	1870	1585	1781	1777	1867	1781	1777	1585
Q Serve(g_s), s	15.1	0.0	4.2	0.5	0.4	1.9	2.2	42.8	42.8	1.1	21.4	19.2
Cycle Q Clear(g_c), s	15.1	0.0	4.2	0.5	0.4	1.9	2.2	42.8	42.8	1.1	21.4	19.2
Prop In Lane	1.00		1.00	1.00		1.00	1.00		0.01	1.00		1.00
Lane Grp Cap(c), veh/h	341	0	255	129	75	117	380	1150	1208	227	2276	1015
V/C Ratio(X)	0.70	0.00	0.25	0.05	0.09	0.23	0.26	0.61	0.61	0.22	0.33	0.30
Avail Cap(c_a), veh/h	341	0	297	344	351	350	420	1150	1208	413	2276	1015
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95	0.95	0.95
Uniform Delay (d), s/veh	45.9	0.0	44.0	54.5	55.5	52.4	9.1	33.5	33.5	15.4	25.4	24.6
Incr Delay (d2), s/veh	6.3	0.0	0.5	0.2	0.5	1.0	0.4	2.4	2.3	0.4	0.4	0.7
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	7.3	0.0	1.7	0.2	0.2	0.8	0.9	21.1	22.2	0.5	10.3	8.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	52.2	0.0	44.5	54.6	56.0	53.3	9.4	35.9	35.8	15.9	25.8	25.3
LnGrp LOS	D	A	D	D	E	D	A	D	D	B	C	C
Approach Vol, veh/h		302			41			1535			1097	
Approach Delay, s/veh		50.6			54.0			34.2			25.2	
Approach LOS		D			D			C			C	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	8.5	82.1	5.5	23.8	9.3	81.4	20.0	9.3
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	16.5	47.5	15.5	22.5	7.5	56.5	15.5	22.5
Max Q Clear Time (g_c+I1), s	3.1	44.8	2.5	6.2	4.2	23.4	17.1	3.9
Green Ext Time (p_c), s	0.1	2.1	0.0	0.2	0.1	7.3	0.0	0.1

Intersection Summary	
HCM 6th Ctrl Delay	32.8
HCM 6th LOS	C

Notes

User approved pedestrian interval to be less than phase max green.

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	257	118	76	32	19	104	46	667	140	529	860	215
Future Volume (veh/h)	257	118	76	32	19	104	46	667	140	529	860	215
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	286	131	73	36	21	88	51	741	112	588	956	183
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	371	192	107	184	116	407	309	1410	213	673	2190	977
Arrive On Green	0.14	0.17	0.17	0.03	0.06	0.06	0.01	0.15	0.15	0.06	0.20	0.20
Sat Flow, veh/h	1781	1128	629	1781	1870	1585	1781	3095	468	3456	3554	1585
Grp Volume(v), veh/h	286	0	204	36	21	88	51	425	428	588	956	183
Grp Sat Flow(s),veh/h/ln	1781	0	1757	1781	1870	1585	1781	1777	1786	1728	1777	1585
Q Serve(g_s), s	16.5	0.0	13.1	2.2	1.3	5.2	1.8	26.5	26.5	20.2	28.2	11.5
Cycle Q Clear(g_c), s	16.5	0.0	13.1	2.2	1.3	5.2	1.8	26.5	26.5	20.2	28.2	11.5
Prop In Lane	1.00		0.36	1.00		1.00	1.00		0.26	1.00		1.00
Lane Grp Cap(c), veh/h	371	0	300	184	116	407	309	809	814	673	2190	977
V/C Ratio(X)	0.77	0.00	0.68	0.20	0.18	0.22	0.17	0.53	0.53	0.87	0.44	0.19
Avail Cap(c_a), veh/h	371	0	432	208	282	548	328	809	814	792	2190	977
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	0.93	0.93	0.93	0.56	0.56	0.56
Uniform Delay (d), s/veh	44.3	0.0	46.7	50.6	53.4	35.1	16.9	39.0	39.0	54.7	29.6	22.9
Incr Delay (d2), s/veh	9.6	0.0	2.7	0.5	0.7	0.3	0.2	2.3	2.3	5.6	0.4	0.2
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	8.9	0.0	5.9	1.0	0.6	2.1	0.8	13.2	13.2	9.9	13.5	4.9
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	53.8	0.0	49.4	51.1	54.1	35.3	17.1	41.3	41.3	60.3	29.9	23.1
LnGrp LOS	D	A	D	D	D	D	B	D	D	E	C	C
Approach Vol, veh/h		490			145			904			1727	
Approach Delay, s/veh		52.0			42.0			39.9			39.5	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	27.9	59.2	8.0	25.0	8.6	78.5	21.0	12.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	27.5	39.9	5.1	29.5	5.4	62.0	16.5	18.1
Max Q Clear Time (g_c+I1), s	22.2	28.5	4.2	15.1	3.8	30.2	18.5	7.2
Green Ext Time (p_c), s	1.1	4.2	0.0	0.9	0.0	9.0	0.0	0.2

