

Traffic Impact Study

QuikTrip 424

Happy Valley Parkway and 115th Avenue
1st Submittal

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Executive Summary

Introduction

This report documents a traffic impact study (TIS) performed for the proposed QuikTrip gas station located at the southeast corner of the intersection of Happy Valley Parkway and 115th Avenue located in unincorporated Maricopa County, Arizona. The current site plan consists of a 4,977 square-foot QuikTrip convenience market with 16 gasoline pumps. The purpose of this study is to address the traffic impacts of the proposed development on the intersections of Happy Valley Parkway and 115th Avenue, Happy Valley Parkway and State Route 303 and the three proposed site driveways. The analysis was prepared based on Maricopa County Department of Transportation (MCDOT) Traffic Impact Study manual and discussions with MCDOT staff for a Category I study.

Site Location and Study Area

The proposed QuikTrip is located at the southeast corner of Happy Valley Parkway and 115th Avenue within Section 6, Township 4N, Range 1E, Maricopa County, Arizona.

Conclusions and Recommendations

Existing Conditions without development

The existing signalized intersection of Happy Valley Parkway and 115th Avenue currently operates with split phasing due to the vertical sight distance restrictions in the north/south direction. The split phasing results in failing level-of-service in the PM peak hour.

The existing PM peak hour westbound left-turn volume at Happy Valley Parkway and 115th Avenue is 403 vph. This volume meets the requirement for a dual left-turn lane. However, adding dual left-turn lanes would require the signal phase to be protected further adding to the overall delay at the intersection.

The intersection of SR 303 and Happy Valley Parkway operates with acceptable levels-of-service with existing traffic volumes.

2020 & 2025 Background Without QuikTrip Site Traffic

The City of Peoria will be widening Happy Valley Parkway to three through lanes in each direction with bike lanes, curb, gutter and sidewalk on both sides of Happy Valley Parkway from SR 303 to Lake Pleasant Parkway. The construction is assumed to be completed by 2020 and therefore the background analysis utilizes this future geometry for Happy Valley Parkway.

To obtain the 2020 and 2025 traffic volumes, a five percent exponential growth rate was applied to the existing 2018 traffic volumes on Happy Valley Parkway and a three percent exponential growth rate was applied to the existing 2018 traffic volumes on 115th Avenue.

The signalized intersection of SR 303 and Happy Valley Parkway is expected to operate at LOS "D" or better during the weekday AM and PM peak hours based on the background 2020 and background 2025 traffic volumes and future lane geometrics.

Similar to the existing condition, the intersection of Happy Valley Parkway and 115th Avenue is expected to operate at LOS "F" during the weekday AM and PM peak hours based on the background 2020 and background 2025 traffic volumes and future lane geometrics. The poor level-of-service is due to the split phasing of the traffic signal operations.

Total 2020 and 2025 With QuikTrip Site Traffic

The proposed QuikTrip is expected to generate 3,689 daily trips, 450 AM peak hour trips and 368 PM peak hour trips based on the average trip generation rate for ITE land use code 960. After pass-by reductions, 241 AM peak hour trips and 214 PM peak hour trips will be new trips on the adjacent street network.

The proposed development is expected to be built out by the 2020 in a single phase.

The signalized intersection of SR 303 and Happy Valley Parkway is expected to operate at LOS "D" or better during the weekday AM and PM peak hours based on the total 2020 and total 2025 traffic volumes and future lane geometrics.

Similar to the existing and background conditions, the intersection of Happy Valley Parkway and 115th Avenue is expected to operate at LOS "F" during the weekday AM and PM peak hours based on the total 2020 and total 2025 traffic volumes and future lane geometrics. The poor level-of-service is due to the split phasing of the traffic signal operations.

Driveway 1 on Happy Valley Parkway is a right-in/right-out only driveway therefore there will be no left-turn lane.

Driveway 2 and Driveway 3 on 115th Avenue operate with acceptable LOS during both the AM and PM peak hour as a shared through and left-turn lane. Therefore left-turn lanes into the development at Driveway 1 and Driveway 2 are not required.

Driveway 1 on Happy Valley Parkway has more than two approach through lanes and a posted speed limit of 45 mph however the right-turn volume into the development does not exceed 300 vph in either the AM or PM peak hour and provides acceptable levels-of-service. Therefore, a right-turn lane at Driveway 1 is not required. It should be noted that the Happy Valley Parkway improvement project will be constructing a right-turn lane at Driveway 1. The storage length of the right-turn lane is limited by the location Driveway 1 in relation to 115th Avenue. The design has maximized the length of the right-turn lane for Driveway 1.

Driveway 2 and Driveway 3 on 115th Avenue have one approach through lane and a posted speed limit of 40 mph, right-turn volumes that do not exceed 300 vph in either the AM or PM peak hour and provide acceptable levels-of-service. Therefore, right-turn lanes are not required at Driveway 2 or Driveway 3 on 115th Avenue.

The proposed QuikTrip development does not require any additional roadway improvements beyond the Happy Valley Parkway improvement project to widen Happy Valley Parkway.

Introduction

This report documents a traffic impact analysis performed for the proposed QuikTrip gas station located at the southeast corner of the intersection of Happy Valley Parkway and 115th Avenue located in unincorporated Maricopa County, Arizona. The current site plan consists of a 4,977 square-foot QuikTrip convenience market with 16 gasoline pumps. The purpose of this study is to address the traffic impacts of the proposed development on the intersections of Happy Valley Parkway and 115th Avenue, Happy Valley Parkway and SR 303 and the three proposed site driveways. The analysis was prepared based on Maricopa County Department of Transportation (MCDOT) Traffic Impact Study manual and discussions with MCDOT staff for a Category I study.

Proposed Development

The proposed QuikTrip is located at the southeast corner of Happy Valley Parkway and 115th Avenue within Section 6, Township 4N, Range 1E, Maricopa County, Arizona. **Figure 1** is a local vicinity map.

The proposed development consists of 16 fueling stations and 4,977 square feet of convenience market. The appropriate ITE land use category for the proposed development is 960 – Super Convenience Market/Gas Station.

Figure 2 is a conceptual plan of the proposed development. Access to the development is provided through three driveways: Driveway 1 on Happy Valley Parkway, Driveway 2 on 115th Avenue and Driveway 3 on 115th Avenue.

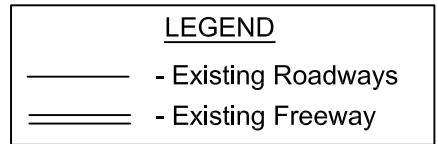
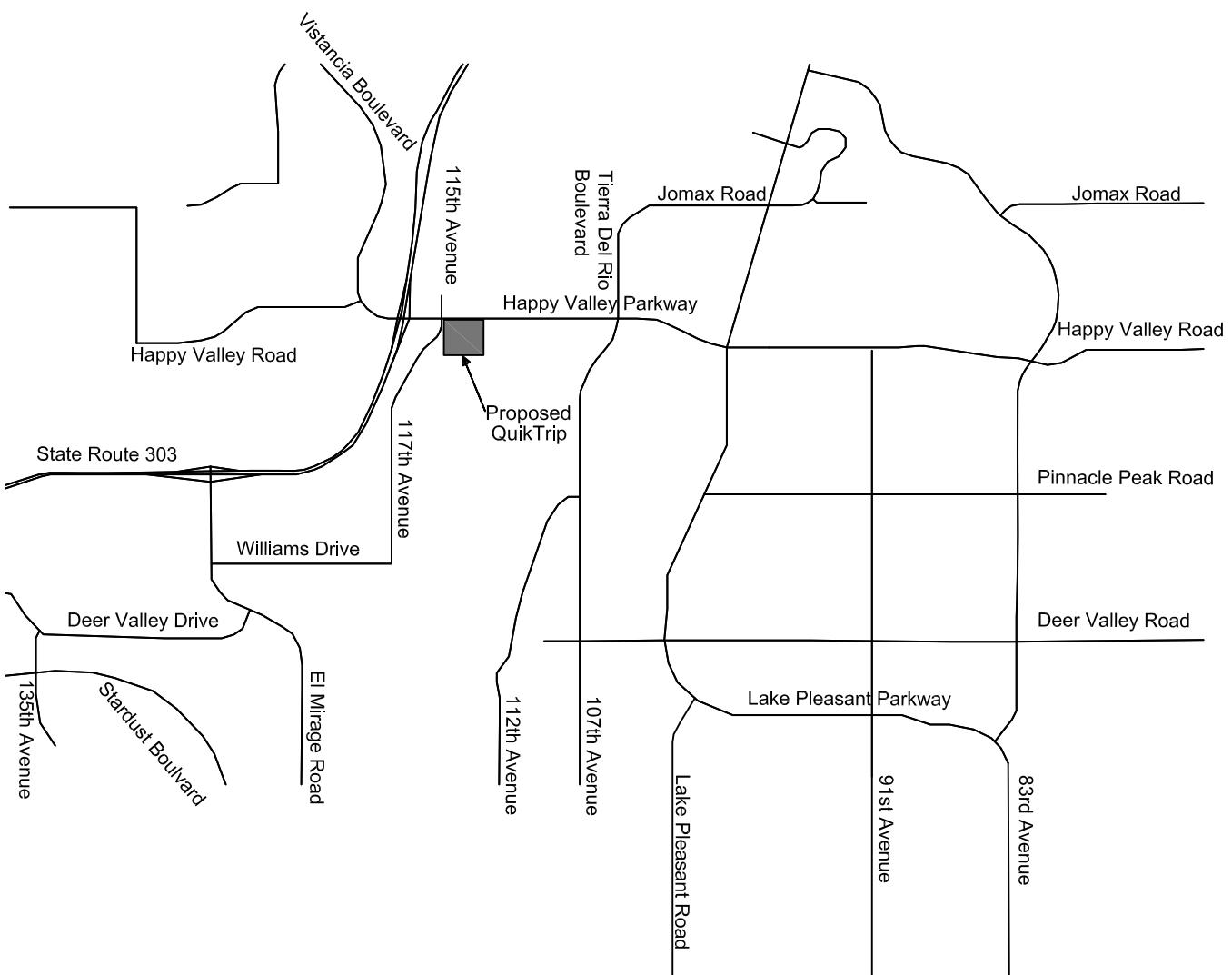
Driveway 1 is located on Happy Valley Parkway approximately 230 feet east of 115th Avenue, centerline to centerline. The inside-edge to inside-edge distance between 115th Avenue and Driveway 1 is approximately 200 feet. Driveway 1 is proposed to be a right-in/right-out only driveway.

Driveway 2 is located on 115th Avenue approximately 250 feet south of Happy Valley Parkway, centerline to centerline. The inside-edge to inside-edge distance between Happy Valley Parkway and Driveway 2 is approximately 215 feet. Driveway 2 is proposed to be a full access driveway.

Driveway 3 is located on 115th Avenue 190 feet south of Driveway 2, centerline to centerline. The inside-edge to inside-edge distance between Driveway 3 and Driveway 2 is approximately 155 feet. Driveway 3 is proposed to be a full access driveway.

On a typical weekday, the proposed QuikTrip is expected to generate 3,689 daily trips, 450 AM peak hour trips and 368 PM peak hour trips based on the average trip generation rate for ITE land use code 960.

The proposed development is expected to be built out by 2020 in a single phase.

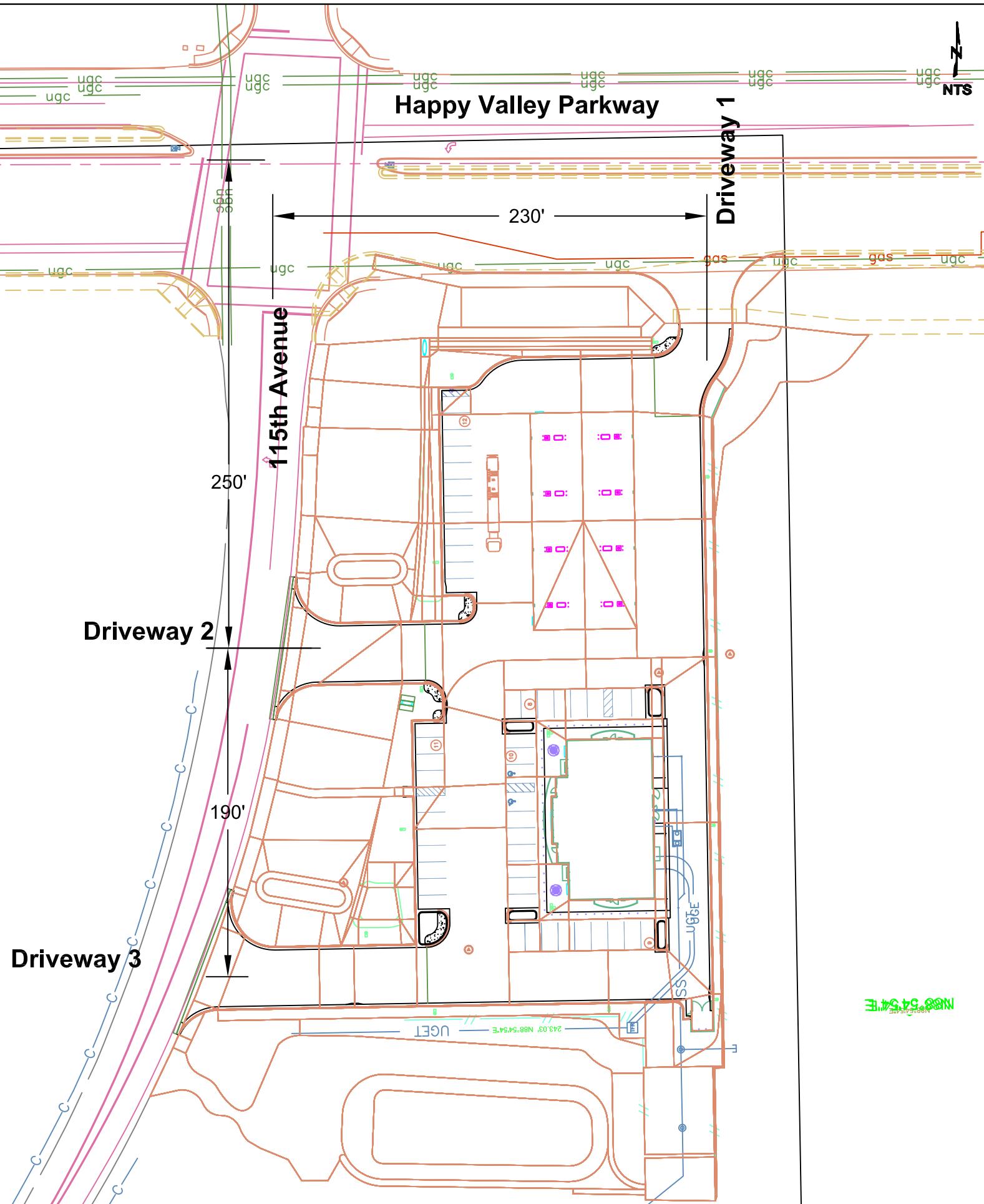

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Stanley Consultants INC.

Vicinity Map

Figure 1



Study Area Conditions

Study Area

The study area for this TIS has been determined following MCDOT's TIS Manual for a Category I TIS. The minimum study area is defined as all site access driveways, adjacent signal-controlled intersections within $\frac{1}{4}$ mile and/or major street intersections without signal control and driveways within 500 feet. The study area for this TIS includes the following:

Road Segments:

- Happy Valley Parkway from State Route 303 (SR 303) to Driveway 1
- 115th Avenue from Happy Valley Parkway to Driveway 3

Intersections:

- Happy Valley Parkway and SR 303
- Happy Valley Parkway and 115th Avenue

Driveways:

- Driveway 1 on Happy Valley Parkway
- Driveway 2 on 115th Avenue
- Driveway 3 on 115th Avenue

Surrounding Land Use

The land in the immediate vicinity surrounding the proposed development mostly consists of open land that could be used for residential or commercial use. The Agua Fria River is just east of the proposed QuikTrip. There are some residences located within the vicinity as well.

Existing Conditions

Physical Conditions

The study area for this report is currently suburban. The existing transportation system for the study area is depicted in **Figure 3**. The study area includes the following roadways:

1. **115th Avenue** runs north-south and is classified as a Major *Collector Road* in the vicinity of the site. Currently, the 115th Avenue cross-section consists of one lane in each direction. The posted speed limit is 40 miles-per-hour (mph) through the study area. Curb, gutter and sidewalk do not exist on either side of 115th Avenue in the vicinity of the development. There is no roadway lighting in the vicinity of the development on 115th Avenue.
2. **Happy Valley Parkway** runs east-west and is classified as a Principal Arterial in the vicinity of the site. Currently, the Happy Valley Parkway cross-section consists of three travel lanes in the eastbound direction and two travel lanes in the westbound direction with a raised median in the vicinity of the development. The posted speed limit on Happy Valley Parkway is 45 mph. Curb and gutter are not present on either side of Happy Valley Parkway in the vicinity of the area. Sidewalk is present only at the corners of the intersection with 115th Avenue. Roadway lighting is present at the corners of the intersection with 115th Avenue. Happy Valley Parkway within Peoria limits is classified as a limited access parkway. The section of Happy Valley Parkway in the vicinity of the site is currently owned and maintained by MCDOT. However, the City of Peoria has plans to annex the roadway with the completion of the Happy Valley Parkway

improvement project. This project consists of widening Happy Valley Parkway to three lanes in each direction including bike lanes, curb, gutter and sidewalk on both sides of Happy Valley Parkway between SR 303 and Lake Pleasant Parkway. The improvement project is expected to be completed by 2020.

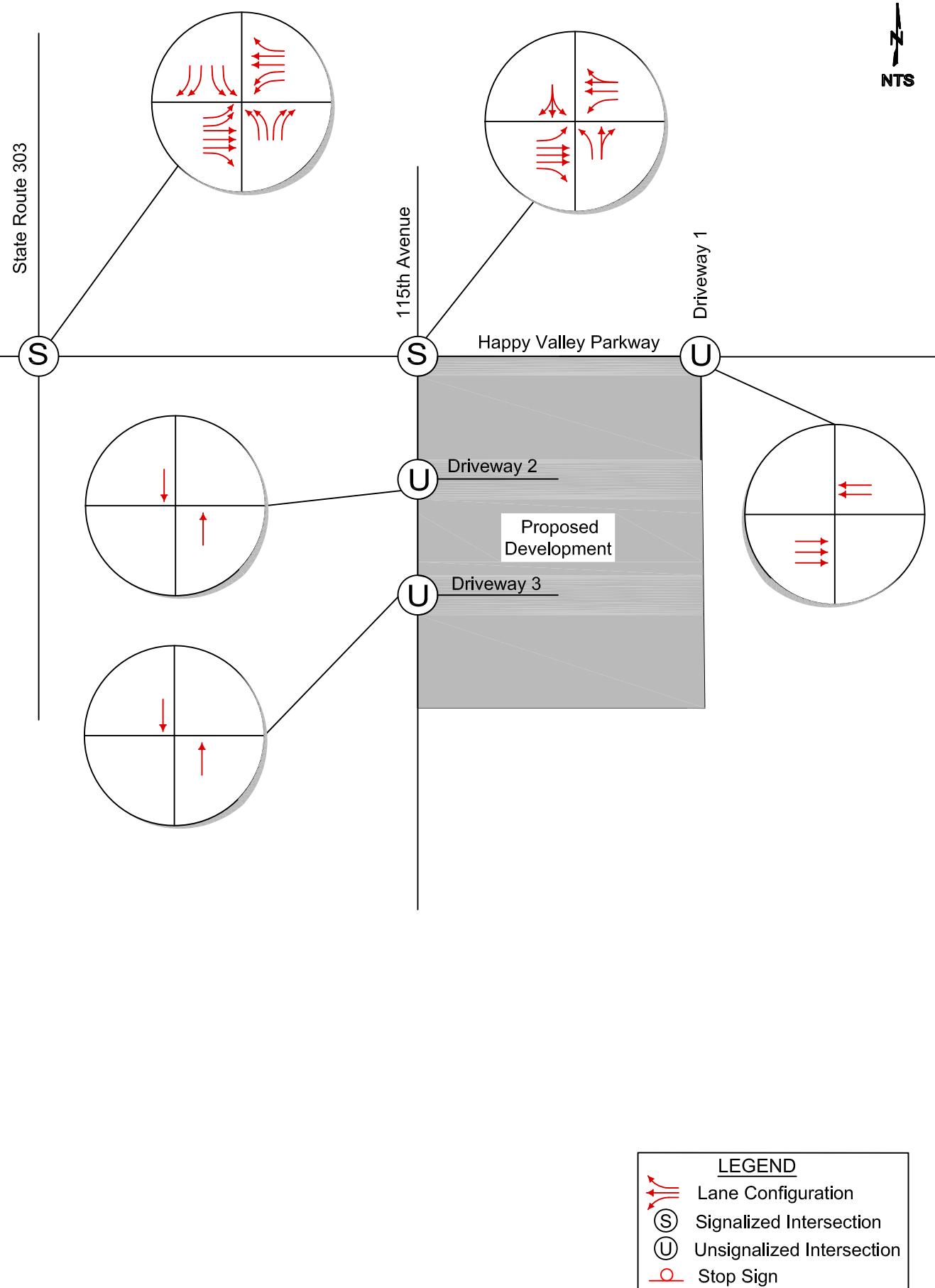
3. **State Route 303 (SR 303)** runs north-south and is classified as urban freeway in the vicinity of the site. In the vicinity of the development, SR 303 has two lanes each direction. Happy Valley Parkway provides direct access to SR 303 through a single point urban interchange. The posted speed limit on SR 303 at the vicinity of the development is 55 mph.

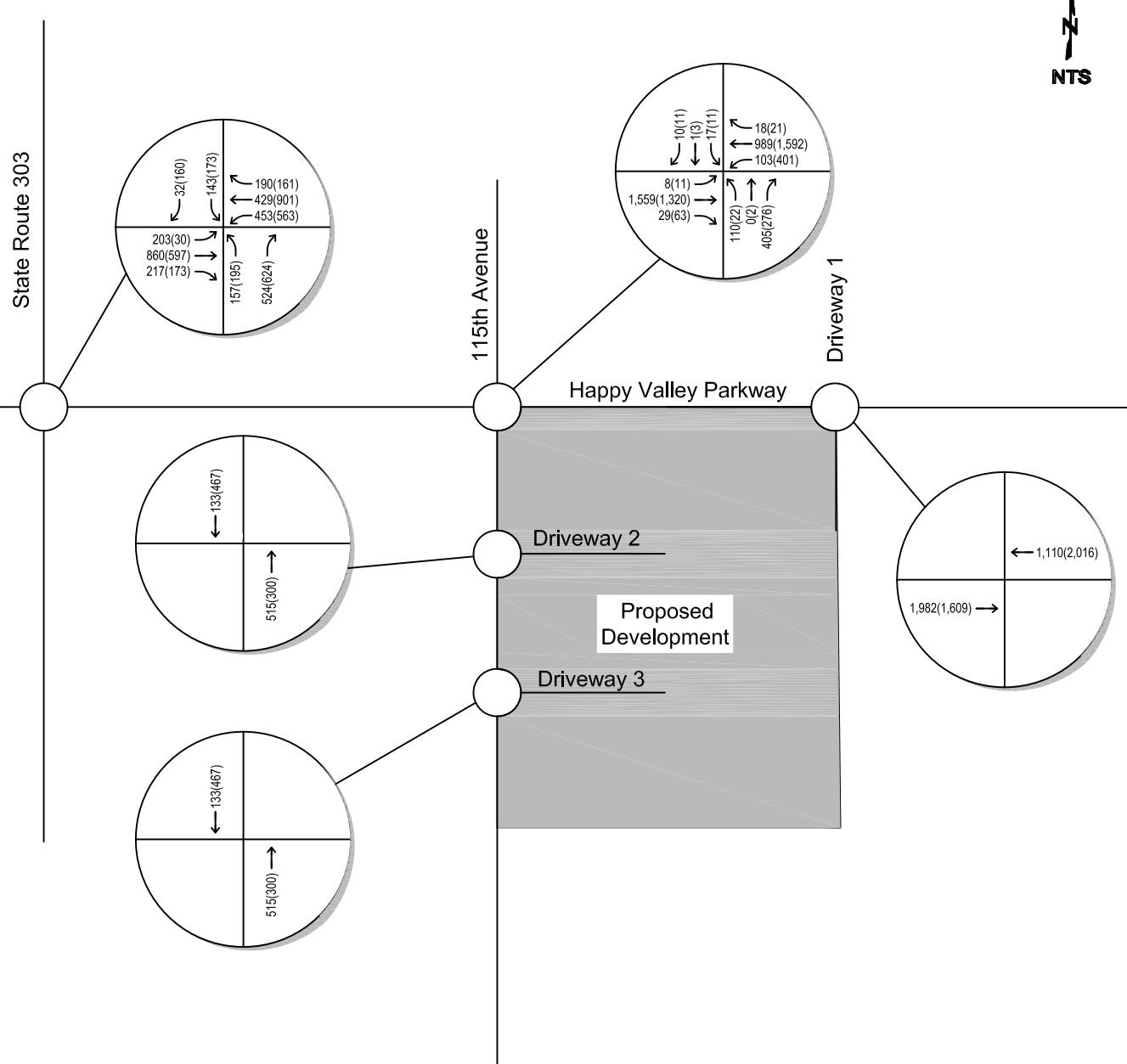
Existing Traffic Volumes

Traffic Research and Analysis Inc. counted current weekday traffic volumes at the study area intersections on Tuesday, December 11, 2018 through contract with Stanley Consultants. Turning movement counts were collected in fifteen-minute intervals from 7:00 AM to 9:00 AM and 4:00 PM to 6:00 PM.

Average daily traffic (ADT) volumes for 2017 were obtained from MCDOT's website.

The existing weekday daily, AM and PM peak hour traffic volumes are depicted in **Figure 4** and are included in **Appendix A**.





LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

↔
XXXX - Daily Volumes
→

Existing Levels-of-Service

The ability of a transportation system to transmit the transportation demand is characterized as its level-of-service (LOS). LOS is a rating system from A, representing the best operation, to F, representing the worst operation. The appropriate reference for LOS operation is the *Highway Capacity Manual*, published by the Transportation Research Board. This manual considers the average delay per vehicle as the measure to determine the LOS of a signalized and unsignalized intersections. Based on the MCDOT TIS Manual, the minimum acceptable LOS at signalized and unsignalized intersections is "D".

The delay and LOS are calculated for the intersection, each approach, and each turning movement. **Table 1** and **Table 2** lists the LOS criteria for signalized and unsignalized intersections, respectively, as stated in the *Highway Capacity Manual*.

Table 1: Level-of-Service Criteria for Signalized Intersections

Level-of-Service	Average Control Delay (s/veh)
A	≤ 10
B	> 10-20
C	> 20-35
D	> 35-55
E	> 55-80
F	> 55-80

Table 2: Level-of-Service Criteria for Unsignalized Intersections

Level-of-Service	Average Control Delay (s/veh)
A	≤ 10
B	> 10-15
C	> 15-25
D	> 25-35
E	> 35-50
F	> 50

One of the important conditions for determining LOS at an intersection is the number of lanes provided for each movement on each approach at the intersection. The existing intersection geometry for each study intersection is discussed within the section of this report titled **Description of Surrounding Transportation System**. The existing intersection geometry for the study area intersections is shown in **Figure 3**. 2018 weekday traffic volumes shown in **Figure 4** were utilized for the existing 2018 LOS analysis. The existing traffic signal timing was obtained from the City of Peoria for the SR 303 signal and from MCDOT for the 115th Avenue signal and was utilized for the analysis.

The LOS for the study area intersections was evaluated using *Synchro* software version 10, which utilizes the criteria described in **Table 1** and **Table 2**. The existing LOS for the signalized study area intersections is shown in **Table 3**. **Appendix B** provides the complete results of the existing 2018 weekday LOS analyses.

Table 3: Existing Traffic Level-of-Service Summary - Signalized Intersections

Intersection		Existing 2018 Level-of-Service											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
<i>SR 303 and Happy Valley Parkway</i>													
AM Peak Hour	Movement	D	C	B	D	B	B	D	-	D	D	-	D
	Total								C				
PM Peak Hour	Movement	D	C	C	D	B	B	D	-	D	D	-	D
	Total								C				
<i>115th Avenue and Happy Valley Parkway</i>													
AM Peak Hour	Movement	B	C	B	C	C	C	C	C				D
	Total								C				
PM Peak Hour	Movement	C	C	B	F	D	C	D					D
	Total								E				

Based on the existing traffic volumes, existing signal timing and existing lane geometrics, the signalized study area intersections operate at LOS "C" or better during the weekday AM and PM peak hours with the exception of 115th Avenue and Happy Valley Parkway in the PM Peak period. The westbound left-turn movement at the intersection of 115th Avenue and Happy Valley Parkway operates at a LOS "F" during the PM peak hour. The poor LOS is due to the signal operations at this intersection. The signal is currently operating with split phasing in the northbound and southbound directions due to vertical sight distance limitations approaching the intersection. In addition, the cross-section of Happy Valley Parkway is very wide resulting in long pedestrian clearance times. The minimum green time required for each the northbound and southbound direction is 48.8 seconds. In addition, there are 403 left-turning vehicles in the westbound direction in a single left-turn lane.

