

# Westworld Sports Fields

Scottsdale, Arizona

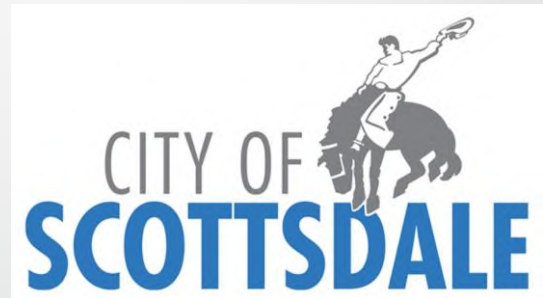
## Traffic Study

Lee Engineering Project No. 1079.10

*July 2021*

**APPROVED**

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**Westworld Sports Fields**

**Traffic Study**

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July 2021



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## 1.0 BACKGROUND

A City of Scottsdale Capital Project proposes to construct a series of multi-use athletic fields, suitable for soccer and other sports, across several parcels located near the Westworld development near the west corner of Thompson Peak Parkway and McDowell Mountain Ranch Road in Scottsdale, Arizona. Lee Engineering was recently engaged to conduct a traffic analysis of the development for the purposes of estimating its traffic impacts on the adjacent roadway network.

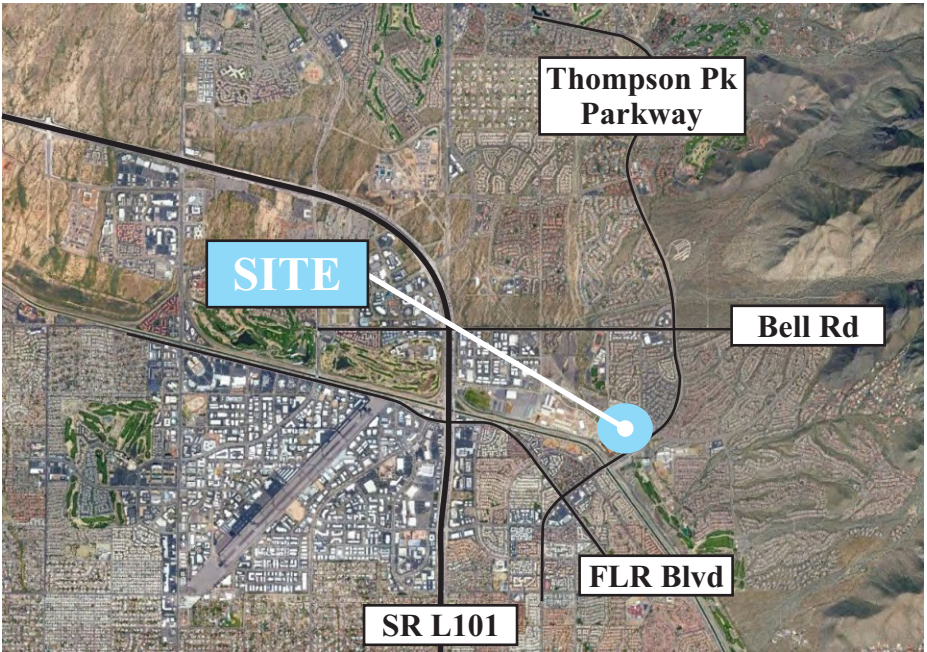
The location of the site is shown in Figure 1; a preliminary site plan, provided by Gavan & Barker, Inc. is shown in Figure 2.

### 1.1 Scope

In a conference call on March 31, 2021, the City of Scottsdale asked that this study include the following elements:

- Weekday and weekend peak-period traffic volume data collection at these intersections:
  - Thompson Peak Parkway and McDowell Mountain Ranch Road
  - McDowell Mountain Ranch Road and 98<sup>th</sup> Street
  - Thompson Peak Parkway northbound and driveway to McDowell Mountain Ranch Park and Aquatic Center
  - Thompson Peak Parkway southbound and driveway to McDowell Mountain Ranch Park and Aquatic Center
- Crash analysis for the intersections adjacent to the site for a 3-year period
- Trip generation, distribution, and assignment for the proposed soccer complex
- Traffic analysis for the site's opening year at the site's primary access points as well as the intersections listed above. The analysis will include intersection operations, storage length requirements, and pavement marking or design improvements.

The remainder of this report will address these scope elements in turn.



Vicinity Map, Scottsdale Area

Enlargement Area



  
 Not to scale

*Westworld Sports Fields - Traffic Analysis*

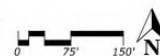


Vicinity Map

Figure 1



**WestWorld Sports Complex - Preliminary Site Plan**  
 McDowell Mountain Ranch Rd & Thompson Peak Pkwy



## **2.0 STUDY AREA CHARACTERISTICS**

### **2.1 General Study Area**

The vision of Scottsdale is to convert under-utilized properties near the southwest portion of Westworld to athletic fields that will also double as overflow parking areas for large events in the area. Traffic on the adjacent roadway network can be assumed as mostly local drivers originating and destined to the residential areas in the immediate project area or other Scottsdale residents located north of Bell Road and east of Pima Road. The vehicular population is limited due to the overall curvilinear nature of the roadways, limited roadway connectivity outside of this area, absence of regional high density commercial areas and the natural border created by the McDowell Mountains. Overall, the area could be considered mostly residential in nature generating mostly commuter traffic during peak hours.

The construction of the athletic fields will draw additional local and some regional traffic to the area.

The majority of regional traffic approaching the site from the west is anticipated to use eastbound State Route 101 (SR 101) and exit at the Princess Drive/Bell Road off-ramp, accessing the site from the north via Bell Road to southbound 98<sup>th</sup> Street. Motorists originating from the south using northbound SR 101 are anticipated to exit at Raintree Drive and approach the site from northbound Thompson Peak Parkway. Drivers west of SR 101 originating near Bell Road will likely stay on the Bell Road/Frank Lloyd Wright Boulevard surface street corridor and approach the proposed facility from northbound Thompson Peak Parkway as well. Traffic originating from the residential areas north of the site could use either 98<sup>th</sup> Street or Thompson Peak Parkway southbound. Repeat visitors to the athletic fields, especially local traffic from the north or local/regional traffic from the south will have options to use the Aquatic Center/Park roadway off of Thompson Peak Parkway or use McDowell Mountain Ranch Road, depending upon if their destination is a northern or southern athletic field.

Based on the travel routing, the study area intersections and roadways that are expected to accommodate the majority of approaching and departing site traffic have been identified in the scope of work above and are shown in Figure 1.

### **2.2 Study Area Roadway Characteristics**

According to the City of Scottsdale Street Classification map, Thompson Peak Parkway is classified as a “minor arterial – suburban” in the vicinity of the proposed development. Thompson Peak Parkway carries two vehicular lanes and one bicycle lane in each direction, separated by a raised median. The roadway cross section also provides sidewalks on both sides of the street along with roadway lighting. Right-turn lanes are provided at all study intersections. Breaks are not provided in the raised median between 100<sup>th</sup> Street and McDowell Mountain Ranch Road, which includes the access driveways to the McDowell Mountain Ranch Park and Aquatic Center, rendering intersection movements at these locations to right-turn only movements. The posted speed on this roadway is 45 mph.

McDowell Mountain Ranch Road is classified as a “major collector – suburban” roadway on the City’s Street Classification Map providing access to mostly residential developments east and west



of Thompson Peak Parkway. West of Thompson Peak Parkway, the roadway provides for two travel lanes in each direction divided by a two-way left turn lane for most of its length east of its intersection with 98<sup>th</sup> Street. Bike lanes are present along both sides of the street. Curb, gutter, and adjacent sidewalk are provided along the roadway's north side adjacent to developed areas while the south side of the roadway adjacent to the proposed athletic fields are without these elements. West of 98<sup>th</sup> Street, the roadway reduces to a rural cross-section with one lane in each direction and a continuous center turn lane to its intersection with Westworld Way. A manual swing gate exists between 98<sup>th</sup> Street and Westworld Way to close vehicle access to the Westworld complex when needed. The roadway has a posted speed limit of 30 mph.

Running along a north-south alignment, 98<sup>th</sup> Street is identified as a major collector – suburban roadway. This roadway is approximately 0.6 miles in length originating at Bell Road in the north and terminating at McDowell Mountain Ranch Road in the south. The roadway provides access to residential developments on its east side and Notre Dame Prep Academy to its west. The roadway is a 4-lane divided facility along the Academy's frontage and a 2-lane undivided facility south of the school. The roadway's posted speed limit is 35 mph, except during school hours when the flashing beacons are activated to warn motorists approaching a school street crossing that the speed limit is 30 mph.

Access to the McDowell Mountain Ranch Park and Aquatic Center, as well as a golf maintenance yard, library, and access to 102<sup>nd</sup> Way and the Desert Canyon Middle School, is available from northbound and southbound Thompson Peak Parkway via the Aquatic Center/Park roadway. The access roadway is not classified on the City's *Street Classification Map* but could be considered a local street due to its low speed and low volume. The roadway is an undivided 2-lane roadway that circles beneath Thompson Peak Parkway that has curb and gutter, a detached sidewalk and roadway lighting. The access roadway does not have posted regulatory speed limit signs.

The only signalized study intersection is Thompson Peak Parkway and McDowell Mountain Ranch Road. The approaches consist of dual left-turn lanes, two through lanes (and a bike lane), and individual right-turn lanes except for the northbound Thompson Peak Parkway approach where two right-turn lanes are provided.

The remaining three study area intersections are minor-street STOP controlled. The McDowell Mountain Ranch Park and Aquatic Center approaches to both northbound and southbound Thompson Peak Parkway are both single-lane right-turn only movements while exclusive right-turn lanes are provided from the two-lane directional mainline approaches. At the 98<sup>th</sup> Street/McDowell Mountain Ranch Road intersection, the east leg transitions from a 5-lane cross-section to 2 lanes over 350 feet via a wide hatched pavement area to separate the westbound right-turn only lane and the westbound through lane such that the east/west movements through the intersection align. Three driveways at or near this intersection exist for access to an equestrian parking area, an overflow/vehicle staging area for Westworld, and additional overflow parking on the south side of roadway proposed to be re-imagined as part of the athletic field development.

### 3.0 DATA COLLECTION

#### 3.1 Traffic Volume

Lee Engineering arranged for traffic volume data collection at the four study area intersections for a three-day period on Saturday, Sunday, and Tuesday, April 10 to April 13, 2021. Data was collected when no major events were scheduled at Westworld. Because traffic volumes were collected in April, a month associated with higher traffic volumes, no seasonal volume adjustments were applied to the captured data. It is noted that SR 101 eastbound was closed on Saturday and Sunday between Scottsdale Road and Pima Drive; however, no significant detour traffic was anticipated at the study intersections due to the closure. Overall, normal street circulation patterns were assumed. Moreover, no vehicle adjustment due to Covid considerations were applied. However, it is likely that school operation/traffic was limited due to the coronavirus restrictions, resulting in the westbound approach and southbound left-turn volumes at the 98<sup>th</sup> Street and McDowell Mountain Ranch Road intersection during the Tuesday AM and PM peak hours under-represented. The amount of additional traffic that should be added to this location (and other intersections noting other area schools) is unknown, but noted for other potential considerations within this report.

Traffic volumes at the intersections were collected in 15-minute increments for 5 hours on Saturday and Sunday (10AM to 3 PM) and for 2 hours during the traditional weekday AM and PM peak periods (7AM to 9AM and 4PM to 6PM). A summary of the peak-hour traffic volumes are graphically depicted in Figure 3 and tabulated below in Table 1. Complete raw count data is provided in Appendix A.