Intersection Summary	
HCM 6th Ctrl Delay	41.6
HCM 6th LOS	D

Intersection	
Intersection Delay, s/veh	0.6
Intersection LOS	A

Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	2	2	2
Adj Approach Flow, veh/h	874	0	172
Demand Flow Rate, veh/h	891	0	175
Vehicles Circulating, veh/h	0	175	0
Vehicles Exiting, veh/h	175	0	0
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	0.0	0.0	3.6
Approach LOS	A	-	A

Lane	Left	Bypass	Left	Left	Bypass
Designated Moves	T	R	LT	L	R
Assumed Moves	T	R	LT	L	R
RT Channelized		Free			Free
Lane Util	1.000		1.000	1.000	
Follow-Up Headway, s	2.535		2.535	2.535	
Critical Headway, s	4.328	891	4.328	4.328	0
Entry Flow, veh/h	0	1938	0	175	1938
Cap Entry Lane, veh/h	1420	0.980	1224	1420	0.980
Entry HV Adj Factor	1.000	874	1.000	0.983	0
Flow Entry, veh/h	0	1900	0	172	1900
Cap Entry, veh/h	1420	0.460	1224	1396	0.000
V/C Ratio	0.000	0.0	0.000	0.123	0.0
Control Delay, s/veh	2.5	A	2.9	3.6	A
LOS	A	3	A	A	0
95th %tile Queue, veh	0		0	0	

Intersection	
Intersection Delay, s/veh	7.2
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	1	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	873	57	88	78
Demand Flow Rate, veh/h	890	58	90	79
Vehicles Circulating, veh/h	19	415	747	40
Vehicles Exiting, veh/h	40	422	16	415
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	8.1	4.1	6.1	0.7
Approach LOS	A	A	A	A

Lane	Left	Bypass	Left	Bypass	Left	Bypass	Left	Bypass
Designated Moves	LT	R	LT	R	LT	R	LT	R
Assumed Moves	LT	R	LT	R	LT	R	LT	R
RT Channelized		Yield		Yield		Free		Free
Lane Util	1.000		1.000		1.000		1.000	
Follow-Up Headway, s	2.667		2.535		2.535		2.535	
Critical Headway, s	4.645	146	4.328	18	4.328	0	4.328	60
Entry Flow, veh/h	744	1358	40	904	90	1938	19	1938
Cap Entry Lane, veh/h	1326	0.980	998	0.980	753	0.980	1373	0.980
Entry HV Adj Factor	0.981	143	0.980	18	0.980	0	0.983	59
Flow Entry, veh/h	730	1331	39	886	88	1900	19	1900
Cap Entry, veh/h	1301	0.107	978	0.020	738	0.000	1350	0.031
V/C Ratio	0.561	3.6	0.040	4.2	0.120	0.0	0.014	0.0
Control Delay, s/veh	9.0	A	4.0	A	6.1	A	2.8	A
LOS	A	0	A	0	A	0	A	0
95th %tile Queue, veh	4		0		0		0	

Intersection	
Intersection Delay, s/veh	5.0
Intersection LOS	A

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	415	87	50
Demand Flow Rate, veh/h	423	88	51
Vehicles Circulating, veh/h	11	273	18
Vehicles Exiting, veh/h	58	161	343
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	5.4	4.2	3.0
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	423	88	51
Cap Entry Lane, veh/h	1364	1045	1355
Entry HV Adj Factor	0.981	0.984	0.976
Flow Entry, veh/h	415	87	50
Cap Entry, veh/h	1339	1028	1322
V/C Ratio	0.310	0.084	0.038
Control Delay, s/veh	5.4	4.2	3.0
LOS	A	A	A
95th %tile Queue, veh	1	0	0