Data Sources

As mentioned in the Existing Conditions section of this report, Happy Valley Parkway is planned to be widened in the near future. The City of Peoria has completed the design phase of the project and will be advertising for construction as early as March 2019. The project consists of widening Happy Valley Parkway to three lanes in each direction with bike lanes, curb, gutter and sidewalk on both sides of Happy Valley Parkway. The project is assumed to be completed by 2020. Signing and marking plans for the project are included in **Appendix C**.

Project Conditions

A category I TIS requires the analysis of opening year of the development and 3-5 years after opening. The horizon years for this study will be 2020 (opening year) and 2025.

Background Traffic

Historical daily traffic volumes were obtained from MCDOT's website for Happy Valley Parkway and 115th Avenue. An exponential growth rate was calculated for Happy Valley Parkway based on 2014 and 2017 ADT's. 115th Avenue becomes 117th Avenue approximately ¼ mile south of Happy Valley Parkway. Therefore, the growth rate for 115th Avenue were calculated using the historic ADT information for 117th Avenue. An exponential growth rate was calculated for 115th Avenue based on 2013 and 2017 ADT's for 117th Avenue. ADT's for Happy Valley Parkway and 117th Avenue are included in **Appendix D**. The growth rates are summarized in **Table 4**.

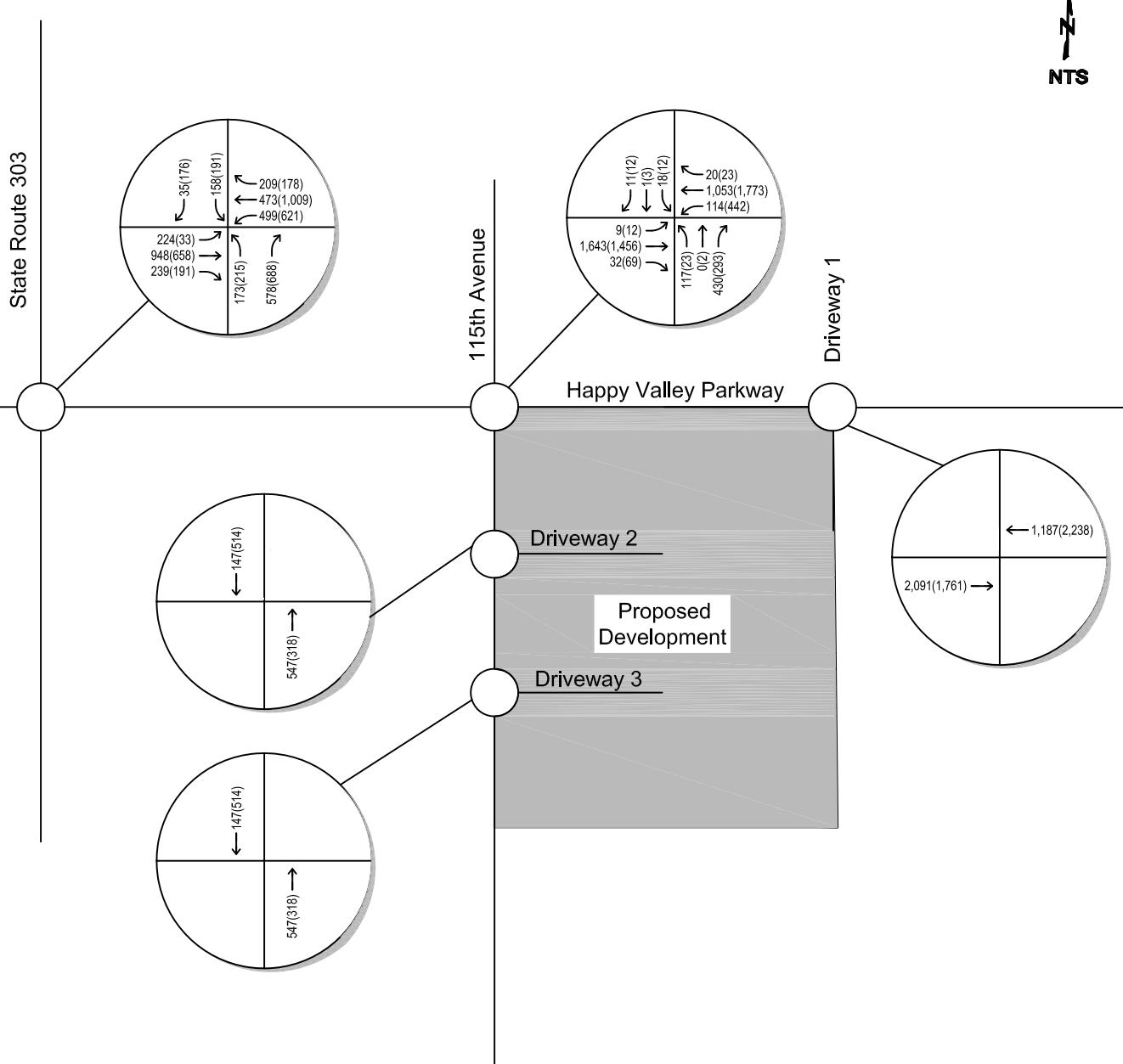
Table 4: Growth Rate

Year	ADT	Yearly Exponential Growth %
Happy Valley Parkway East of 115th Ave		
2014	29,639	
		5%
2017	34,340	
117th south of Happy Valley		
2013	7,984	
		3%
2017	8,818	

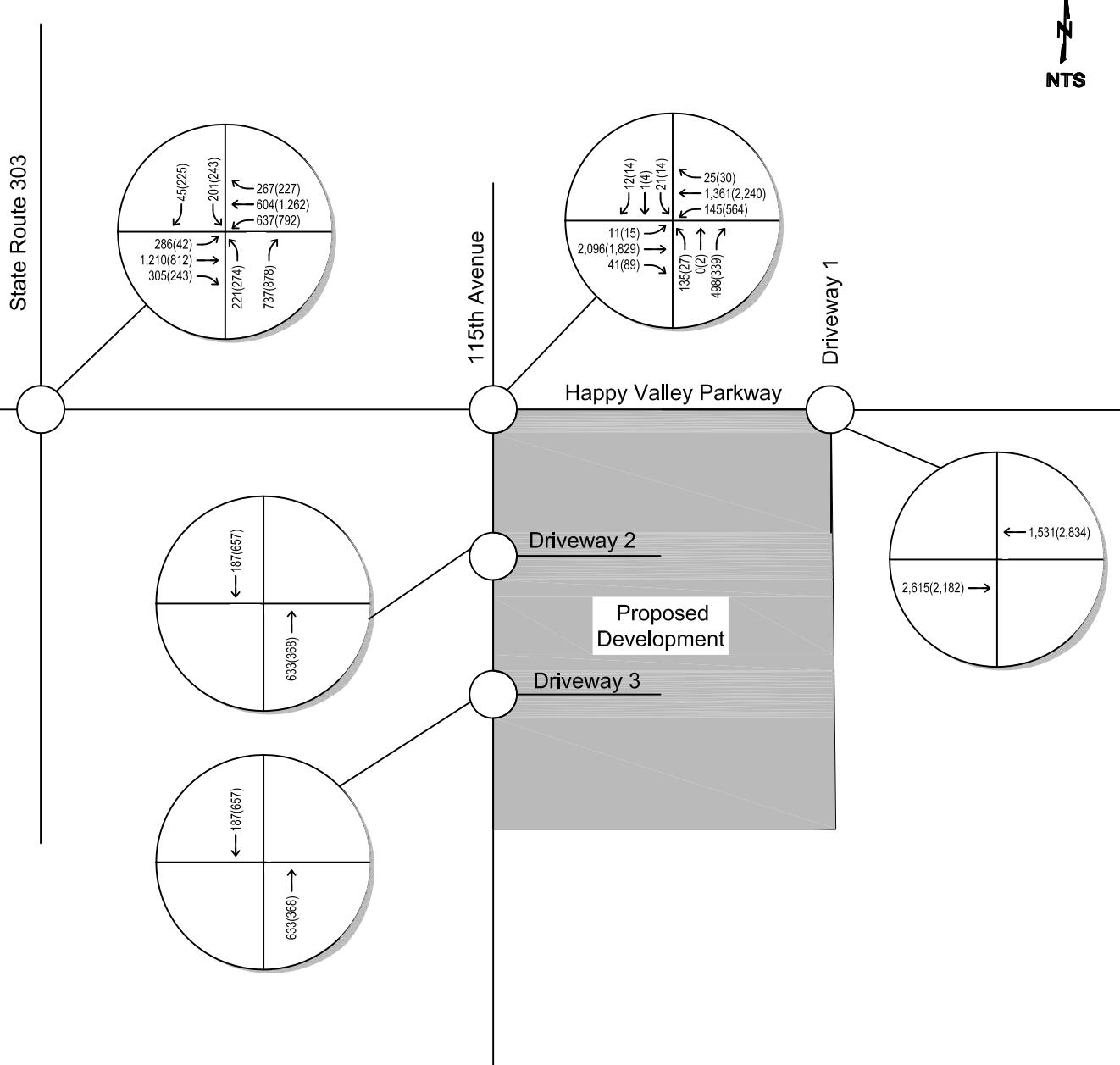
As shown in calculations above, the growth rate based on the historic traffic results in a five percent exponential growth rate on Happy Valley Parkway and a three percent exponential growth rate on 115th Avenue in the vicinity of the proposed development.

The background traffic volumes at the study area intersections for the analysis horizon year of 2020 and 2025 were calculated by applying an annual exponential growth rate to the existing 2018 turning movement volumes. The 2020 and 2025 background traffic volumes are shown in **Figure 5** and **Figure 6** respectively.



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LEGEND
 XX (XX) - AM (PM) Peak Hour Volumes



LEGEND
XX (XX) - AM (PM) Peak Hour Volumes

Site Traffic

Trip Generation

The estimated trip generation for this proposed project was determined through the procedures and data contained within the Institute of Transportation Engineers (ITE) *Trip Generation*, 10th Edition, published in 2017 (Trip Generation Manual). This document provides traffic volume data from existing developments throughout North America that can be utilized to estimate vehicle trips that might be generated from proposed developments. The traffic data are provided for 176 different land use categories. The estimated traffic volume is dependent upon independent variables defined by the characteristics and size of each land use category.

Based on the Trip Generation Manual, for developments including gas station with convenience market, three different land use categories are provided to estimate the trips generated by the proposed development:

- Convenience Market with Gasoline Pump, ITE Code – 853,
- Gasoline/Service Station with Convenience Market, ITE Code – 945, and
- Super Convenience Market/Gas Station, ITE Code 960.

Based on the Trip Generation Manual, Gasoline/Service Station with Convenience Market land uses may include ancillary facilities for servicing and repairing motor vehicles and therefore ITE Code 945 was not used. The proposed QuikTrip development does not include servicing/repairing motor vehicle facilities. The proposed development is expected to include only a convenience market with vehicle fueling stations. ITE Code 853 – Convenience Market with Gasoline Pumps should be used when the gross floor area of the convenience market is at least 2,000 gross square feet and the number of fueling positions is less than 10, therefore, ITE Code – 853 is not used since the proposed development has more than 10 pumps. ITE Code 960 – Super Convenience Market/Gas Station should be used when the gross floor area of the convenience market is at least 3,000 gross square feet and the number of fueling positions is at least 10, therefore, ITE Code – 960 is used to estimate the trips generated by the proposed development.

There is considerable data for Super Convenience Market/Gas Station, ITE Code – 960. Four independent variables are available to predict trips: vehicle fueling positions, gross floor area, employees, and peak hour of adjacent street. All four have excellent statistical attributes and therefore are acceptable for use. Gross floor area and vehicle fueling positions are known for this development. A trip generation comparison was made for the proposed QuikTrip development based on the gross floor area and vehicle fueling positions. The number of trips generated by using vehicle fueling positions is greater than the number of trips generated by using the gross floor area. Therefore, to be conservative, the independent variable, vehicle fueling positions, was utilized for estimating the number of generated trips by the proposed QuikTrip development.

For this land use category, average trip generation rate was provided. Weekday trips can be predicted for morning and evening peak hour of the adjacent street, and morning and evening peak hour of the development (also known as generator). Typically, when a single land use is analyzed, the peak hour generator will be used to estimate the number of trips generated. Therefore, for this study, peak hour generator was selected for the weekday analysis.

Pass-by Trips

Chapter 5 of ITE's Trip Generation Handbook, 10th Edition, defines pass-by trips as intermediate stops on the way from an origin to a primary trip destination without a route diversion. Pass-by trips are not considered to be new trips on the street network adjacent to the site. ITE's Trip Generation Handbook, 10th Edition lists average pass-by percentages for various land uses and does not include ITE land use code 960 – Super Convenience Market/Gas Station. However, based on discussions with MCDOT staff, pass-by percentages for ITE land use code 945 can be applied. The average pass-by trip percentage for the AM and PM peak hour is 62% and 56% respectively. However, due to driveway access restrictions, the pass-by percentages were only applied to 75% of the site traffic generated.

Table 5 summarizes the weekday trip generation for the proposed site. **Appendix E** provides the complete results of these calculations.

Table 5: Weekday Trip Generation for Proposed Development

Land Use	ITE Code	Size	Generated Trips					
			Weekday Daily		Weekday AM Peak Hour		Weekday PM Peak Hour	
			Enter	Exit	Enter	Exit	Enter	Exit
Super Convenience Market / Gas Station	960	16 Pumps	1,845	1,844	225	225	184	184
				3,689		450		368
			1,845	1,844	225	225	184	184
				3,689		450		368
			NA	NA	105	105	77	77
				0		209		154
			1,845	1,844	121	121	107	107
				3,689		241		214
Total New Site Trips								

*due to driveway access restriction, pass by reductions are applied to 75% of the site traffic generated from the west and south of the site.

On a typical weekday, the proposed QuikTrip is expected to generate 3,689 daily trips, 450 AM peak hour trips and 368 PM peak hour trips. After pass-by reductions, the proposed QuikTrip is expected to generate 3,689 daily trips, 241 AM peak hour trips and 214 PM peak hour trips new trips on the adjacent roadway network.

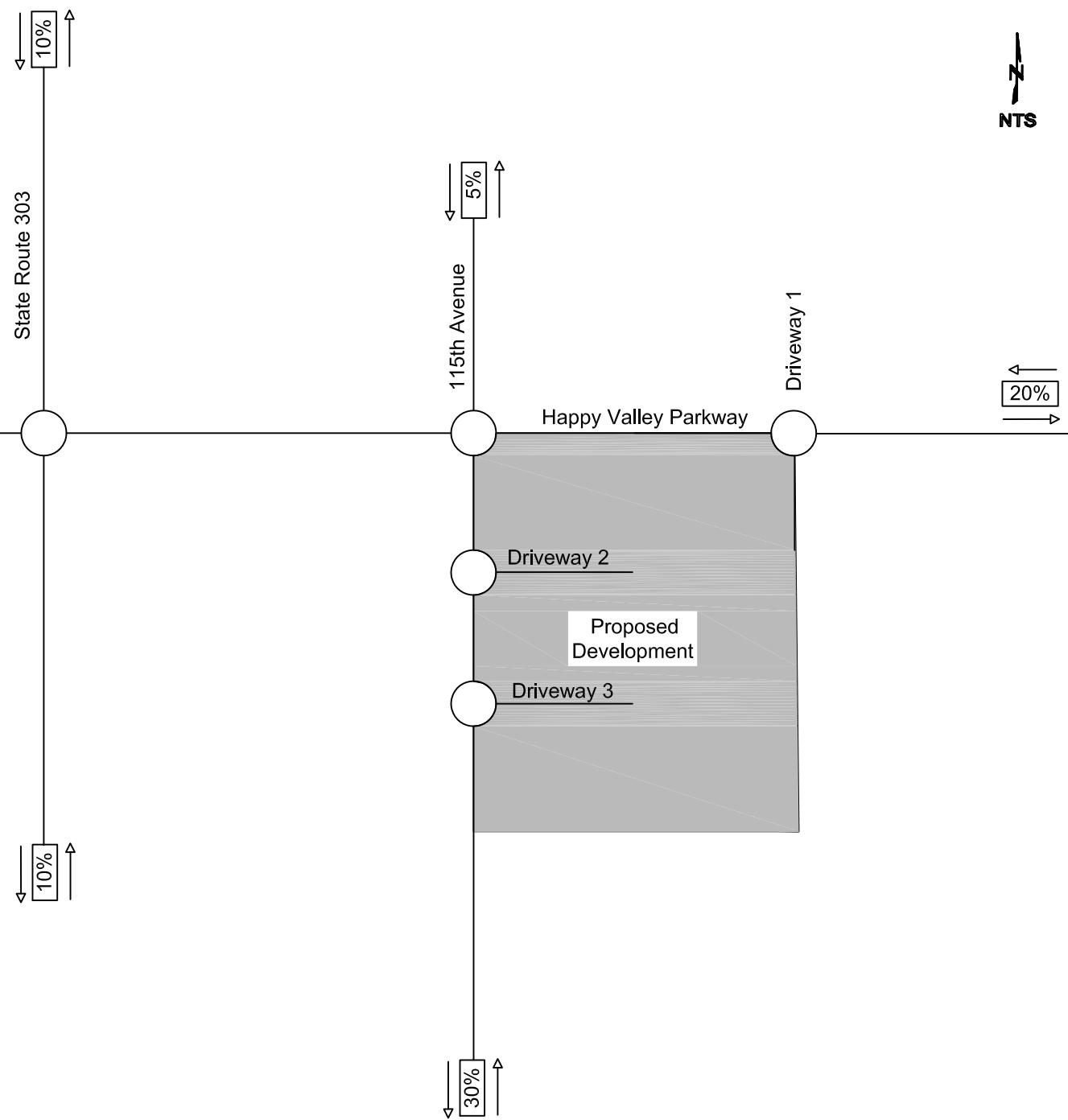
Trip Distribution

The final determination related to site traffic is the determination of the direction the generated traffic utilizes to enter and exit the site. The land uses and the conditions of the street system surrounding the proposed QuikTrip were taken into account when determining where the traffic would be traveling to and from the development.

Figure 7 depicts the entering and exiting trip distribution of the generated trips into and out of the proposed development.

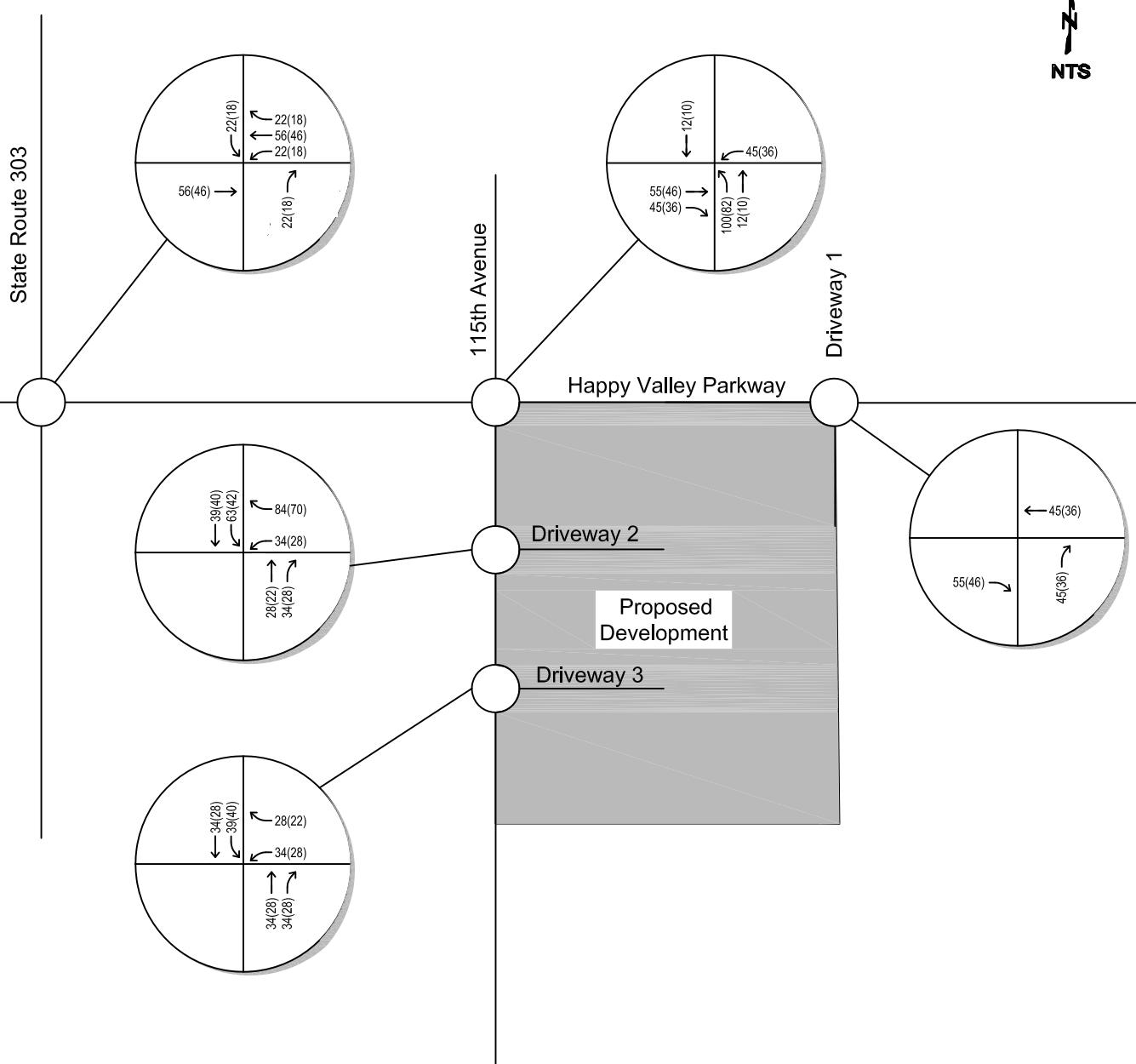
Trips Added to Street System

Based on the trip generation, pass-by reductions and trip distribution, new trips that can be expected from the proposed development have been added to the street system and driveways. **Figure 8** depicts the trips added to the street system from the proposed development for the weekday AM and PM peak hours and **Figure 9** depicts the pass-by reductions.

**LEGEND**

← Entering/Exiting Percentage

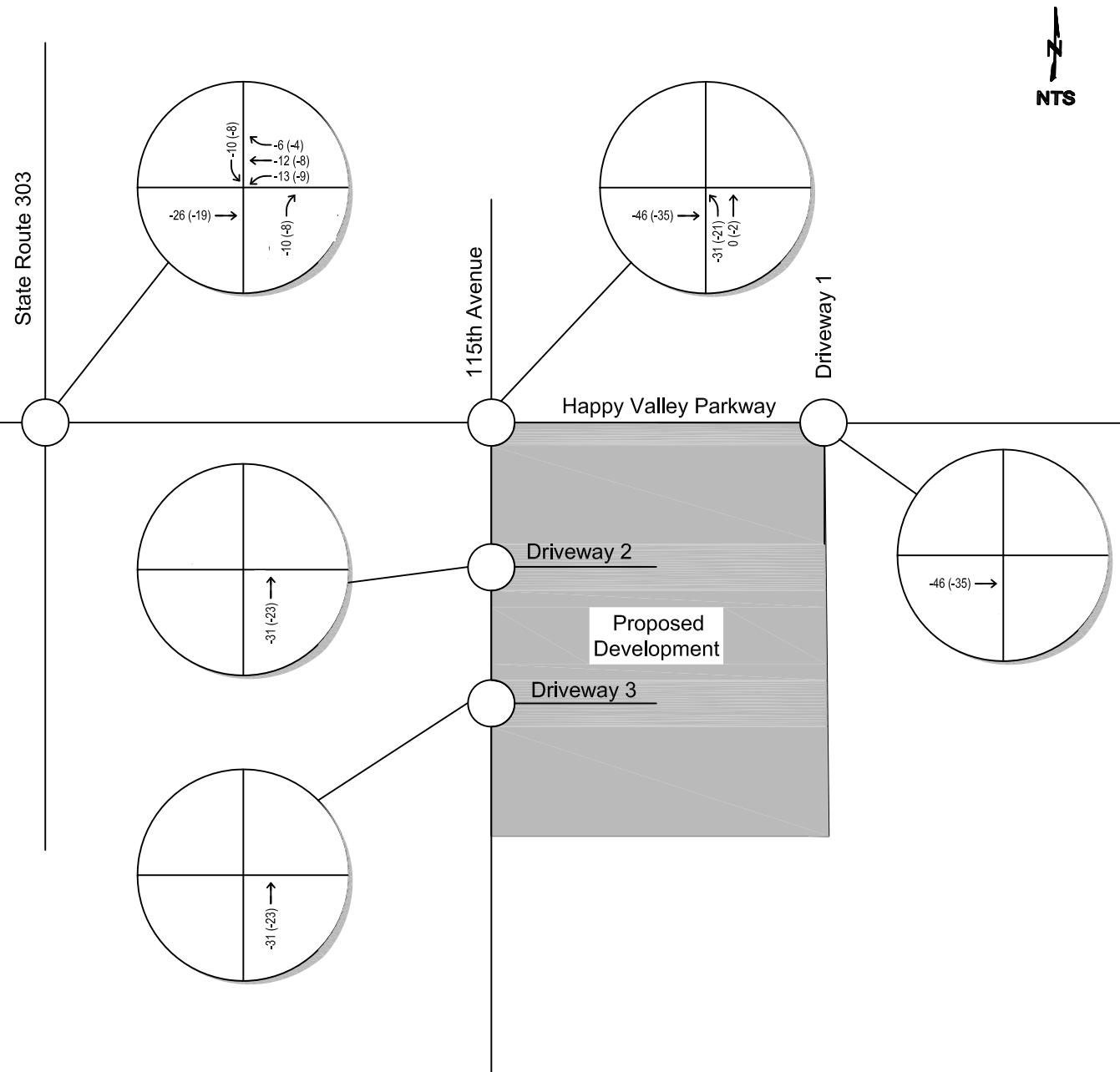


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XX (XX) - AM (PM) Peak Hour Volumes

↔
XXXX - Daily Volumes



LEGEND
XX (XX) - AM (PM) Peak Hour Volumes



Total Traffic

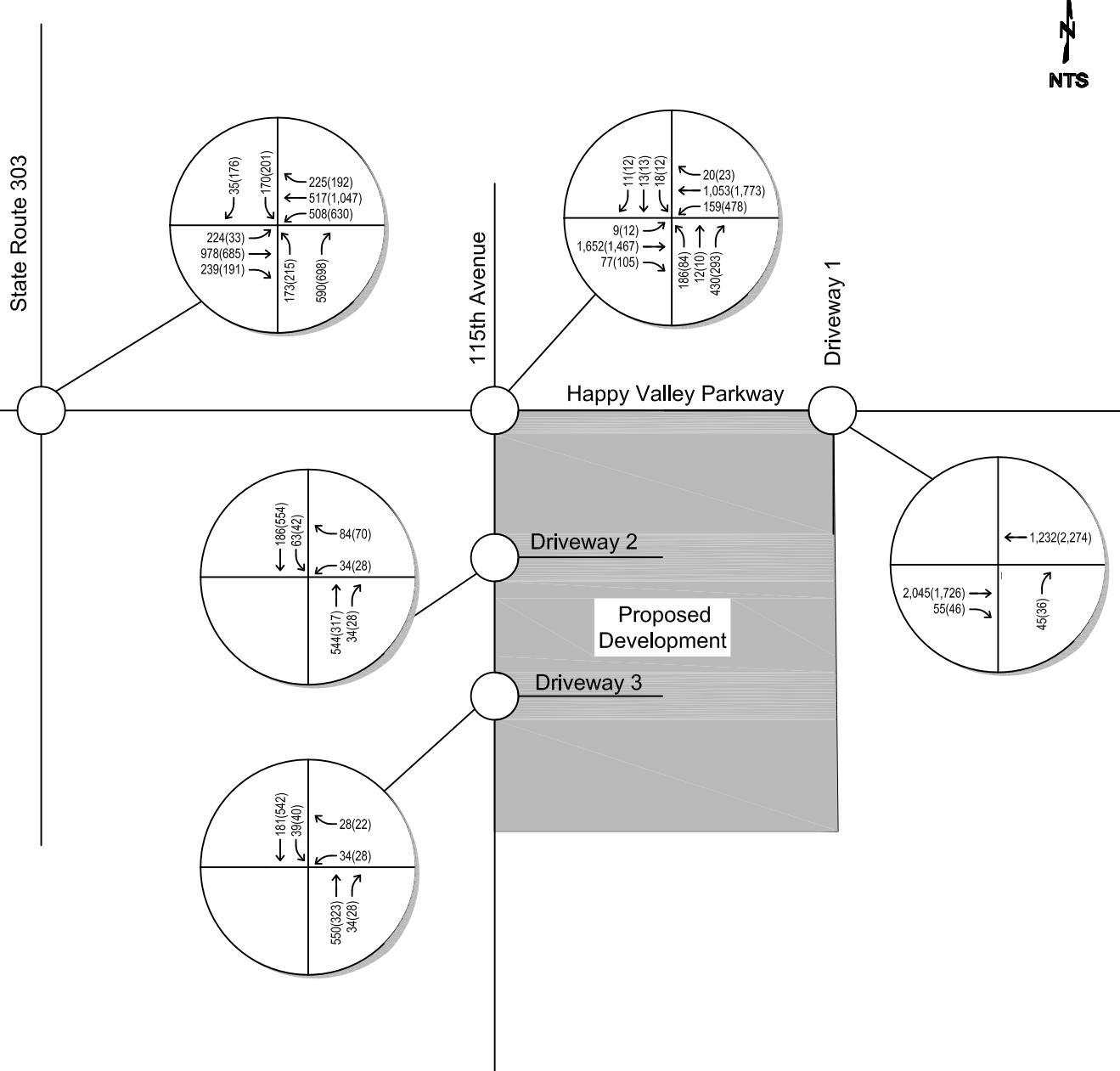
Weekday 2020 total traffic volumes are shown in **Figure 10**, which is the sum of the following traffic volumes:

- Weekday 2020 background traffic volumes; shown in **Figure 5**,
- Weekday site generated traffic volumes; shown in **Figure 8**, and
- Pass-by reductions; shown in **Figure 9**.