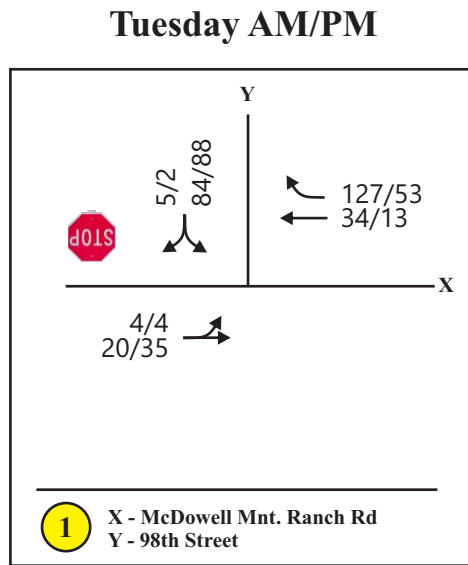
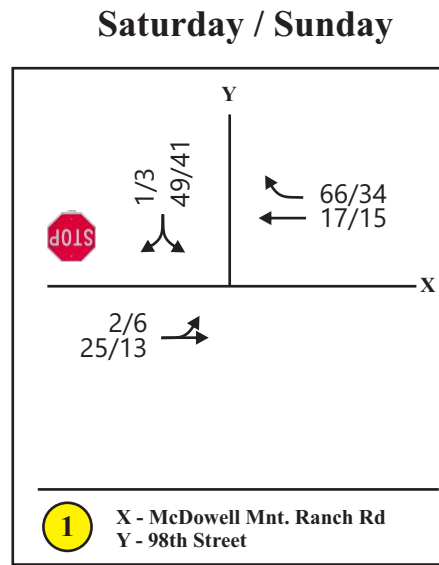
**Table 1. Existing Traffic Volumes**

Intersection Location		Saturday		Sunday		Tuesday AM		Tuesday PM	
		Pk Hr	Total Int. Volume	Pk Hr	Total Int. Volume	Pk Hr	Total Int. Volume	Pk Hr	Total Int. Volume
Int 1	MMRR & 98th St	10:30	160	10:15	112	7:00	274	16:30	195
Int 2	MMRR & TPP	11:00	2521	10:30	2001	7:15	2439	16:45	2564
Int 3	AC/P Access Rd & TPP SB	10:45	1322	11:00	989	7:00	1362	16:30	1155
Int 4	AC/P Access Rd & TPP NB	11:00	1035	10:45	859	7:15	1171	16:45	1369
Total			<b>5038</b>		<b>3961</b>		<b>5246</b>		<b>5283</b>
Percent of Highest			<b>95.4%</b>		<b>75.0%</b>		<b>99.3%</b>		<b>100.0%</b>

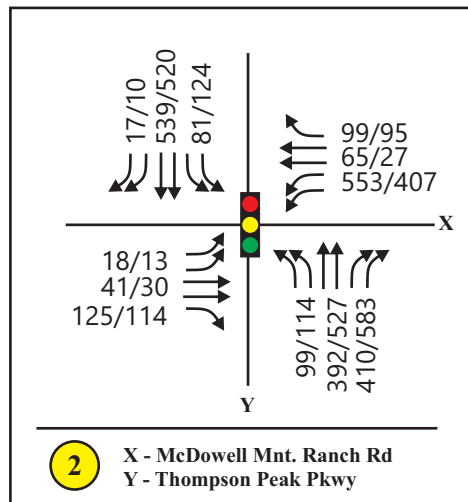
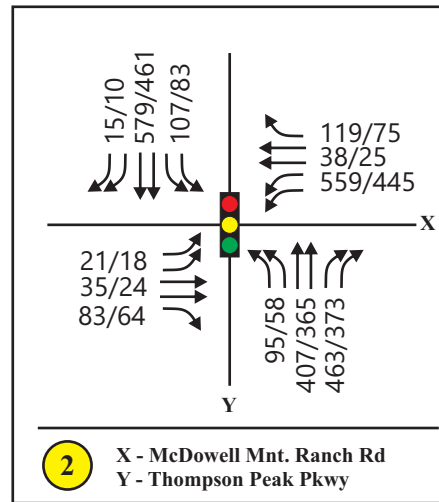
Note: MMRR - McDowell Mountain Ranch Road, TPP - Thompson Peak Parkway, AC/P - Aquatic Center and Park

When summarizing the traffic volumes at each intersection, peak volume conditions are associated with weekday evening conditions (5,283 total entering vehicles), while weekday morning peak-hour volumes were 99.3% of evening conditions. Peak Saturday volumes were 95.4% of Tuesday evening volumes and peak Sunday volumes are 75% of Tuesday evening conditions.

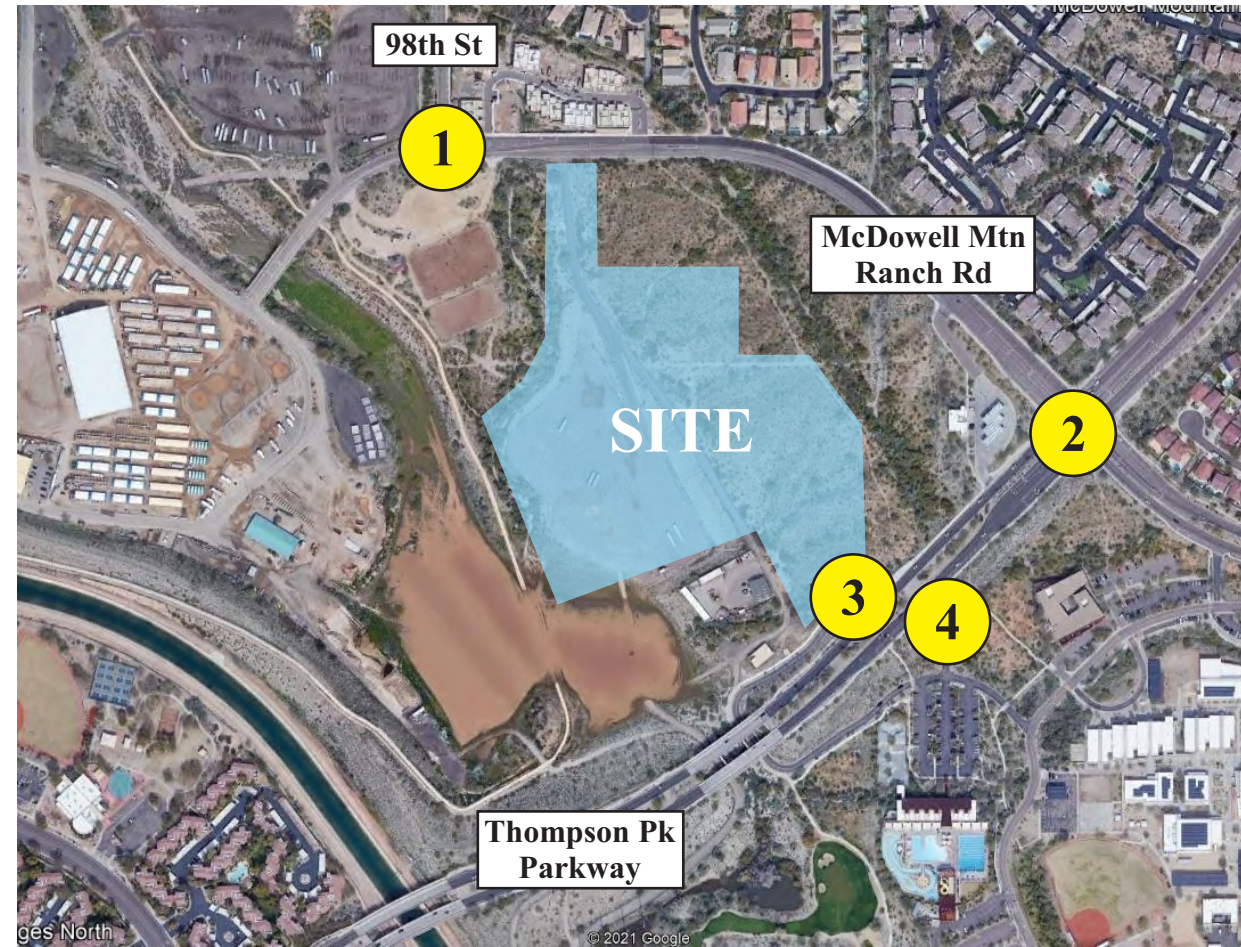
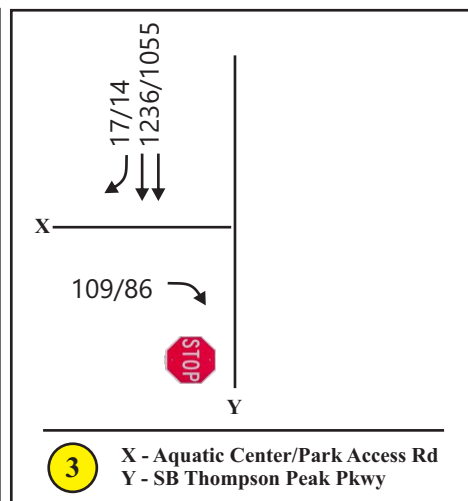
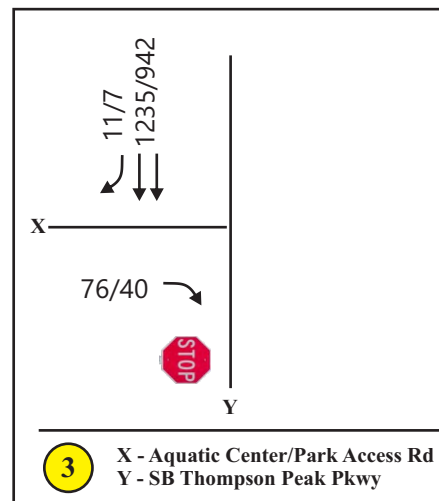
Int. #1  
 Peak Hour Sat: 10:30AM  
 Peak Hour Sun: 10:15AM  
 Peak Hour Tue AM: 7:00AM  
 Peak Hour Tue PM: 4:30PM



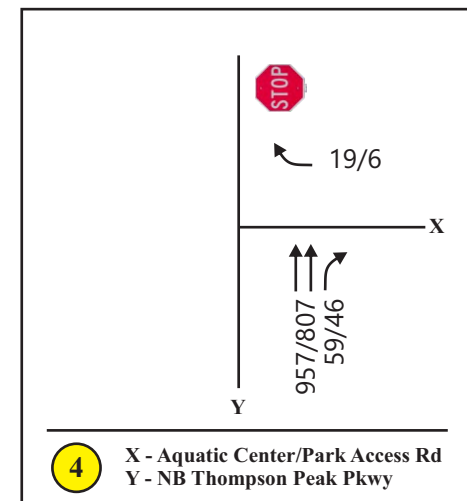
Int. #2  
 Peak Hour Sat: 11:00AM  
 Peak Hour Sun: 10:30AM  
 Peak Hour Tue AM: 7:15AM  
 Peak Hour Tue PM: 4:45PM



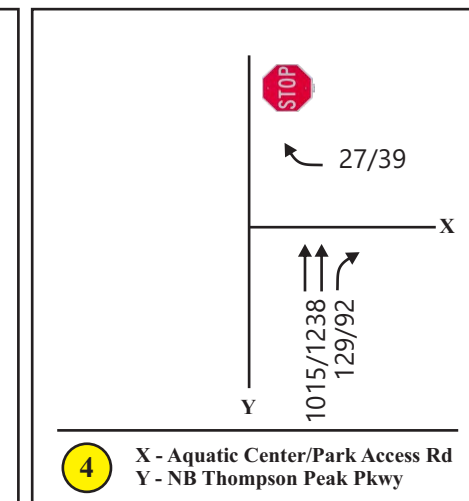
Int. #3  
 Peak Hour Sat: 10:45AM  
 Peak Hour Sun: 11:00AM  
 Peak Hour Tue AM: 7:00AM  
 Peak Hour Tue PM: 4:30PM



**Saturday / Sunday**



**Tuesday AM/PM**



Int. #4  
 Peak Hour Sat: 11:00AM  
 Peak Hour Sun: 10:45AM  
 Peak Hour Tue AM: 7:15AM  
 Peak Hour Tue PM: 4:45PM



Not to scale



#### 4.0 CRASH DATA

Lee Engineering queried ADOT’s Traffic Safety DataMart to identify crashes that occurred at the 4 study intersections. Crashes were queried that occurred in the three-year period from 2017 through 2019, the most recent three-year period for which data is available and occurred within 250 feet of the center of the intersection.

Table 2 provides a tabular yearly summary of the crashes, while Figure 4 shows the location of crashes. Overall, a total of 20 crashes were identified at the four study area intersections. No crashes were identified at the McDowell Mountain Ranch/98<sup>th</sup> Street intersection, one single-vehicle crash occurred at the Aquatic Center/Park Access Road with northbound and southbound Thompson Peak Parkway, and the remaining 18 crashes were at the signalized McDowell Mountain Ranch/Thompson Peak Parkway intersection. Of the total 20 crashes that were reported, zero crashes were coded as major or fatal crashes, 2 crashes were listed as minor injury, and the remaining crashes coded as possible or no injury. When reviewing the collision manner of the 18 crashes at the signalized intersection, 6 were sideswipe same direction crashes, 6 angle other than left turn, 3 rear end, 2 single vehicle and 1 left-turn. Only 1 crash was considered to have occurred at night and no crashes involved non-motorists.

**Table 2. Crash Summary, 2017 thru 2019**

Intersection Location		Total Crashes				Injury Severity					
		2017	2018	2019	Total Crashes	None	Possible	Minor	Major	Fatal	Total Crashes
Int 1	MMRR & 98th St	0	0	0	<b>0</b>	0	0	0	0	0	<b>0</b>
Int 2	MMRR & TPP	7	4	7	<b>18</b>	13	3	2	0	0	<b>18</b>
Int 3	AC/P Access Rd & TPP SB	0	1	0	<b>1</b>	0	1	0	0	0	<b>1</b>
Int 4	AC/P Access Rd & TPP NB	1	0	0	<b>1</b>	1	0	0	0	0	<b>1</b>
Total		8	5	7	<b>20</b>	14	4	2	0	0	<b>20</b>
Percent of Total		40%	25%	35%		70%	20%	10%	0%	0%	

Generally, it is believed that the number and severity of crashes document safe operating conditions at the intersections studied. A listing of crashes can be found in Appendix B.