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	215	23	57	137	121	615	87	1287	33	103	672	271
Future Volume (veh/h)	215	23	57	137	121	615	87	1287	33	103	672	271
Initial Q (Qb), veh	0	0	0	0	0	0	0	0	0	0	0	0
Ped-Bike Adj(A_pbT)	1.00		1.00	1.00		1.00	1.00		1.00	1.00		1.00
Parking Bus, Adj	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Work Zone On Approach		No			No			No			No	
Adj Sat Flow, veh/h/ln	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870	1870
Adj Flow Rate, veh/h	239	26	52	152	134	461	97	1430	26	114	747	218
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Percent Heavy Veh, %	2	2	2	2	2	2	2	2	2	2	2	2
Cap, veh/h	318	132	264	466	507	509	311	1726	31	173	1745	778
Arrive On Green	0.05	0.24	0.24	0.08	0.27	0.27	0.01	0.16	0.16	0.02	0.16	0.16
Sat Flow, veh/h	1781	557	1113	1781	1870	1585	1781	3571	65	3456	3554	1585
Grp Volume(v), veh/h	239	0	78	152	134	461	97	711	745	114	747	218
Grp Sat Flow(s),veh/h/ln	1781	0	1670	1781	1870	1585	1781	1777	1859	1728	1777	1585
Q Serve(g_s), s	5.5	0.0	4.5	7.5	6.8	32.5	3.2	46.5	46.6	3.9	22.7	14.5
Cycle Q Clear(g_c), s	5.5	0.0	4.5	7.5	6.8	32.5	3.2	46.5	46.6	3.9	22.7	14.5
Prop In Lane	1.00		0.67	1.00		1.00	1.00		0.03	1.00		1.00
Lane Grp Cap(c), veh/h	318	0	396	466	507	509	311	859	898	173	1745	778
V/C Ratio(X)	0.75	0.00	0.20	0.33	0.26	0.91	0.31	0.83	0.83	0.66	0.43	0.28
Avail Cap(c_a), veh/h	318	0	396	509	507	509	347	859	898	446	1745	778
HCM Platoon Ratio	1.00	1.00	1.00	1.00	1.00	1.00	0.33	0.33	0.33	0.33	0.33	0.33
Upstream Filter(I)	1.00	0.00	1.00	1.00	1.00	1.00	0.70	0.70	0.70	0.89	0.89	0.89
Uniform Delay (d), s/veh	40.0	0.0	36.6	29.7	34.4	39.0	17.2	45.6	45.6	58.0	35.1	31.7
Incr Delay (d2), s/veh	9.6	0.0	0.2	0.4	0.3	19.9	0.4	6.5	6.3	3.8	0.7	0.8
Initial Q Delay(d3),s/veh	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
%ile BackOfQ(50%),veh/ln	4.9	0.0	1.9	3.3	3.1	15.6	1.4	23.7	24.8	1.8	11.0	6.3
Unsig. Movement Delay, s/veh												
LnGrp Delay(d),s/veh	49.6	0.0	36.9	30.1	34.6	58.9	17.5	52.1	51.9	61.8	35.8	32.5
LnGrp LOS	D	A	D	C	C	E	B	D	D	E	D	C
Approach Vol, veh/h		317			747			1553			1079	
Approach Delay, s/veh		46.5			48.7			49.9			37.9	
Approach LOS		D			D			D			D	

Timer - Assigned Phs	1	2	3	4	5	6	7	8
Phs Duration (G+Y+Rc), s	10.5	62.5	14.0	33.0	9.6	63.4	10.0	37.0
Change Period (Y+Rc), s	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Max Green Setting (Gmax), s	15.5	48.5	12.5	25.5	7.5	56.5	5.5	32.5
Max Q Clear Time (g_c+I1), s	5.9	48.6	9.5	6.5	5.2	24.7	7.5	34.5
Green Ext Time (p_c), s	0.2	0.0	0.1	0.3	0.0	6.9	0.0	0.0

Intersection Summary	
HCM 6th Ctrl Delay	45.8
HCM 6th LOS	D

Intersection	
Intersection Delay, s/veh	9.9
Intersection LOS	A

Approach	EB	WB	NB
Entry Lanes	1	1	1
Conflicting Circle Lanes	2	2	2
Adj Approach Flow, veh/h	177	0	970
Demand Flow Rate, veh/h	181	0	989
Vehicles Circulating, veh/h	0	989	0
Vehicles Exiting, veh/h	989	0	0
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	0.0	0.0	11.8
Approach LOS	A	-	B

Lane	Left	Bypass	Left	Left	Bypass
Designated Moves	T	R	LT	L	R
Assumed Moves	T	R	LT	L	R
RT Channelized		Free			Free
Lane Util	1.000		1.000	1.000	
Follow-Up Headway, s	2.535		2.535	2.535	
Critical Headway, s	4.328	181	4.328	4.328	0
Entry Flow, veh/h	0	1938	0	989	1938
Cap Entry Lane, veh/h	1420	0.980	613	1420	0.980
Entry HV Adj Factor	1.000	177	1.000	0.981	0
Flow Entry, veh/h	0	1900	0	970	1900
Cap Entry, veh/h	1420	0.093	613	1393	0.000
V/C Ratio	0.000	0.0	0.000	0.696	0.0
Control Delay, s/veh	2.5	A	5.9	11.8	A
LOS	A	0	A	B	0
95th %tile Queue, veh	0		0	6	

Intersection	
Intersection Delay, s/veh	5.8
Intersection LOS	A

Approach	EB	WB	NB	SB
Entry Lanes	2	1	1	1
Conflicting Circle Lanes	2	2	2	2
Adj Approach Flow, veh/h	177	241	18	474
Demand Flow Rate, veh/h	181	246	18	483
Vehicles Circulating, veh/h	117	85	171	243
Vehicles Exiting, veh/h	609	104	127	88
Ped Vol Crossing Leg, #/h	0	0	0	0
Ped Cap Adj	1.000	1.000	1.000	1.000
Approach Delay, s/veh	3.5	4.3	3.1	7.5
Approach LOS	A	A	A	A