Weekday 2025 total traffic volumes are shown in **Figure 11**, which is the sum of the following traffic volumes:

- Weekday 2025 background traffic volumes; shown in **Figure 6**,
- Weekday site generated traffic volumes; shown in **Figure 8**, and
- Pass-by reductions; shown in **Figure 9**.



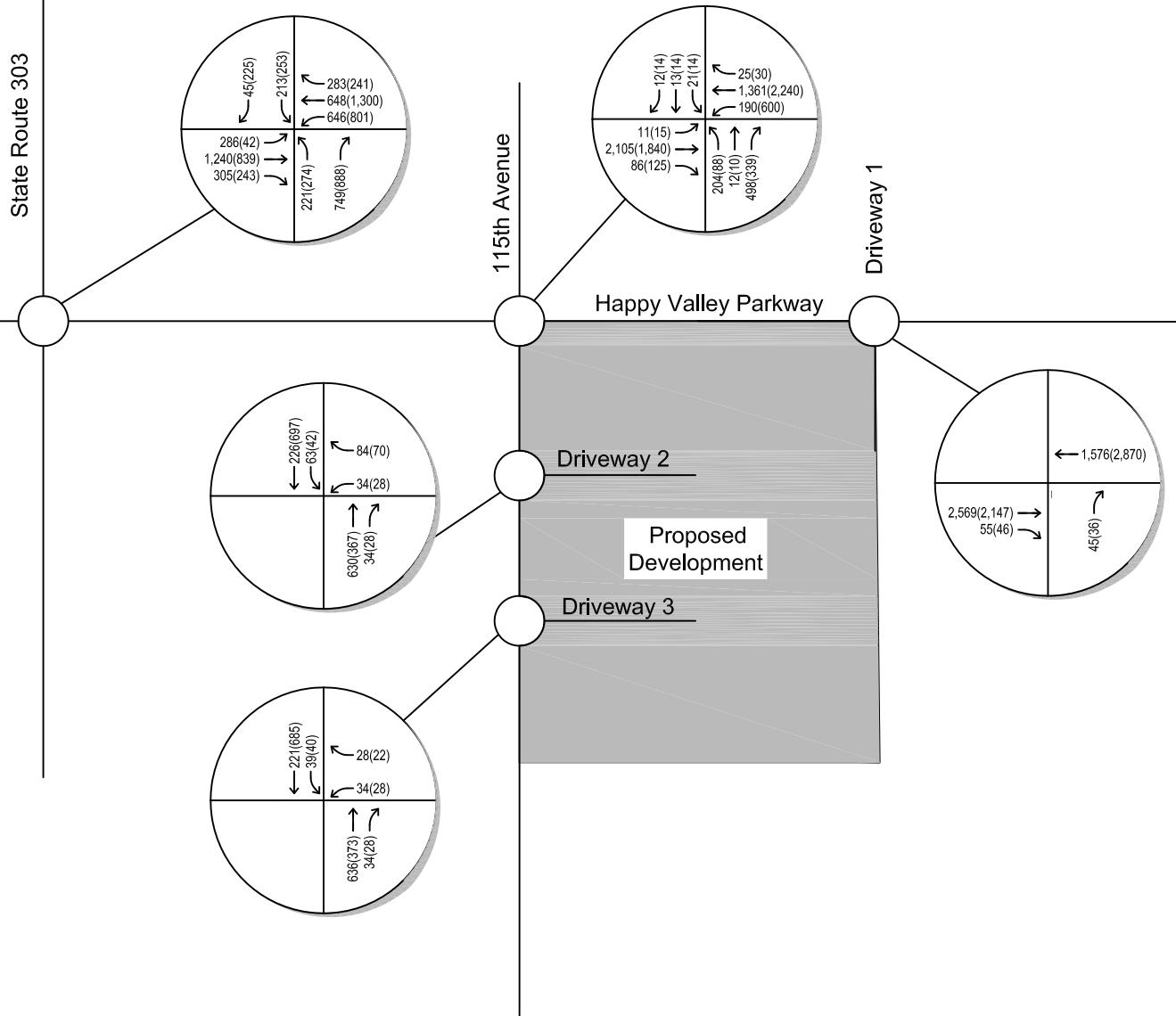
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LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

XXXX - Daily Volumes



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LEGEND

XX (XX) - AM (PM) Peak Hour Volumes

XXXX - Daily Volumes

Traffic and Improvement Analysis

Level-of-Service Analysis

Level-of-service (LOS) for the study area intersections were analyzed for the years 2020 and 2025 with the background traffic and total traffic volumes. The LOS criteria for the signalized and unsignalized study area intersections are described in the section **Existing Level-of-Service Analysis**.

Existing intersection control and future lane geometrics based on Happy Valley Parkway widening project were utilized to determine the background and total traffic LOS at the study area intersections for the years 2020 and 2025.

Synchro software was utilized to calculate the average delay and LOS for the study area intersections. The input and output for these analyses are provided as **Appendix F** to this report. **Table 6** through **Table 9** present the background and total traffic LOS summary for the study area intersections for the years 2020 and 2025.

The existing signal timing was used to analyze the background and total traffic LOS at the study area signalized intersections.

Table 6: 2020 Background Traffic Level-of-Service Summary – Signalized Intersections

Intersection		Background 2020 Level-of-Service											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
SR 303 and Happy Valley Parkway													
AM Peak Hour	Movement	D	C	B	D	B	B	D	-	D	D	-	D
	Total								C				
PM Peak Hour	Movement	D	C	C	D	B	B	D	-	D	D	-	D
	Total								C				
115th Avenue and Happy Valley Parkway													
AM Peak Hour	Movement	B	D	B	C	B	C	C	C				D
	Total								C				
PM Peak Hour	Movement	B	B	B	F	C	C	C	C				D
	Total								F				

As shown in **Table 6**, the signalized intersections of SR 303/Happy Valley Parkway and 115th Avenue/Happy Valley Parkway are expected to operate with LOS “C” or better during the weekday AM and PM peak hours with 2020 background traffic volumes, existing signal timing and future lane geometrics with the exception of 115th Avenue and Happy Valley Parkway in the PM Peak hour. Similar to the existing condition, the westbound left-turn movement at the intersection of 115th Avenue and Happy Valley Parkway operates at a LOS “F” during the PM peak hour. The poor LOS is due to the signal operations at this intersection. The signal is currently operating with split phasing in the northbound and southbound directions due to vertical sight distance limitations approaching the intersection. In addition, the cross-section of Happy Valley Parkway is very wide resulting in long pedestrian clearance times. The minimum green time required for each the northbound and southbound direction is 48.8 seconds. In addition, there are 499 left-turning vehicles in the westbound direction in a single left-turn lane. Adding more time for the westbound left-turn phase or dual left-turn lanes will only add to the delay for the overall intersection due to the split phasing.

Table 7: 2025 Background Traffic Level-of-Service Summary – Signalized Intersections

Intersection		Background 2025 Level-of-Service											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
<i>SR 303 and Happy Valley Parkway</i>													
AM Peak Hour	Movement	D	C	C	D	B	B	D	-	D	D	-	D
	Total							C					
PM Peak Hour	Movement	D	C	C	E	C	B	D	-	E	D	-	D
	Total							D					
<i>115th Avenue and Happy Valley Parkway</i>													
AM Peak Hour	Movement	B	F	B	E		C	C	C				D
	Total						F						
PM Peak Hour	Movement	C	D	B	F		E	C	D				D
	Total						F						

As shown in **Table 7**, the signalized intersection of SR 303 and Happy Valley Parkway is expected to operate with LOS “D” or better during the weekday AM and PM peak hours with 2025 background traffic volumes, existing signal timing and future lane geometrics.

The intersection of 115th Avenue and Happy Valley Parkway is expected to operate with LOS “F” during the weekday AM and PM peak hours with 2025 background traffic volumes, existing signal timing and future lane geometrics. Similar to the existing and 2020 condition, the westbound left-turn movement at the intersection of 115th Avenue and Happy Valley Parkway operates at a LOS “F” during the PM peak hour. The eastbound through movement also operates with LOS “F” during the AM peak hour. The poor LOS is due to the signal operations at this intersection. The signal is currently operating with split phasing in the northbound and southbound directions due to vertical sight distance limitations approaching the intersection. In addition, the cross-section of Happy Valley Parkway is very wide resulting in long pedestrian clearance times. The minimum green time required for each the northbound and southbound direction is 48.8 seconds. In addition, there are 564 left-turning vehicles in the westbound direction in a single left-turn lane. Adding more time for the westbound left-turn phase or dual left-turn lanes will only add to the delay for the overall intersection due to the split phasing.

Table 8: 2020 Total Traffic Level-of-Service Summary – Signalized Intersections

Intersection		Total Traffic 2020 Level-of-Service											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
<i>SR 303 and Happy Valley Parkway</i>													
AM Peak Hour	Movement	D	C	B	D	B	B	D	-	D	D	-	D
	Total							C					
PM Peak Hour	Movement	D	C	C	D	B	B	D	-	D	D	-	D
	Total							C					
<i>115th Avenue and Happy Valley Parkway</i>													
AM Peak Hour	Movement	C	F	C	F		C	C	C				D
	Total						F						
PM Peak Hour	Movement	B	C	B	F		E	C	C				C
	Total						F						

As shown in **Table 8**, the signalized intersection of SR 303 and Happy Valley Parkway is expected to operate with LOS “D” or better during the weekday AM and PM peak hours with 2020 total traffic volumes, existing signal timing and future lane geometrics.

The intersection of 115th Avenue and Happy Valley Parkway is expected to operate with LOS "F" during the weekday PM peak hour with 2020 total traffic volumes, existing signal timing and future lane geometrics. Similar to the existing and 2020 background condition, the poor LOS is due to the signal operations at this intersection. Until the sight distance restrictions on the north leg of the intersection is improved, the signal operation will remain as split phase resulting in poor LOS. In addition, the cross-section of Happy Valley Parkway is very wide resulting in long pedestrian clearance times. If pedestrians are excluded from the northbound and southbound phases, a shorter green time can be used to accommodate the northbound/southbound volumes. LOS would improve for the eastbound and westbound directions but there would be more delay for the northbound and southbound direction and the intersection would fail overall. Adding more time for the westbound left-turn phase or dual left-turn lanes will only add to the delay for the overall intersection due to the split phasing.

Table 9: 2020 Total Traffic Level-of-Service Summary – Site Driveways

Intersection	Total Traffic 2020 Level-of-Service											
	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
Happy Valley Parkway and Driveway 1												
AM Peak Hour	-	A		-	A	-	-	-	B		-	
PM Peak Hour	-	A		-	A	-	-	-	A		-	
115th Avenue and Driveway 2												
AM Peak Hour		-		C		-	A		A		-	
PM Peak Hour		-		C		-	A		A		-	
115th Avenue and Driveway 3												
AM Peak Hour		-		C		-	A		A		-	
PM Peak Hour		-		C		-	A		A		-	

As shown in **Table 9**, Driveway 1 on Happy Valley Parkway and Driveway 2 and 3 on 115th Avenue are expected to operate with LOS "C" during the weekday AM and PM peak hours with 2020 total traffic volumes and existing lane geometrics.

Table 10: 2025 Total Traffic Level-of-Service Summary – Signalized Intersections

Intersection	Total Traffic 2025 Level-of-Service											
	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
SR 303 and Happy Valley Parkway												
AM Peak Hour	Movement	D	C	C	D	C	B	D	-	D	D	-
	Total						C					
PM Peak Hour	Movement	D	C	C	E	C	B	D	-	E	D	-
	Total						D					
115th Avenue and Happy Valley Parkway												
AM Peak Hour	Movement	C	F	C	F	E		C	C		D	
	Total							F				
PM Peak Hour	Movement	C	F	B	F	F		C	C		D	
	Total							F				

As shown in **Figure 10**, the signalized intersection of SR 303 and Happy Valley Parkway is expected to operate with LOS "D" or better during the weekday AM and PM peak hours with 2025 total traffic volumes, existing signal timing and future lane geometrics.

The intersection of 115th Avenue and Happy Valley Parkway is expected to operate with LOS "F" during the weekday AM and PM peak hours with 2025 total traffic volumes, existing signal timing and future lane geometrics. Similar to the 2020 total traffic condition, the poor LOS is due to the signal operations at this intersection. Until the sight distance restrictions on the north leg of the intersection is improved, the signal operation will remain as split phase resulting in poor LOS.

Table 11: 2025 Total Traffic Level-of-Service Summary –Site Driveways

Intersection	Total Traffic 2025 Level-of-Service											
	Eastbound			Westbound			Northbound			Southbound		
	L	T	R	L	T	R	L	T	R	L	T	R
<i>Happy Valley Parkway and Driveway 1</i>												
AM Peak Hour	-	A		-	A	-	-	-	B		-	
PM Peak Hour	-	A		-	A	-	-	-	B		-	
<i>115th Avenue and Driveway 2</i>												
AM Peak Hour		-		C		-	A		A		-	
PM Peak Hour		-		C		-	A		A		-	
<i>115th Avenue and Driveway 3</i>												
AM Peak Hour		-		C		-	A		A		-	
PM Peak Hour		-		D		-	A		A		-	

As shown in **Figure 11**, Driveway 1 on Happy Valley Parkway and Driveway 2 and 3 on 115th Avenue are expected to operate with LOS "C" during the weekday AM and PM peak hours with 2025 total traffic volumes and existing lane geometrics.

Site Access – Turn Lane Evaluation

Per the MCDOT TIS Manual, auxiliary lanes shall be analyzed at all site driveways. The criteria for right and left-turn lanes follow the MCDOT Roadway Design Manual section 6.1.6 Intersection Lane Requirements was used to determine the need for right- and left-turn lanes. Pertinent excerpts from section 6.1.6 are included in **Appendix G**.

Left-Turn Lane Determination

MCDOT Roadway Design Manual requires a left-turn lane to be provided at all signalized intersections or when the left-turn movement into another roadway results in a LOS less than the minimum LOS "D" during any peak hour.

Driveway 1 on Happy Valley Parkway is a right-in/right-out only driveway therefore there will be no left-turn lane required.

Driveway 2 and Driveway 3 on 115th Avenue operate with acceptable LOS during both the AM and PM peak hour as a shared through and left-turn lane. Therefore, left-turn lanes into the development at Driveway 1 and Driveway 2 are not required.

Right-Turn Deceleration Lanes

Following the MCDOT Roadway Design Manual, a right-turn lane is to be provided when:

1. The roadway has two approach through lanes, a posted speed limit of 45 mph or greater, and an expected right-turn peak hour volume of 300 vph or greater.
2. The roadway has one approach through lane, a posted speed limit of 35 mph or greater, and an expected right-turn peak hour volume of 300 vph or greater.
3. On any roadway where a traffic impact analysis indicates the LOS would be increased to a LOS of D or better with the addition of a right-turn lane.
4. In rural and developing urban areas with higher speeds, a separate right-turn lane may be required for lower right turn volumes.

Driveway 1 on Happy Valley Parkway has more than two approach through lanes and a posted speed limit of 45 mph however the right-turn volume into the development does not exceed 300 vph in either the AM or PM peak hour. Therefore, a right-turn deceleration lane at Driveway 1 is not required. It should be noted that the Happy Valley Parkway improvement project will be constructing a right-turn lane at Driveway 1. The storage length of the right-turn lane is limited by the location of Driveway 1 in relation to 115th Avenue. The design has maximized the length of the right-turn lane for Driveway 1. The length of the right-turn deceleration lane at Driveway 1 on Happy Valley Parkway is approximately 100 feet based on the Happy Valley Parkway Improvement plans.

Driveway 2 and Driveway 3 on 115th Avenue have one approach through lane and a posted speed limit of 30 mph and right-turn volumes that do not exceed 300 vph in either the AM or PM peak hour. Therefore, right-turn deceleration lanes are not required at Driveway 2 or Driveway 3 on 115th Avenue.

Conclusions and Recommendations

Existing Conditions without development

The existing signalized intersection of Happy Valley Parkway and 115th Avenue currently operates with split phasing due to the vertical sight distance restrictions in the north/south direction. The split phasing results in failing level-of-service in the PM peak hour.

The existing PM peak hour westbound left-turn volume at Happy Valley Parkway and 115th Avenue is 403 vph. This volume meets the requirement for a dual left-turn lane. However, adding dual left-turn lanes would require the signal phase to be protected further adding to the overall delay at the intersection.

The intersection of SR 303 and Happy Valley Parkway operates with acceptable levels-of-service with existing traffic volumes.

2020 & 2025 Background Without QuikTrip Site Traffic

The City of Peoria will be widening Happy Valley Parkway to three through lanes in each direction with bike lanes, curb, gutter and sidewalk on both sides of Happy Valley from SR 303 to Lake Pleasant Parkway. The construction is assumed to be completed by 2020 and therefore the background analysis utilizes this future geometry for Happy Valley Parkway.



To obtain the 2020 and 2025 traffic volumes, a five percent exponential growth rate was applied to the existing 2018 traffic volumes on Happy Valley Parkway and a three percent exponential growth rate was applied to the existing 2018 traffic volumes on 115th Avenue.

The signalized intersection of SR 303 and Happy Valley Parkway is expected to operate at LOS "D" or better during the weekday AM and PM peak hours based on the background 2020 and background 2025 traffic volumes and future lane geometrics.

Similar to the existing condition, the intersection of Happy Valley Parkway and 115th Avenue is expected to operate at LOS "F" during the weekday AM and PM peak hours based on the background 2020 and background 2025 traffic volumes and future lane geometrics. The poor level-of-service is due to the split phasing of the traffic signal operations.

Total 2020 and 2025 With QuikTrip Site Traffic

The proposed QuikTrip is expected to generate 3,689 daily trips, 450 AM peak hour trips and 368 PM peak hour trips based on the average trip generation rate for ITE land use code 960. After pass-by reductions, 241 AM peak hour trips and 214 PM peak hour trips will be new trips on the adjacent street network.

The proposed development is expected to be built out by the 2020 in a single phase.

The signalized intersection of SR 303 and Happy Valley Parkway is expected to operate at LOS "D" or better during the weekday AM and PM peak hours based on the total 2020 and total 2025 traffic volumes and future lane geometrics.

Similar to the existing and background conditions, the intersection of Happy Valley Parkway and 115th Avenue is expected to operate at LOS "F" during the weekday AM and PM peak hours based on the total 2020 and total 2025 traffic volumes and future lane geometrics. The poor level-of-service is due to the split phasing of the traffic signal operations.

Driveway 1 on Happy Valley Parkway is a right-in/right-out only driveway therefore there will be no left-turn lane.

Driveway 2 and Driveway 3 on 115th Avenue operate with acceptable LOS during both the AM and PM peak hour as a shared through and left-turn lane. Therefore left-turn lanes into the development at Driveway 1 and Driveway 2 are not required.

Driveway 1 on Happy Valley Parkway has more than two approach through lanes and a posted speed limit of 45 mph however the right-turn volume into the development does not exceed 300 vph in either the AM or PM peak hour and provides acceptable levels-of-service. Therefore, a right-turn lane at Driveway 1 is not required. It should be noted that the Happy Valley Parkway improvement project will be constructing a right-turn lane at Driveway 1. The storage length of the right-turn lane is limited by the location Driveway 1 in relation to 115th Avenue. The design has maximized the length of the right-turn lane for Driveway 1.

Driveway 2 and Driveway 3 on 115th Avenue have one approach through lane and a posted speed limit of 40 mph, right-turn volumes that do not exceed 300 vph in either the AM or PM peak hour and provide



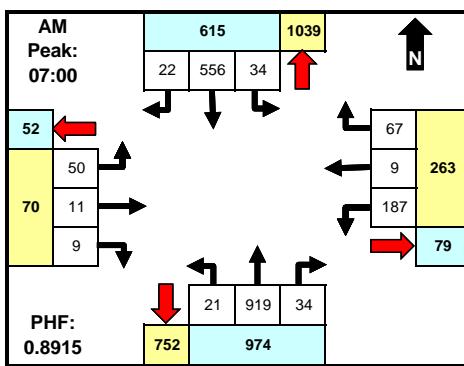
acceptable levels-of-service. Therefore, right-turn lanes are not required at Driveway 2 or Driveway 3 on 115th Avenue.

The proposed QuikTrip development does not require any additional roadway improvements beyond the Happy Valley Parkway improvement project to widen Happy Valley Parkway.

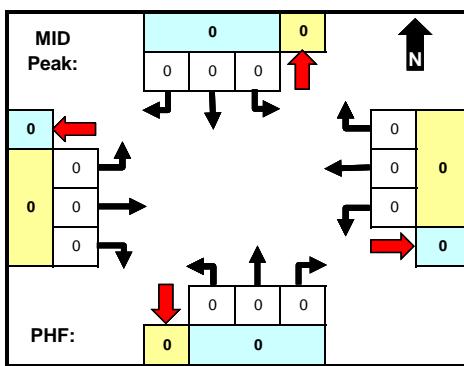
Appendix A

Existing Traffic Counts

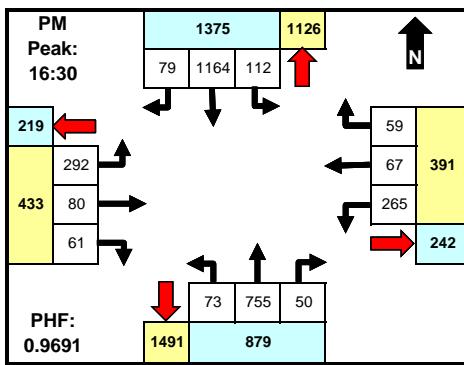
Intersection ID: 1800443
Count Date: 2/20/2018



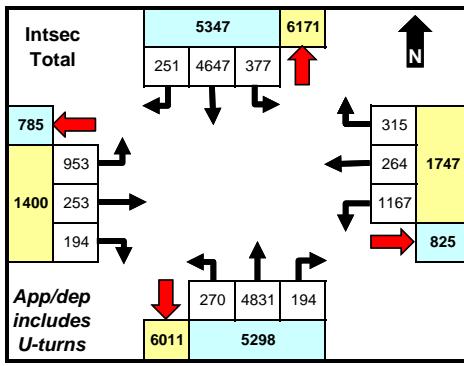
Weather: Clear



100



Weather: Clear

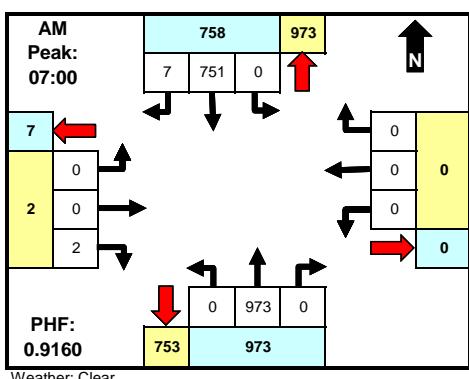


	North		East		South		West		
	App	Dep	App	Dep	App	Dep	App	Dep	Total
AM	615	1039	263	79	974	752	70	52	1922
MID	0	0	0	0	0	0	0	0	0
PM	1375	1126	391	242	879	1491	433	219	3078
Total	5347	6171	1747	825	5298	6011	1400	785	13792

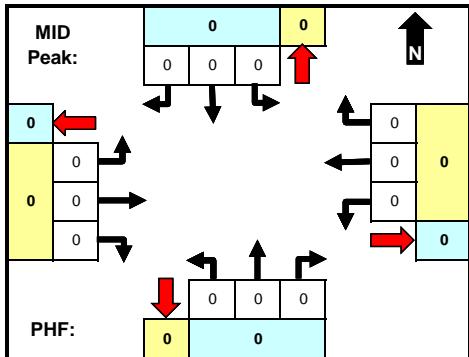
Comments

Unless shown otherwise, MID period defined as 10:00 AM - 2:00 PM. Peaks defined based on total intersection volume for all vehicle types. Chart totals do not include crosswalk data.

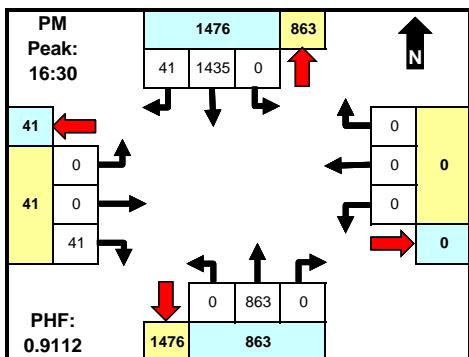
Intersection ID: 1800444
Count Date: 2/20/2018



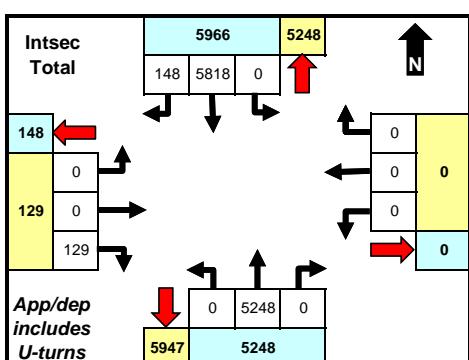
Weather: Clear



10 of 10



Weather: Clear

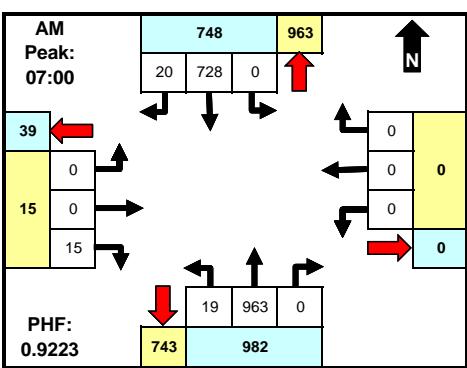


	North		East		South		West		Total
	App	Dep	App	Dep	App	Dep	App	Dep	
AM	758	973	0	0	973	753	2	7	1733
MID	0	0	0	0	0	0	0	0	0
PM	1476	863	0	0	863	1476	41	41	2380

Comments

Unless shown otherwise, MID period defined as 10:00 AM - 2:00 PM. Peaks defined based on total intersection volume for all vehicle types. Chart totals do not include crosswalk data.