Not to scale

## 5.0 PROPOSED DEVELOPMENT

### 5.1 Development Description

The proposed development is expected to consist of five rectangular lighted multi-use athletic fields along with a restroom building, 450 paved parking spaces to the north, east, and west sides of the fields, sidewalks and asphalt pathways. Other elements associated with the project include realigning the existing wash on the northwest side of the property, adding box and pipe culverts as necessary, constructing retaining walls where needed, reconstructing portions of the existing trail and path near the Westworld Trailhead, adding fencing and netting around the periphery of the fields, as well as other items.

The parking area will be accessible via two driveways, one from McDowell Mountain Ranch Road located about 370 feet east of 98<sup>th</sup> Street (centerline to centerline) on the north side of the property and one from the Aquatic Center/Park access roadway, located about 200 feet south of the Thompson Peak Parkway southbound intersection. Both site driveway approaches will be STOP-controlled for exiting traffic and all parking spaces will be accessible from either access point.

From a more detailed review of Figure 2, the McDowell Mountain Ranch access will be located at an existing curb cut location that provides access to an unpaved overflow parking area continuing south to serve as the north access to the golf course maintenance yard. The pavement markings on McDowell Mountain Ranch Road will require slight modification to extend the center left-turn lane about 50 feet west to provide the full turn lane width to the widened driveway apron. The separate left- and right-turn lane egress movements will be separated from the ingress lane by an approximate 10-foot landscaped median island. In the future, a potential connection from the 98<sup>th</sup> Street intersection to the proposed driveway may be considered, maintaining a driveway throat length of 150 feet.

The south site access off of the Aquatic Center/Park driveway will be a new driveway approximately 150 feet from southbound Thompson Peak Parkway. The driveway will provide a 100-foot right-turn deceleration lane to separate vehicles turning into the sports facility. Vehicles entering from northbound Thompson Peak Parkway and using the access road will make a left turn from the existing through lane. This access will have 1 entry and 2 exit lanes and provide about 150 feet of throat length to the first cross drive into the parking area.

The parking stalls are scaled to be 10 feet by 18 feet and the drive aisles 24 feet, matching or exceeding the minimum dimension for each element set forth within the City's *Design Standards & Policies Manual* (DSPM).

The parking lot layout will provide vehicular connectivity between McDowell Mountain Ranch Road near 98<sup>th</sup> Street and southbound Thompson Peak Parkway/Aquatic Center/Park access road. However, due to the circuitous travel path through the parking area, it is unlikely drivers will consider this new path as an alternative to travel along the adjacent roadway network. The amount of any "cut-through" traffic is expected to be negligible and is not quantified as part of this study.

## 5.2 Projected Traffic

### 5.2.1 Trip Generation

The first step in estimating traffic to and from the proposed development is to calculate trip generation, which is the total vehicle trips to and from the site over a given time period. Two methods were used to estimate trip generation.

#### ITE Method

The *Trip Generation Manual*, 10th Edition, published by the Institute of Transportation Engineers (ITE) provides trip generation estimates for a wide variety of land uses. Based on the site's expected use, the ITE land use code (LUC) that best represents the site is LUC #488, Soccer Complex.

*Trip Generation* includes limited information about LUC #488 because of a small sample size of similar developments. The small sample size tends to limit confidence in the trip generation estimate, which is one reason a second trip generation method was used, as discussed later.

*Trip Generation* does include information for both weekday morning and afternoon peak hours both for the generator and for adjacent street traffic. For both morning and afternoon periods, the peak hour of the generator was used. In both cases, the value is slightly higher than the peak of the adjacent street traffic.

Only one time period (Saturday peak hour) includes a fitted curve, but the average trip rate was used for all time periods evaluated. The difference between the fitted curve and the average rate for the Saturday peak hour is small, and the average rate shows a slightly higher (more conservative) number of trips.

Table 3 presents the trip generation data for the site using the ITE method. In total, this method predicts that site is expected to generate about 357 trips on a typical weekday, with about 85 of those trips in the afternoon peak hour. Traffic is expected to be much higher on weekends than on weekdays. Expected daily traffic is more than 5 times greater on Saturday than on a weekday, and Saturday's peak hour traffic is more than double the weekday afternoon peak hour. ITE does not provide a daily traffic estimate for Sunday, but Sunday peak hour traffic is expected to be about 70 percent greater than the weekday afternoon peak hour.

No trip reduction factors were applied to the ITE trip forecast, so all trips generated by the site are considered to be new trips added to the adjacent roadway network.

**Table 3. Site Trip Generation – ITE Method**

Westworld Multi-Use Fields												
ITE Land Use: (488) Soccer Complex												
# of Fields	Weekday Daily		Weekday AM Peak		Weekday PM Peak		Saturday Daily		Saturday Peak Hour		Sunday Peak Hour	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
5												
Dir. Dist.	50%	50%	53%	47%	47%	53%	50%	50%	48%	52%	46%	54%
ITE Trip Rate	71.33		1.77		16.9		404.88		40.1		28.78	
Trips	179	178	5	4	40	45	1013	1012	96	105	66	78
	357		9		85		2025		201		144	

*Comparison Site Method*

Because the ITE method relies on a limited supply of data, the City of Scottsdale collected traffic volume information for a similar nearby site, located on the northeast corner of Bell and Hayden Roads. Data at this site was collected from October 14 through 18, 2020, and reflects the fact that only seven of the comparison site’s ten athletic fields were in use during this period. The City of Scottsdale provided the trip rate information shown in Table 4, reflecting the volume collected at the comparison site. A copy of the raw Scottsdale trip generation data used for this analysis is provided in Appendix C.

**Table 4. Site Trip Generation – Comparison Site Method**

Westworld Multi-Use Fields												
Scottsdale Specific Data: Soccer Complex												
# of Fields	Weekday Daily		Weekday AM Peak		Weekday PM Peak		Saturday Daily		Saturday Peak Hour		Sunday Peak Hour	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
5												
Dir. Dist.	50%	50%	53%	47%	47%	53%	50%	50%	48%	52%	46%	54%
Trip Rate	120		8		34		305		47		38	
Trips	300	300	21	19	80	90	763	762	113	122	87	103
	600		40		170		1525		235		190	

The city’s data reflects only a single data collection period at one site, but the results are considered more applicable than the ITE Method as the proposed athletic fields are anticipated to operate in a similar manner to the other Scottsdale facility analyzed.

The differences between the two trip generation methods are as follows:

- The comparison site method predicts considerably more trips on weekdays, including both morning and afternoon peak hours. About twice as many site trips are predicted using the local method during the weekday afternoon peak hour.
- The comparison site method predicts about 25 percent fewer trips than the ITE method during the day on Saturday, though Saturday peak hour volume is slightly higher by about 17 percent.
- The comparison site method predicts about 32 percent more trips during the Sunday peak hour.



Considering that the comparison site method produced a higher estimate of trip generation for most time periods evaluated, this method’s trip generation will be used for the remainder of the analysis, to provide a more conservative estimate of conditions.

### 5.2.2 Trip Distribution and Assignment

Site-generated trips have been distributed onto the adjacent roadway network based in part on existing traffic volume collected in this study and in part on engineering judgment, considering traffic patterns in the nearby and broader area. The distribution percentages assumed for this study are presented in Table 5. City of Scottsdale Parks Department staff concurred with the trip distribution assumptions during a telephone call on June 24, 2021.

**Table 5. Site Trip Distribution**

<b>To/From SR 101 (WEST)</b>	<b>25%</b>
98th Street	15%
McDowell Mnt. Ranch Road	5%
Northbound TPP, Access Road	5%
<b>To/From McDowell Mountain Ranch Road (EAST)</b>	<b>5%</b>
McDowell Mnt. Ranch Road	3%
Southbound TPP, Access Road	2%
<b>To/From Thompson Peak Parkway (NORTH)</b>	<b>10%</b>
McDowell Mnt. Ranch Road	5%
Southbound TPP, Access Road	5%
<b>To/From Thompson Peak Parkway (SOUTH)</b>	<b>60%</b>
McDowell Mnt. Ranch Road	20%
Northbound TPP, Access Road	40%

Optional approach and departure paths are available to site-generated traffic, depending upon their knowledge of the roadway system and location of the soccer fields in relation to the parking areas. The above entries in the blue rows indicate the overall distribution of site-generated trips, while the non-highlighted rows are a breakdown of the travel paths drivers may take when entering and exiting the facility. Figure 5 shows the localized, non-highlighted traffic percentages and how site traffic is estimated to approach and depart the site. From the percentages shown in Figure 5, it is estimated that 48% of site traffic will enter and exit the north site driveway off of McDowell Mountain Ranch Road (Driveway D1) while 52% will use the south site driveway off of the Aquatic Center/Park access road (Driveway D2).

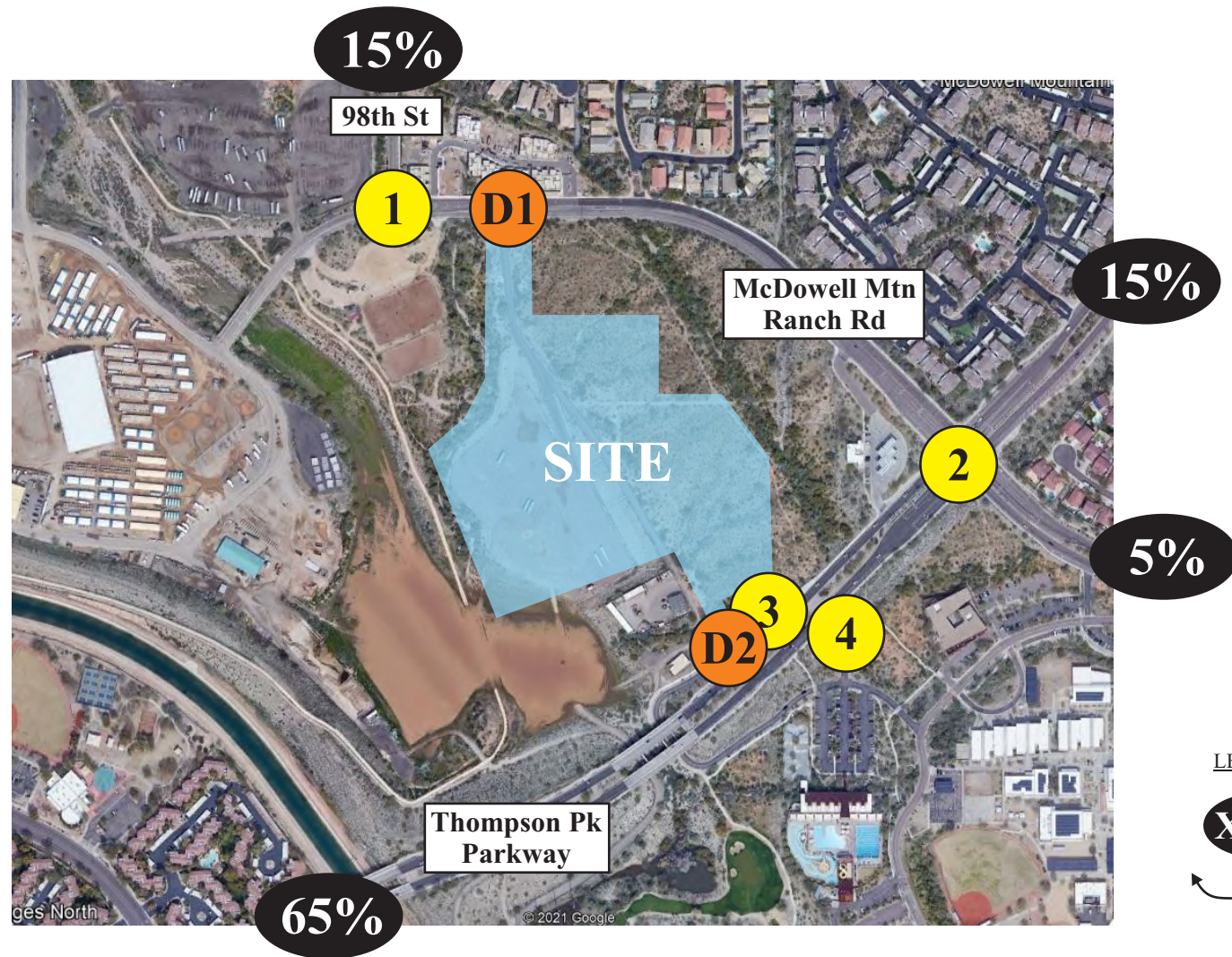
Utilizing the trip generation values in Table 4 and the distribution percentages in Figure 5, the hourly site-generated traffic volumes at each study intersection can be calculated for each time period. The site-generated peak-hour traffic assignment for Saturday and Sunday (top half) and for Tuesday morning and Tuesday evening (bottom half) is presented in Figure 6. When looking at the higher Saturday peak-hour condition, 54 vehicles are estimated to enter and 49 vehicles are estimated to exit the northern D1 driveway while 59 vehicles and 64 vehicles are to enter/exit the southern D2 driveway, respectively. Based on these values, it is estimated that an average of about 1 vehicle per

minute will enter and exit each site driveway during the busiest hour of the athletic fields. (Traffic flows will likely have sharper peaks just prior to and following conclusion of particular athletic events at the site.)