Lane	Left	Right	Left	Left	Left
Designated Moves	L	TR	LTR	LTR	LTR
Assumed Moves	L	TR	LTR	LTR	LTR
RT Channelized					
Lane Util	0.370	0.630	1.000	1.000	1.000
Follow-Up Headway, s	2.667	2.535	2.535	2.535	2.535
Critical Headway, s	4.645	4.328	4.328	4.328	4.328
Entry Flow, veh/h	67	114	246	18	483
Cap Entry Lane, veh/h	1212	1286	1321	1228	1155
Entry HV Adj Factor	0.985	0.977	0.981	0.980	0.982
Flow Entry, veh/h	66	111	241	18	474
Cap Entry, veh/h	1194	1256	1296	1204	1134
V/C Ratio	0.055	0.089	0.186	0.015	0.418
Control Delay, s/veh	3.5	3.6	4.3	3.1	7.5
LOS	A	A	A	A	A
95th %tile Queue, veh	0	0	1	0	2

Intersection	
Intersection Delay, s/veh	4.3
Intersection LOS	A

Approach	EB	NB	SB
Entry Lanes	1	1	1
Conflicting Circle Lanes	1	1	1
Adj Approach Flow, veh/h	102	17	309
Demand Flow Rate, veh/h	104	17	315
Vehicles Circulating, veh/h	72	55	3
Vehicles Exiting, veh/h	246	121	69
Ped Vol Crossing Leg, #/h	0	0	0
Ped Cap Adj	1.000	1.000	1.000
Approach Delay, s/veh	3.5	2.9	4.6
Approach LOS	A	A	A

Lane	Left	Left	Left
Designated Moves	LR	LT	TR
Assumed Moves	LR	LT	TR
RT Channelized			
Lane Util	1.000	1.000	1.000
Follow-Up Headway, s	2.609	2.609	2.609
Critical Headway, s	4.976	4.976	4.976
Entry Flow, veh/h	104	17	315
Cap Entry Lane, veh/h	1282	1305	1376
Entry HV Adj Factor	0.981	0.984	0.980
Flow Entry, veh/h	102	17	309
Cap Entry, veh/h	1257	1284	1348
V/C Ratio	0.081	0.013	0.229
Control Delay, s/veh	3.5	2.9	4.6
LOS	A	A	A
95th %tile Queue, veh	0	0	1

AXON Scottsdale Headquarters **Queue Length Analysis**

Signalized Intersection

2035

Average Vehicle Length (ft): 25 Cycles: 1.5
Intersection Cycle Length (sec): 120
Equation Used: storage length = 1.5 x (vehicles/hour)/(cycles/hour) x average vehicle length

Intersection	Approach	AM Peak (veh/hr)	Midday Peak	PM Peak (veh/hr)	Max vehs per 1.5 cycles	Max trucks per 1.5 cycles	Storage Length
Hayden Road & Mayo Boulevard	NB Left	18	0	9	1	0	**25'**
	SB Left	529	0	103	27	0	**675'**
	EB Left	18	0	16	1	0	**25'**
	WB Left	21	0	135	7	0	**175'**
	SB Right	15	0	41	3	0	**75'**
	WB Right	104	0	615	31	0	**775'**

SMITHGROUP

AXON CAMPUS

International Green Construction Code (IgCC) 2015

Development Review (DR) Energy Analysis Report

SMITHGROUP

Contents

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Introduction

The proposed Axon campus is located near the Loop 101 freeway and N. Union Hill Drive in Scottsdale, AZ. The building is a new 5-story Class A office building and warehouse.

Methodology

To evaluate the total energy performance of the actual design whether meet the requirement of International Green Construction Code (IgCC) 2015, the hourly simulation baseline building model and proposed building model are built by IES Virtual Environment software, version VE2019 computer software.

The following systems and loads are included in the simulation: heating systems, cooling systems, fan systems, lighting power, receptacle loads, and process loads. The Baseline building was developed with the same architecture and zoning, receptacle power, occupancy, schedule of the actual design, but comply with the ASHRAE90.1 2013 standard refence design envelope and mechanical system.

In section 602.2, IgCC defines that the performance-based designs shall demonstrate a z EPI of not more than 50 as determined in accordance with equation shown below.

zEPI = 52 x (Proposed building performance/Baseline building performance) (**Equation-1**)

where:
Proposed Building Performance = The proposed building performance in source kBtu for the proposed design of the building and its site calculated in accordance with IgCC Section 602.2.1.

Baseline Building Performance = The baseline building performance in source kBtu for a baseline building and its site calculated in accordance with IgCC Section 602.2.1.

52 = a fixed value representing the performance of a baseline building designed to comply with ASHRAE Standard 90.1-2013.

Similarly, the CO_2e emissions associated with the proposed design shall be less than the associated with the standard reference design in accordance with equation shown below.
CO_2e pdp <= (zEPI x CO_2e bbp)/52 (**Equation-2**)

Local Climate

The climate of the Scottsdale area is hot and dry in the summer, while mild in winter. The ASHRAE 1% design conditions were used in the evaluation of this project, and are as shown below,
Heating Design Day Outdoor Temperature: 35.96 ℉
Cooling Design Day Outdoor Dry-bulb Temperature: 110.84 ℉
Wet-bulb Temperature: 70.16 ℉

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Building Zoning

Building HVAC zones are defined as shown below for both baseline model and proposed model,