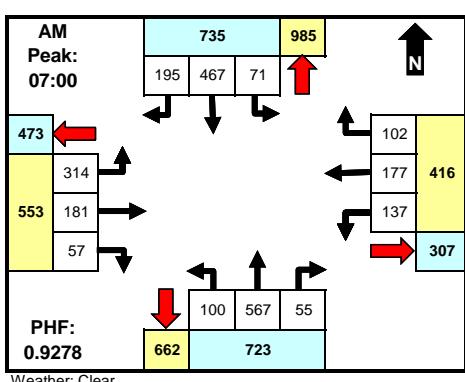
Intersection ID: 1800445
Count Date: 2/20/2018



Weather: Clear

		From North S WATSON RD			From East DRIVEWAY 2 - S OF DIRT LOT			From South S WATSON RD			From West NONE			INTSEC		
Time	LT	Thru	RT	U	CW	LT	Thru	RT	U	CW	LT	Thru	RT	U	CW	TOTAL
0:00																0
0:15																0
0:30																0
0:45																0
1:00																0
1:15																0
1:30																0
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5:15																0
5:30																0
5:45																0
6:00		64	1	0												277
6:15		75	3	0												296
6:30		130	4	0												376
6:45		143	12	0												365
7:00		184	2	0												411
7:15		160	4	0												450
7:30		203	6	0												473
7:45		181	8	0												411
8:00		144	2	0												372
8:15		140	7	0												370
8:30		138	8	0												370
8:45		114	6	0												319
9:00																0
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14:45																0
15:00		311	6	0												529
15:15		314	14	0												561
15:30		352	11	0												632
15:45		310	21	0												618
16:00		329	14	0												608
16:15		338	14	0												620
16:30		329	20	0												608
16:45		334	21	0												613
17:00		345	14	0												637
17:15		387	19	0												678
17:30		343	17	0												605
17:45		311	12	0												557
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23:00																0
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23:30																0
23:45																0
Total	0	5679	246	0	0	0	0	0	0	0	368	5129	0	7	0	0
																11756
AM Peak Hr:																7:00
Pk Vol	0	728	20	0	0	0	0	0	0	0	19	963	0	0	0	0
PHF	n/a	0.897	0.625	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.950	0.875	n/a	n/a	n/a	0.922
MID Peak Hr:																0
Pk Vol																0
PHF																0
PM Peak Hr:																16:30
Pk Vol	0	1395	74	0	0											

Intersection ID: 1800446
Count Date: 2/20/2018



Time	From North S WATSON RD				From East W YUMA RD				From South S WATSON RD				From West W YUMA RD				INTSEC TOTAL
	LT	Thru	RT	U	CW	LT	Thru	RT	U	CW	LT	Thru	RT	U	CW	LT	
0:00																	0
0:15																	0
0:30																	0
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5:30																	0
5:45																	0
6:00	6	47	7	0		5	5	22	0		10	139	4	0		54	4
6:15	4	63	10	0		14	12	28	0		6	130	5	0		65	8
6:30	13	94	20	0		20	10	28	0		4	149	6	0		55	12
6:45	13	98	33	0		33	24	23	0		10	130	11	0		61	21
7:00	22	134	34	0		47	29	28	0		18	136	15	0		51	29
7:15	11	112	47	1		25	51	22	0		37	173	19	0		80	39
7:30	18	123	59	0		30	49	29	0		26	142	13	1		97	51
7:45	20	98	55	1		35	48	23	0		19	116	8	0		86	62
8:00	12	104	29	1		35	32	21	0		19	145	13	0		68	32
8:15	21	108	20	1		35	22	29	0		20	144	19	0		46	23
8:30	20	90	24	1		13	24	23	0		14	109	12	0		79	15
8:45	21	85	21	2		22	22	22	0		11	109	7	0		63	15
9:00																	0
9:15																	0
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14:30																	0
14:45																	0
15:00	46	181	68	1		44	58	28	0		32	101	9	2		79	43
15:15	34	190	69	2		37	47	36	0		34	90	9	1		98	73
15:30	69	251	67	5		35	43	42	0		39	118	14	2		88	70
15:45	54	246	62	5		35	39	30	0		31	168	24	3		68	58
16:00	73	193	73	1		44	71	36	0		45	150	13	1		82	57
16:15	61	237	72	2		47	59	31	0		39	130	19	0		87	63
16:30	67	237	70	4		29	51	26	0		38	132	20	0		95	77
16:45	74	221	76	2		31	41	36	0		27	117	14	1		84	56
17:00	69	260	68	4		36	37	36	0		41	151	22	1		79	50
17:15	91	237	61	1		28	55	26	0		34	131	18	0		76	54
17:30	70	262	81	10		34	43	29	0		29	120	15	0		79	57
17:45	75	207	75	4		35	47	31	0		22	105	13	1		64	44
18:00																	0
18:15																	0
18:30																	0
18:45																	0
19:00																	0
19:15																	0
19:30																	0
19:45																	0
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22:00																	0
22:15																	0
22:30																	0
22:45																	0
23:00																	0
23:15																	0
23:30																	0
23:45																	0
Total	964	3878	1201	48	0	749	919	685	0	0	605	3135	322</td				

Appendix B

Existing Level-of-Service

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Existing 2018 AM
01/16/2019

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑↑	↑	↑	↑↑		↑	↑			↔	
Traffic Volume (vph)	8	1490	29	103	952	18	110	0	405	17	1	10
Future Volume (vph)	8	1490	29	103	952	18	110	0	405	17	1	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.95		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.97	
Satd. Flow (prot)	1770	5085	1583	1770	3527		1770	1583			1739	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.97	
Satd. Flow (perm)	263	5085	1583	235	3527		1770	1583			1739	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	9	1620	32	124	1147	28	139	0	445	28	4	12
RTOR Reduction (vph)	0	0	20	0	1	0	0	354	0	0	11	0
Lane Group Flow (vph)	9	1620	12	124	1174	0	139	91	0	0	33	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	29.0	28.3	28.3	35.8	31.7		15.9	15.9			5.2	
Effective Green, g (s)	29.0	28.3	28.3	35.8	31.7		15.9	15.9			5.2	
Actuated g/C Ratio	0.37	0.37	0.37	0.46	0.41		0.21	0.21			0.07	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	112	1856	578	189	1442		363	324			116	
v/s Ratio Prot	0.00	0.32		c0.03	c0.33		c0.08	0.06			c0.02	
v/s Ratio Perm	0.03		0.01	0.27								
v/c Ratio	0.08	0.87	0.02	0.66	0.81		0.38	0.28			0.28	
Uniform Delay, d1	16.6	22.9	15.7	15.6	20.3		26.6	26.0			34.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	5.3	0.0	6.1	4.1		1.4	1.0			2.8	
Delay (s)	16.7	28.2	15.8	21.7	24.4		28.0	27.0			37.2	
Level of Service	B	C	B	C	C		C	C			D	
Approach Delay (s)		27.9			24.2			27.2			37.2	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			26.5			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.66									
Actuated Cycle Length (s)			77.5			Sum of lost time (s)			24.0			
Intersection Capacity Utilization			73.9%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Existing 2018 AM
01/16/2019

Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	203	860	217	453	429	190	157	524	143	32
Future Volume (vph)	203	860	217	453	429	190	157	524	143	32
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	221	935	236	492	466	207	171	570	155	35
RTOR Reduction (vph)	0	0	138	0	0	105	0	506	0	31
Lane Group Flow (vph)	221	935	98	492	466	102	171	64	155	4
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	11.7	41.7	41.7	19.1	49.1	49.1	11.2	11.2	11.2	11.2
Effective Green, g (s)	11.7	41.7	41.7	19.1	49.1	49.1	11.2	11.2	11.2	11.2
Actuated g/C Ratio	0.12	0.42	0.42	0.19	0.49	0.49	0.11	0.11	0.11	0.11
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	401	2120	660	655	1737	777	384	312	384	312
v/s Ratio Prot	0.06	c0.18		c0.14	c0.13		c0.05		0.05	
v/s Ratio Perm			0.06			0.06		0.02		0.00
v/c Ratio	0.55	0.44	0.15	0.75	0.27	0.13	0.45	0.20	0.40	0.01
Uniform Delay, d1	41.7	20.8	18.1	38.2	14.9	13.8	41.5	40.4	41.3	39.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	0.1	0.1	4.8	0.4	0.3	0.8	0.3	0.7	0.0
Delay (s)	43.3	21.0	18.2	43.1	15.3	14.2	42.3	40.7	42.0	39.5
Level of Service	D	C	B	D	B	B	D	D	D	D
Approach Delay (s)		24.1			26.8					
Approach LOS		C			C					
Intersection Summary										
HCM 2000 Control Delay			29.5				HCM 2000 Level of Service		C	
HCM 2000 Volume to Capacity ratio			0.54							
Actuated Cycle Length (s)			100.0				Sum of lost time (s)		28.0	
Intersection Capacity Utilization			Err%				ICU Level of Service		H	
Analysis Period (min)			15							

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Existing 2018 PM Peak Hour

01/25/2019

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	11	1320	63	2	401	1592	21	22	2	276	11	3
Future Volume (vph)	11	1320	63	2	401	1592	21	22	2	276	11	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Lane Util. Factor	1.00	0.91	1.00		1.00	0.95		1.00	1.00			1.00
Frt	1.00	1.00	0.85		1.00	1.00		1.00	0.85			0.96
Flt Protected	0.95	1.00	1.00		0.95	1.00		0.95	1.00			0.98
Satd. Flow (prot)	1770	5085	1583		1770	3530		1770	1585			1750
Flt Permitted	0.11	1.00	1.00		0.10	1.00		0.95	1.00			0.98
Satd. Flow (perm)	201	5085	1583		183	3530		1770	1585			1750
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25
Adj. Flow (vph)	12	1435	68	2	483	1918	33	28	2	303	18	12
RTOR Reduction (vph)	0	0	39	0	0	0	0	0	266	0	0	12
Lane Group Flow (vph)	12	1435	29	0	485	1951	0	28	39	0	0	31
Turn Type	pm+pt	NA	Perm	pm+pt	pm+pt	NA		Split	NA		Split	NA
Protected Phases	1	6		5	5	2		4	4		8	8
Permitted Phases	6		6	2	2							
Actuated Green, G (s)	37.7	37.0	37.0		50.2	45.5		10.5	10.5			5.4
Effective Green, g (s)	37.7	37.0	37.0		50.2	45.5		10.5	10.5			5.4
Actuated g/C Ratio	0.44	0.43	0.43		0.58	0.53		0.12	0.12			0.06
Clearance Time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Vehicle Extension (s)	2.0	5.0	5.0		2.0	5.0		5.0	5.0			5.0
Lane Grp Cap (vph)	100	2185	680		276	1865		215	193			109
v/s Ratio Prot	0.00	0.28		c0.19	0.55		0.02	c0.02			c0.02	
v/s Ratio Perm	0.05		0.02	c0.84								
v/c Ratio	0.12	0.66	0.04		1.76	1.05		0.13	0.20			0.28
Uniform Delay, d1	20.1	19.5	14.3		22.0	20.3		33.7	34.0			38.5
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00			1.00
Incremental Delay, d2	0.2	1.0	0.1		355.3	34.0		0.6	1.1			3.0
Delay (s)	20.3	20.5	14.3		377.3	54.3		34.3	35.1			41.5
Level of Service	C	C	B		F	D		C	D			D
Approach Delay (s)		20.2				118.6			35.0			41.5
Approach LOS		C				F			D			D
Intersection Summary												
HCM 2000 Control Delay		77.0								E		
HCM 2000 Volume to Capacity ratio		1.44										
Actuated Cycle Length (s)		86.1								24.0		
Intersection Capacity Utilization		79.5%								D		
Analysis Period (min)		15										

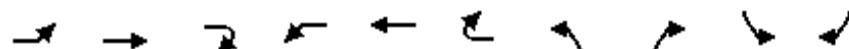
c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	11
Future Volume (vph)	11
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.83
Adj. Flow (vph)	13
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Existing 2018 PM Peak Hour

01/25/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	30	597	173	563	901	161	195	624	173	160
Future Volume (vph)	30	597	173	563	901	161	195	624	173	160
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	33	649	188	612	979	175	212	678	188	174
RTOR Reduction (vph)	0	0	118	0	0	80	0	537	0	152
Lane Group Flow (vph)	33	649	70	612	979	95	212	141	188	22
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	4.8	37.3	37.3	21.8	54.3	54.3	12.9	12.9	12.9	12.9
Effective Green, g (s)	4.8	37.3	37.3	21.8	54.3	54.3	12.9	12.9	12.9	12.9
Actuated g/C Ratio	0.05	0.37	0.37	0.22	0.54	0.54	0.13	0.13	0.13	0.13
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	164	1896	590	748	1921	859	442	359	442	359
v/s Ratio Prot	0.01	0.13		c0.18	c0.28		c0.06		0.05	
v/s Ratio Perm			0.04			0.06		0.05		0.01
v/c Ratio	0.20	0.34	0.12	0.82	0.51	0.11	0.48	0.39	0.43	0.06
Uniform Delay, d1	45.8	22.5	20.6	37.2	14.4	11.1	40.4	40.0	40.1	38.2
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.6	0.1	0.1	6.9	1.0	0.3	0.8	0.7	0.7	0.1
Delay (s)	46.4	22.6	20.7	44.2	15.4	11.4	41.3	40.7	40.8	38.3
Level of Service	D	C	C	D	B	B	D	D	D	D
Approach Delay (s)		23.1			25.0					
Approach LOS		C			C					

Intersection Summary

HCM 2000 Control Delay	29.5	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Appendix C

Happy Valley Parkway Improvement Plans

F.H.W.A. REGION	STATE	PROJECT NO.	HEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

SIGNING & STRIPING

SIGNING AND STRIPING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) ADOPTED BY THE ARIZONA DEPARTMENT OF TRANSPORTATION (ADOT) AND THE CITY OF PEORIA STANDARD DETAILS PE-011 THROUGH PE-018.

SIGNING AND STRIPING LAYOUT SHALL BE APPROVED BY THE ENGINEERING INSPECTOR PRIOR TO ANY INSTALLATION. THE CONTRACTOR SHALL NOTIFY THE CITY OF PEORIA'S ENGINEERING INSPECTION DIVISION, 623-773-8445, AT LEAST 48-HOURS IN ADVANCE OF ANY SIGNING OR STRIPING INSTALLATION. SIGNING OR STRIPING INSTALLATIONS COMPLETED PRIOR TO CONTACTING THE CITY'S ENGINEERING INSPECTION DIVISION SHALL BE REMOVED AND/OR MODIFIED IF IT IS NOT DEEMED ADEQUATE BY THE ENGINEERING INSPECTOR.

STRIPING

- ALL ROAD SURFACES SHALL BE PREPARED PER MANUFACTURER'S INSTRUCTION OR TO THE SATISFACTION OF THE ENGINEERING INSPECTOR PRIOR TO APPLICATION OF PAVEMENT MARKINGS. AT A MINIMUM SURFACES SHALL HAVE DEBRIS REMOVED, BE CLEANED AND DRIED PRIOR TO APPLICATION.
- ALL PAVEMENT MARKINGS SHALL BE INSTALLED IN ACCORDANCE WITH CITY OF PEORIA STANDARDS, CITY OF PEORIA DETAILS PE-011-1 THROUGH PE-018, AND THE MANUFACTURER'S RECOMMENDATIONS.

 - LONGITUDINAL LINE MARKINGS, SHORT-LINE MARKINGS, INCLUDING CROSSWALKS, STOP BARS, CHEVRONS, AND CROSSHATCH MARKINGS SHALL BE INSTALLED USING THERMOPLASTIC MATERIAL APPLIED AT A MINIMUM .90 MIL THICKNESS.
 - WORD SYMBOL AND OTHER LEGEND MARKINGS SHALL BE INSTALLED IN 3M STAMARK PAVEMENT MARKING TAPE.

- THE OBLITERATION OF PRIOR OR CONFLICTING THERMOPLASTIC STRIPING SHALL BE ACCOMPLISHED BY WATER BLASTING WITH VACUUM RECOVERY OR OTHER METHODS APPROVED BY THE ENGINEERING INSPECTOR. A TYPE II MICRO SEAL TREATMENT APPROVED BY THE ENGINEERING INSPECTOR SHALL BE APPLIED IN A MINIMUM THREE-FOOT WIDE, CONTINUOUS APPLICATION TO THE PORTIONS OF THE AFFECTED ASPHALT FOLLOWING OBLITERATION.

THE TYPE II MICRO SEAL TREATMENT CAN BE APPLIED DIRECTLY OVER WATER-BASED PAINT WITHOUT PAINT OBLITERATION. ALL TYPE II MICRO SEAL TREATMENT SHALL BE APPROVED BY THE ENGINEERING INSPECTOR.

- AT THE COMPLETION OF THE FINAL PAVEMENT SURFACE EACH DAY, CENTER LINES, LANE LINES, EDGE LINES AND STOP BARS SHALL BE STRIPED WITH ONE APPLICATION OF STANDARD REFLECTORIZED TRAFFIC PAINT AT THE LOCATIONS OF THE PERMANENT STRIPING. THE PAINT SHALL HAVE A MAXIMUM THICKNESS OF 15 MILS WET (5 MILS DRY).

- ALL PAVEMENT MARKING SHALL BE STRINGLINED FOR 500' FROM ALL INTERSECTIONS.

SIGNING

- ALL SIGN BLANKS SHALL BE .080 GAUGE ALUMINUM, UNLESS OTHERWISE NOTED AND ALL SIGNS SHALL BE ASTM TYPE IV HIGH INTENSITY SHEETING, UNLESS OTHERWISE NOTED, PER CITY OF PEORIA DETAIL PE-032.

- ALL SIGNS SHALL BE INSTALLED PER CITY OF PEORIA STANDARD DETAIL PE-032 AND THE CONTRACTOR SHALL CONTACT BLUE STAKE BEFORE DIGGING. CARE SHALL BE TAKEN TO ENSURE UNOBSTRUCTED VIEWS FOR ALL SIGNS INSTALLED.

- SIGNS INSTALLED ON STREET LIGHT POLES SHALL BE INSTALLED PER PE-032-2, USING A MINIMUM $\frac{1}{2}$ " WIDE STAINLESS STEEL BANDING (C2049) WITH A MINIMUM THICKNESS OF .030, A BANDING BUCKLE (C2549) AND A (D02189) BANDING BRACKET. STREET NAME SIGNS SHALL BE INSTALLED USING BANDING LISTED ABOVE EXCEPT REPLACING THE BANDING BRACKET WITH A (KC250) CANTILEVER BRACKET, ROUND BRACKET (922SF), AND A CROSS BRACKET (990SF); 6" SIGNS SHALL HAVE 6" WIDE BRACKETS AND 9" SIGNS SHALL HAVE 12" WIDE BRACKETS.

- PARKING RESTRICTION SIGNS SHALL BE SET AT AN ANGLE OF NOT LESS THAN 30 DEGREES OR MORE THAN 45 DEGREES WITH THE LINE OF TRAFFIC FLOW IN ORDER TO BE VISIBLE TO APPROACHING TRAFFIC, PER GUIDANCE IN SECTION 2B OF THE MUTCD.

- ALL SIGNS SHALL BE PROVIDED AND INSTALLED BY THE CONTRACTOR PER THE APPROVED PLANS.

- THE CONTRACTOR SHALL RETURN ALL TRAFFIC SIGNAL EQUIPMENT AND SIGNS THAT ARE REMOVED TO THE CITY OF PEORIA MUNICIPAL OPERATIONS CENTER (MOC), 8850 N. 79TH AVENUE. CONTACT THE STREETS ADMINISTRATIONS OFFICE AT 623-773-7456 TO SET UP A DROP-OFF TIME.

- THE SIGN TYPES AND SIZES INCLUDED IN THE PEORIA SIGN REFERENCE GUIDE PROVIDE ADDITIONAL GUIDANCE AND CLARIFICATION TO THE MUTCD, AS IT IS APPLIED IN THE CITY OF PEORIA.

- UNLESS OTHERWISE NOTED, ALL DIMENSIONS ARE TO THE FACE OF CURB AND THE CENTER OF THE STRIPE. IN THE CASE OF A DOUBLE STRIPE, DIMENSION IS TO THE CENTER OF THE DOUBLE STRIPE.

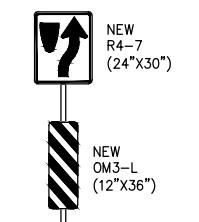
- THE ENGINEERING INSPECTOR MAY REQUIRE THE CONTRACTOR TO MAKE ANY ADJUSTMENTS DEEMED NECESSARY TO ADDRESS CONDITIONS NOT INCLUDED IN THE APPROVED PLANS.

ENGINEER'S NOTES:

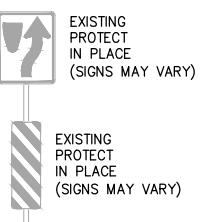
- CONTRACTOR TO VERIFY THAT ALL SIGNING & STRIPING, PER THIS PLAN, MATCH WITH EXISTING STRIPING. IF A DISCREPANCY IS NOTED BETWEEN THE EXISTING STRIPING SHOWN ON THIS PLAN AND WHAT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE APPROPRIATE AGENCY PRIOR TO IMPLEMENTATION.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE LAYOUT AND INSTALLATION OF THE PERMANENT PAVEMENT MARKINGS FOLLOWING CONTROL POINTS THAT HAVE BEEN SET NO MORE THAN 50 FEET APART ALONG THE LINES TO BE STRIPED. PAVEMENT MARKING DIMENSIONS ARE TO CENTER OF THE STRIPE FOR SINGLE LINE STRIPING, AND TO THE CENTER OF THE SPACE BETWEEN THE TWO LINES FOR DOUBLE LINE STRIPING. WHERE CURB AND GUTTER IS PRESENT, DIMENSIONS ARE TO THE FACE OF CURB.
- THE CONTRACTOR SHALL REMOVE THE EXISTING PAVEMENT MARKERS IN CONNECTION WITH THE STRIPE OBLITERATION ACTIVITIES. THERE SHALL BE NO MEASUREMENT OR PAYMENT FOR THE REMOVAL OF THE EXISTING RAISED PAVEMENT MARKERS.
- FOR ALL GROUND MOUNTED D3 STREET NAME SIGNS CONTRACTOR SHALL COORDINATE/PREPARE SIGN DESIGN IN ACCORDANCE WITH THE ADOT MANUAL OF APPROVED SIGNS.
- LEFT AND RIGHT TURN LANES REQUIRING TWO TURN ARROWS SHALL HAVE THE FIRST ARROW PLACED AT THE BEGINNING OF THE TURN LANE AND THE SECOND TURN ARROW PLACED 20 FEET BACK FROM THE END OF THE HOLDING BAR.

APPROXIMATE PAVEMENT MARKING QUANTITIES			
BID ITEM NUMBER	ITEM	UNIT	QUANTITY
450.010	PAVEMENT MARKING WATER BASED PAINT 15 MIL.	LF	104,704
450.011	4" WHITE (EQUIVALENT)	LF	4,158
450.020	PAVEMENT MARKING THERMOPLASTIC BASED PAINT 90 MIL.	LF	104,704
450.021	4" YELLOW (EQUIVALENT)	LF	4,158
450.030	PAVEMENT MARKING (TRANSVERSE)	LF	8,497
450.040	3M STAMARK PAVEMENT MARKING TAPE	EA	70
450.050	BIKE LANE (COP PE-013)	EA	41
450.060	RAISED PAVEMENT MARKERS	TYPE G	EA, 1,380
450.070	RAISED PAVEMENT MARKERS	TYPE H	EA, 137
450.080	RAISED PAVEMENT MARKERS	TYPE BB	EA, 16
460.010	OBLITERATE PAVEMENT MARKING (STRIPE)	LF	7,992
460.020	OBLITERATE PAVEMENT MARKERS	EA	680
460.030	OBLITERATE PAVEMENT MARKING (ARROW, SYMBOL, LEGEND)	EA	58

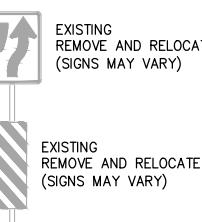
APPROXIMATE SIGN QUANTITIES			
BID ITEM NO.	ITEM	UNIT	QUANTITY
403.010	REMOVE AND SALVAGE SIGNS	EA	63
403.020	RELOCATE EXISTING SIGNS	EA	19
403.030	SIGN POST (PREFORATED) (SINGLE)	FT	504
403.040	FOUNDATION FOR SQUARE TUBE POST	EA	41
403.050	REGULATORY, WARN, OR MARKER SIGN PANEL W/TYP XI SHEETING	SQ.FT.	275



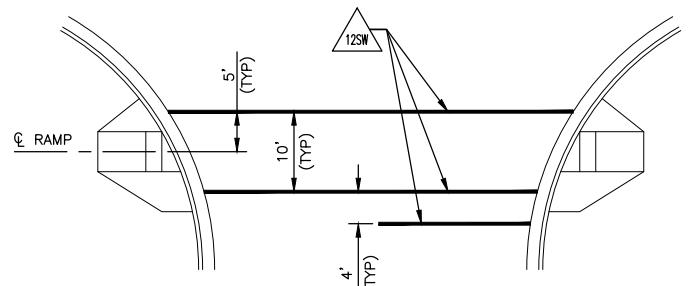
DETAIL "A"
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TYPICAL MEDIAN NOSE MARKINGS
PER COP STD. PE-018



DETAIL "B"
NO SCALE
TYPICAL MEDIAN NOSE MARKINGS
PER COP STD. PE-018



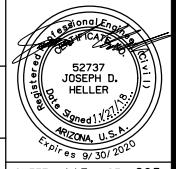
DETAIL "C"
NO SCALE
TYPICAL MEDIAN NOSE MARKINGS
PER COP STD. PE-018



DETAIL "D"
NO SCALE
TYPICAL STOP BAR & CROSSWALK LAYOUT

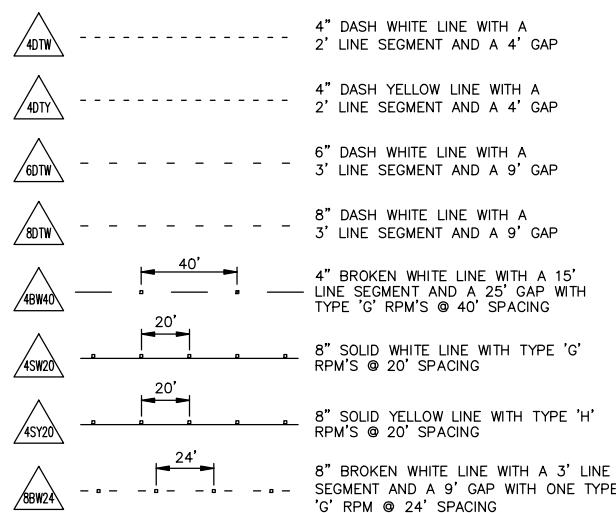


NO.	REVISION	BY	APPR	DATE
CITY OF PEORIA ENGINEERING DEPARTMENT				
TY-LIN INTERNATIONAL engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85281				
SIGNING AND PAVEMENT MARKING				
DRAWING NO.	LOCATION	HAPPY VALLEY PARKWAY IMPROVEMENTS		
SM01				

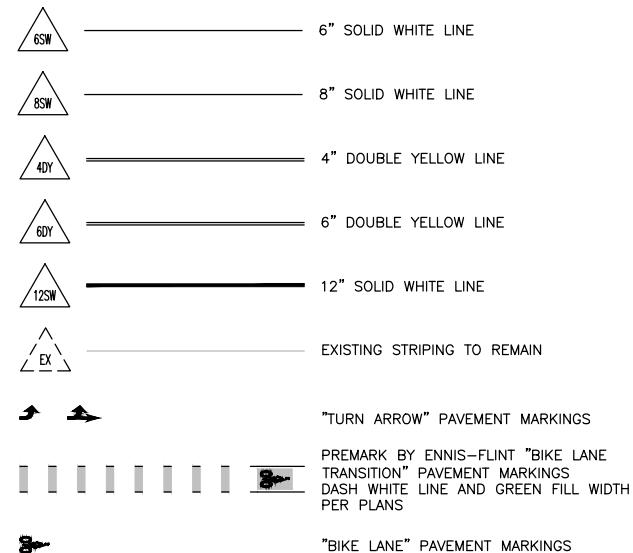


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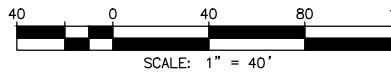
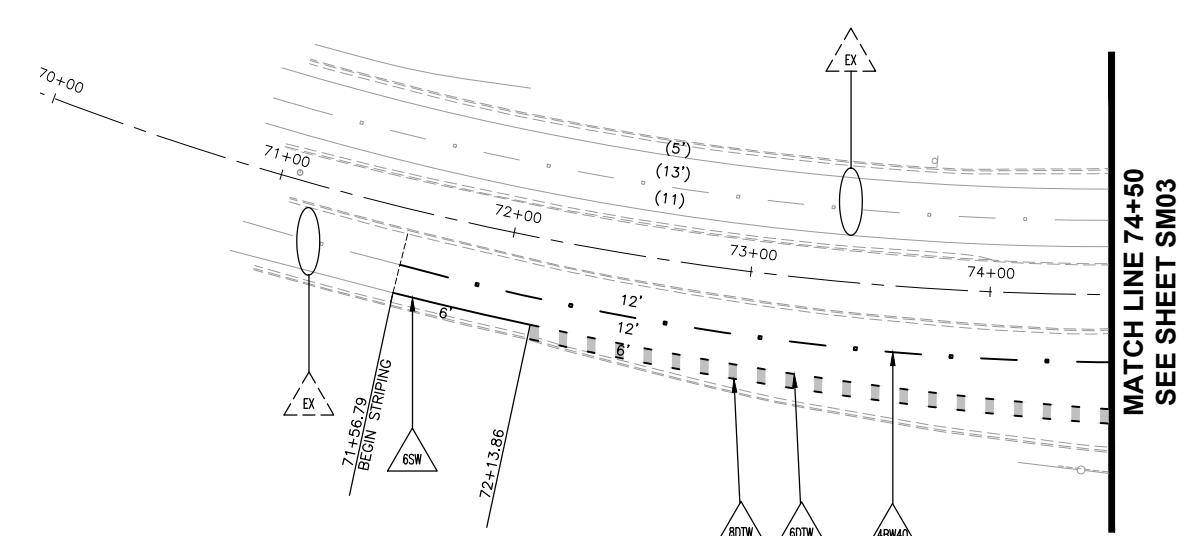
STRIPING LEGEND:



STRIPING LEGEND CONT:

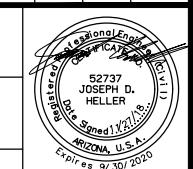


SIGN LEGEND:



NO.	REVISION	BY	APPR	DATE

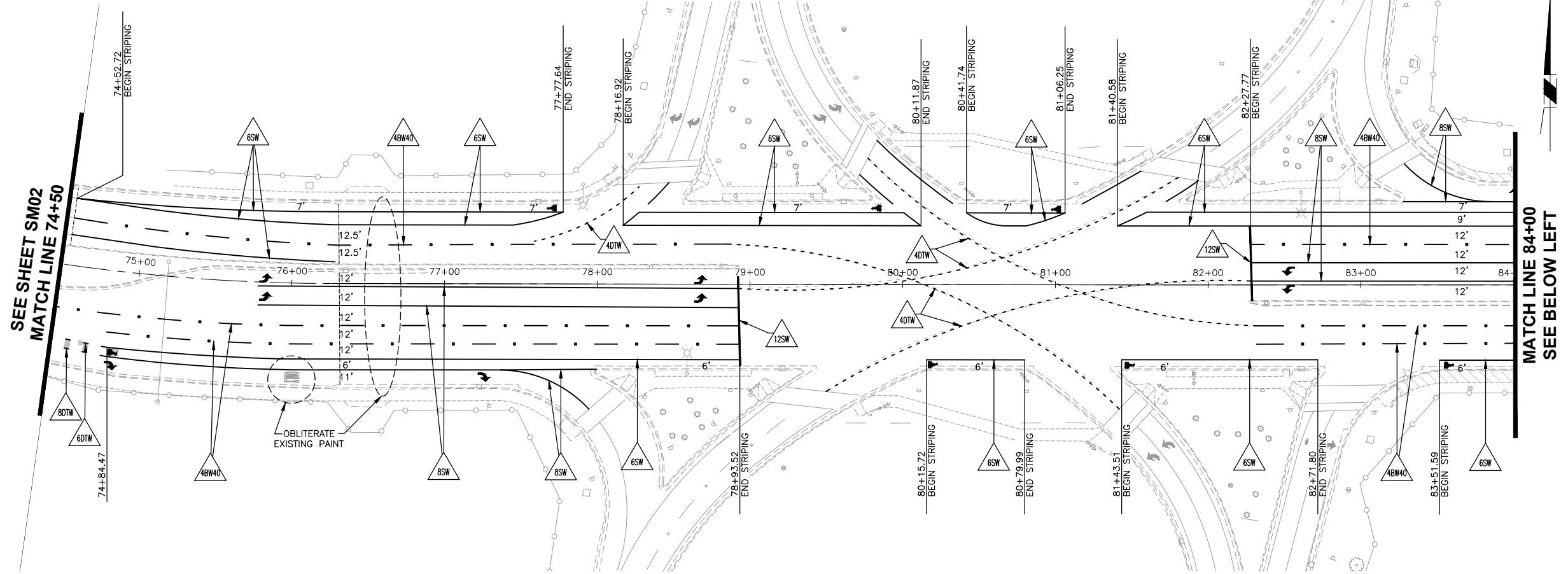
DESIGN	JH,LV,DR,CC	07/18	CITY OF PEORIA ENGINEERING DEPARTMENT
DRAWN	DR,CC,AB	07/18	
CHECKED	JAB	07/18	
TY-LIN INTERNATIONAL engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85281			SIGNING AND PAVEMENT MARKING
DRAWING NO.	LOCATION		
SM02	HAPPY VALLEY PARKWAY IMPROVEMENTS		



HAPPY VALLEY PKWY

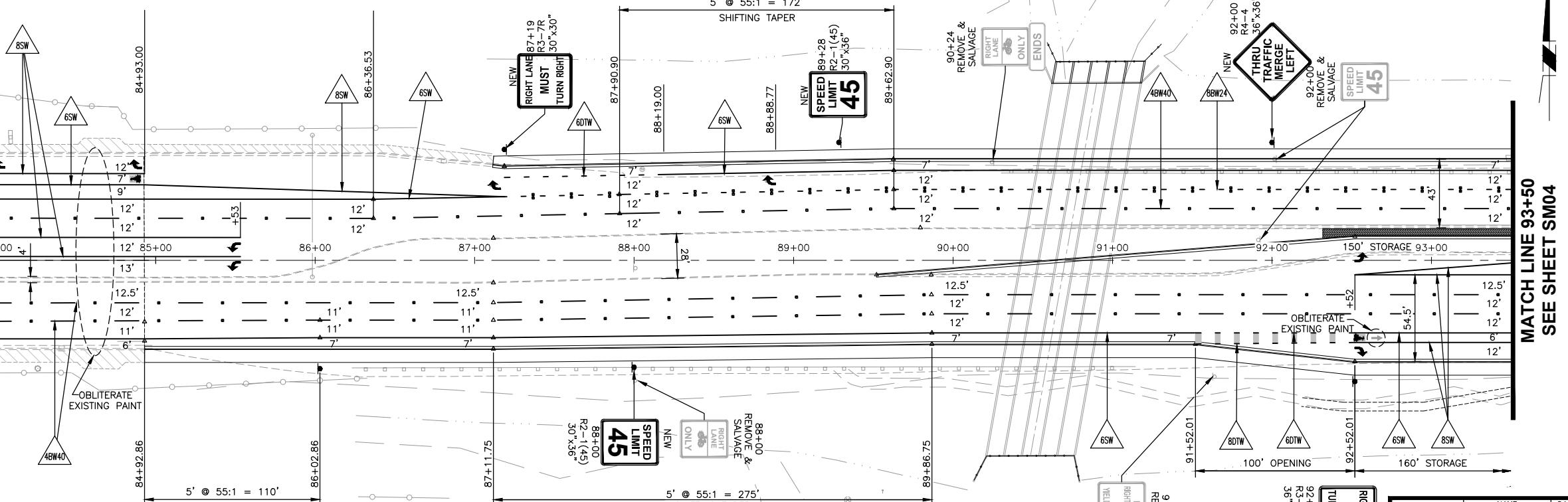
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

**SEE SHEET SM02
MATCH LINE 74+50**



HAPPY VALLEY PKWY

**SEE ABOVE RIGHT
MATCH LINE 84+00**



HAPPY VALLEY PKWY



O.	REVISION	BY	APPR	DATE

CITY OF PEORIA
ENGINEERING DEPARTMENT

	NAME	DATE
NEW		
DESIGN	JH,LV,DR,CC	07/18
DRAWN	DR,CC,AB	07/18
CHECKED	HP	07/18
RIGHT LANE MUST TURN RIGHT	32+22+52 33+7R X36"	

checked JAB 07/18
TY-LIN INTERNATIONAL
engineers | planners | scientists
60 East Rio Salado Parkway
Tempe, AZ 85281

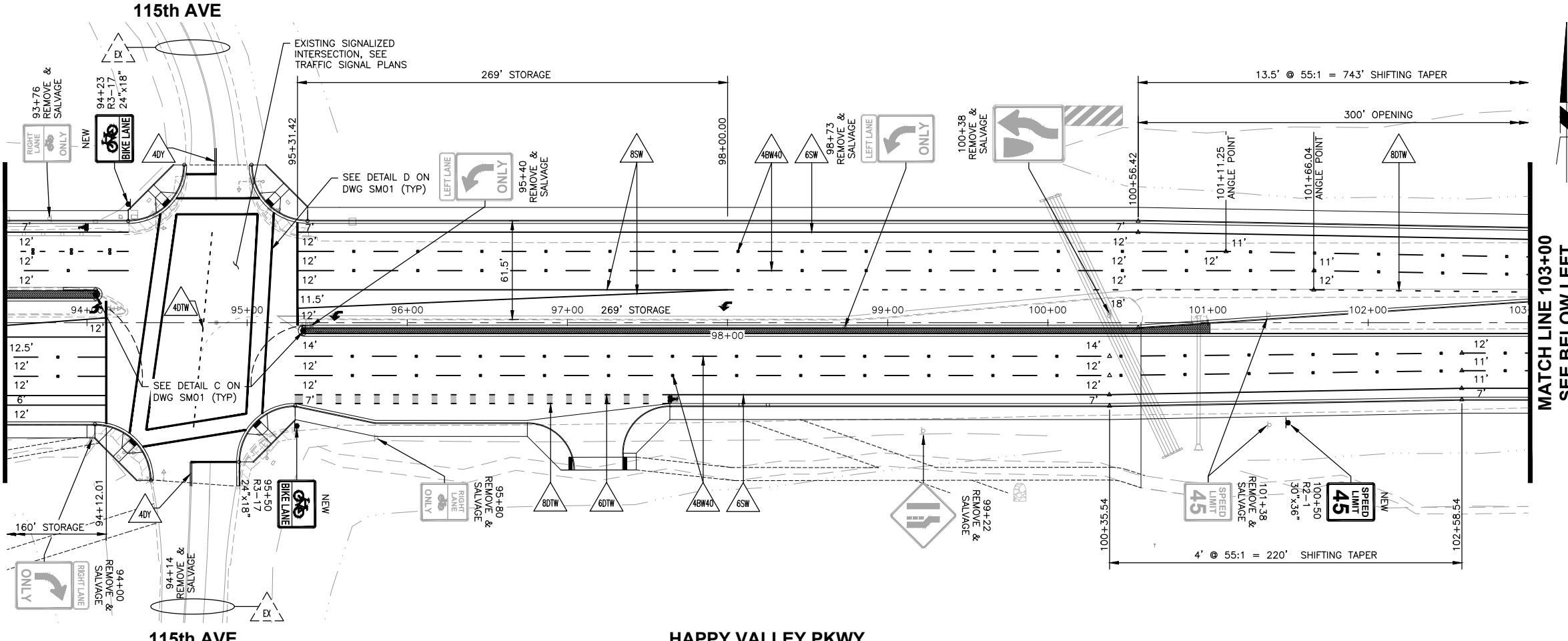
SIGNING AND PAVEMENT MARKING



F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
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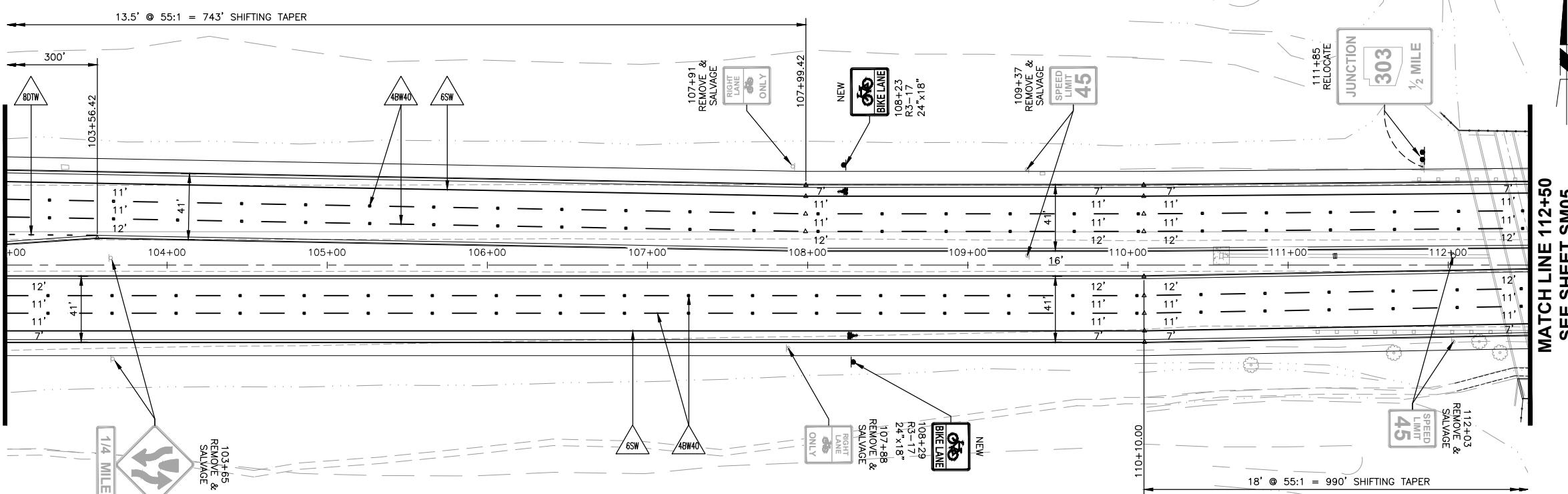
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MATCH LINE 93+50**

MATCH LINE 93+50



SEE ABOVE RIGHT
MATCH LINE 103+00

MATCH LINE 103+00



NO.	REVISION	BY	APPR	DATE

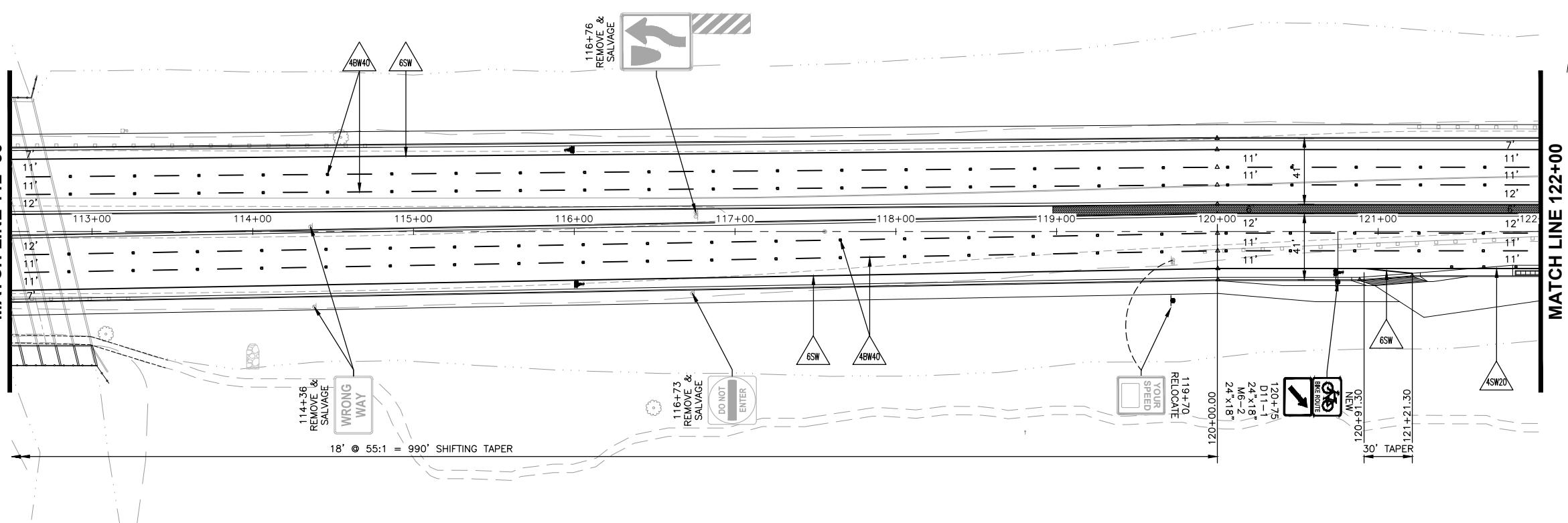
CITY OF PEORIA
ENGINEERING DEPARTMENT

SIGNING AND PAVEMENT MARKING

	NAME	DATE	CITY OF PEORIA ENGINEERING DEPARTMENT
IGN	JH,LV,DR,CC	07/18	
WN	DR,CC,AB	07/18	
CKED	JAB	07/18	
Y. LIN INTERNATIONAL Engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85281			SIGNING AND PAVEMENT MARKING
WING NO. SM04	LOCATION	HAPPY VALLEY PARKWAY IMPROVEMENTS	
			 52737 JOSEPH D. HELLER Date Signed 10/27/18 ARIZONA, U.S.A. Expires 9/30/2020
SHEET 116 OF 295			

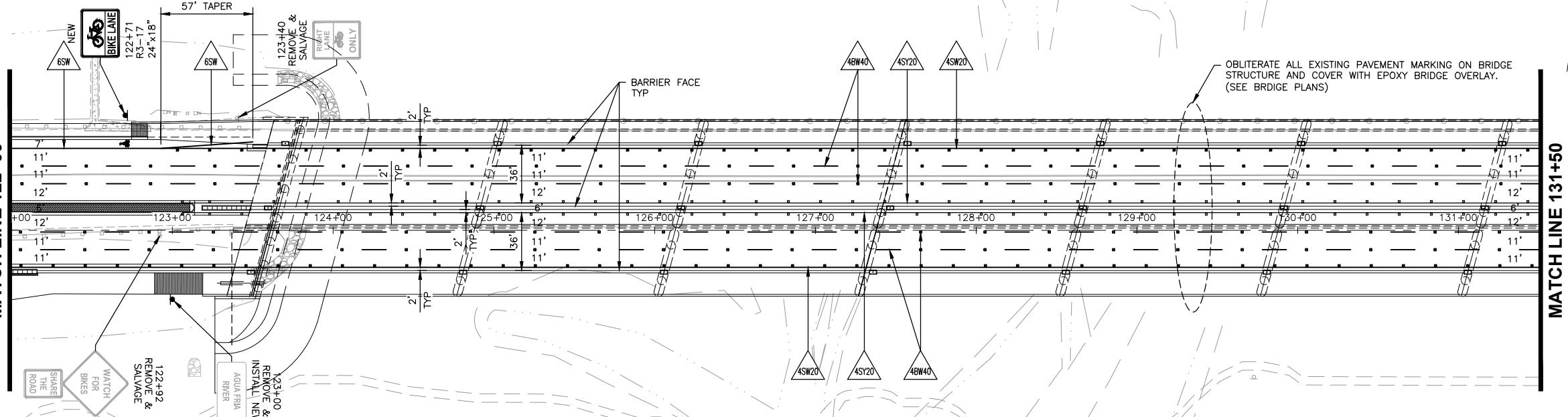
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9	AZ	EN00463	.	.	.

**SEE SHEET SM04
MATCH LINE 112+50**



HAPPY VALLEY PKWY

**SEE ABOVE RIGHT
MATCH LINE 122+00**



HAPPY VALLEY PKWY

NO.	REVISION	BY	APPR	DATE

DATE
07/18
07/18

CITY OF PEORIA
ENGINEERING DEPARTMENT



SIGNING AND PAVEMENT MARKING



Call at least two full working days before you begin excavation.

ARIZONA 811
Arizona Blue Stake, Inc.

ial 8-1-1 or 1-800-STAKE-IT (782-5348)
In Maricopa County (602) 263-1100

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CITY OF PEORIA

ENGINEERING DEPARTMENT

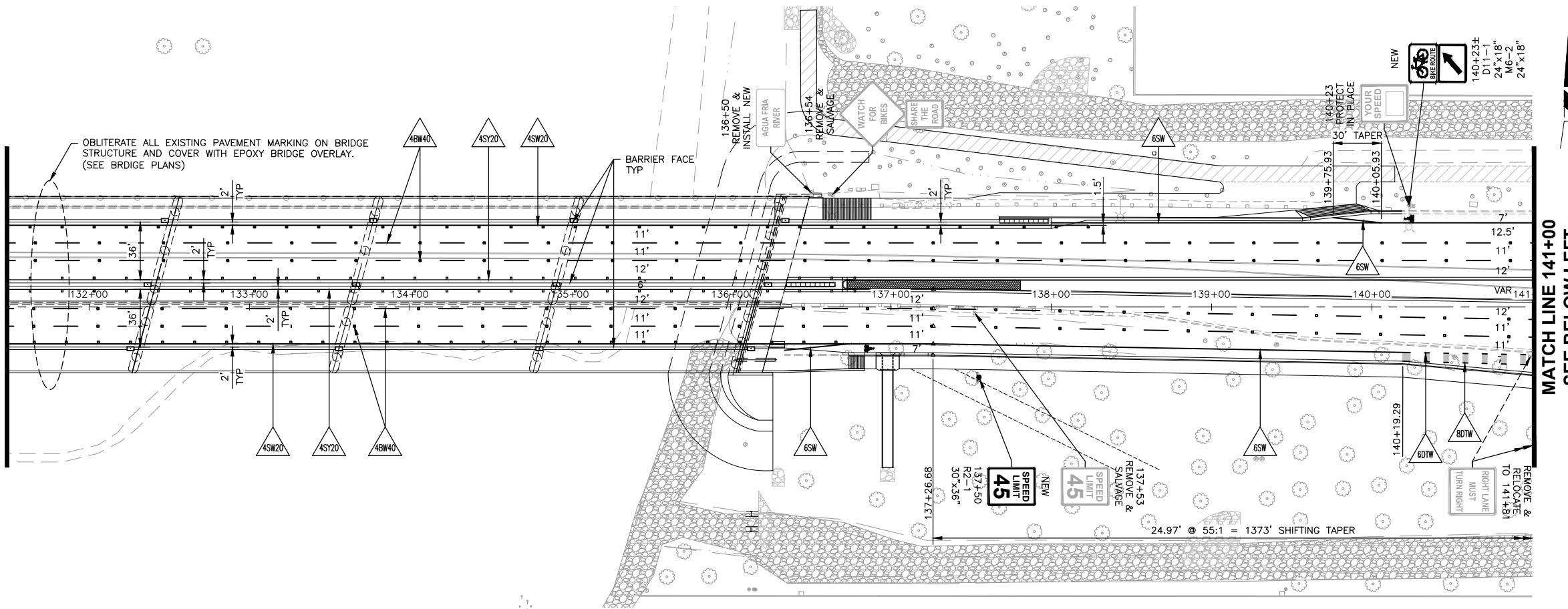
© 2017, PRACTITIONER LEARNING

PAVEMENT MARKING

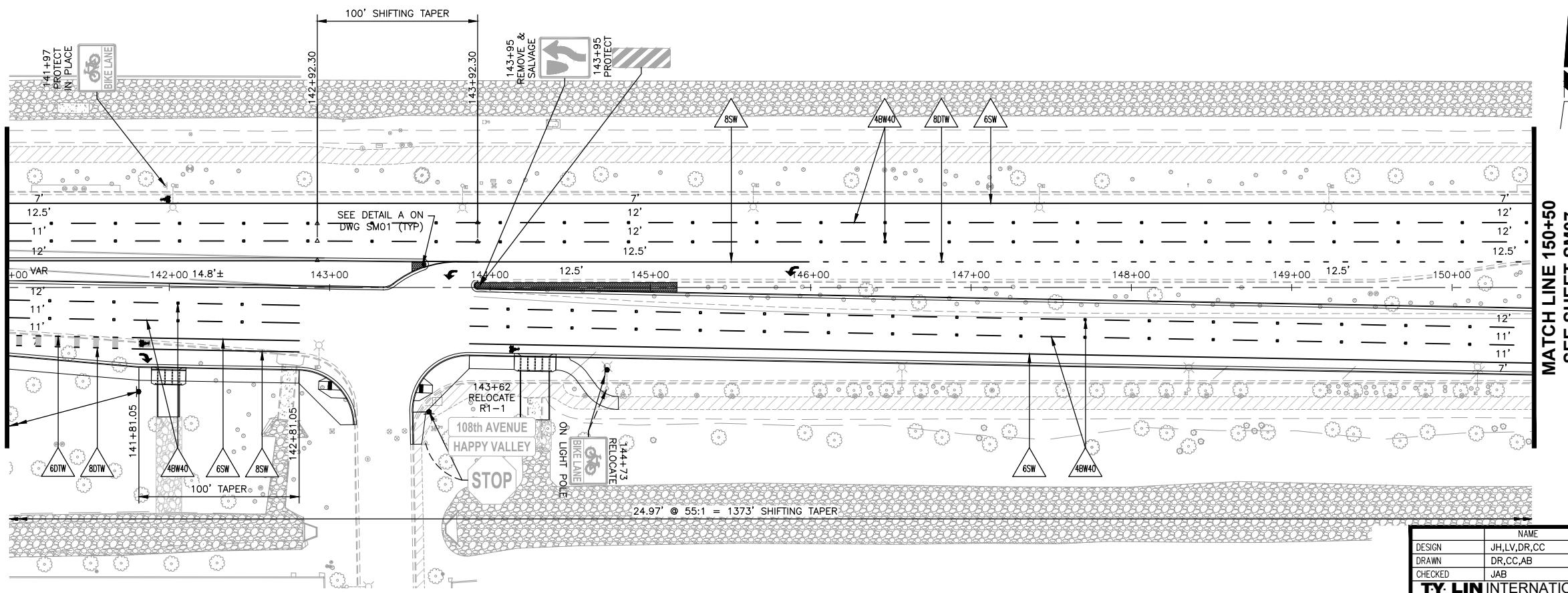
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F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

**SEE SHEET SM05
MATCH LINE 131+50**



SEE ABOVE RIGHT
MATCH LINE 141+00



SIGNING AND PAVEMENT MARKING

SIGNING AND PAVEMENT MARKING

SIGNING AND PAVEMENT MARKING

VALLEY PARKWAY IMPROVEMENTS



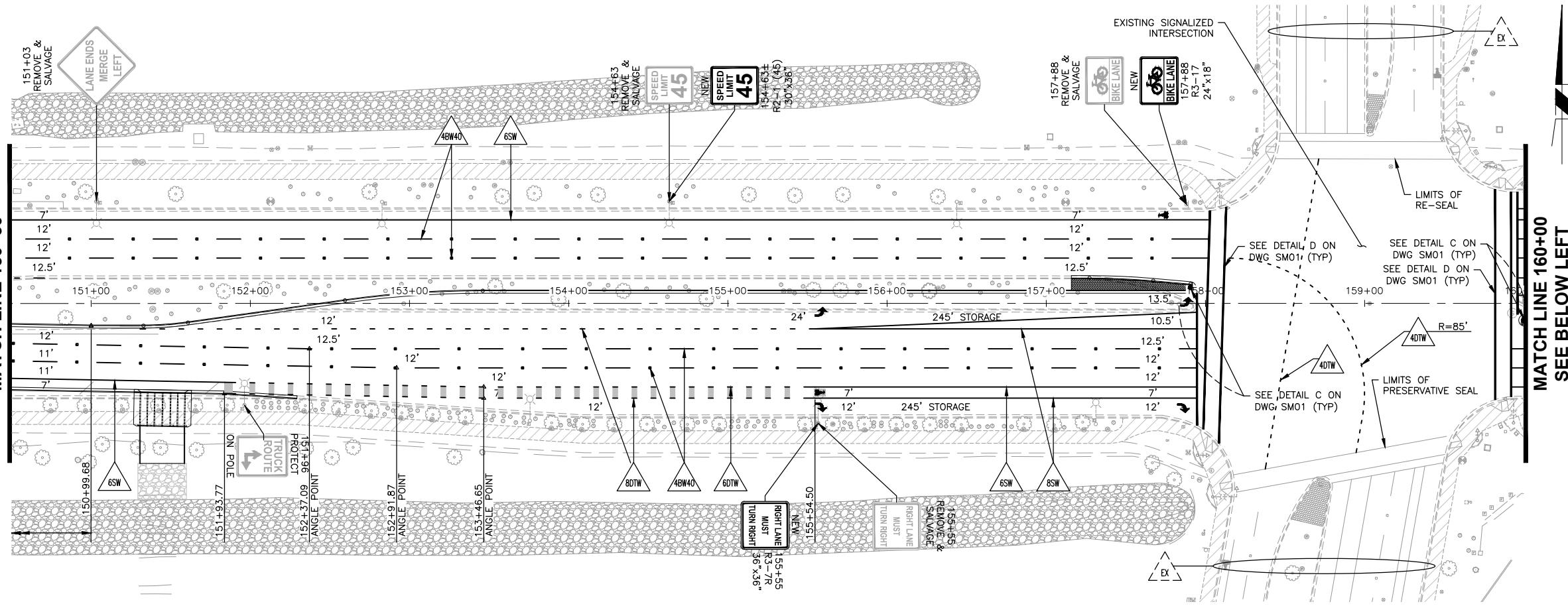
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WING

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

TIERRA DEL RIO BLVD.