### *5.2.3 Total Traffic Volume*

Due to the site's location and limited nearby area for substantial development activity (no identified planned or programmed major development projects), it can be expected that the existing traffic volumes captured for this project will be similar to roadway conditions in the near future when excluding site traffic.

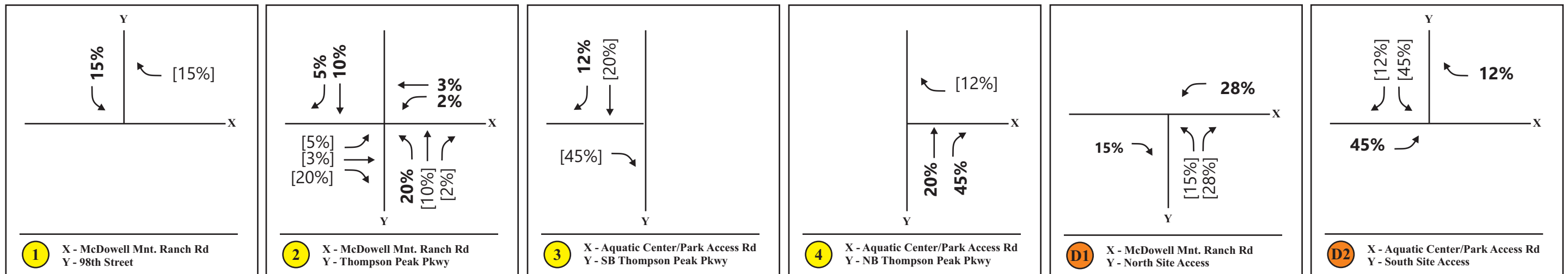
To estimate total traffic volume conditions on the study area roadway network at build-out of the athletic fields, the traffic volumes shown in Figure 3 were added to the site-generated traffic volumes shown in Figure 6. The resulting traffic volumes, presented in Figure 7, are considered the total peak-hour volumes for this study for both weekday and weekend conditions.



**LEGEND**

**XX%** Local Site Distribution Percentage

**XX%** Movement Distribution Percentage  
Inbound / [Outbound]

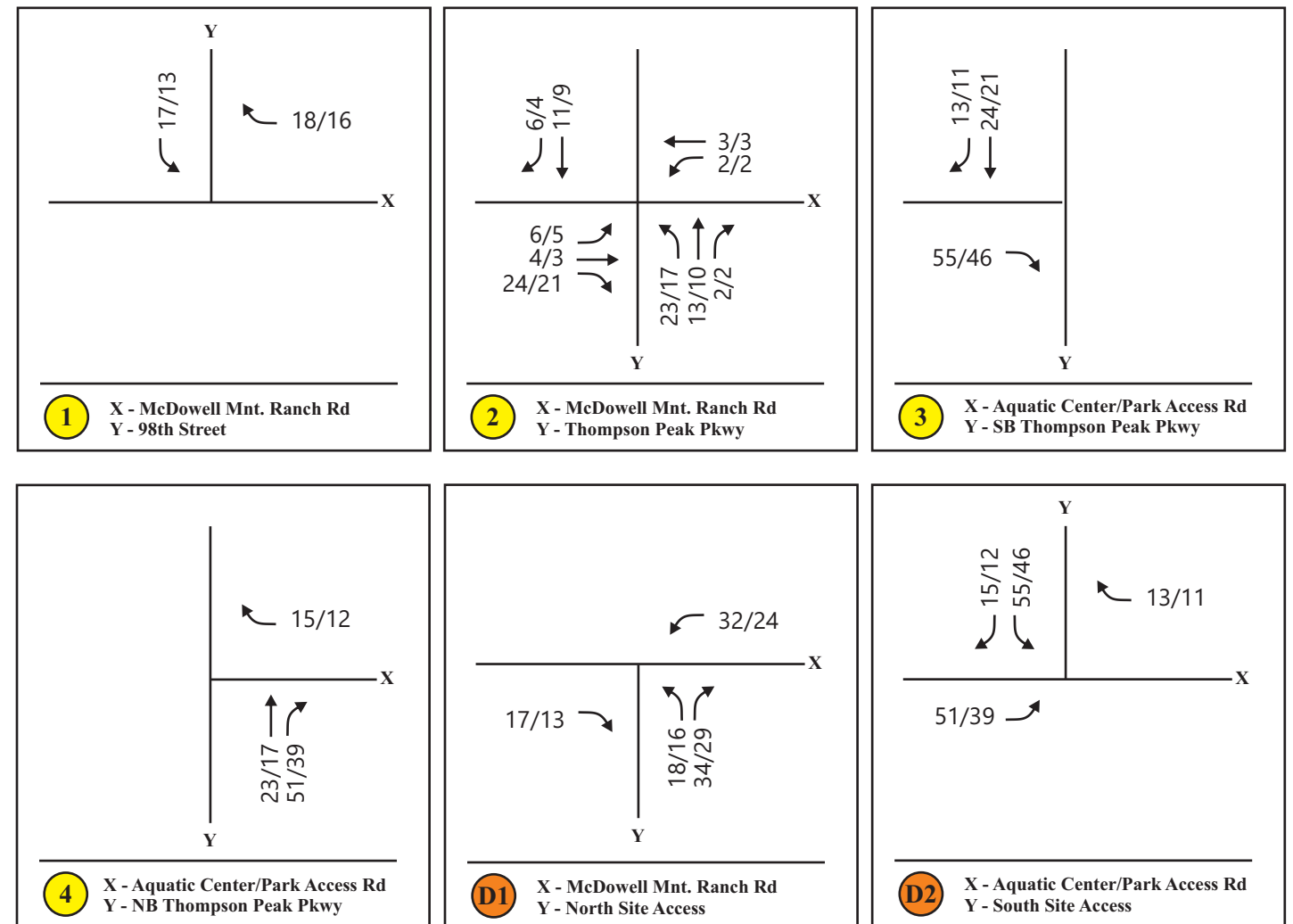


Not to scale



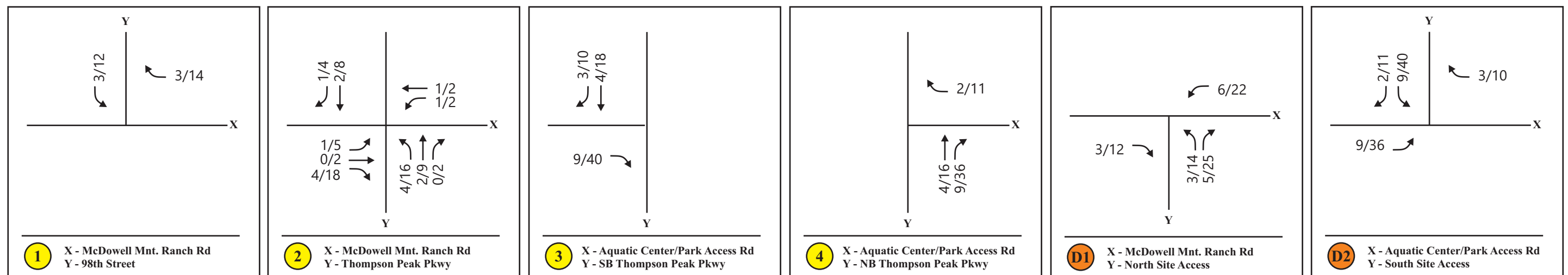
**LEGEND**

XX/XX  
 Peak-Hour Trip Assignment  
 Saturday / Sunday or  
 Weekday AM / PM



**Saturday / Sunday**

**Weekday AM / PM**



Not to scale

Westworld Sports Fields - Traffic Analysis

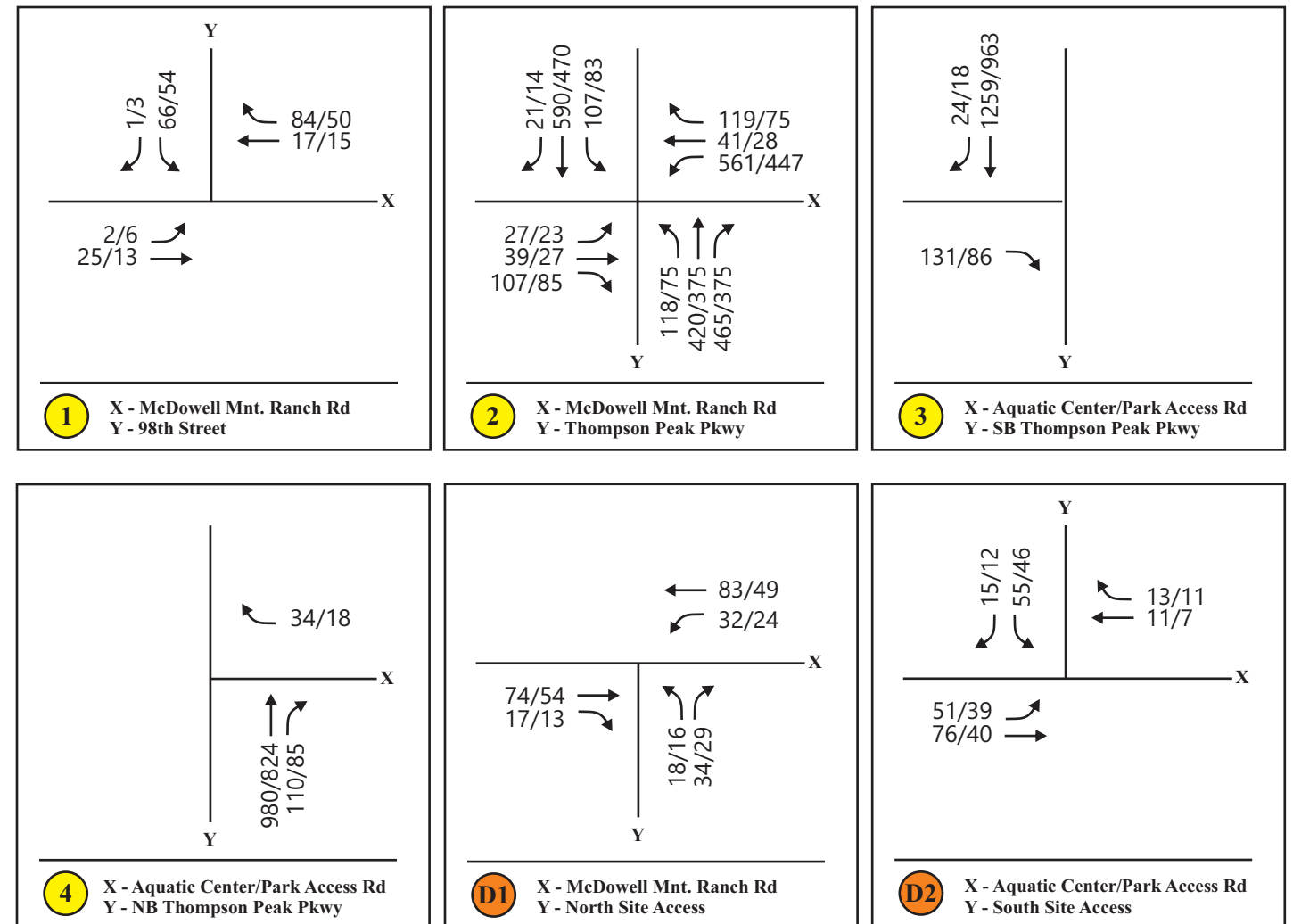


**Trip Assignment**

**Figure 6**

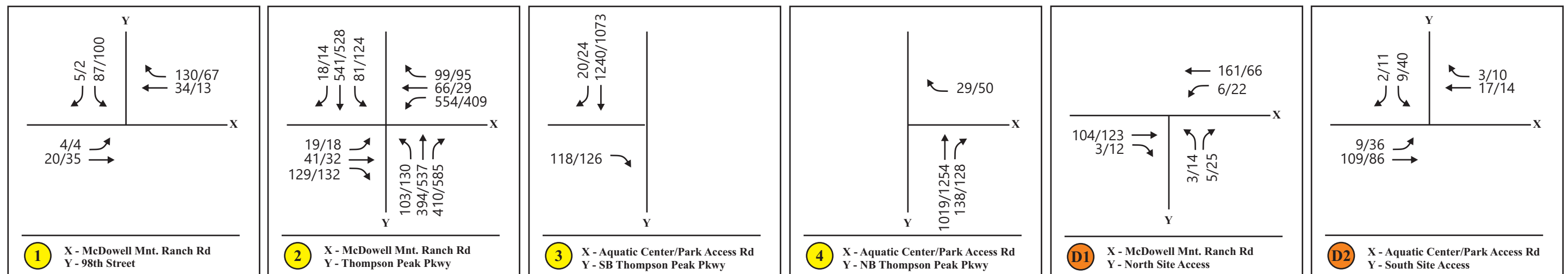


**LEGEND**  
 XX/XX Saturday / Sunday or  
 Weekday AM / PM



**Saturday / Sunday**

**Weekday AM / PM**



Not to scale

Westworld Sports Fields - Traffic Analysis



**Total Peak-Hour Traffic Volumes with Site Traffic**

**Figure 7**

### 5.3 Traffic Operations

The traffic operational characteristics of the study area intersections were evaluated using Synchro software, version 11, which implements the methodologies of the *Highway Capacity Manual* (HCM), 6th edition. The analysis is based on the volumes presented above, along with existing and proposed lane configuration data.