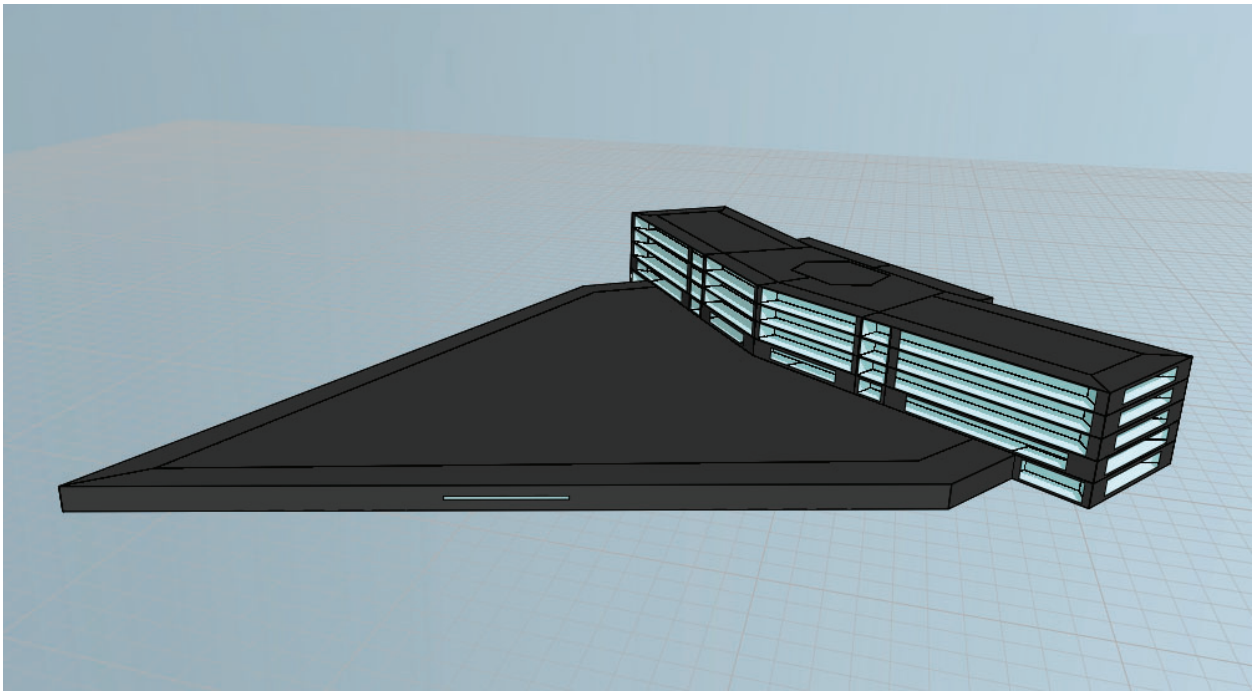

Figure1 - Building Block in IESVE Model

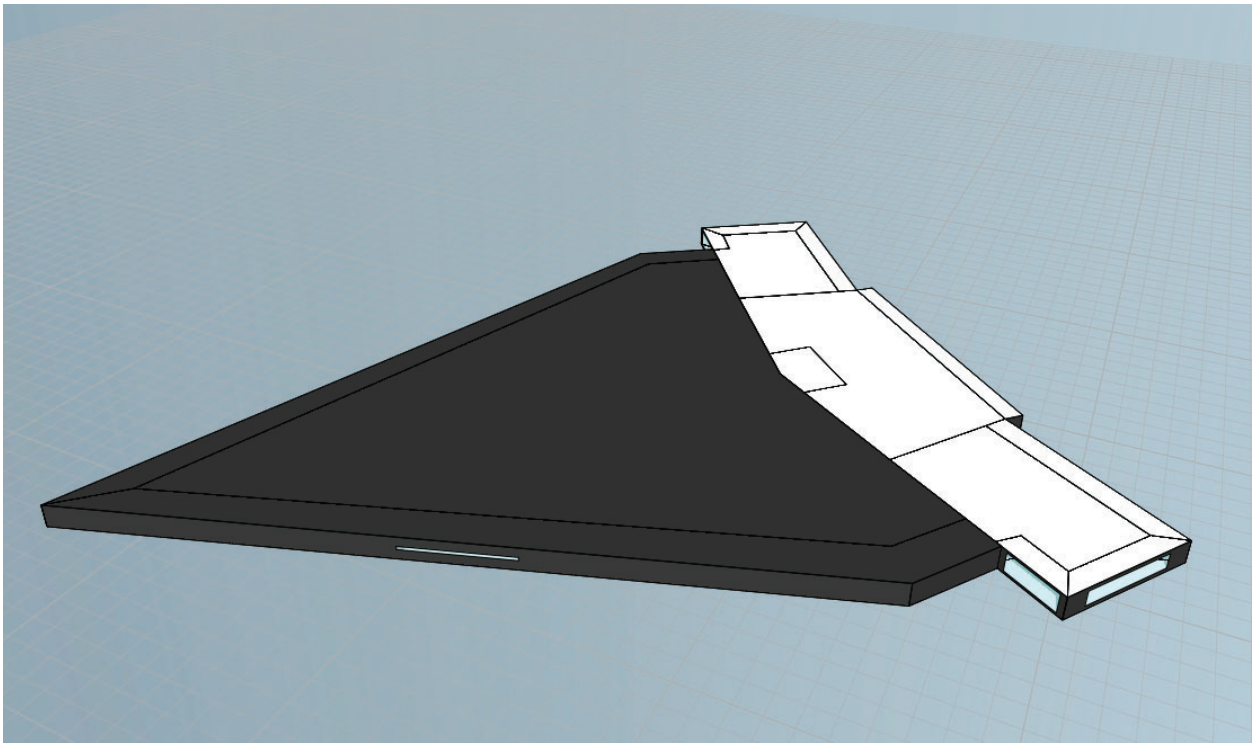

Figure2 – 1st Floor Zoning

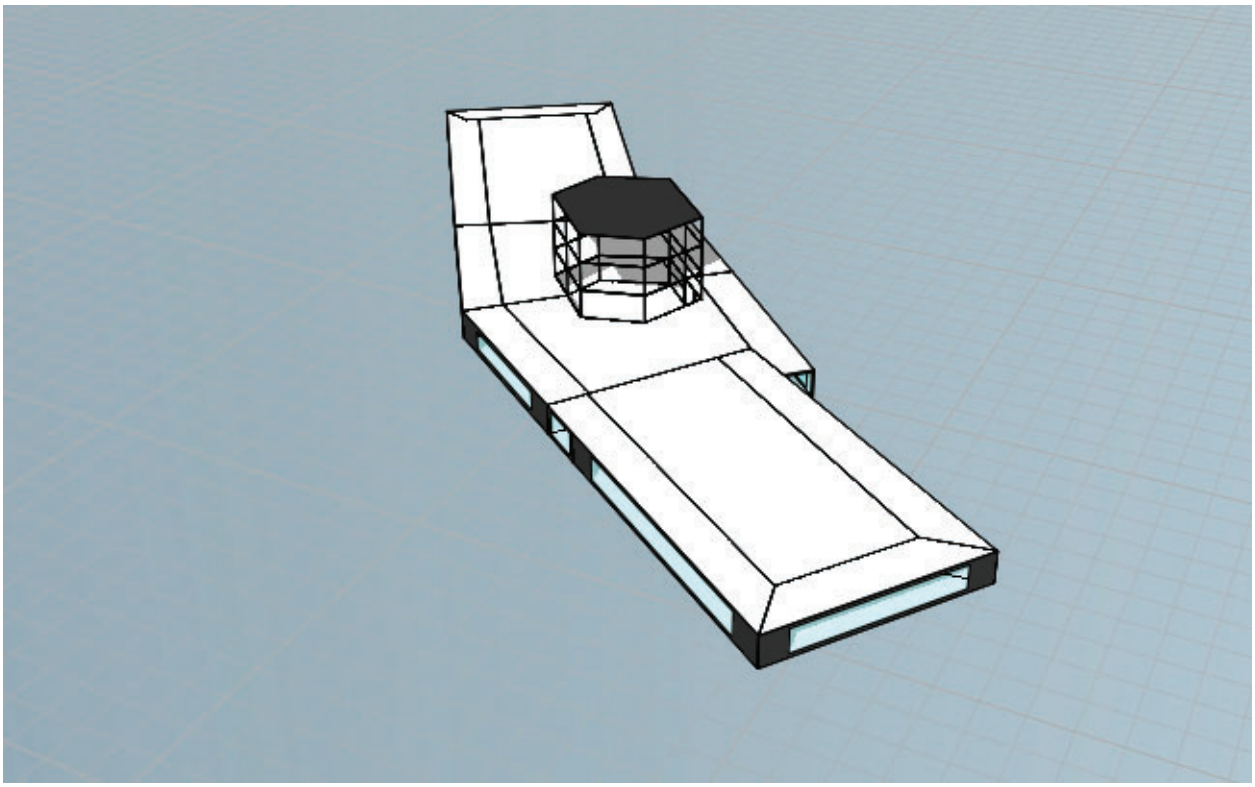

Figure 3 – 2nd Floor Zoning

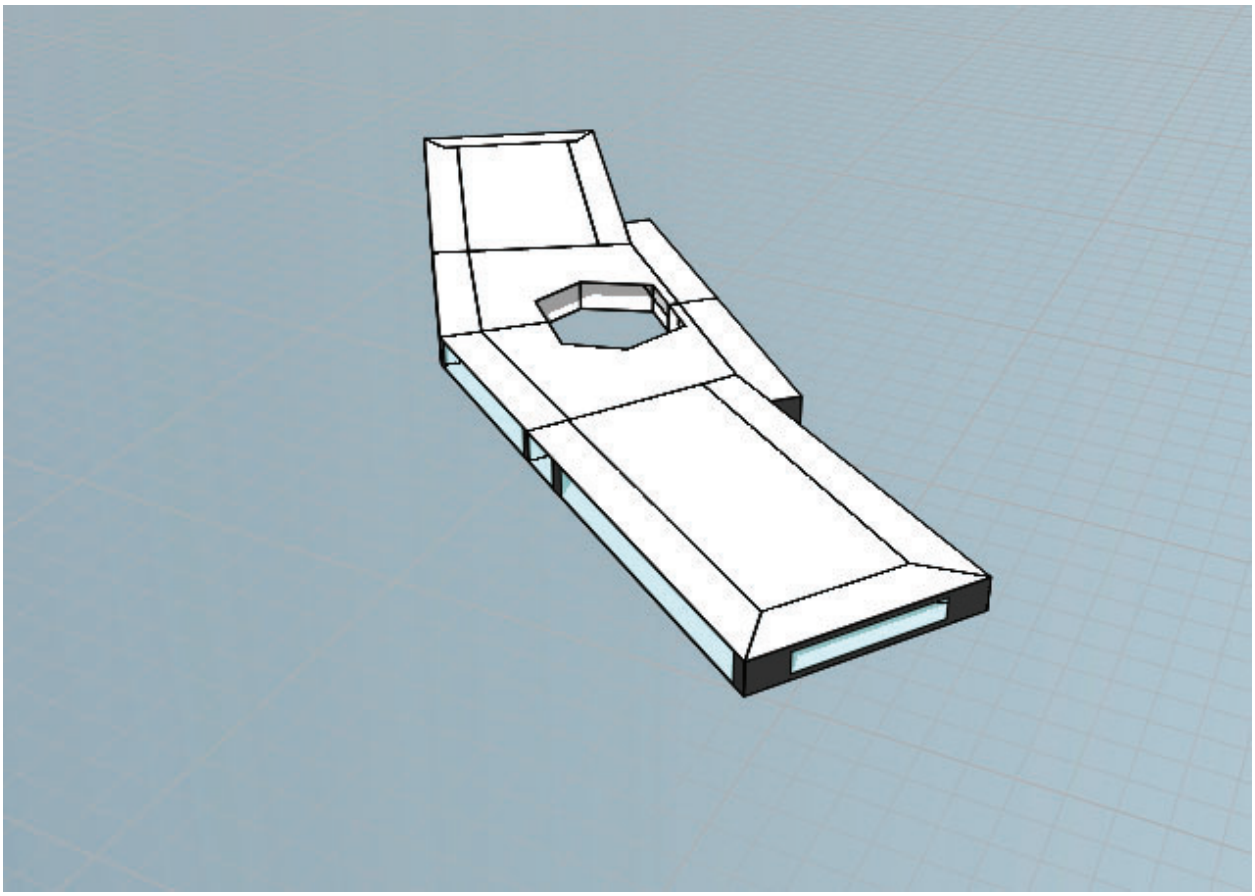

Figure 4 – 3rd thru 5th Floor Office and Conference Zoning

Each open space is composed of at least five zones: one perimeter zone for each orientation and one interior zone.

Envelope

The ASHRAE 90.1 -2013 Appendix G thermal envelope assembly requirement for CZ2, where Scottsdale is located has been applied to the Baseline model. The Construction Parameter Comparison is shown below.

Orientation	Proposed			Baseline		
	Above-grade wall area (ft²)	Vertical glazing area (ft²)	Vertical glazing area (%)	Above-grade wall area (ft²)	Vertical glazing area (ft²)	Vertical glazing area (%)
North	23526	11604	49.3	23526	8955	38.1