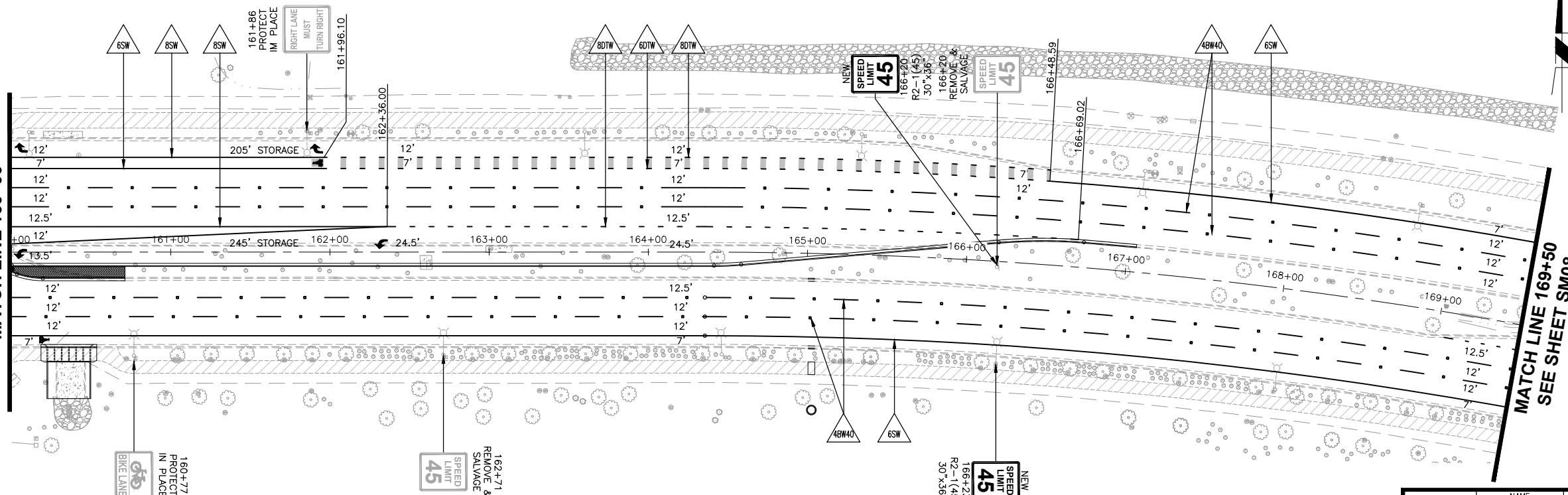
SEE SHEET SM06
MATCH LINE 150+50



HAPPY VALLEY PKWY

107th AVE

**SEE ABOVE RIGHT
MATCH LINE 160+00**



HAPPY VALLEY PKWY



NO.	REVISION	BY	APPR	DATE

CITY OF PEORIA
ENGINEERING DEPARTMENT

SIGNING AND PAVEMENT MARKING

NAME	DATE	CITY OF PEORIA ENGINEERING DEPARTMENT	
DESIGN	JH,LV,DR,CC	07/18	 CITY OF PEORIA ARIZONA U.S.A. Expires 9/30/2020
DRAWN	DR,CC,AB	07/18	
CHECKED	JAB	07/18	
TY-LIN INTERNATIONAL engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85261		SIGNING AND PAVEMENT MARKING	
DRAWING NO.	LOCATION	HAPPY VALLEY PARKWAY IMPROVEMENTS	
SM07		SHEET 119 OF 295	

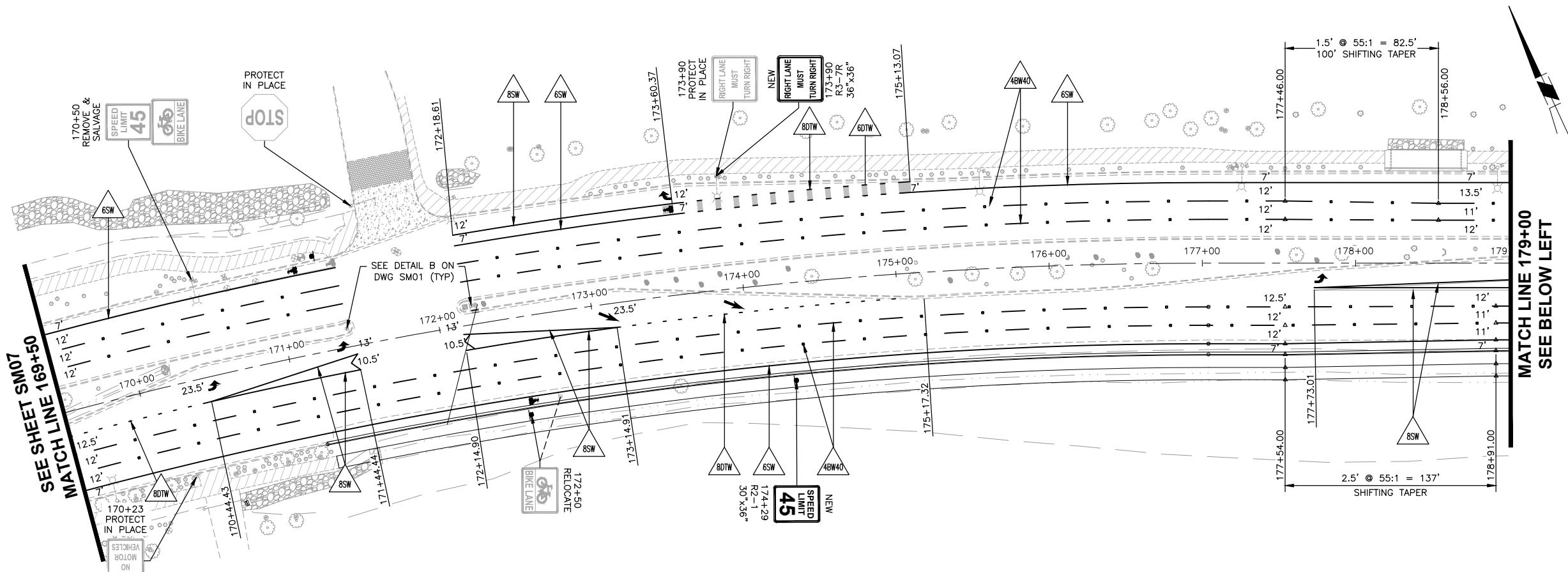
F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

TY Lin Half Scale.ctb

Anson Ouyang

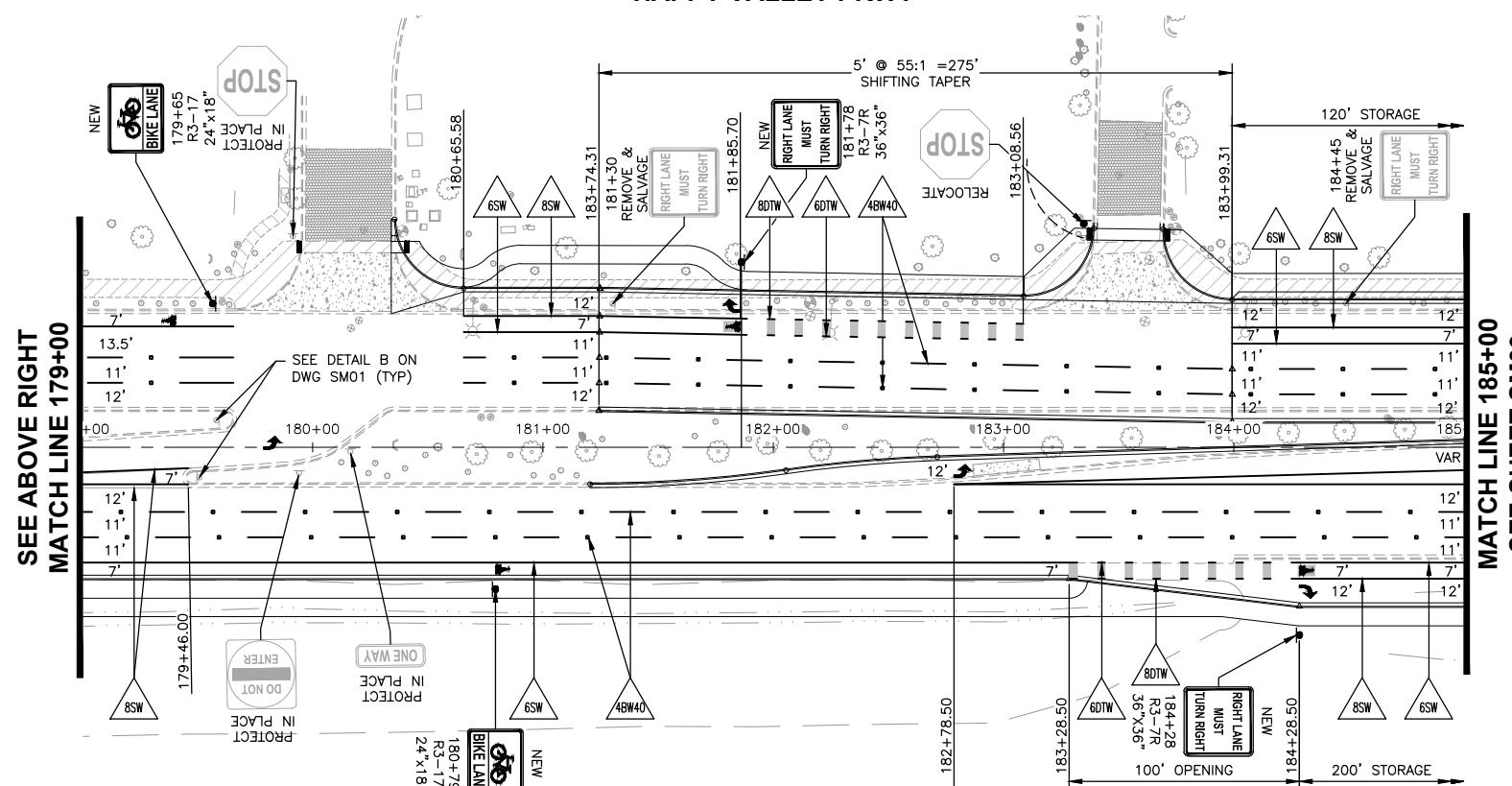
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Drawing! .dmg



HAPPY VALLEY PKWY

100th LANE



**MATCH LINE 185+00
SEE SHEET SM09**



O.	REVISION	BY	APPR	DATE

	NAME	DATE
DESIGN	JH,LV,DR,CC	07/18
RAWN	DR,CC,AB	07/18
CHECKED	JAB	07/18

TY LIN INTERNATIONAL
 engineers | planners | scientists
 60 East Rio Salado Parkway
 Tempe, AZ 85281

CITY OF PEORIA
ENGINEERING DEPARTMENT

SIGNING AND PAVEMENT MARKING

HAPPY VALLEY PARKWAY IMPROVEMENT

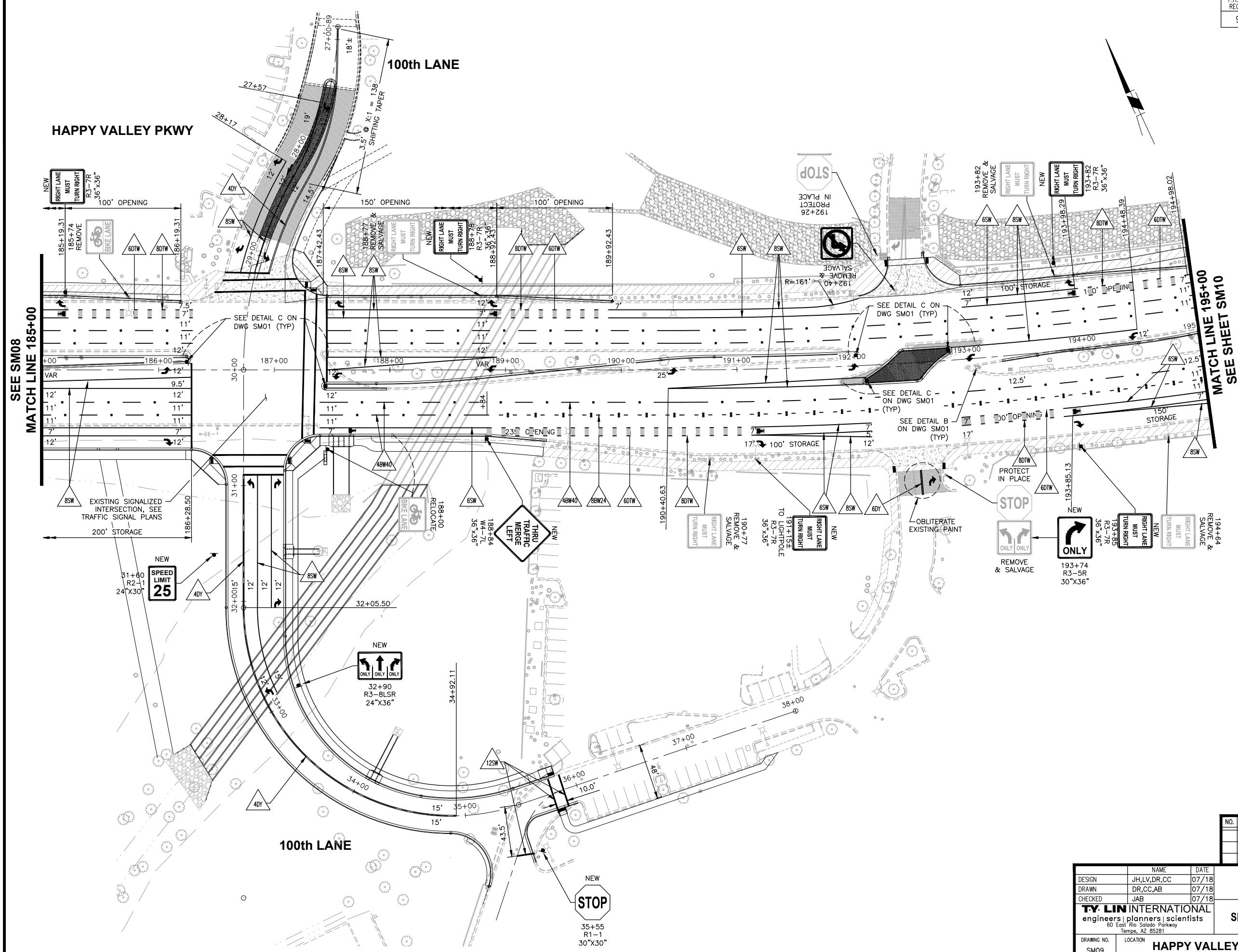
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9	AZ	EN00463	.	.	.

TRY Lin Half Scale.ctb

Allison Burkhardt

11/27/2018 11:02:55 AM

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NO.	REVISION	BY	APPR	DATE

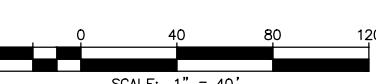
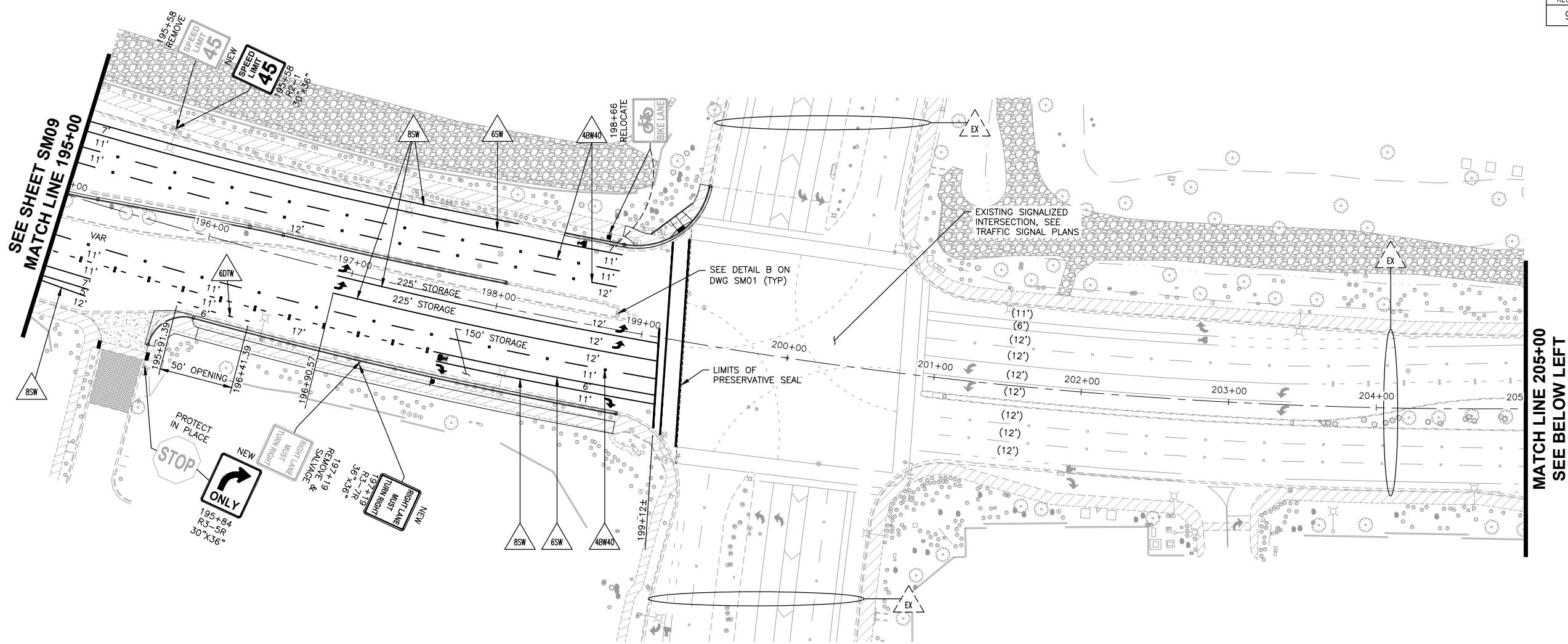
	NAME	DATE	
DESIGN	JH,LV,DR,CC	07/18	CITY OF PEORIA ENGINEERING DEPARTMENT
DRAWN	DR,CC,AB	07/18	
CHECKED	JAB	07/18	
TY-LIN INTERNATIONAL engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85281		SIGNING AND PAVEMENT MARKING	
DRAWING NO. SM09	LOCATION	HAPPY VALLEY PARKWAY IMPROVEMENTS	
		SHEET 121 OF 295	

F.H.W.A. REGION	STATE	PROJECT NO.	HEET NO.	TOTAL SHEETS	RECORD DRAWING
9	AZ	EN00463	.	.	.

TY Lin Half Scale 2:10

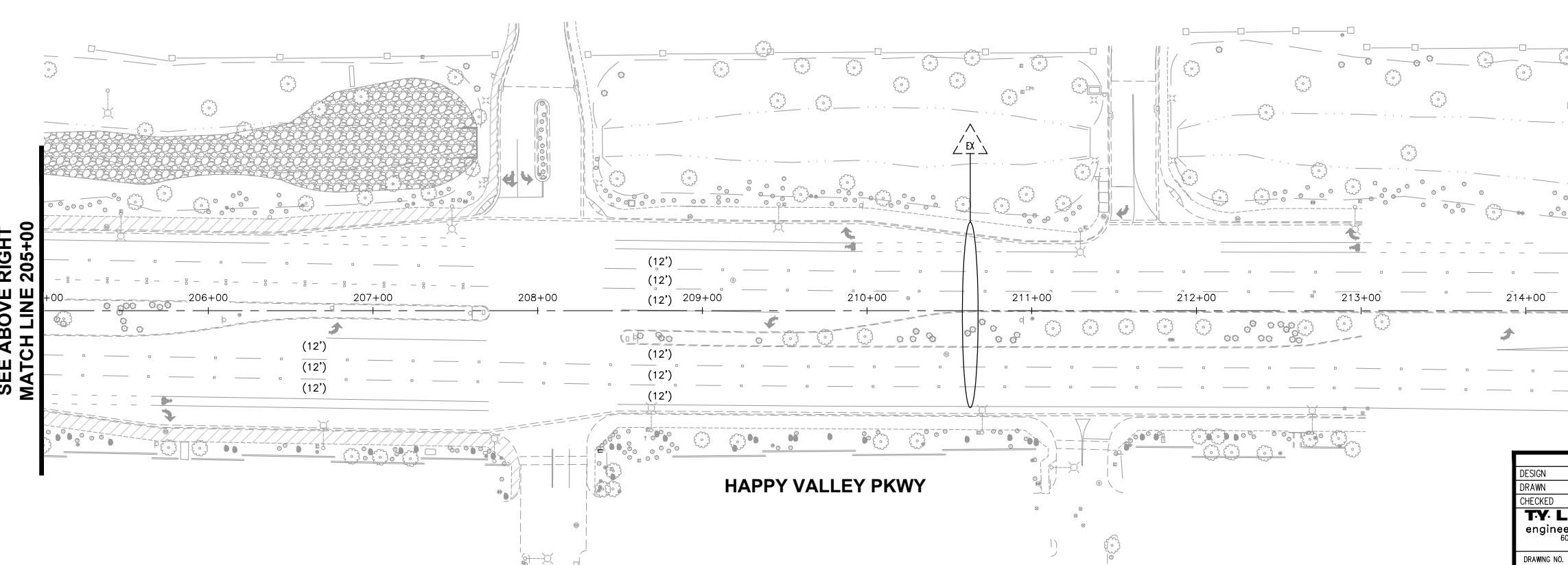
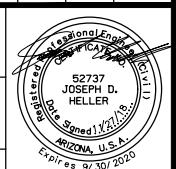
Allison Burkhardt

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NO.	REVISION	BY APPR	DATE

CITY OF PEORIA ENGINEERING DEPARTMENT	
SIGNING AND PAVEMENT MARKING	
NAME DESIGN JH,LV,DR,CC DRAWN DR,CC,AB CHECKED JAB	DATE 07/18 07/18 07/18
TY-LIN INTERNATIONAL engineers planners scientists 60 East Rio Salado Parkway Tempe, AZ 85281	
DRAWING NO. SM10	LOCATION HAPPY VALLEY PARKWAY IMPROVEMENTS



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TY Lin Half Scale 2:10

Allison Burkhardt

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Appendix D

Growth Rate Information

How Can We Help?



Happy Valley Pkwy to Hazen Rd

Heritage Dr to Hyder Rd

MDOT > Technical > Traffic Counts > Alphabetical Listing > H > Happy Valley Pkwy to Hazen Rd > Historical Counts (Happy Valley Pkwy to Hazen Rd)

Historical Counts (Happy Valley Pkwy to Hazen Rd)

On Road	Direction	Ref Road	Travel	2016	2015	2014	2013
Happy Valley Pkwy	E	115th Ave	E	15897	14485	14655	—
Happy Valley Pkwy	E	115th Ave	W	16246	14697	14984	—
Happy Valley Rd	E	195th Ave	B	638	792	595	633
Happy Valley Rd	W	195th Ave	B	401	622	440	485
Happy Valley Rd	E	El Granada Blvd	E	252	118	64	44
Happy Valley Rd	E	El Granada Blvd	W	238	139	116	67
Happy Valley Rd	W	Vistancia Blvd	E	1645	851	478	298
Happy Valley Rd	W	Vistancia Blvd	W	1567	807	493	258
Harquahala Valley Rd	N	Baseline Rd	B	436	449	234	331
Harquahala Valley Rd	S	Baseline Rd	B	171	132	145	—
Harquahala Valley Rd	N	Courthouse Rd	B	442	667	389	297



How Can We Help?



Numerical Roads (1-10)

Numerical Roads (11-99)

Numerical Roads (100-999)

MDOT > Technical > Traffic Counts > Numerical Roads > Numerical Roads (100-999) > 111th Ave to 135th Ave > Historical Counts (111th Ave to 125th Ave)

Historical Counts (111th Ave to 135th Ave)

On Road	Direction	Ref Road	Travel	2016	2015	2014	2013
111th Ave	N	Olive Ave	B	C	6020	7337	5270
111th Ave	N	Peoria Ave	B	9636	C	8609	8066
111th Ave	S	Peoria Ave	B	7196	6577	6551	6149
111th Ave	N	Tennessee Ave	B	10836	1024	—	—
111th Ave	N	Tennessee Ave	N	*	*	5318	4816
111th Ave	N	Tennessee Ave	S	*	*	5019	4469
111th Ave	N	Thunderbird Blvd	B	1075	900	940	936
111th Ave	S	Thunderbird Blvd	B	8245	7526	7889	5792
114th Ave	S	Bell Rd	B	1647	1401	1838	—
115th Ave	N	Happy Valley Rd	B	740	549	570	528
117th Ave	S	Happy Valley Rd	B	10412	8507	8964	7904

Year	ADT	Yearly Exponential Growth %
Happy Valley Parkway East of 115th Ave		
2014	29,639	
		5%
2017	34,340	
117th south of Happy Valley		
2013	7,984	
		3%
2017	8,818	
115th North of Happy Valley		
2016	740	
		9%
2017	805	

Appendix E

Trip Generation

PROJECT ITE LAND USE CATEGORY AND CODE INDEPENDENT VARIABLE SIZE	QuikTrip 424 SUPER CONVENIENCE MARKET/GAS STATION - 960 FUELING POSITIONS 16			
	RATE	TRIPS		
		ENTERING	EXISTING	TOTAL
WEEKDAY DAILY		50%	50%	
NUMBER OF STUDIES	13			
AVERAGE SIZE	14			
MINIMUM RATE	125.67	1,006	1,005	2,011
AVERAGE RATE	230.52	1,845	1,844	3,689
MAXIMUM RATE	355.6	2,845	2,845	5,690
STANDARD DEVIATION	71.75			
EQUATION: NOT GIVEN	R ² =*	NA	NA	NA
AM PEAK HOUR ADJACENT STREET		50%	50%	
NUMBER OF STUDIES	39			
AVERAGE SIZE	14			
MINIMUM RATE	5.4	44	44	87
AVERAGE RATE	28.08	225	225	450
MAXIMUM RATE	49.31	395	395	789
STANDARD DEVIATION	11.98			
EQUATION: NOT GIVEN	R ² =*	NA	NA	NA
AM PEAK HOUR GENERATOR		50%	50%	
NUMBER OF STUDIES	18			
AVERAGE SIZE	14			
MINIMUM RATE	9	72	72	144
AVERAGE RATE	21.3	171	170	341
MAXIMUM RATE	49.31	395	395	789
STANDARD DEVIATION	11.15			
EQUATION: NOT GIVEN	R ² =*	NA	NA	NA
PM PEAK HOUR ADJACENT STREET		50%	50%	
NUMBER OF STUDIES	48			
AVERAGE SIZE	14			
MINIMUM RATE	8.75	70	70	140
AVERAGE RATE	22.96	184	184	368
MAXIMUM RATE	44.83	359	359	718
STANDARD DEVIATION	8.34			
EQUATION: NOT GIVEN	R ² =*	NA	NA	NA
PM PEAK HOUR GENERATOR		50%	50%	
NUMBER OF STUDIES	19			
AVERAGE SIZE	14			
MINIMUM RATE	9.83	79	79	158
AVERAGE RATE	20.25	162	162	324
MAXIMUM RATE	37.42	300	300	599
STANDARD DEVIATION	7.73			
EQUATION: NOT GIVEN	R ² =*	NA	NA	NA

Appendix F

Future Level-of-Service

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Background 2020 AM Peak Hour

01/23/2019

Movement	EBL	EBT	EBC	WBL	WBT	WBC	NBL	NBT	NBC	SBL	SBT	SBC
Lane Configurations	↑	↑↑↑	↑	↑	↑↑↑	↑	↑	↑	↑	↓	↓	↓
Traffic Volume (vph)	9	1643	32	114	1053	20	117	0	430	18	1	11
Future Volume (vph)	9	1643	32	114	1053	20	117	0	430	18	1	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.97	
Satd. Flow (prot)	1770	5085	1583	1770	5067		1770	1583			1738	
Flt Permitted	0.15	1.00	1.00	0.13	1.00		0.95	1.00			0.97	
Satd. Flow (perm)	281	5085	1583	234	5067		1770	1583			1738	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	10	1786	35	137	1269	31	148	0	473	30	4	13
RTOR Reduction (vph)	0	0	22	0	1	0	0	372	0	0	12	0
Lane Group Flow (vph)	10	1786	13	137	1299	0	148	101	0	0	35	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	29.1	28.4	28.4	35.9	31.8		16.7	16.7			5.3	
Effective Green, g (s)	29.1	28.4	28.4	35.9	31.8		16.7	16.7			5.3	
Actuated g/C Ratio	0.37	0.36	0.36	0.46	0.41		0.21	0.21			0.07	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	117	1839	572	187	2052		376	336			117	
v/s Ratio Prot	0.00	c0.35		c0.04	0.26		c0.08	0.06			c0.02	
v/s Ratio Perm	0.03		0.01	0.30								
v/c Ratio	0.09	0.97	0.02	0.73	0.63		0.39	0.30			0.30	
Uniform Delay, d1	16.0	24.6	16.1	17.2	18.7		26.5	26.0			34.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.1	14.9	0.0	12.0	0.9		1.4	1.1			3.0	
Delay (s)	16.1	39.5	16.1	29.2	19.6		28.0	27.0			37.8	
Level of Service	B	D	B	C	B		C	C			D	
Approach Delay (s)		39.0			20.5			27.3			37.8	
Approach LOS		D			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			30.4			HCM 2000 Level of Service			C			
HCM 2000 Volume to Capacity ratio			0.71									
Actuated Cycle Length (s)			78.5			Sum of lost time (s)			24.0			
Intersection Capacity Utilization			79.0%			ICU Level of Service			D			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Background 2020 AM Peak Hour
01/23/2019

Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	224	948	239	499	473	209	173	578	158	35
Future Volume (vph)	224	948	239	499	473	209	173	578	158	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	243	1030	260	542	514	227	188	628	172	38
RTOR Reduction (vph)	0	0	157	0	0	118	0	555	0	34
Lane Group Flow (vph)	243	1030	103	542	514	109	188	73	172	4
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	12.3	39.6	39.6	20.8	48.1	48.1	11.6	11.6	11.6	11.6
Effective Green, g (s)	12.3	39.6	39.6	20.8	48.1	48.1	11.6	11.6	11.6	11.6
Actuated g/C Ratio	0.12	0.40	0.40	0.21	0.48	0.48	0.12	0.12	0.12	0.12
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	422	2013	626	714	1702	761	398	323	398	323
v/s Ratio Prot	0.07	c0.20		c0.16	c0.15		c0.05		0.05	
v/s Ratio Perm			0.07			0.07		0.03		0.00
v/c Ratio	0.58	0.51	0.16	0.76	0.30	0.14	0.47	0.23	0.43	0.01
Uniform Delay, d1	41.4	22.9	19.5	37.2	15.8	14.5	41.3	40.1	41.1	39.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.2	0.1	4.6	0.5	0.4	0.9	0.4	0.8	0.0
Delay (s)	43.3	23.1	19.6	41.9	16.2	14.9	42.2	40.5	41.9	39.2
Level of Service	D	C	B	D	B	B	D	D	D	D
Approach Delay (s)		25.7			26.8					
Approach LOS		C			C					
Intersection Summary										
HCM 2000 Control Delay		30.2				HCM 2000 Level of Service		C		
HCM 2000 Volume to Capacity ratio		0.59								
Actuated Cycle Length (s)		100.0			Sum of lost time (s)			28.0		
Intersection Capacity Utilization		Err%				ICU Level of Service		H		
Analysis Period (min)		15								