To provide an indication of intersection performance, intersections are typically reported in terms of Levels of Service (LOS). Signalized intersections are based on approach control delay, which includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay for all movements. Unsignalized two-way-stop-controlled (TWSC) intersection analysis is based on the minor street approach or critical movement, whichever is applicable. The capacity criteria for signalized and unsignalized intersection analysis are presented in Table 6.

**Table 6. Level of Service Criteria for Unsignalized Intersections**

Level of Service LOS	Average Control Delay (seconds/vehicle)	
	Signalized	Unsignalized & Roundabouts
A	≤10.0	≤10.0
B	>10.0 and ≤20.0	>10.0 and ≤15.0
C	>20.0 and ≤35.0	>15.0 and ≤25.0
D	>35.0 and ≤55.0	>25.0 and ≤35.0
E	>55.0 and ≤80.0	>35.0 and ≤50.0
F	>80.0	>50.0

Source: *Highway Capacity Manual, HCM 6<sup>th</sup> Edition*, Transportation Research Board, 2016.

Additional performance measures such as volume to capacity (v/c) ratios and queue lengths also provide an indication of operation. The HCM offers the following in Chapter 19:

“For a typical major street with two lanes in each direction and an average traffic volume in the range of 15,000 to 20,000 vehicles/day (roughly equivalent to a peak hour flow rate of 1,500 to 2,000 vehicles/hour), the delay equation will predict greater than 50s of delay (LOS F) for many urban two-way-stop-controlled (TWSC) intersections that allow minor-street left-turn movements. LOS F will be predicted regardless of the volume of minor-street left-turning traffic. Even with a LOS F estimate, most low-volume minor-street approaches would not meet any of the volume or delay warrants for signalization noted in the *Manual on Uniform Traffic Control Devices*. As a result, analysts who use the HCM LOS thresholds as the sole measure to determine the design accuracy of TWSC intersections should do so with caution. In evaluating the overall performance of TWSC intersections, it is important to consider measures of effectiveness such as volume-to-capacity ratios for individual movements, average queue lengths, and 95<sup>th</sup> percentile queue lengths in addition to considering delay. By focusing on a single measure of effectiveness for the worst movement only, such as delay for the minor-street left-turn, users may make less effective traffic control decisions.”

Considering the above guidance, for the purposes of this study, TWSC movements operating at LOS E or F with v/c ratios under 0.80 and acceptable queue lengths will be considered as operating at an acceptable level when the side street traffic volumes do not warrant a traffic signal.

The four study area intersections and two new site access locations were evaluated for both existing and total traffic volume conditions for all 4 peak-hour scenarios. The signal timing data utilized at the intersection of Thompson Peak Parkway and McDowell Mountain Ranch Road was obtained from the City's Engineering Department. Coordination data was provided by the City for weekday conditions, but it was not identified if weekend conditions utilize a coordination pattern. For analysis purposes, the weekday midday timing plan was assumed for both Saturday and Sunday conditions. Other software input parameters utilized default values. No signal modifications were assumed between existing and total conditions. Output results for all analysis conditions can be found in Appendix D.

Table 7 shows a summary of the intersection operations for the existing and total traffic conditions. The 4 time periods on the right side of the table document existing conditions, while the left side of the table shows the results under the estimated total traffic condition. Any result in the total traffic section that shows a degradation of LOS condition and estimated to operate at LOS F is highlighted in red (none identified). Volume to capacity ratios are shown for movements operating at LOS E or F.

From review of Table 7, all minor-street STOP controlled movements operate at LOS C or better conditions during all time periods under existing peak-hour traffic conditions. Under the total traffic conditions, all STOP-controlled intersections, including the new athletic field site driveways, continue to operate at a LOS C or better. In addition to the very good level-of-service conditions, the 95<sup>th</sup> percentile queue lengths are shown to be very low, less than two vehicles (50 feet) in all scenarios evaluated.

At the lone signalized intersection in the study area, the overall intersection is estimated to operate at LOS C during all time periods. With the estimated site traffic, the overall average vehicle delay will only increase by a maximum 0.4 seconds per vehicle during peak-hour conditions (Sunday). Although some individual movements are shown to operate at LOS E, the majority of their volume to capacity ratios are below 0.80, indicating existing movement capacity is available. In these cases, the high delays can be associated more with longer cycle lengths than a lack of capacity. Only one movement shows a v/c ratio near 0.90, the westbound McDowell Mountain Ranch Road left-turn movement on Saturday. In this instance, peak-hour volumes are over 561 vehicles (the athletic fields adding only 2 vehicles to the movement). The City may wish to consider shifting 1 or 2 seconds to this movement from the N/S through movement, if the signal is operating under the assumed 108 second midday coordination pattern. In this condition, the 95<sup>th</sup> percentile queue length is identified to be 314 feet, near the maximum storage area available to the movement. Based on overall conditions, no physical capacity modifications are recommended for this location. The City could consider minor timing changes to Saturday operations, if warranted.

**Table 7. Level of Service Summary, Existing and Total Traffic Conditions**

Intersection	Existing Conditions without Athletic Fields								Future Conditions with Athletic Fields																															
	Saturday Peak				Sunday Peak				Weekday AM Peak				Weekday PM Peak				Saturday Peak				Sunday Peak				Weekday AM Peak				Weekday PM Peak											
	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue	LOS	Delay	V/C	Queue								
<b>Int 1. MMRR and 98th St (MSS)</b>																																								
EB Left	A	7.4	--	<50	A	7.3	--	<50	A	7.6	--	<50	A	7.4	--	<50	A	7.4	--	<50	A	7.4	--	<50	A	7.4	--	<50	A	7.4	--	<50	A	7.4	--	<50	A	7.4	--	<50
SB Left/Right	A	9.1	--	<50	A	9.2	--	<50	A	9.6	--	<50	A	9.6	--	<50	A	9.4	--	<50	A	9.3	--	<50	A	9.6	--	<50	A	9.7	--	<50	A	9.7	--	<50	A	9.7	--	<50
<b>Int 2. MMRR and TPP (S)</b>																																								
	C	28.2			C	25.3			C	28.5			C	24.5			C	28.4			C	25.7			C	28.1			C	24.5			C	24.5			C	24.5		
EB Left	D	51.1	--	<50	D	50.9	--	<50	E	57.3	0.14	<50	E	56.5	0.10	<50	D	51.8	--	<50	D	51.4	--	<50	E	57.4	0.14	<50	E	57.3	0.14	<50	E	57.3	0.14	<50	E	57.3	0.14	<50
EB Thru	D	49.6	--	<50	D	48.8	--	<50	D	54.8	--	<50	E	55.7	0.16	<50	D	49.8	--	<50	D	49.0	--	<50	E	56.4	0.22	<50	E	55.8	0.17	<50	E	55.8	0.17	<50	E	55.8	0.17	<50
EB Right	A	7.2	--	<50	A	4.7	--	<50	B	15.7	--	79	B	11.9	--	54	B	10.6	--	56	A	6.8	--	<50	B	18.0	--	84	B	11.7	--	58	B	11.7	--	58	B	11.7	--	58
WB Left	E	59.3	0.89	311	D	54.1	--	220	D	53.5	--	275	D	35.1	--	198	E	59.6	0.90	314	D	54.1	--	221	D	53.5	--	276	E	55.8	0.76	215	E	55.8	0.76	215	E	55.8	0.76	215
WB Thru	C	34.2	--	<50	C	33.1	--	<50	C	32.5	--	<50	C	30.5	--	<50	C	34.3	--	<50	C	34.7	--	<50	C	33.6	--	<50	D	38.4	--	<50	D	38.4	--	<50	D	38.4	--	<50
WB Right	A	3.8	--	<50	A	0.9	--	<50	A	4.0	--	<50	A	3.4	--	<50	A	3.8	--	<50	A	1.0	--	<50	A	4.2	--	<50	A	4.5	--	<50	A	4.5	--	<50	A	4.5	--	<50
NB Left	D	37.9	--	55	D	37.5	--	<50	E	59.3	0.44	72	E	70.6	0.64	82	D	38.3	--	66	D	37.6	--	<50	E	59.7	0.46	73	E	75.3	0.71	107	E	75.3	0.71	107	E	75.3	0.71	107
NB Thru	B	16.6	--	133	B	15.3	--	119	C	20.9	--	154	C	29.0	--	223	B	16.7	--	136	B	15.4	--	122	B	19.4	--	153	B	18.9	--	204	B	18.9	--	204				
NB Right	A	0.7	--	<50	A	0.7	--	<50	A	0.7	--	<50	A	1.1	--	<50	A	0.7	--	<50	A	0.7	--	<50	A	0.6	--	<50	A	1.2	--	<50	A	1.2	--	<50				
SB Left	E	59.0	0.54	70	E	55.7	0.44	57	E	63.4	0.47	62	D	54.5	--	84	E	59.0	0.54	70	E	55.7	0.44	57	E	63.4	0.47	62	D	54.4	--	84	D	54.4	--	84				
SB Thru	C	27.4	--	240	C	23.1	--	188	C	23.6	--	222	C	25.0	--	203	C	27.5	--	245	C	24.6	--	192	C	21.9	--	221	B	15.9	--	185	B	15.9	--	185				
SB Right	A	0.1	--	<50	A	0.0	--	<50	A	0.1	--	<50	A	0.0	--	<50	A	0.0	--	<50	A	0.1	--	<50	A	0.1	--	<50	A	0.0	--	<50	A	0.0	--	<50				
<b>Int 3. SB TPP and AC/P (MSS)</b>																																								
EB Right	C	16.4	--	<50	B	12.8	--	<50	C	17.8	--	<50	B	14.8	--	<50	C	19.4	--	<50	B	13.9	--	<50	C	18.3	--	<50	C	16.2	--	<50	C	16.2	--	<50				
<b>Int 4. NB TPP and AC/P (MSS)</b>																																								
WB Right	B	12.9	--	<50	B	11.7	--	<50	B	14.0	--	<50	C	16.0	--	<50	B	13.7	--	<50	B	12.2	--	<50	B	14.1	--	<50	C	17.0	--	<50								
<b>Int D1. MMRR and North Site Driveway (MSS)</b>																																								
WB Left																	A	7.5	--	<50	A	7.4	--	<50	A	7.5	--	<50	A	7.6	--	<50	A	7.6	--	<50				
NB Left																	A	9.9	--	<50	A	9.6	--	<50	A	9.8	--	<50	B	10.0	--	<50	B	10.0	--	<50				
NB Right																	A	8.7	--	<50	A	8.6	--	<50	A	8.6	--	<50	A	8.8	--	<50	A	8.8	--	<50				
<b>Int D2. AC/P and South Site Driveway (MSS)</b>																																								
EB Left																	B	10.2	--	<50	A	9.6	--	<50	A	9.4	--	<50	A	9.9	--	<50	A	9.9	--	<50				
EB Right																	A	8.4	--	<50	A	8.4	--	<50	A	8.4	--	<50	A	8.4	--	<50	A	8.4	--	<50				
NB Left																	A	7.3	--	<50	A	7.3	--	<50	A	7.3	--	<50	A	7.3	--	<50	A	7.3	--	<50				

Notes:

1. MMS = Minor Street Stop Control, S = Signal Control, Delay in seconds, Queue = 95th %-ile in feet.
2. V/C shown in LOS E or F.



Although the estimated volumes and delays at the study area driveways are relatively low, recreational fields can cause sharp traffic peaking patterns, in which a high percentage of hourly traffic may arrive or depart in a relatively short period (15 minutes), as opposed to a more even distribution throughout the hour. Under these scenarios, it is likely that delays and queues may be greater than predicted by the Synchro analysis. However, the peaking characteristics are mitigated by the following:

- Because of low main-street opposing volumes, left-turning vehicles entering the site will likely complete their movements without significant delay or back-ups. Longer delays and vehicle queues will likely be associated with vehicles exiting the fields, where queues would be contained on-site and would not impact the roadway network.
- Separate left and right-turn egress lanes are proposed at each site driveway. This will minimize delays for right-turn vehicles even in the presence of left-turning queues.
- Optional travel routes are available to motorists exiting the north site access destined to the west.
- Signing could be added to help direct motorists to preferred travel routes, if needed.