East	19455	8820	45.3	19455	7481	38.5
South	32854	16972	51.7	32854	14071	42.8
West	24531	11759	47.9	24531	9453	38.5
Sum	100366	49155	49.0	100366	39960	39.8

	Baseline		Proposed	
	U-value	R-value	U-value	R-value
Category	Btu/hft2F	hft2F/Btu	Btu/hft2F	hft2F/Btu
Ground/Exposed Floor	0.038	30	0.038	30
Internal Ceiling/Floor	0.19	4	0.19	4
External Wall	0.083	R13+R3.8 c.i.	0.07	13 c.i.
Roof	0.039	25 c.i.	0.26	40 c.i.

	Baseline			Proposed		
	Whole Window U-value	SHGC	Area	Whole Window U-value	SHGC	Area
Category	Btu/hft2F		% of Wall	Btu/hft2F		% of Wall
Clear Window	0.57	0.25	39.8%	0.3	0.15	49%

Operational Hours

The operation setting for Baseline and Proposed model are same.

The facility will be occupied between 8am-6pm from Monday to Friday; 9am-5pm in Sat and 10am-4pm in Sun.

Cooling/heating Setpoint: 75/70F when occupied, 80/60F when unoccupied.

Internal Heat Gain

The building electrical power of receptacle and lighting is simulated as table shown below,

Space Use		Conference	Corridor	Lobby	Manufacturing	Office
Baseline Internal Gains	Lighting(W/SF)	1.23	0.66	0.9	1.29	0.98
	Receptacle (W/SF)	1	0.2	0.5	1	1.5
	Occupancy (SF/person)	20	N/A	6.67	50	20
Proposed Internal Gains	Lighting(W/SF)	1	0.66	0.9	1	0.75
	Receptacle (W/SF)	1	0.2	0.5	1	1.5
	Occupancy (SF/person)	20	N/A	6.67	50	20

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Mechanical System

The mechanical system for proposed model is same as baseline model, whose system type based on ASHREA 90.1-2013 Appendix G3.1.1A table requirement. The building will be conditioned by a variable air volume (VAV) water-cooled chilled water system. Centralized air handling units will provide conditioned air to single-duct VAV terminal units with electric reheat.