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Background 2020 PM Peak

01/23/2019

Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	12	1456	69	2	442	1773	23	23	2	293	12	3
Future Volume (vph)	12	1456	69	2	442	1773	23	23	2	293	12	3
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Lane Util. Factor	1.00	0.91	1.00		1.00	0.91		1.00	1.00			1.00
Frt	1.00	1.00	0.85		1.00	1.00		1.00	0.85			0.96
Flt Protected	0.95	1.00	1.00		0.95	1.00		0.95	1.00			0.98
Satd. Flow (prot)	1770	5085	1583		1770	5073		1770	1585			1748
Flt Permitted	0.11	1.00	1.00		0.10	1.00		0.95	1.00			0.98
Satd. Flow (perm)	208	5085	1583		190	5073		1770	1585			1748
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25
Adj. Flow (vph)	13	1583	75	2	533	2136	36	29	2	322	20	12
RTOR Reduction (vph)	0	0	41	0	0	1	0	0	279	0	0	13
Lane Group Flow (vph)	13	1583	34	0	535	2171	0	29	45	0	0	33
Turn Type	pm+pt	NA	Perm	pm+pt	pm+pt	NA		Split	NA		Split	NA
Protected Phases	1	6		5	5	2		4	4		8	8
Permitted Phases	6		6	2	2							
Actuated Green, G (s)	36.4	35.8	35.8		43.4	39.3		10.7	10.7			5.3
Effective Green, g (s)	36.4	35.8	35.8		43.4	39.3		10.7	10.7			5.3
Actuated g/C Ratio	0.46	0.45	0.45		0.54	0.49		0.13	0.13			0.07
Clearance Time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Vehicle Extension (s)	2.0	5.0	5.0		2.0	5.0		5.0	5.0			5.0
Lane Grp Cap (vph)	106	2278	709		184	2495		237	212			115
v/s Ratio Prot	0.00	0.31		c0.15	0.43		0.02	c0.03				c0.02
v/s Ratio Perm	0.05		0.02	c1.43								
v/c Ratio	0.12	0.69	0.05		2.91	0.87		0.12	0.21			0.29
Uniform Delay, d1	15.1	17.7	12.4		14.2	18.0		30.5	30.8			35.5
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00			1.00
Incremental Delay, d2	0.2	1.2	0.1		873.1	3.9		0.5	1.1			2.9
Delay (s)	15.3	18.9	12.5		887.2	21.9		31.0	31.9			38.4
Level of Service	B	B	B		F	C		C	C			D
Approach Delay (s)		18.6				193.0			31.8			38.4
Approach LOS		B				F			C			D
Intersection Summary												
HCM 2000 Control Delay		118.6										F
HCM 2000 Volume to Capacity ratio		2.28										
Actuated Cycle Length (s)		79.9										24.0
Intersection Capacity Utilization		85.3%										E
Analysis Period (min)		15										

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	12
Future Volume (vph)	12
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.83
Adj. Flow (vph)	14
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Background 2020 PM Peak
01/23/2019

Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	33	658	191	621	1009	178	215	688	191	176
Future Volume (vph)	33	658	191	621	1009	178	215	688	191	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	715	208	675	1097	193	234	748	208	191
RTOR Reduction (vph)	0	0	134	0	0	90	0	511	0	164
Lane Group Flow (vph)	36	715	74	675	1097	103	234	237	208	27
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	4.8	35.5	35.5	22.6	53.3	53.3	13.9	13.9	13.9	13.9
Effective Green, g (s)	4.8	35.5	35.5	22.6	53.3	53.3	13.9	13.9	13.9	13.9
Actuated g/C Ratio	0.05	0.36	0.36	0.23	0.53	0.53	0.14	0.14	0.14	0.14
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	164	1805	561	775	1886	843	477	387	477	387
v/s Ratio Prot	0.01	0.14		c0.20	c0.31		0.07		0.06	
v/s Ratio Perm			0.05			0.06		c0.08		0.01
v/c Ratio	0.22	0.40	0.13	0.87	0.58	0.12	0.49	0.61	0.44	0.07
Uniform Delay, d1	45.8	24.2	21.8	37.3	15.8	11.7	39.8	40.5	39.5	37.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.1	0.1	10.5	1.3	0.3	0.8	2.8	0.6	0.1
Delay (s)	46.5	24.3	21.9	47.8	17.1	12.0	40.6	43.4	40.1	37.5
Level of Service	D	C	C	D	B	B	D	D	D	D
Approach Delay (s)		24.7			27.2					
Approach LOS		C			C					
Intersection Summary										
HCM 2000 Control Delay		31.2								C
HCM 2000 Volume to Capacity ratio		0.70								
Actuated Cycle Length (s)		100.0								28.0
Intersection Capacity Utilization		Err%								H
Analysis Period (min)		15								

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Background 2025 AM Peak Hour

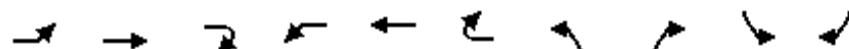
01/23/2019

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑↑	↑	↑	↑↑↑	↑↑	↑	↑	0	498	21	1 12
Traffic Volume (vph)	11	2096	41	145	1361	25	135	0	498	21	1	12
Future Volume (vph)	11	2096	41	145	1361	25	135	0	498	21	1	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.97	
Satd. Flow (prot)	1770	5085	1583	1770	5068		1770	1583			1738	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.97	
Satd. Flow (perm)	262	5085	1583	234	5068		1770	1583			1738	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	12	2278	45	175	1640	39	171	0	547	34	4	14
RTOR Reduction (vph)	0	0	29	0	1	0	0	419	0	0	13	0
Lane Group Flow (vph)	12	2278	16	175	1678	0	171	128	0	0	39	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	29.1	28.4	28.4	35.9	31.8		19.0	19.0			5.5	
Effective Green, g (s)	29.1	28.4	28.4	35.9	31.8		19.0	19.0			5.5	
Actuated g/C Ratio	0.36	0.35	0.35	0.44	0.39		0.23	0.23			0.07	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	107	1782	555	181	1989		415	371			118	
v/s Ratio Prot	0.00	c0.45		c0.05	0.33		c0.10	0.08			c0.02	
v/s Ratio Perm	0.04		0.01	0.38								
v/c Ratio	0.11	1.28	0.03	0.97	0.84		0.41	0.35			0.33	
Uniform Delay, d1	18.3	26.3	17.3	22.1	22.3		26.3	25.8			36.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	129.7	0.0	56.3	3.8		1.4	1.2			3.4	
Delay (s)	18.5	156.0	17.3	78.5	26.2		27.7	27.0			39.4	
Level of Service	B	F	B	E	C		C	C			D	
Approach Delay (s)		152.7			31.1			27.2			39.4	
Approach LOS		F			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			87.9			HCM 2000 Level of Service			F			
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			81.0			Sum of lost time (s)			24.0			
Intersection Capacity Utilization			93.7%			ICU Level of Service			F			
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Background 2025 AM Peak Hour
01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	286	1210	305	637	604	267	221	737	201	45
Future Volume (vph)	286	1210	305	637	604	267	221	737	201	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	311	1315	332	692	657	290	240	801	218	49
RTOR Reduction (vph)	0	0	217	0	0	161	0	542	0	42
Lane Group Flow (vph)	311	1315	115	692	657	129	240	259	218	7
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	13.5	34.7	34.7	23.3	44.5	44.5	14.0	14.0	14.0	14.0
Effective Green, g (s)	13.5	34.7	34.7	23.3	44.5	44.5	14.0	14.0	14.0	14.0
Actuated g/C Ratio	0.14	0.35	0.35	0.23	0.44	0.44	0.14	0.14	0.14	0.14
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	463	1764	549	799	1574	704	480	390	480	390
v/s Ratio Prot	0.09	c0.26		c0.20	c0.19		0.07		0.06	
v/s Ratio Perm			0.07			0.08		c0.09		0.00
v/c Ratio	0.67	0.75	0.21	0.87	0.42	0.18	0.50	0.66	0.45	0.02
Uniform Delay, d1	41.1	28.8	23.0	36.9	18.9	16.8	39.8	40.8	39.5	37.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	3.8	1.8	0.2	9.7	0.8	0.6	0.8	4.2	0.7	0.0
Delay (s)	45.0	30.5	23.2	46.6	19.7	17.3	40.6	45.0	40.2	37.1
Level of Service	D	C	C	D	B	B	D	D	D	D
Approach Delay (s)		31.6			30.6					
Approach LOS		C			C					

Intersection Summary

HCM 2000 Control Delay	34.3	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Background 2025 PM Peak Hour

01/23/2019

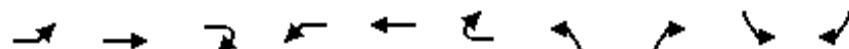
Movement	EBL	EBT	EBR	WBU	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT
Lane Configurations												
Traffic Volume (vph)	15	1829	89	3	564	2240	30	27	2	339	14	4
Future Volume (vph)	15	1829	89	3	564	2240	30	27	2	339	14	4
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Lane Util. Factor	1.00	0.91	1.00		1.00	0.91		1.00	1.00			1.00
Frt	1.00	1.00	0.85		1.00	1.00		1.00	0.85			0.96
Flt Protected	0.95	1.00	1.00		0.95	1.00		0.95	1.00			0.98
Satd. Flow (prot)	1770	5085	1583		1770	5072		1770	1585			1750
Flt Permitted	0.11	1.00	1.00		0.10	1.00		0.95	1.00			0.98
Satd. Flow (perm)	202	5085	1583		182	5072		1770	1585			1750
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25
Adj. Flow (vph)	16	1988	97	3	680	2699	47	34	2	373	23	16
RTOR Reduction (vph)	0	0	57	0	0	1	0	0	324	0	0	14
Lane Group Flow (vph)	16	1988	40	0	683	2745	0	34	51	0	0	42
Turn Type	pm+pt	NA	Perm	pm+pt	pm+pt	NA		Split	NA		Split	NA
Protected Phases	1	6		5	5	2		4	4		8	8
Permitted Phases	6		6	2	2							
Actuated Green, G (s)	37.6	36.9	36.9		50.0	45.3		11.8	11.8			7.7
Effective Green, g (s)	37.6	36.9	36.9		50.0	45.3		11.8	11.8			7.7
Actuated g/C Ratio	0.42	0.41	0.41		0.56	0.51		0.13	0.13			0.09
Clearance Time (s)	4.0	6.4	6.4		4.0	6.4		6.8	6.8			6.8
Vehicle Extension (s)	2.0	5.0	5.0		2.0	5.0		5.0	5.0			5.0
Lane Grp Cap (vph)	97	2096	652		263	2567		233	208			150
v/s Ratio Prot	0.00	0.39		c0.26	0.54		0.02	c0.03			c0.02	
v/s Ratio Perm	0.07		0.03	c1.19								
v/c Ratio	0.16	0.95	0.06		2.60	1.07		0.15	0.25			0.28
Uniform Delay, d1	21.3	25.4	15.9		25.1	22.1		34.4	34.9			38.3
Progression Factor	1.00	1.00	1.00		1.00	1.00		1.00	1.00			1.00
Incremental Delay, d2	0.3	10.3	0.1		729.6	39.7		0.6	1.3			2.2
Delay (s)	21.6	35.7	15.9		754.7	61.8		35.0	36.2			40.5
Level of Service	C	D	B		F	E		C	D			D
Approach Delay (s)		34.7				199.8			36.1			40.5
Approach LOS		C				F			D			D
Intersection Summary												
HCM 2000 Control Delay		129.3										F
HCM 2000 Volume to Capacity ratio		2.01										
Actuated Cycle Length (s)		89.5										24.0
Intersection Capacity Utilization		102.2%										G
Analysis Period (min)		15										

c Critical Lane Group

Movement	SBR
Lane Configurations	
Traffic Volume (vph)	14
Future Volume (vph)	14
Ideal Flow (vphpl)	1900
Total Lost time (s)	
Lane Util. Factor	
Frt	
Flt Protected	
Satd. Flow (prot)	
Flt Permitted	
Satd. Flow (perm)	
Peak-hour factor, PHF	0.83
Adj. Flow (vph)	17
RTOR Reduction (vph)	0
Lane Group Flow (vph)	0
Turn Type	
Protected Phases	
Permitted Phases	
Actuated Green, G (s)	
Effective Green, g (s)	
Actuated g/C Ratio	
Clearance Time (s)	
Vehicle Extension (s)	
Lane Grp Cap (vph)	
v/s Ratio Prot	
v/s Ratio Perm	
v/c Ratio	
Uniform Delay, d1	
Progression Factor	
Incremental Delay, d2	
Delay (s)	
Level of Service	
Approach Delay (s)	
Approach LOS	
Intersection Summary	

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Background 2025 PM Peak Hour
01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	42	812	243	792	1262	227	274	878	243	225
Future Volume (vph)	42	812	243	792	1262	227	274	878	243	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	883	264	861	1372	247	298	954	264	245
RTOR Reduction (vph)	0	0	186	0	0	111	0	547	0	205
Lane Group Flow (vph)	46	883	78	861	1372	136	298	407	264	40
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	4.8	29.5	29.5	26.3	51.0	51.0	16.2	16.2	16.2	16.2
Effective Green, g (s)	4.8	29.5	29.5	26.3	51.0	51.0	16.2	16.2	16.2	16.2
Actuated g/C Ratio	0.05	0.29	0.29	0.26	0.51	0.51	0.16	0.16	0.16	0.16
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	164	1500	466	902	1804	807	556	451	556	451
v/s Ratio Prot	0.01	0.17		c0.25	c0.39		0.09		0.08	
v/s Ratio Perm			0.05			0.09		c0.15		0.01
v/c Ratio	0.28	0.59	0.17	0.95	0.76	0.17	0.54	0.90	0.47	0.09
Uniform Delay, d1	45.9	30.1	26.1	36.3	19.6	13.1	38.5	41.1	38.0	35.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.6	0.2	19.7	3.1	0.5	1.0	20.9	0.6	0.1
Delay (s)	46.9	30.7	26.3	55.9	22.7	13.6	39.4	62.0	38.7	35.7
Level of Service	D	C	C	E	C	B	D	E	D	D
Approach Delay (s)		30.3			33.3					
Approach LOS		C			C					

Intersection Summary

HCM 2000 Control Delay	38.4	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Total 2020 AM Peak Hour

01/23/2019

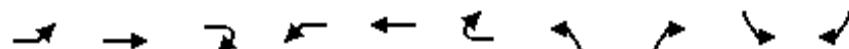
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑↑	↑	↑	↑↑↑	↑	↑	↑			↔	
Traffic Volume (vph)	9	1652	77	159	1053	20	186	12	430	18	13	11
Future Volume (vph)	9	1652	77	159	1053	20	186	12	430	18	13	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1770	5085	1583	1770	5067		1770	1591			1800	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	263	5085	1583	235	5067		1770	1591			1800	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	10	1796	84	192	1269	31	235	13	473	30	52	13
RTOR Reduction (vph)	0	0	57	0	1	0	0	352	0	0	5	0
Lane Group Flow (vph)	10	1796	27	192	1299	0	235	134	0	0	90	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	29.0	28.3	28.3	35.8	31.7		22.6	22.6			9.5	
Effective Green, g (s)	29.0	28.3	28.3	35.8	31.7		22.6	22.6			9.5	
Actuated g/C Ratio	0.33	0.32	0.32	0.40	0.36		0.26	0.26			0.11	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	98	1626	506	166	1814		452	406			193	
v/s Ratio Prot	0.00	0.35		c0.05	0.26		c0.13	0.08			c0.05	
v/s Ratio Perm	0.03		0.02	c0.41								
v/c Ratio	0.10	1.10	0.05	1.16	0.72		0.52	0.33			0.46	
Uniform Delay, d1	20.8	30.1	20.8	26.6	24.5		28.3	26.8			37.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	56.7	0.1	118.2	1.7		2.0	1.0			3.7	
Delay (s)	20.9	86.8	20.9	144.8	26.2		30.3	27.8			40.8	
Level of Service	C	F	C	F	C		C	C			D	
Approach Delay (s)		83.6			41.5			28.6			40.8	
Approach LOS		F			D			C			D	
Intersection Summary												
HCM 2000 Control Delay			58.2			HCM 2000 Level of Service		E				
HCM 2000 Volume to Capacity ratio			0.88									
Actuated Cycle Length (s)			88.5			Sum of lost time (s)		24.0				
Intersection Capacity Utilization			82.3%			ICU Level of Service		E				
Analysis Period (min)			15									

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Total 2020 AM Peak Hour

01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	224	978	239	508	517	225	173	590	170	35
Future Volume (vph)	224	978	239	508	517	225	173	590	170	35
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	243	1063	260	552	562	245	188	641	185	38
RTOR Reduction (vph)	0	0	158	0	0	127	0	559	0	34
Lane Group Flow (vph)	243	1063	102	552	562	118	188	82	185	4
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	12.3	39.2	39.2	21.1	48.0	48.0	11.7	11.7	11.7	11.7
Effective Green, g (s)	12.3	39.2	39.2	21.1	48.0	48.0	11.7	11.7	11.7	11.7
Actuated g/C Ratio	0.12	0.39	0.39	0.21	0.48	0.48	0.12	0.12	0.12	0.12
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	422	1993	620	724	1698	759	401	326	401	326
v/s Ratio Prot	0.07	c0.21		c0.16	c0.16		c0.05		0.05	
v/s Ratio Perm			0.06			0.07		0.03		0.00
v/c Ratio	0.58	0.53	0.16	0.76	0.33	0.15	0.47	0.25	0.46	0.01
Uniform Delay, d1	41.4	23.4	19.8	37.1	16.1	14.6	41.2	40.2	41.2	39.0
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.9	0.3	0.1	4.8	0.5	0.4	0.9	0.4	0.8	0.0
Delay (s)	43.3	23.6	19.9	41.9	16.6	15.0	42.1	40.6	42.1	39.1
Level of Service	D	C	B	D	B	B	D	D	D	D
Approach Delay (s)		26.1			26.6					
Approach LOS		C			C					

Intersection Summary

HCM 2000 Control Delay	30.2	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.60		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
12: 115th Avenue & Driveway 2

Total 2020 AM Peak Hour

01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	84	544	34	63	186
Future Volume (Veh/h)	34	84	544	34	63	186
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	91	591	37	68	202
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)					252	
pX, platoon unblocked	0.94					
vC, conflicting volume	948	610		628		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	910	610		628		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	86	82		93		
cM capacity (veh/h)	265	495		954		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	128	628	270			
Volume Left	37	0	68			
Volume Right	91	37	0			
cSH	396	1700	954			
Volume to Capacity	0.32	0.37	0.07			
Queue Length 95th (ft)	34	0	6			
Control Delay (s)	18.4	0.0	2.8			
Lane LOS	C		A			
Approach Delay (s)	18.4	0.0	2.8			
Approach LOS	C					
Intersection Summary						
Average Delay		3.0				
Intersection Capacity Utilization		61.0%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
13: 115th Avenue & Driveway 3

Total 2020 AM Peak Hour

01/23/2019

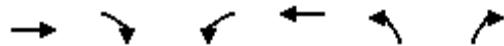


Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	28	550	34	39	181
Future Volume (Veh/h)	34	28	550	34	39	181
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	30	598	37	42	197
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						438
pX, platoon unblocked						
vC, conflicting volume	898	616			635	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	898	616			635	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	88	94			96	
cM capacity (veh/h)	296	490			948	
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	67	635	239			
Volume Left	37	0	42			
Volume Right	30	37	0			
cSH	360	1700	948			
Volume to Capacity	0.19	0.37	0.04			
Queue Length 95th (ft)	17	0	3			
Control Delay (s)	17.3	0.0	1.9			
Lane LOS	C		A			
Approach Delay (s)	17.3	0.0	1.9			
Approach LOS	C					
Intersection Summary						
Average Delay		1.7				
Intersection Capacity Utilization		53.3%		ICU Level of Service		A
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
16: Driveway 1 & Happy Valley Parkway

Total 2020 AM Peak Hour

01/23/2019



Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑↑	↑	↑↑↑		↑			
Traffic Volume (veh/h)	2045	55	0	1232	0	45		
Future Volume (Veh/h)	2045	55	0	1232	0	45		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	2223	60	0	1339	0	49		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	Raised			Raised				
Median storage veh)	1			1				
Upstream signal (ft)	375							
pX, platoon unblocked		0.69		0.69	0.69			
vC, conflicting volume		2283		2669	741			
vC1, stage 1 conf vol				2223				
vC2, stage 2 conf vol				446				
vCu, unblocked vol		1278		1840	0			
tC, single (s)		4.1		6.8	6.9			
tC, 2 stage (s)				5.8				
tF (s)		2.2		3.5	3.3			
p0 queue free %		100		100	93			
cM capacity (veh/h)		371		136	746			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	741	741	741	60	446	446	446	49
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	60	0	0	0	49
cSH	1700	1700	1700	1700	1700	1700	1700	746
Volume to Capacity	0.44	0.44	0.44	0.04	0.26	0.26	0.26	0.07
Queue Length 95th (ft)	0	0	0	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.2
Lane LOS								B
Approach Delay (s)	0.0				0.0			10.2
Approach LOS								B
Intersection Summary								
Average Delay			0.1					
Intersection Capacity Utilization		49.5%			ICU Level of Service			A
Analysis Period (min)			15					

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Total 2020 PM Peak Hour

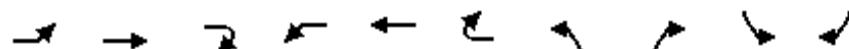
01/23/2019

Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	1467	105	478	1773	23	84	10	293	12	13	12
Future Volume (vph)	12	1467	105	478	1773	23	84	10	293	12	13	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	5085	1583	1770	5073		1770	1593			1801	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.99	
Satd. Flow (perm)	266	5085	1583	237	5073		1770	1593			1801	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	13	1595	114	576	2136	36	106	11	322	20	52	14
RTOR Reduction (vph)	0	0	73	0	1	0	0	268	0	0	6	0
Lane Group Flow (vph)	13	1595	41	576	2171	0	106	65	0	0	80	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	28.7	28.0	28.0	35.5	31.4		13.0	13.0			8.6	
Effective Green, g (s)	28.7	28.0	28.0	35.5	31.4		13.0	13.0			8.6	
Actuated g/C Ratio	0.37	0.36	0.36	0.46	0.40		0.17	0.17			0.11	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	111	1832	570	189	2050		296	266			199	
v/s Ratio Prot	0.00	0.31		c0.16	0.43		c0.06	0.04			c0.04	
v/s Ratio Perm	0.04		0.03	c1.23								
v/c Ratio	0.12	0.87	0.07	3.05	1.06		0.36	0.24			0.40	
Uniform Delay, d1	19.3	23.2	16.3	19.7	23.2		28.7	28.1			32.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	5.2	0.1	935.4	37.6		1.6	1.0			2.8	
Delay (s)	19.5	28.4	16.4	955.0	60.8		30.2	29.1			34.9	
Level of Service	B	C	B	F	E		C	C			C	
Approach Delay (s)		27.5			248.2			29.4			34.9	
Approach LOS		C			F			C			C	
Intersection Summary												
HCM 2000 Control Delay		149.2			HCM 2000 Level of Service			F				
HCM 2000 Volume to Capacity ratio		2.12										
Actuated Cycle Length (s)		77.7			Sum of lost time (s)			24.0				
Intersection Capacity Utilization		87.8%			ICU Level of Service			E				
Analysis Period (min)		15										
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Total 2020 PM Peak Hour

01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	33	685	191	630	1047	192	215	698	201	176
Future Volume (vph)	33	685	191	630	1047	192	215	698	201	176
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	36	745	208	685	1138	209	234	759	218	191
RTOR Reduction (vph)	0	0	137	0	0	97	0	573	0	165
Lane Group Flow (vph)	36	745	71	685	1138	112	234	186	218	26
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	4.8	34.3	34.3	23.9	53.4	53.4	13.8	13.8	13.8	13.8
Effective Green, g (s)	4.8	34.3	34.3	23.9	53.4	53.4	13.8	13.8	13.8	13.8
Actuated g/C Ratio	0.05	0.34	0.34	0.24	0.53	0.53	0.14	0.14	0.14	0.14
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	164	1744	542	820	1889	845	473	384	473	384
v/s Ratio Prot	0.01	0.15		c0.20	c0.32		c0.07		0.06	
v/s Ratio Perm			0.05			0.07		0.07		0.01
v/c Ratio	0.22	0.43	0.13	0.84	0.60	0.13	0.49	0.48	0.46	0.07
Uniform Delay, d1	45.8	25.3	22.6	36.2	16.0	11.7	39.9	39.8	39.7	37.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.7	0.2	0.1	7.4	1.4	0.3	0.8	1.0	0.7	0.1
Delay (s)	46.5	25.5	22.7	43.6	17.4	12.0	40.7	40.8	40.4	37.6
Level of Service	D	C	C	D	B	B	D	D	D	D
Approach Delay (s)		25.6			25.7					
Approach LOS		C			C					
Intersection Summary										
HCM 2000 Control Delay	30.3			HCM 2000 Level of Service					C	
HCM 2000 Volume to Capacity ratio	0.68									
Actuated Cycle Length (s)	100.0			Sum of lost time (s)					28.0	
Intersection Capacity Utilization	Err%			ICU Level of Service					H	
Analysis Period (min)	15									

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
12: 115th Avenue & Driveway 2

Total 2020 PM Peak Hour

01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	28	70	317	28	42	554
Future Volume (Veh/h)	28	70	317	28	42	554
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	76	345	30	46	602
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						252
pX, platoon unblocked	0.72					
vC, conflicting volume	1054	360		375		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	880	360		375		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	86	89		96		
cM capacity (veh/h)	220	684		1183		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	106	375	648			
Volume Left	30	0	46			
Volume Right	76	30	0			
cSH	428	1700	1183			
Volume to Capacity	0.25	0.22	0.04			
Queue Length 95th (ft)	24	0	3			
Control Delay (s)	16.2	0.0	1.0			
Lane LOS	C		A			
Approach Delay (s)	16.2	0.0	1.0			
Approach LOS	C					
Intersection Summary						
Average Delay		2.1				
Intersection Capacity Utilization		65.7%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
13: 115th Avenue & Driveway 3

Total 2020 PM Peak Hour

01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	28	22	323	28	40	542
Future Volume (Veh/h)	28	22	323	28	40	542
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	24	351	30	43	589
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						438
pX, platoon unblocked	0.73					
vC, conflicting volume	1041	366		381		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	875	366		381		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	87	96		96		
cM capacity (veh/h)	226	679		1177		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	54	381	632			
Volume Left	30	0	43			
Volume Right	24	30	0			
cSH	322	1700	1177			
Volume to Capacity	0.17	0.22	0.04			
Queue Length 95th (ft)	15	0	3			
Control Delay (s)	18.4	0.0	1.0			
Lane LOS	C		A			
Approach Delay (s)	18.4	0.0	1.0			
Approach LOS	C					
Intersection Summary						
Average Delay		1.5				
Intersection Capacity Utilization		62.8%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
16: Driveway 1 & Happy Valley Parkway

Total 2020 PM Peak Hour

01/23/2019



Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑↑	↗	↖	↑↑↑	↖	↗		
Traffic Volume (veh/h)	1726	46	0	2274	0	36		
Future Volume (Veh/h)	1726	46	0	2274	0	36		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	1876	50	0	2472	0	39		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	Raised			Raised				
Median storage veh)	1			1				
Upstream signal (ft)	375							
pX, platoon unblocked		0.71		0.71	0.71			
vC, conflicting volume		1926		2700	625			
vC1, stage 1 conf vol				1876				
vC2, stage 2 conf vol				824				
vCu, unblocked vol		875		1965	0			
tC, single (s)		4.1		6.8	6.9			
tC, 2 stage (s)				5.8				
tF (s)		2.2		3.5	3.3			
p0 queue free %		100		100	95			
cM capacity (veh/h)		545		168	770			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	625	625	625	50	824	824	824	39
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	50	0	0	0	39
cSH	1700	1700	1700	1700	1700	1700	1700	770
Volume to Capacity	0.37	0.37	0.37	0.03	0.48	0.48	0.48	0.05
Queue Length 95th (ft)	0	0	0	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.9
Lane LOS								A
Approach Delay (s)	0.0				0.0			9.9
Approach LOS								A
Intersection Summary								
Average Delay			0.1					
Intersection Capacity Utilization		47.3%			ICU Level of Service			A
Analysis Period (min)			15					