At this time, it is not recommended that any mitigation measures be taken to address hypothetical vehicle queues or delays. Rather, the city may wish to monitor operations at the study area intersections after opening to confirm the operational characteristics before implementing any changes.

## **5.4 Turn Lanes**

This section evaluates the necessity and appropriateness of turn lanes for each approach at each site access point.

### *5.4.1 McDowell Mountain Road and North Site Driveway*

#### Location

The proposed north site driveway is located approximately 365 feet east of the 98<sup>th</sup> Street (centerline to centerline) and 225 feet west of the driveway into the 28-unit Graythorn condominium development. This spacing exceeds the City's minimum driveway spacing of 150 feet but is slightly short of the standard driveway spacing of 250 feet between streets or other driveways on a major collector (DS&PM Figure 5-3.35). However, due to low speed (posted speed limit of 30 mph) and low left-turn volume conditions projected into the athletic fields (maximum 37 peak-hour vehicles on Saturday and 26 peak-hour vehicles on a weekday evening) as well as into the condominium development (5 left-turn vehicles assumed considering a 50/50 split of entering vehicles, per ITE Trip Generation Manual LUC #220) the driveway spacing is adequate.

#### Eastbound Right-Turn Lane

The site plan does not currently show an eastbound right-turn lane from McDowell Mountain Ranch Road at the north site driveway. Per distribution and assignment analysis, only 17 vehicles are projected to make this right-turn during the highest 60-minute period (peak Saturday conditions). Noting this section of McDowell Mountain Ranch Road is posted 30 mph, none of the City's

warrants identified below are met; therefore, we concur that a right-turn deceleration lane at this location is not warranted.

City Right-Turn Lane Criteria (DS&PM 5-3.206):

- A. At least 5,000 vpd are expected to use the street;
- B. The 85<sup>th</sup> percentile traffic speed of the street is at least 35 mph;
- C. At least 30 vehicles will make right turns into the driveway during a 1-hour period

Westbound Left-Turn Lane

Scottsdale requires left-turn lanes at all intersections on major collectors and arterials.<sup>1</sup> A westbound left-turn lane approaching the site is provided by utilizing a portion of the existing two-way center turn lane shown on the site plan, in conformance with this requirement. Capacity analysis indicates a 95<sup>th</sup> percentile queue of less than 2 vehicles (50 feet) during all peak-hour scenarios for the left-turning vehicles entering the athletic fields. Assuming a 50-foot storage area is also needed for left-turn vehicles into the adjacent Graythorn development, the 225-foot center turn lane length separating the two access points is adequate to accommodate the estimated peak-hour queue demands. When considering the striping design between the 2 driveways, TWLTL striping will be from point-of-curvature to point-of-tangent, scaled to be 160 feet. The striping design will permit eastbound entering Graythorn residents 110 feet of turn lane (160 feet – 50 feet) to turn into the center lane and wait for an adequate gap in the westbound traffic stream to complete their desired turn movement.

*5.4.2 Aquatic Center/Park Roadway and South Site Driveway*

Location

The proposed south site driveway centerline is located approximately 200 feet south of the dedicated right-turn lane off southbound Thompson Peak Parkway on the low-volume/low-speed Aquatic Center/Park roadway. Movement of the driveway farther to the west would result in impacts to the existing golf maintenance yard and need to overcome significant grade issues. As located, the driveway is best situated to minimize on-site circulation issues. Although not an ideal spacing separation, it exceeds the standard 165-foot and minimum 125-foot driveway spacing requirement along a minor collector or lower classified roadway.

Southwest Right-Turn Lane

A proposed right-turn deceleration lane is planned for access into the site, having a 140-foot total design length. Although minimum City taper (70-foot) and storage (100-foot) lengths are not provided, entering vehicles do not have to come to a complete stop and will be travelling at reduced speeds as they turn onto the Aquatic Center drive from the dedicated turn lane off southbound Thompson Peak Parkway. Noting existing low volume conditions from southbound Thompson Peak Parkway (maximum peak-hour volume of 17 vehicles) and low projected site vehicles (maximum 8 peak-hour vehicles), no changes to the proposed turn lane are recommended.

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<sup>1</sup> Scottsdale Design Standards & Policies Manual, 2018 Update, Sec. 5-3.123 - E2, p. 308.

### Northeast Left-Turn Lane

Because the Aquatic Center/Park roadway is not classified as an arterial or major collector roadway, a dedicated left-turn lane into the site is not required, with the left-turn movement to occur from the through lane. Noting estimated left-turn volumes into the site during peak-hour conditions is a maximum of 51 vehicles and opposing through and right-turn traffic (with site) is 20 vehicles or less, motorists will not be significantly delayed when entering or passing by the site access, as indicated by the LOS A operation in Table 7 for this movement in all 4 analysis scenarios. Based on these conditions, a left-turn lane is not required for this location.

## **5.5 Sight Distance**

All site access points should be designed to accommodate sight distance recommendations in *A Policy on Geometric Design of Highways and Streets*, published by the American Association of State Highway and Transportation Officials (AASHTO). A review of the site reveals that the roadways near the proposed access points are generally on horizontal tangent alignments, with the exception of the Aquatic Center/Park roadway to the south, with little vertical profile, suggesting that roadway elements are not likely to constrain sight distance. Existing native desert vegetation may need to be adjusted to ensure adequate sight distance. Assuming a roadway design speed of 35 mph on McDowell Mountain Ranch Road for the north site access and 30/25 mph on the Aquatic Center/Park roadway for the south site driveway, the following minimum required intersection sight distance needs are identified (DS&PM, Appendix 5-3B):

- North Access Looking East (Right, for left-turn movement) – 480 feet (rounded)
- North Access Looking West (Left, for right-turn movement) – 425 feet
- South Access Looking South (Right, for left-turn movement) – 280 feet (rounded, 25 mph)
- South Access Looking North (Left, for right-turn movement) – 290 feet (rounded, 30 mph)

The recommended sight distance, when viewed via Google Earth plan view, can be provided at both site driveway locations.

## **5.6 Access Design**

Both access points, designed as a high-volume access (CH-3) with separated ingress and egress lanes, are appropriate to accommodate the potential high-demand conditions with simultaneous games ending at or near the same time. Over 150 feet of on-site vehicle queue or “throat length” is provided at each access point to minimize interference to cross-aisle traffic and vehicle maneuvering into and out of parking stalls. Both driveways are angled at near 90 degrees to the main roadway, permitting ease of maneuvering and good sight visibility conditions. No modification to the access design is recommended. However, signing that indicates RIGHT TURN YIELD TO PEDESTRIANS could be considered by the City for installation at the south access egress location.

## 5.7 Traffic Control Considerations at 98<sup>th</sup> Street and McDowell Mountain Ranch Road

The City has requested an evaluation of the traffic control at the 98<sup>th</sup> Street/McDowell Mountain Ranch Road (MMRR) intersection to potentially change conditions from minor-street STOP control to multi-way STOP control citing a number of existing and future potential concerns pertaining to pedestrians and vehicle operations.

The MUTCD in Section 2B.04 that states “*YIELD or STOP signs should not be used for speed control*”; in fact, where stop signs are perceived to be unwarranted, drivers are found to accelerate at a high rate of speed to make up for lost time created by the unnecessary stop.

The MUTCD states that multi-way stop control can be a useful safety measure if certain traffic conditions exist. Safety concerns associated with multi-way stops include pedestrians, bicyclists, and all road users expecting other road users to stop and used where the volume of traffic on the intersecting roads is approximately equal.

Guidance provided within the MUTCD states that the decision to install multi-way stop control should be based on an engineering study that considers the following:

- A. *Where traffic control signals are justified, the multi-way stop is an interim measure that can be installed quickly to control traffic while arrangements are being made for the installation of the traffic control signal.*
- B. *Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.*
- C. *Minimum volumes:*
  1. *The vehicular volume entering the intersection from the major street approaches (total of both approaches) averages at least 300 vehicles per hour for any 8 hours of an average day; and*
  2. *The combined vehicular, pedestrian, and bicycle volume entering the intersection from the minor street approaches (total of both approaches) averages at least 200 units per hour for the same 8 hours, with an average delay to minor-street vehicular traffic of at least 30 seconds per vehicle during the highest hour; but*
  3. *If the 85th-percentile approach speed of the major-street traffic exceeds 40 mph, the minimum vehicular volume warrants are 70 percent of the values provided in Items 1 and 2.*
- D. *Where no single criterion is satisfied, but where Criteria B, C.1, and C.2 are all satisfied to 80 percent of the minimum values. Criterion C.3 is excluded from this condition.*

The MUTCD also indicates other criteria may be considered in an engineering study including:

- A. The need to control left-turn conflicts;
- B. The need to control vehicle/pedestrian conflicts near locations that generate high pedestrian volumes;
- C. Locations where a road user, after stopping, cannot see conflicting traffic and is not able to negotiate the intersection unless conflicting cross traffic is also required to stop; and

- D. An intersection of two residential neighborhood collector (through) streets of similar design and operating characteristics where multi-way stop control would improve traffic operational characteristics of the intersection.

In reviewing the initial 4 engineering study criteria, the following is provided:

- A traffic signal is not being considered at this location by the City and therefore this criterion is not met.
- The crash analysis at this location has indicated zero crashes have occurred at this location in the latest available 12-month period, and therefore this criterion is not met.
- Because this study did not perform a full 24-hour count or a speed study at this location, only an estimate of conditions can be considered. Assuming the 85<sup>th</sup> percentile speed on MMRR does not exceed 40 mph, major street volumes must meet the 100% volume thresholds listed in the MUTCD. Based on the volumes captured and estimated site-generated traffic at this location, peak-hour approach volumes are estimated to be less than 200 vehicles on MMRR and slightly over 110 hourly vehicles on 98<sup>th</sup> Street. These values fall considerably short of the MUTCD thresholds of 300 vehicles per hour for 8 hours on the major street 200 vehicles per hour for 8 hours on the minor street. In addition, peak period movement delays were calculated to be below 10 seconds per vehicle during all time periods, well below the 30-second MUTCD threshold. Therefore, this criterion is not met.
- Criterion D is not met since an 80% reduction to volume, delay, and crash data will not meet warranting levels.

When considering the other criteria that may permit multi-way stop control:

- There is not an overwhelming need to control left-turn conflicts at this location.
- The need to control vehicle/pedestrian conflicts may be appropriate for this location since the new athletic fields could generate high pedestrian and bicycle users from the adjacent school and the residential community to the northeast. However, treatments other than multi-way stop control may be better equipped to address pedestrian crossing comfort, as discussed below.
- Because of low speeds and the gated roadway condition of the roadway segment to/from Westworld, conflicting left-turn traffic is not a significant concern at this location. If conflicts do exist, elimination of vegetation on the northwest corner would improve visibility.
- It is possible that the two roadways could be considered of similar design and operating characteristics, and it could be argued that multi-way stop control would improve the operating characteristics of the southbound approach and pedestrian crossings. However, it could also be argued that multi-way stop control would degrade operating characteristics of the higher-volume MMRR approaches.

The following general findings can be drawn about the potential for multi-way stop control:

- The traffic volumes collected as part of this study do not justify the installation of multi-way stop control. It is recognized that the volumes are lower than might be typical of times when schools are in session and typical traffic patterns are in place further west on MMRR that might contribute more traffic through the Westworld area. If the city's decision to install multi-way stop is based on MUTCD traffic volume thresholds, the city may wish to collect

additional traffic volume data and reevaluate the intersection during a time of year when traffic volumes are more typical.

- The intersection has a perfect crash record, so safety is not a reason to install multi-way stop control. Although multi-way stop control is generally considered among the safest forms of intersection control, any traffic control change at an intersection that has experienced zero crashes can have the effect of worsening the intersection's safety performance.
- The city could probably justify installing multi-way stop control based on MUTCD guidance that such control can be considered at two collector roadways with similar operating characteristics. If this decision were made, it could be made either independent of or in conjunction with the athletic field development.
- Advantages of multi-way stop control include the following:
  - Reduced delay for southbound traffic. However, southbound delay already amounts to less than 10 seconds per vehicle during the peak hours, which corresponds to LOS A conditions. It does not appear to be essential to implement multi-way stop control to gain this delay advantage when delay is already so low.
  - Improved pedestrian crossing of MMRR. However, multi-way stop control is not usually considered a pedestrian safety countermeasure. If pedestrian crossings are the main reason for considering a traffic control change, the city may wish to consider alternative pedestrian accommodations, such as a pedestrian hybrid beacon (PHB), which has been designated a proven safety countermeasure by the Federal Highway Administration for its ability to control pedestrian crossings. (The recent Notice of Proposed Amendments to the MUTCD proposes to remove MUTCD language limiting PHBs to non-intersection locations.)
  - Improved ability of the intersection to accommodate the westbound left-turn movement. Under existing conditions, a westbound left-turning vehicle must stop in the through lane to wait for a gap in opposing traffic, which could pose a risk of (but has not resulted in) rear-end crashes. Under multi-way stop control, a left-turn lane is not needed since all traffic on the approach must stop.
- Disadvantages of multi-way stop control include the following:
  - Increased delay, stops, and corresponding environmental measures on MMRR, the higher-volume of the two streets.
  - Uncertain handling of the eastbound right-turn movement. This movement is made from a right-turn lane separated from the eastbound through lane by a painted island and bike lane that total about 27 feet wide. Its separation from the main intersection conflict points allows the eastbound right-turn movement to operate safely and effectively uncontrolled, but it would likely need to be stop-controlled in a multi-way stop configuration. Right-turning vehicles may not perceive a need to stop, and compliance may be low, which could pose a threat to conflicting pedestrians.