The chilled water system will consist of high efficiency chillers, cooling towers and pumps. The chillers will be centrifugal type with crossflow cooling towers. Base mounted end-suction pumps will be used in the chilled water and condenser water systems.

The detailed information of mechanical system is shown below,

Model Input			Baseline	Proposed
Mechanical System	Air Side	Terminal Unit	Single Duct VAV Box	Single Duct VAV Box
		Reheat	Electric Reheat	Electric Reheat
		Total AHU Fan Design Flow Rate (CFM)	356,627	383,371
		AHU Fan Design Pressure (INWG)	8	5
		AHU Cooling Coil Air Supply T (F)	55	55
		Fan Control	VFD	VFD
	Water Side	Design Chiller Efficiency (KW/ton)	0.56 (Based on ASHREA90.1-2013)	0.547
		Waterside Economizer	Yes	Yes
		Condenser	Cooling Tower	Cooling Tower
		Chilled Water Supply T (F)	44	44
		Chilled Water Delta T (F)	12	12
		Pump Control	VFD	VFD

Analysis Results

Results of the analysis are summarized in Table shown below.

Site Energy Usage Breakdown	Interior Lighting (MBtu)	Receptacle Equipment (MBtu)	Space Heating (MBtu)	Space Cooling (MBtu)	Heat Rejection (MBtu)	Interior Central Fans (MBtu)	Pumps (MBtu)
Baseline	4099	4752	765	3951	1348	2582	307
Proposed without PV panel	3271	4752	1061	3781	849	2141	256

Energy Usage	Electricity (MBtu)	Saving
Baseline	17804	
Proposed without PV panel	16111	9.51%
Proposed with PV panel	15628	12.22%

Based on IgCC table 602.2.1.1 Electricity Generation Energy Conversion Factors by EPA eGRID Sub-region, this project in AZNM should use the energy conversion factor 3 .10 to calculate Source Energy Usage, which is summarized in Table shown below.

Source Energy Usage Breakdown	Interior Lighting (MBtu)	Receptacle Equipment (MBtu)	Space Heating (MBtu)	Space Cooling (MBtu)	Heat Rejection (MBtu)	Interior Central Fans (MBtu)	Pumps (MBtu)
Baseline	12706	14731	2371	12248	4178	8006	953
Proposed without PV panel	10141	14731	3289	11722	2631	6636	793

Source Energy Usage	Electricity (MBtu)	Saving
Baseline	55192	
Proposed without PV panel	49944	9.51%
Proposed with PV panel	48446	12.22%

The proposed building design energy reduction can reach up to 9.51%. In addition to the saving above, this project has additional 3% energy saving from PV panel installation and application, so it is 12.22% energy saving totally it achieves. According to Equation-1, its zEPI value is 45.6, which is not more than 50 as IgCC requirement.

Based on IgCC table 602.3.1 *Electricity Emission Rate by EPA eGRID Sub-region*, this project in AZNM should use CO_2e rate 0.671 kg/kWh to calculation CO_2e emission, which is shown below.

CO2e Emission Calculation	Site Electricity (MBtu)	Electricity Emission Rate(kg/kWh)	CO_2e emission (kg) =Site Electricity * Electricity Emission Rate		(Zepi *CO_2e bbp)/52
Baseline	17804	0.671	CO_2e bbp	3500312	3072433
Proposed	15628	0.671	CO_2e pdp	3072433	N/A

As a result, the CO_2e emissions associated with the proposed design is less than the associated with the standard reference design in accordance with Equation-2, CO_2e pdp <= (zEPI x CO_2e bbp)/52.

In summary, based on above energy performance and CO_2e emissions analysis, per IgCC section 602.2, this building will comply with IgCC2015.

City of Scottsdale
International Green Construction Code (IgCC)

Development Review (DR) Checklist

This is an abbreviated checklist for IgCC compliance measures that need to be addressed during the DR process. Please refer to the building plan review checklist for complete IgCC compliance requirements.

1. HEAT ISLAND MITIGATION
    a. Please refer to attached sheet DR1.3 for heat island mitigation approach and calculations.

2. ENERGY COMPLIANCE PATH
    a. Refer to the attached preliminary energy report indicating the energy reduction of the building from the baseline requirements.

3. ONSITE RENEWABLE ENERGY SYSTEM
    a. To comply with the 2015 IgCC renewable energy requirement of not less than 3% of the project's annual energy consumption through on-site renewable energy, the design includes 30,000 SF of roof top solar panels.
    b. The estimated energy usage of the building based on the preliminary energy report is 4,721 MWh. The solar system is required to provide 142 MWh. A solar system of 7,636 square feet is required to meet this energy production. This is based on 11 watts per square foot of solar panel.

4. REFUSE AND RECYCLING COLLECTION
    a. Please refer to attached sheet DR6.1 for design approach to refuse and recycling collection.