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Total 2025 AM Peak Hour

01/23/2019

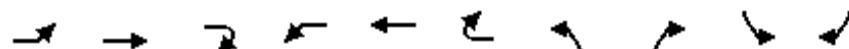
Movement	EBL	EBT	EBC	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations	↑	↑↑↑	↑	↑	↑↑↑	↑	↑	↑		↓	↔	
Traffic Volume (vph)	11	2105	86	190	1361	25	204	12	498	21	13	12
Future Volume (vph)	11	2105	86	190	1361	25	204	12	498	21	13	12
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	5.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.98	
Satd. Flow (prot)	1770	5085	1583	1770	5068		1770	1590			1797	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.98	
Satd. Flow (perm)	261	5085	1583	240	5068		1770	1590			1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	12	2288	93	229	1640	39	258	13	547	34	52	14
RTOR Reduction (vph)	0	0	65	0	1	0	0	399	0	0	5	0
Lane Group Flow (vph)	12	2288	28	229	1678	0	258	161	0	0	95	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6			5	2		4	4		8	8
Permitted Phases	6			6	2							
Actuated Green, G (s)	29.0	28.5	28.5	35.0	31.0		25.6	25.6			12.3	
Effective Green, g (s)	29.0	28.5	28.5	35.0	31.0		25.6	25.6			12.3	
Actuated g/C Ratio	0.31	0.30	0.30	0.37	0.33		0.27	0.27			0.13	
Clearance Time (s)	5.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	88	1535	477	153	1664		480	431			234	
v/s Ratio Prot	0.00	0.45		c0.06	0.33		c0.15	0.10			c0.05	
v/s Ratio Perm	0.04			0.02	c0.49							
v/c Ratio	0.14	1.49	0.06	1.50	1.01		0.54	0.37			0.41	
Uniform Delay, d1	25.9	33.0	23.4	30.0	31.7		29.3	27.9			37.7	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.3	224.3	0.1	254.6	24.1		2.1	1.1			2.4	
Delay (s)	26.1	257.2	23.5	284.6	55.8		31.5	29.0			40.1	
Level of Service	C	F	C	F	E		C	C			D	
Approach Delay (s)		247.0			83.2			29.8			40.1	
Approach LOS		F			F			C			D	
Intersection Summary												
HCM 2000 Control Delay				149.1			HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio				1.02								
Actuated Cycle Length (s)				94.4			Sum of lost time (s)			25.0		
Intersection Capacity Utilization				97.0%			ICU Level of Service			F		
Analysis Period (min)				15								

c Critical Lane Group

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Total 2025 AM Peak Hour

01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	286	1240	305	646	648	283	221	749	213	45
Future Volume (vph)	286	1240	305	646	648	283	221	749	213	45
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	311	1348	332	702	704	308	240	814	232	49
RTOR Reduction (vph)	0	0	221	0	0	172	0	532	0	42
Lane Group Flow (vph)	311	1348	111	702	704	136	240	282	232	7
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	12.7	33.4	33.4	23.5	44.2	44.2	15.1	15.1	15.1	15.1
Effective Green, g (s)	12.7	33.4	33.4	23.5	44.2	44.2	15.1	15.1	15.1	15.1
Actuated g/C Ratio	0.13	0.33	0.33	0.24	0.44	0.44	0.15	0.15	0.15	0.15
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	435	1698	528	806	1564	699	518	420	518	420
v/s Ratio Prot	0.09	c0.27		c0.20	c0.20		0.07		0.07	
v/s Ratio Perm			0.07			0.09		c0.10		0.00
v/c Ratio	0.71	0.79	0.21	0.87	0.45	0.19	0.46	0.67	0.45	0.02
Uniform Delay, d1	41.9	30.2	23.9	36.8	19.4	17.0	38.8	40.1	38.7	36.1
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	5.5	2.6	0.2	10.2	0.9	0.6	0.7	4.2	0.6	0.0
Delay (s)	47.4	32.8	24.1	47.0	20.4	17.7	39.4	44.3	39.3	36.2
Level of Service	D	C	C	D	C	B	D	D	D	D
Approach Delay (s)		33.6			30.8					
Approach LOS		C			C					

Intersection Summary

HCM 2000 Control Delay	34.9	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.80		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
12: 115th Avenue & Driveway 2

Total 2025 AM Peak Hour

01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	84	630	34	63	226
Future Volume (Veh/h)	34	84	630	34	63	226
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	91	685	37	68	246
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						252
pX, platoon unblocked	0.91					
vC, conflicting volume	1086	704		722		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1045	704		722		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	83	79		92		
cM capacity (veh/h)	213	437		880		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	128	722	314			
Volume Left	37	0	68			
Volume Right	91	37	0			
cSH	335	1700	880			
Volume to Capacity	0.38	0.42	0.08			
Queue Length 95th (ft)	43	0	6			
Control Delay (s)	22.2	0.0	2.7			
Lane LOS	C		A			
Approach Delay (s)	22.2	0.0	2.7			
Approach LOS	C					
Intersection Summary						
Average Delay		3.2				
Intersection Capacity Utilization		67.7%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
13: 115th Avenue & Driveway 3

Total 2025 AM Peak Hour

01/23/2019

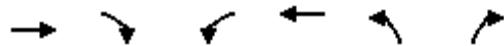


Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	34	28	636	34	39	221
Future Volume (Veh/h)	34	28	636	34	39	221
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	37	30	691	37	42	240
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						438
pX, platoon unblocked	0.96					
vC, conflicting volume	1034	710		728		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1013	710		728		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	85	93		95		
cM capacity (veh/h)	241	434		876		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	67	728	282			
Volume Left	37	0	42			
Volume Right	30	37	0			
cSH	301	1700	876			
Volume to Capacity	0.22	0.43	0.05			
Queue Length 95th (ft)	21	0	4			
Control Delay (s)	20.3	0.0	1.8			
Lane LOS	C		A			
Approach Delay (s)	20.3	0.0	1.8			
Approach LOS	C					
Intersection Summary						
Average Delay		1.7				
Intersection Capacity Utilization		55.1%		ICU Level of Service		B
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
16: Driveway 1 & Happy Valley Parkway

Total 2025 AM Peak Hour

01/23/2019



Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑↑	↑	↑↑↑	↑↑↑	↑			
Traffic Volume (veh/h)	2569	55	0	1576	0	45		
Future Volume (Veh/h)	2569	55	0	1576	0	45		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	2792	60	0	1713	0	49		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	Raised			Raised				
Median storage veh)	1			1				
Upstream signal (ft)	375							
pX, platoon unblocked		0.71		0.71	0.71			
vC, conflicting volume		2852		3363	931			
vC1, stage 1 conf vol				2792				
vC2, stage 2 conf vol				571				
vCu, unblocked vol		2164		2888	0			
tC, single (s)		4.1		6.8	6.9			
tC, 2 stage (s)				5.8				
tF (s)		2.2		3.5	3.3			
p0 queue free %		100		100	94			
cM capacity (veh/h)		172		49	765			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	931	931	931	60	571	571	571	49
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	60	0	0	0	49
cSH	1700	1700	1700	1700	1700	1700	1700	765
Volume to Capacity	0.55	0.55	0.55	0.04	0.34	0.34	0.34	0.06
Queue Length 95th (ft)	0	0	0	0	0	0	0	5
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.0
Lane LOS								B
Approach Delay (s)	0.0				0.0			10.0
Approach LOS								B
Intersection Summary								
Average Delay			0.1					
Intersection Capacity Utilization		59.6%			ICU Level of Service			B
Analysis Period (min)			15					

HCM Signalized Intersection Capacity Analysis
3: 115th Avenue & Happy Valley Parkway

Total 2025 PM Peak Hour

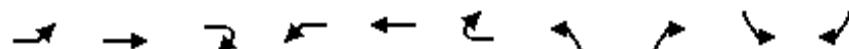
01/23/2019

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	15	1840	125	600	2240	30	88	10	339	14	14	14
Future Volume (vph)	15	1840	125	600	2240	30	88	10	339	14	14	14
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Lane Util. Factor	1.00	0.91	1.00	1.00	0.91		1.00	1.00			1.00	
Frt	1.00	1.00	0.85	1.00	1.00		1.00	0.85			0.98	
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00			0.99	
Satd. Flow (prot)	1770	5085	1583	1770	5072		1770	1591			1797	
Flt Permitted	0.14	1.00	1.00	0.13	1.00		0.95	1.00			0.99	
Satd. Flow (perm)	265	5085	1583	237	5072		1770	1591			1797	
Peak-hour factor, PHF	0.92	0.92	0.92	0.83	0.83	0.64	0.79	0.92	0.91	0.61	0.25	0.83
Adj. Flow (vph)	16	2000	136	723	2699	47	111	11	373	23	56	17
RTOR Reduction (vph)	0	0	76	0	1	0	0	307	0	0	7	0
Lane Group Flow (vph)	16	2000	60	723	2745	0	111	77	0	0	89	0
Turn Type	pm+pt	NA	Perm	pm+pt	NA		Split	NA		Split	NA	
Protected Phases	1	6		5	2		4	4		8	8	
Permitted Phases	6		6	2								
Actuated Green, G (s)	28.8	28.1	28.1	35.6	31.5		14.1	14.1			9.0	
Effective Green, g (s)	28.8	28.1	28.1	35.6	31.5		14.1	14.1			9.0	
Actuated g/C Ratio	0.36	0.35	0.35	0.45	0.40		0.18	0.18			0.11	
Clearance Time (s)	4.0	6.4	6.4	4.0	6.4		6.8	6.8			6.8	
Vehicle Extension (s)	2.0	5.0	5.0	2.0	5.0		5.0	5.0			5.0	
Lane Grp Cap (vph)	109	1801	560	185	2014		314	282			203	
v/s Ratio Prot	0.00	0.39		c0.20	0.54		c0.06	0.05			c0.05	
v/s Ratio Perm	0.05		0.04	c1.55								
v/c Ratio	0.15	1.11	0.11	3.91	1.36		0.35	0.27			0.44	
Uniform Delay, d1	19.9	25.6	17.2	22.0	23.9		28.6	28.2			32.8	
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00			1.00	
Incremental Delay, d2	0.2	58.3	0.2	1321.6	166.6		1.4	1.1			3.1	
Delay (s)	20.1	83.9	17.4	1343.6	190.5		30.0	29.3			35.9	
Level of Service	C	F	B	F	F		C	C			D	
Approach Delay (s)		79.2			430.8			29.5			35.9	
Approach LOS		E			F			C			D	
Intersection Summary												
HCM 2000 Control Delay				270.9			HCM 2000 Level of Service			F		
HCM 2000 Volume to Capacity ratio				2.61								
Actuated Cycle Length (s)				79.3			Sum of lost time (s)			24.0		
Intersection Capacity Utilization				104.6%			ICU Level of Service			G		
Analysis Period (min)				15								
c Critical Lane Group												

HCM Signalized Intersection Capacity Analysis
7: SR 303 & Happy Valley Parkway

Total 2025 PM Peak Hour

01/23/2019



Movement	EBL	EBT	EBR2	WBL	WBT	WBR2	NBL	NBR2	SBL	SBR2
Lane Configurations	↑↑	↑↑↑↑	↑	↑↑	↑↑	↑	↑↑	↑↑	↑↑	↑↑
Traffic Volume (vph)	42	839	243	801	1300	241	274	888	253	225
Future Volume (vph)	42	839	243	801	1300	241	274	888	253	225
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Lane Util. Factor	0.97	0.91	1.00	0.97	0.95	1.00	0.97	0.88	0.97	0.88
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (prot)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Flt Permitted	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	0.95	1.00
Satd. Flow (perm)	3433	5085	1583	3433	3539	1583	3433	2787	3433	2787
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	46	912	264	871	1413	262	298	965	275	245
RTOR Reduction (vph)	0	0	189	0	0	117	0	529	0	201
Lane Group Flow (vph)	46	912	75	871	1413	145	298	436	275	44
Turn Type	Prot	NA	Perm	Prot	NA	Perm	Prot	Perm	Prot	Perm
Protected Phases	1	6		5	2		7		3	
Permitted Phases			6			2		7		3
Actuated Green, G (s)	4.8	28.4	28.4	25.8	49.4	49.4	17.8	17.8	17.8	17.8
Effective Green, g (s)	4.8	28.4	28.4	25.8	49.4	49.4	17.8	17.8	17.8	17.8
Actuated g/C Ratio	0.05	0.28	0.28	0.26	0.49	0.49	0.18	0.18	0.18	0.18
Clearance Time (s)	10.0	9.0	9.0	10.0	9.0	9.0	9.0	9.0	9.0	9.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	164	1444	449	885	1748	782	611	496	611	496
v/s Ratio Prot	0.01	0.18		c0.25	c0.40		0.09		0.08	
v/s Ratio Perm			0.05			0.09		c0.16		0.02
v/c Ratio	0.28	0.63	0.17	0.98	0.81	0.18	0.49	0.88	0.45	0.09
Uniform Delay, d1	45.9	31.2	26.9	36.9	21.3	14.1	37.0	40.1	36.7	34.3
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.9	0.9	0.2	26.2	4.1	0.5	0.6	16.2	0.5	0.1
Delay (s)	46.9	32.1	27.1	63.1	25.5	14.6	37.6	56.3	37.3	34.4
Level of Service	D	C	C	E	C	B	D	E	D	C
Approach Delay (s)		31.6			37.2					
Approach LOS		C			D					

Intersection Summary

HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.94		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	28.0
Intersection Capacity Utilization	Err%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

HCM Unsignalized Intersection Capacity Analysis
12: 115th Avenue & Driveway 2

Total 2025 PM Peak Hour

01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	28	70	367	28	42	697
Future Volume (Veh/h)	28	70	367	28	42	697
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	76	399	30	46	758
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						252
pX, platoon unblocked	0.61					
vC, conflicting volume	1264	414		429		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1115	414		429		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	78	88		96		
cM capacity (veh/h)	135	638		1130		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	106	429	804			
Volume Left	30	0	46			
Volume Right	76	30	0			
cSH	311	1700	1130			
Volume to Capacity	0.34	0.25	0.04			
Queue Length 95th (ft)	37	0	3			
Control Delay (s)	22.4	0.0	1.1			
Lane LOS	C		A			
Approach Delay (s)	22.4	0.0	1.1			
Approach LOS	C					
Intersection Summary						
Average Delay		2.4				
Intersection Capacity Utilization		75.9%		ICU Level of Service		D
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
13: 115th Avenue & Driveway 3

Total 2025 PM Peak Hour
01/23/2019



Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	28	22	373	28	40	685
Future Volume (Veh/h)	28	22	373	28	40	685
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	30	24	405	30	43	745
Pedestrians						
Lane Width (ft)						
Walking Speed (ft/s)						
Percent Blockage						
Right turn flare (veh)						
Median type			None			None
Median storage veh						
Upstream signal (ft)						438
pX, platoon unblocked	0.63					
vC, conflicting volume	1251	420		435		
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1103	420		435		
tC, single (s)	6.4	6.2		4.1		
tC, 2 stage (s)						
tF (s)	3.5	3.3		2.2		
p0 queue free %	79	96		96		
cM capacity (veh/h)	141	633		1125		
Direction, Lane #	WB 1	NB 1	SB 1			
Volume Total	54	435	788			
Volume Left	30	0	43			
Volume Right	24	30	0			
cSH	216	1700	1125			
Volume to Capacity	0.25	0.26	0.04			
Queue Length 95th (ft)	24	0	3			
Control Delay (s)	27.2	0.0	1.0			
Lane LOS	D		A			
Approach Delay (s)	27.2	0.0	1.0			
Approach LOS	D					
Intersection Summary						
Average Delay			1.8			
Intersection Capacity Utilization		72.9%		ICU Level of Service		C
Analysis Period (min)		15				

HCM Unsignalized Intersection Capacity Analysis
16: Driveway 1 & Happy Valley Parkway

Total 2025 PM Peak Hour
01/23/2019



Movement	EBT	EBR	WBL	WBT	NBL	NBR		
Lane Configurations	↑↑↑	↑	↑↑↑		↑			
Traffic Volume (veh/h)	2147	46	0	2870	0	36		
Future Volume (Veh/h)	2147	46	0	2870	0	36		
Sign Control	Free			Free	Stop			
Grade	0%			0%	0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	2334	50	0	3120	0	39		
Pedestrians								
Lane Width (ft)								
Walking Speed (ft/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	Raised			Raised				
Median storage veh)	1			1				
Upstream signal (ft)	375							
pX, platoon unblocked		0.65		0.65	0.65			
vC, conflicting volume		2384		3374	778			
vC1, stage 1 conf vol				2334				
vC2, stage 2 conf vol				1040				
vCu, unblocked vol		1267		2780	0			
tC, single (s)		4.1		6.8	6.9			
tC, 2 stage (s)				5.8				
tF (s)		2.2		3.5	3.3			
p0 queue free %		100		100	95			
cM capacity (veh/h)		356		101	710			
Direction, Lane #	EB 1	EB 2	EB 3	EB 4	WB 1	WB 2	WB 3	NB 1
Volume Total	778	778	778	50	1040	1040	1040	39
Volume Left	0	0	0	0	0	0	0	0
Volume Right	0	0	0	50	0	0	0	39
cSH	1700	1700	1700	1700	1700	1700	1700	710
Volume to Capacity	0.46	0.46	0.46	0.03	0.61	0.61	0.61	0.05
Queue Length 95th (ft)	0	0	0	0	0	0	0	4
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.4
Lane LOS								B
Approach Delay (s)	0.0				0.0			10.4
Approach LOS								B
Intersection Summary								
Average Delay		0.1						
Intersection Capacity Utilization		58.8%		ICU Level of Service				B
Analysis Period (min)		15						

Appendix G

Turn Lane Documents

In some circumstances, left turn lanes may not be required at signalized intersections; those intersections will generally require split phase signal operation and will be evaluated by MCDOT Traffic Management on a case by case basis.

6.1.7 INTERSECTION TURN LANE DESIGN

Intersections are to be designed to allow the passenger car (P) design vehicles approaching from opposite directions to turn left simultaneously without conflict with each other. At arterialarterial intersections two WB-50 design vehicles approaching from opposite directions are to be able to turn left simultaneously without conflict.

The design of signalized intersections shall provide sufficient turning space to accommodate design vehicle offtracking for both right and left turns on all approaches. The design vehicle for signalized intersection design is as defined in Section 4.1.2 DESIGN VEHICLE. Design vehicle offtracking shall not cause any part of the design vehicle to encroach into an opposing traffic lane, opposing left turn lane, or extend beyond the face of any curb or any pavement edge. Widening of the receiving lane or lanes is to be provided as needed to accommodate the design vehicle's offtracking turning movements. Receiving lane widening (throat widening) can be accomplished using an asymmetric three centered curve or an offset curve with a closing taper section.

At intersections with dual left turn lanes three receiving lanes on the exit portion of the intersection are usually needed to accommodate truck turning movements. The outside left turn lane and the two exterior receiving lanes on the exit portion of the intersection are used to accommodate the truck turning path of a WB-50 design vehicle. When only two receiving lanes are available then the exterior lane shall have sufficient throat widening to allow the design vehicle to turn without encroaching onto the interior receiving lane or exterior curb.

Right turns onto an arterial roadway by the WB-50 design vehicle shall not encroach into the opposing traffic or left turn lane. Lane widening shall be provided as needed to accommodate the truck turning movement.

The design vehicle's turning template is to be used to ensure sufficient width is provided to accommodate offtracking turning movements. Receiving lane widening (throat widening) shall be provided as needed to accommodate the offtracking turning movements.

For arterial and collector roads the storage length for auxiliary turn lanes is to be determined by a traffic analysis for both signalized and unsignalized intersections. The minimum storage for both collectors and arterials is generally the same due to the possibility of collector roadways becoming signalized at a future date. The storage criteria shown below will apply to both urban and rural conditions.

Exception to the minimum turn lane storage requirements shown below may be granted by the MCDOT Traffic Engineer.

6.1.8 LEFT TURN LANE STORAGE

For arterials and collector roads, the minimum storage length is 160 feet. This will apply to both signalized and unsignalized intersections. For local roads the minimum storage length is 75 feet.

6.1.9 RIGHT TURN LANE STORAGE

For arterials and collector roads, the minimum storage length is 160 feet. This will apply to both signalized and unsignalized intersections.

6.1.10 AUXILIARY LANE TRANSITION TAPERS

Opening tapers for auxiliary turn lanes without curbing are to be added with an opening taper rate of 8:1 (L:W) minimum and 15:1 (L:W) maximum. Use an 8:1 opening taper for design speeds of 30 mph or less and a 15:1 opening taper for design speeds of 50 mph or greater.

For auxiliary lanes with curbing provide reverse curves as illustrated in Fig. 6.1.

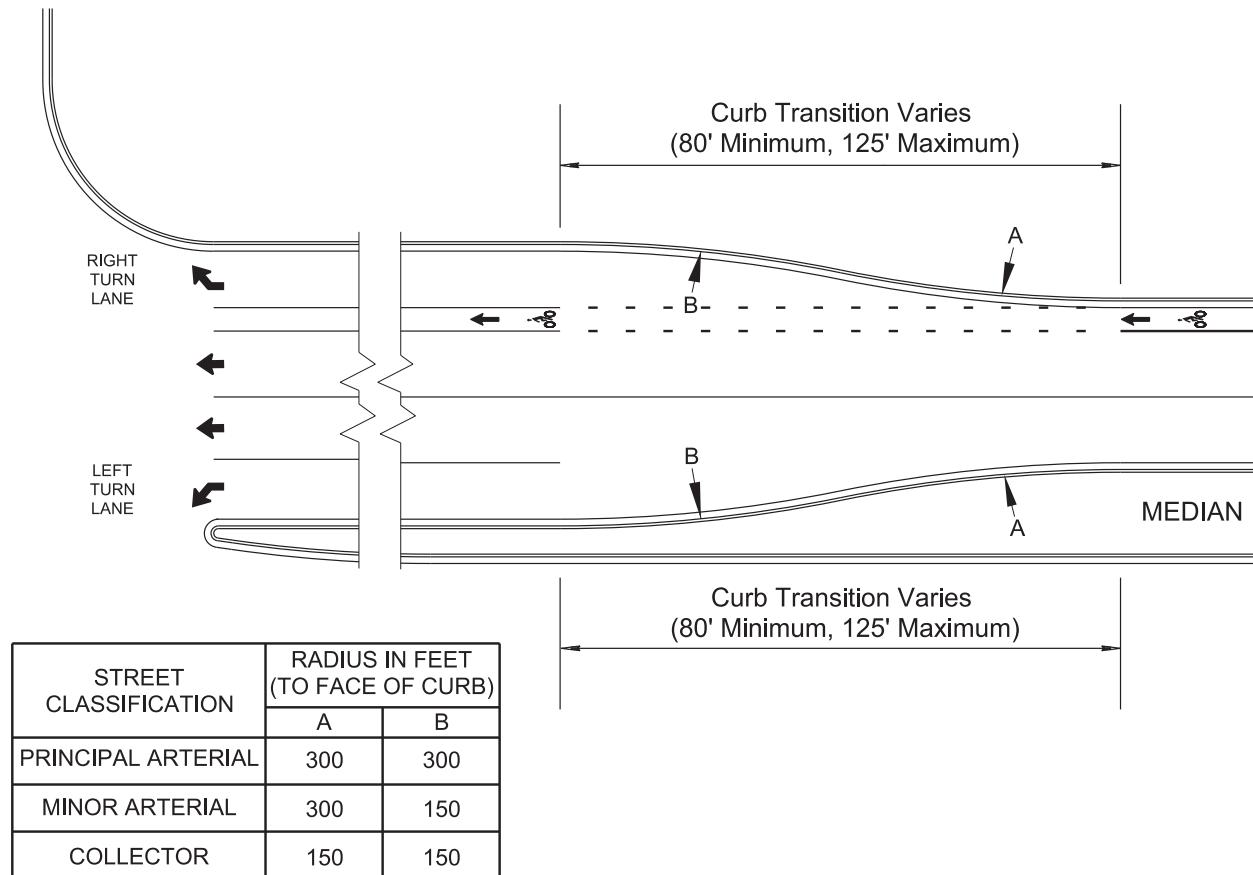


FIGURE 6.1: AUXILIARY TURN LANES – CURB TRANSITIONS

6.1.11 LAYOUT REQUIREMENTS FOR AUXILIARY TURN LANES

Figure 6.2 shows a left turn auxiliary lane layout for a rural principal arterial.

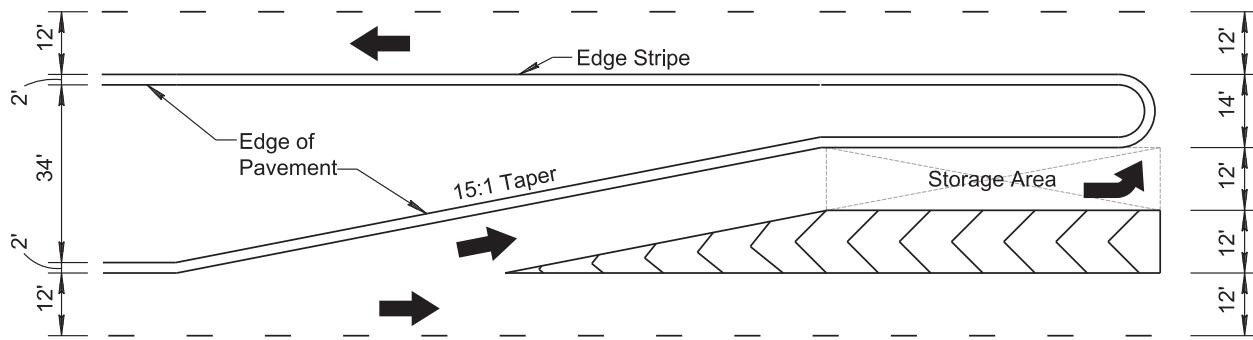


FIGURE 6.2: LEFT-TURN LANE LAYOUT FOR RURAL PRINCIPAL ARTERIAL

Figures 6.3(A) and 6.3(B) illustrate potential methods for adding a left turn lane to a two lane roadway. Note that the offset distance for symmetrical widening is half the distance as required for widening on one side only, therefore the taper length for symmetrical widening is half the length required for widening on one side only.

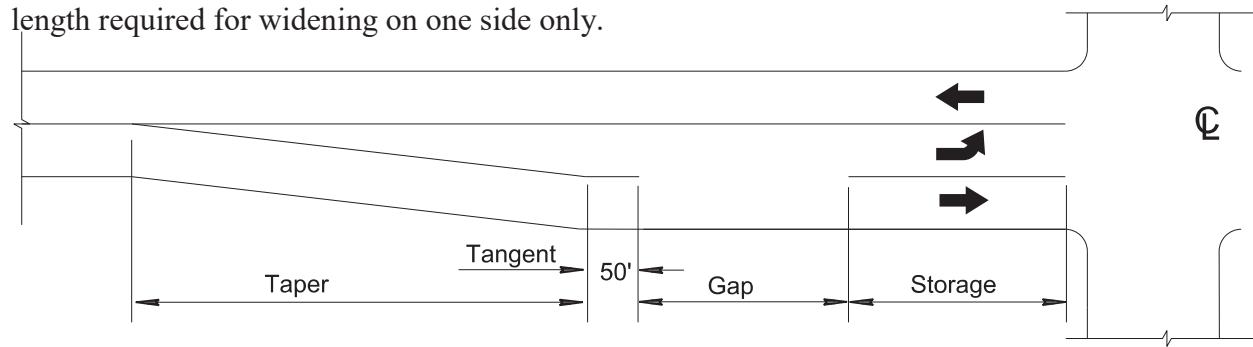


FIGURE 6.3(A): LEFT-TURN LANE – WIDENING ONE SIDE ONLY

Minimum Gap Length for Left Turn Lanes	
Posted Speed (mph)	Minimum Opening (feet)
45 or less	100'
50 or more	120'

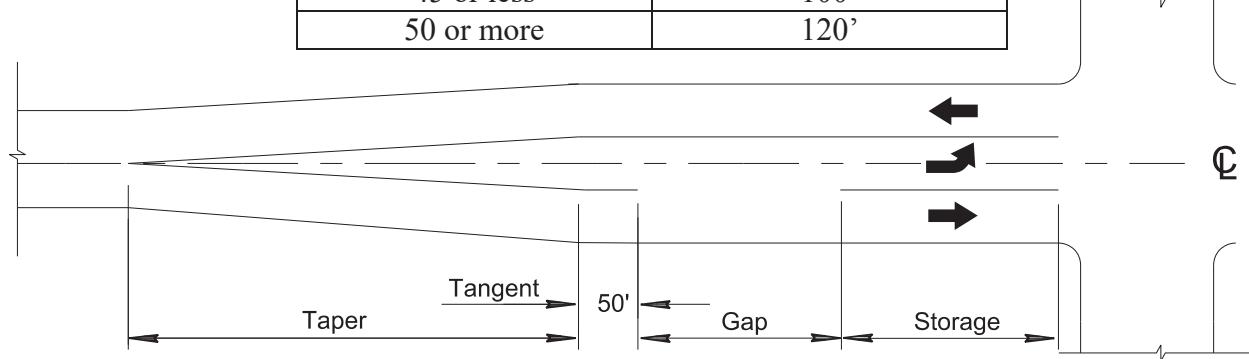


FIGURE 6.3(B): LEFT-TURN LANE – SYMMETRICAL WIDENING