In summary, multi-way stop control does not appear to be necessary or appropriate under existing conditions based on known traffic volume and safety data. The city may wish to re-evaluate a change in traffic control once site development is in place.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

The study has documented the following conclusions and recommendations:

- The proposed development consists of a set of five rectangular multi-use athletic fields near the west corner of Thompson Peak Parkway and McDowell Mountain Ranch Road. A large parking lot, proposed to contain 420 parking spaces, is proposed to have access both from McDowell Mountain Ranch Road and Thompson Peak Parkway via the Aquatic Center/Park roadway.
- Volumes obtained for this study were not adjusted for seasonality, pandemic conditions, or impacts associated with event traffic with Westworld and considered to be typical of everyday traffic conditions. Data collection results at the study area intersections show consistent total volume characteristics during weekday AM, weekday PM, and peak-hour Saturday periods (within 5% of one another), although traffic directionality may differ. Sunday peak-hour volumes are identified to be 75% of peak weekday conditions.
- Crash data showed no notable pattern of crashes adjacent to the site. No crashes were associated with the McDowell Mountain Ranch Road and 98<sup>th</sup> Street intersection while only 1 crash was located near the Aquatic Center/Park roadway intersections with both the northbound and southbound directions of Thompson Peak Parkway over the three-year period analyzed. The intersection of Thompson Peak Parkway and McDowell Mountain Ranch Road had a total of 18 reported crashes over the 3-year period (average of 6 crashes per year), none considered major or fatal crashes and only 2 coded as minor injury crashes.
- Site trip generation was forecast using two methods:
  - ITE Land Use Code #488 (Soccer Complex) is the most representative land-use code from the nationally-recognized *Trip Generation* Manual, but the manual has limited data for this land use.
  - The City of Scottsdale collected traffic data at a comparable nearby soccer complex, which showed somewhat higher levels of trip generation per field than the ITE method during most time periods evaluated. To ensure a conservative analysis, the higher Scottsdale values were used in the study.
- The selected trip generation method (Scottsdale data) estimates the site will generate the most trips on Saturday, with about 1,525 site vehicles per day and about 235 trip ends during the peak hour. Weekday trips are forecast at about 600 new trip ends per day and 170 trip ends during the higher-volume evening peak hour. A daily trip forecast is not available for Sunday, but Sunday peak-hour volume is forecast at about 190 trip ends.
- Site trip distribution assumes most trips (65 percent) will arrive and depart from the south using Thompson Peak Parkway. Traffic using 98<sup>th</sup> Street is expected to account for about 15 percent of site trips while the remaining trips are anticipated to use Thompson Peak Parkway from the north or McDowell Mountain Ranch Road from the east.

- Overall, it is estimated that 43% of vehicles will enter/exit the site using the north site driveway while the other 57% is anticipated to use the proposed south site access.
- Peak-hour analysis of the study intersections indicate overall LOS C or better conditions to occur with the site-added volumes. No capacity improvements are recommended at any study intersection, although the city may wish to consider minor timing changes to the green splits.
- At the proposed site access points, traffic volumes on the major streets are identified to be low, minimizing delays and long queues associated with left-turn entering traffic. Analysis also indicates LOS A/B operation for exiting traffic with vehicle queues of less than 2 vehicles. However, when multiple games end at or near the same time and cause a demand spike of exiting vehicles, adequate vehicle storage is provided on-site to minimize impacts associated with long queues that may occur.
- The proposed location and design of the site access points are acceptable as presented in the site layout plan. No changes to the site access points are recommended.
- At the intersection of 98<sup>th</sup> Street and McDowell Mountain Ranch Road, analysis indicates multi-way stop control does not appear to be necessary or appropriate under existing conditions based on known traffic volume and safety data. The city may wish to re-evaluate a change in traffic control once site development is in place.



## **APPENDIX A: TRAFFIC VOLUME DATA**









## Intersection Turning Movement Prepared by:



**FIELD DATA SERVICES OF ARIZONA, INC.**  
520.316.6745



**veracitytrafficgroup**

N-S STREET: **Thompson Peak Pkwy**      DATE: **04/10/21**      LOCATION: **Scottsdale**  
 E-W STREET: **McDowell Mountain Ranch**      DAY: **SATURDAY**      PROJECT# **21-1216-002**

LANES:	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			TOTAL
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
	2	2	2	2	2	1	2	2	1	2	2	1	
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM	14	111	109	29	162	3	5	3	22	126	9	24	617
10:15 AM	25	116	93	35	119	2	5	3	19	124	11	30	582
10:30 AM	22	110	92	23	151	4	9	6	24	134	11	17	603
10:45 AM	28	99	110	26	124	2	5	7	25	132	6	30	594
11:00 AM	31	124	123	30	137	5	4	7	11	152	14	38	676
11:15 AM	18	85	110	21	141	4	3	12	32	141	7	25	599
11:30 AM	20	99	115	26	158	3	8	10	25	150	8	21	643
11:45 AM	26	99	115	30	143	3	6	6	15	116	9	35	603
12:00 PM	17	110	112	35	144	4	7	19	14	131	7	16	616
12:15 PM	25	83	140	28	115	5	4	8	24	133	10	24	599
12:30 PM	20	94	113	21	123	3	3	7	26	120	4	25	559
12:45 PM	30	132	130	34	107	6	3	9	19	129	2	33	634
1:00 PM	19	123	113	28	128	2	4	13	30	119	8	26	613
1:15 PM	25	111	110	29	102	1	4	7	29	114	8	20	560
1:30 PM	28	130	150	22	122	6	2	8	20	111	9	22	630
1:45 PM	27	97	91	30	102	4	3	4	20	120	6	15	519
2:00 PM	30	106	136	24	108	4	2	10	18	96	16	19	569
2:15 PM	24	94	102	25	103	6	3	11	19	106	15	13	521
2:30 PM	26	90	116	25	114	1	4	8	20	87	2	15	508
2:45 PM	26	85	129	19	106	5	2	12	21	107	2	20	534

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	481	2098	2309	540	2509	73	86	170	433	2448	164	468	11779
Approach %	9.84	42.92	47.24	17.30	80.37	2.34	12.48	24.67	62.84	79.48	5.32	15.19	
App/Depart	4888	/	2652	3122	/	5390	689	/	3019	3080	/	718	

AM Peak Hr Begins at: 1100 AM

**PEAK**

Volumes	95	407	463	107	579	15	21	35	83	559	38	119	2521
Approach %	9.84	42.18	47.98	15.26	82.60	2.14	15.11	25.18	59.71	78.07	5.31	16.62	

**PEAK HR.**

FACTOR:	0.868	0.937	0.739	0.877	0.932
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CONTROL: **Signal**

COMMENT 1:

GPS: **33.629211, -111.863290**

## Intersection Turning Movement Prepared by:



**FIELD DATA SERVICES OF ARIZONA, INC.**  
520.316.6745



**veracitytrafficgroup**

N-S STREET: **Thompson Peak Pkwy**      DATE: **04/11/21**      LOCATION: **Scottsdale**  
 E-W STREET: **McDowell Mountain Ranch**      DAY: **SUNDAY**      PROJECT# **21-1216-003**

LANES:	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			TOTAL
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
	2	2	2	2	2	1	2	2	1	2	2	1	
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM	22	84	78	13	99	3	5	6	16	104	3	17	450
10:15 AM	15	82	89	10	87	6	4	9	11	108	4	23	448
10:30 AM	13	88	88	18	133	4	4	9	19	109	5	19	509
10:45 AM	12	98	97	20	99	3	4	9	17	114	12	25	510
11:00 AM	15	82	95	15	116	0	7	4	16	111	4	20	485
11:15 AM	18	97	93	30	113	3	3	2	12	111	4	11	497
11:30 AM	15	83	105	19	92	1	7	7	13	104	4	20	470
11:45 AM	12	76	107	17	116	2	1	7	21	121	8	18	506
12:00 PM	10	74	103	16	91	8	6	5	15	103	5	21	457
12:15 PM	21	84	115	20	111	4	6	5	14	105	1	15	501
12:30 PM	23	99	101	17	122	5	6	4	19	83	5	15	499
12:45 PM	19	103	102	19	97	2	3	5	14	99	8	18	489
1:00 PM	15	118	107	13	89	4	0	8	15	109	6	20	504
1:15 PM	21	105	117	21	94	4	4	3	15	90	9	13	496
1:30 PM	27	91	81	21	96	6	7	6	28	89	6	15	473
1:45 PM	20	100	109	23	84	4	5	5	14	96	1	17	478
2:00 PM	14	86	103	16	99	3	4	5	23	95	4	17	469
2:15 PM	15	83	83	16	104	5	6	6	15	90	4	21	448
2:30 PM	16	76	97	16	119	2	2	8	13	92	3	16	460
2:45 PM	19	73	106	18	81	0	1	6	24	67	2	15	412

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	342	1782	1976	358	2042	69	85	119	334	2000	98	356	9561
Approach %	8.34	43.46	48.20	14.50	82.71	2.79	15.80	22.12	62.08	81.50	3.99	14.51	
App/Depart	4100	/	2223	2469	/	4376	538	/	2453	2454	/	509	

AM Peak Hr Begins at: 1030 AM

**PEAK**

Volumes	58	365	373	83	461	10	18	24	64	445	25	75	2001
Approach %	7.29	45.85	46.86	14.98	83.21	1.81	16.98	22.64	60.38	81.65	4.59	13.76	

**PEAK HR.**

FACTOR:	0.957	0.894	0.828	0.902	0.981
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CONTROL: **Signal**  
 COMMENT 1:  
 GPS: **33.629211, -111.863290**

## Intersection Turning Movement Prepared by:



**FIELD DATA SERVICES OF ARIZONA, INC.**  
520.316.6745



N-S STREET: **Thompson Peak Pkwy**      DATE: **04/13/21**      LOCATION: **Scottsdale**  
 E-W STREET: **McDowell Mountain Ranch**      DAY: **TUESDAY**      PROJECT# **21-1216-001**

LANES:	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			TOTAL
	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	
	2	2	2	2	2	1	2	2	1	2	2	1	
6:00 AM													
6:15 AM													
6:30 AM													
6:45 AM													
7:00 AM	22	45	53	18	105	1	2	5	21	168	7	20	467
7:15 AM	34	75	81	15	160	2	2	10	30	148	25	16	598
7:30 AM	37	136	130	25	127	3	5	15	36	170	25	34	743
7:45 AM	18	114	122	23	142	5	6	10	34	114	11	26	625
8:00 AM	10	67	77	18	110	7	5	6	25	121	4	23	473
8:15 AM	12	93	127	36	120	6	4	10	24	117	6	25	580
8:30 AM	18	95	119	43	117	4	1	14	26	171	15	38	661
8:45 AM	16	87	128	44	112	4	2	11	25	163	14	28	634
9:00 AM													
9:15 AM													
9:30 AM													
9:45 AM													
10:00 AM													
10:15 AM													
10:30 AM													
10:45 AM													
11:00 AM													
11:15 AM													
11:30 AM													
11:45 AM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	167	712	837	222	993	32	27	81	221	1172	107	210	4781
Approach %	9.73	41.49	48.78	17.80	79.63	2.57	8.21	24.62	67.17	78.71	7.19	14.10	
App/Depart	1716	/	949	1247	/	2386	329	/	1140	1489	/	306	

AM Peak Hr Begins at: 715 AM

**PEAK**

Volumes	99	392	410	81	539	17	18	41	125	553	65	99	2439
Approach %	10.99	43.51	45.50	12.72	84.62	2.67	9.78	22.28	67.93	77.13	9.07	13.81	

**PEAK HR.**

FACTOR:	0.743	0.900	0.821	0.783	0.821
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CONTROL: **Signal**  
 COMMENT 1:  
 GPS: **33.629211, -111.863290**



# Intersection Turning Movement



**FIELD DATA SERVICES OF ARIZONA, INC.**  
520.316.6745



N-S STREET: Thompson Peak Pkwy  
0      DATE: 04/13/21      LOCATION: Scottsdale  
 E-W STREET: McDowell Mountain Ranch      DAY: TUESDAY      PROJECT# 21-1216-001

	NORTHBOUND			SOUTHBOUND			EASTBOUND			WESTBOUND			
LANES:	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
	2	2	2	2	2	1	2	2	1	2	2	1	

1:00 PM													
1:15 PM													
1:30 PM													
1:45 PM													
2:00 PM													
2:15 PM													
2:30 PM													
2:45 PM													
3:00 PM													
3:15 PM													
3:30 PM													
3:45 PM													
4:00 PM	25	130	131	28	136	5	3	9	15	110	8	27	627
4:15 PM	24	124	130	27	120	1	9	9	18	95	6	32	595
4:30 PM	19	133	116	28	151	3	4	11	21	120	6	20	632
4:45 PM	29	123	135	37	127	0	1	4	32	97	3	31	619
5:00 PM	28	143	144	27	130	4	6	6	33	112	10	27	670
5:15 PM	31	126	141	36	123	3	2	10	20	85	4	16	597
5:30 PM	26	135	163	24	140	3	4	10	29	113	10	21	678
5:45 PM	26	128	124	24	115	3	3	4	18	75	4	24	548
6:00 PM													
6:15 PM													
6:30 PM													
6:45 PM													

TOTAL	NL	NT	NR	SL	ST	SR	EL	ET	ER	WL	WT	WR	TOTAL
Volumes	208	1042	1084	231	1042	22	32	63	186	807	51	198	4966
Approach %	8.91	44.64	46.44	17.84	80.46	1.70	11.39	22.42	66.19	76.42	4.83	18.75	
App/Depart	2334	/	1272	1295	/	2035	281	/	1378	1056	/	281	

PM Peak Hr Begins at: 445 PM

**PEAK**

Volumes	114	527	583	124	520	10	13	30	114	407	27	95	2564
Approach %	9.31	43.06	47.63	18.96	79.51	1.53	8.28	19.11	72.61	76.94	5.10	17.96	

**PEAK HR.**

FACTOR:	0.944	0.979	0.872	0.888	0.945
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CONTROL: Signal  
 COMMENT 1: 0  
 GPS: 33.629211, -111.863290



Lee Engineering, LLC.  
 Phoenix, Arizona - Dallas, Texas  
 Oklahoma City, Oklahoma - San Antonio, Texas  
 Albuquerque, New Mexico, United States  
 pguzek@lee-eng.com

Count Name: Westworld  
 Site Code: 2 Sa  
 Start Date: 04/10/2021  
 Page No.: 1

### Turning Movement Data

Start Time	Southbound Approach			Access Road Westbound			Thompson Peak Parkway Northbound			Int. Total
	Left	Thru	App. Total	Left	Right	App. Total	Thru	Right	App. Total	
10:00 AM	0	0	0	0	3	3	229	21	250	253
10:15 AM	0	0	0	0	5	5	232	14	246	251
10:30 AM	0	0	0	0	4	4	216	12	228	232
10:45 AM	0	0	0	0	6	6	228	15	243	249
11:00 AM	0	0	0	0	10	10	263	22	285	295
11:15 AM	0	0	0	0	2	2	216	8	224	226
11:30 AM	0	0	0	0	4	4	239	12	251	255
11:45 AM	0	0	0	0	3	3	239	17	256	259
12:00 PM	0	0	0	0	9	9	221	28	249	258
12:15 PM	0	0	0	0	7	7	233	16	249	256
12:30 PM	0	0	0	0	10	10	223	13	236	246
12:45 PM	0	0	0	0	2	2	271	21	292	294
1:00 PM	0	0	0	0	3	3	259	19	278	281
1:15 PM	0	0	0	0	1	1	251	8	259	260
1:30 PM	0	0	0	0	5	5	298	9	307	312
1:45 PM	0	0	0	0	6	6	213	8	221	227
2:00 PM	0	0	0	0	9	9	258	11	269	278
2:15 PM	0	0	0	0	5	5	221	8	229	234
2:30 PM	0	0	0	0	0	0	228	4	232	232
2:45 PM	0	0	0	0	11	11	231	9	240	251
3:00 PM	0	0	0	0	0	0	0	0	0	0
<b>Grand Total</b>	0	0	0	0	105	105	4769	275	5044	5149
<b>Approach %</b>	0.0	0.0	-	0.0	100.0	-	94.5	5.5	-	-
<b>Total %</b>	0.0	0.0	0.0	0.0	2.0	2.0	92.6	5.3	98.0	-
<b>All Vehicles (no classification)</b>	0	0	0	0	105	105	4769	275	5044	5149
<b>% All Vehicles (no classification)</b>	-	-	-	-	100.0	100.0	100.0	100.0	100.0	100.0





Lee Engineering, LLC.  
 Phoenix, Arizona - Dallas, Texas  
 Oklahoma City, Oklahoma - San Antonio, Texas  
 Albuquerque, New Mexico, United States  
 pguzek@lee-eng.com

Count Name: Westworld  
 Site Code: 2\_Tu  
 Start Date: 04/13/2021  
 Page No.: 1

### Turning Movement Data

Start Time	Southbound Approach		Access Road Westbound		Thompson Peak Parkway Northbound		Int. Total
	Left	App. Total	Right	App. Total	Thru	Right	
7:00 AM	0	0	1	1	123	17	141
7:15 AM	0	0	6	6	200	48	248
7:30 AM	0	0	17	17	275	59	334
7:45 AM	0	0	3	3	248	12	260
8:00 AM	0	0	1	1	163	10	173
8:15 AM	0	0	4	4	221	21	242
8:30 AM	0	0	11	11	227	17	244
8:45 AM	0	0	2	2	176	10	186
*** BREAK ***	-	-	-	-	-	-	-
4:00 PM	0	0	6	6	277	17	294
4:15 PM	0	0	6	6	278	12	290
4:30 PM	0	0	5	5	242	26	268
4:45 PM	0	0	7	7	296	28	324
5:00 PM	0	0	19	19	275	26	301
5:15 PM	0	0	6	6	271	21	292
5:30 PM	0	0	7	7	304	17	321
5:45 PM	0	0	3	3	258	32	290
6:00 PM	0	0	0	0	0	0	0
Grand Total	0	0	104	104	3834	373	4207
Approach %	0.0	-	100.0	-	91.1	8.9	-
Total %	0.0	0.0	2.4	2.4	88.9	8.7	97.6
All Vehicles (no classification)	0	0	104	104	3834	373	4207
% All Vehicles (no classification)	-	-	100.0	100.0	100.0	100.0	100.0



Lee Engineering, LLC.  
 Phoenix, Arizona - Dallas, Texas  
 Oklahoma City, Oklahoma - San Antonio, Texas  
 Albuquerque, New Mexico, United States  
 pguzek@lee-eng.com

Count Name: Westworld  
 Site Code: 3 Sa  
 Start Date: 04/10/2021  
 Page No.: 1

### Turning Movement Data

Start Time	Thompson Peak Parkway Southbound		Access Rd Eastbound		Int. Total
	Thru	Right	Right	App. Total	
10:00 AM	297	1	10	10	308
10:15 AM	251	0	8	8	259
10:30 AM	292	1	7	7	300
10:45 AM	275	4	19	19	298
11:00 AM	298	3	34	34	335
11:15 AM	334	1	13	13	348
11:30 AM	328	3	10	10	341
11:45 AM	281	5	5	5	291
12:00 PM	279	3	11	11	293
12:15 PM	283	2	19	19	304
12:30 PM	274	9	18	18	301
12:45 PM	265	0	5	5	270
1:00 PM	276	0	9	9	285
1:15 PM	252	4	11	11	267
1:30 PM	245	2	5	5	252
1:45 PM	258	0	15	15	273
2:00 PM	228	0	26	26	254
2:15 PM	238	2	11	11	251
2:30 PM	207	4	5	5	216
2:45 PM	243	0	7	7	250
3:00 PM	0	0	0	0	0
<b>Grand Total</b>	<b>5404</b>	<b>44</b>	<b>248</b>	<b>248</b>	<b>5696</b>
Approach %	99.2	0.8	100.0	-	-
Total %	94.9	0.8	4.4	4.4	-
All Vehicles (no classification)	5404	44	248	248	5696
% All Vehicles (no classification)	100.0	100.0	100.0	100.0	100.0



Lee Engineering, LLC.  
 Phoenix, Arizona - Dallas, Texas  
 Oklahoma City, Oklahoma - San Antonio, Texas  
 Albuquerque, New Mexico, United States  
 pguzek@lee-eng.com

Count Name: Westworld  
 Site Code: 3 SU  
 Start Date: 04/11/2021  
 Page No.: 1

### Turning Movement Data

Start Time	SB Thompson Peak Parkway Southbound		Access Road Eastbound		Int. Total
	Thru	Right	Right	App. Total	
10:00 AM	216	2	5	5	223
10:15 AM	213	1	8	8	222
10:30 AM	255	2	1	1	258
10:45 AM	246	0	0	0	246
11:00 AM	230	0	2	2	232
11:15 AM	240	3	4	4	247
11:30 AM	211	1	10	10	222
11:45 AM	261	3	24	24	288
12:00 PM	218	0	3	3	221
12:15 PM	235	0	8	8	243
12:30 PM	231	1	2	2	234
12:45 PM	210	0	7	7	217
1:00 PM	216	0	4	4	220
1:15 PM	201	0	3	3	204
1:30 PM	202	1	6	6	209
1:45 PM	198	4	12	12	214
2:00 PM	219	0	8	8	227
2:15 PM	201	4	5	5	210
2:30 PM	217	2	5	5	224
2:45 PM	173	0	12	12	185
<b>Grand Total</b>	<b>4393</b>	<b>24</b>	<b>129</b>	<b>129</b>	<b>4546</b>
Approach %	99.5	0.5	100.0	-	-
Total %	96.6	0.5	2.8	2.8	-
All Vehicles (no classification)	4393	24	129	129	4546
% All Vehicles (no classification)	100.0	100.0	100.0	100.0	100.0



## **APPENDIX B: CRASH DATA**



Crash Summary Westworld Sports Fields, 2017 thru 2019

IncidentID	IncidentDateTime	IncidentYear	CollisionManner	LightCondition	TotalUnits	TotalMotorists	TotalNonMotorists	InjurySeverity	Onroad	CrossingFeature	Offset	Latitude	Longitude
Thompson Peak Parkway and McDowell Mountain Ranch Road													
3214046	4/4/2017 14:12	2017	6	1	2	2	0	1	Mcdowell Mountain Ra Rd	07 THOMPSON PEAK PKWY	-0.005	33.6291591	-111.86325
3290763	10/24/2017 20:29	2017	2	4	2	2	0	1	Mcdowell Mountain Ra Rd	07 THOMPSON PEAK PKWY	0	33.6292069	-111.86331
3296739	11/1/2017 12:50	2017	2	1	2	4	0	1	Mcdowell Mountain Ra Rd	07 THOMPSON PEAK PKWY	0.0009	33.6292166	-111.86332
3246375	6/20/2017 12:25	2017	4	1	2	2	0	2	Thompson Peak Pkwy	07 MCDOWELL MOUNTAIN RARD	-0.008	33.6291288	-111.8634
3188568	1/21/2017 16:20	2017	4	1	2	2	0	2	Mcdowell Mountain Ra Rd	07 THOMPSON PEAK PKWY	-0.015	33.6293625	-111.8635
3270188	8/15/2017 7:13	2017	6	1	2	2	0	1	Thompson Peak Pkwy	07 MCDOWELL MOUNTAIN RARD	-0.019	33.6290118	-111.86354
3324904	12/16/2017 14:47	2017	4	1	2	3	0	3	Thompson Peak Pkwy	07 MCDOWELL MOUNTAIN RARD	-0.024	33.6289631	-111.8636
3429176	10/4/2018 12:27	2018	6	1	2	2	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	30	33.6291547	-111.86325
3348154	2/14/2018 10:09	2018	2	1	2	3	0	3	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3382002	5/18/2018 17:25	2018	3	1	2	2	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3359576	4/11/2018 7:22	2018	1	1	1	1	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	-108	33.6294221	-111.86357
3537628	5/15/2019 8:06	2019	6	1	2	2	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	-25	33.6291642	-111.86326
3504246	2/4/2019 15:07	2019	2	1	2	3	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3550403	7/6/2019 15:23	2019	1	1	1	1	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3552730	7/19/2019 15:06	2019	2	1	2	2	0	2	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3584180	9/13/2019 13:44	2019	6	1	2	3	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	0	33.6292119	-111.86332
3504265	2/7/2019 15:14	2019	6	1	2	3	0	1	07 THOMPSON PEAK PKWY	McDowell Mountain Ra Rd	25	33.6292598	-111.86326
3535854	6/4/2019 17:57	2019	2	1	2	2	0	1	MCDOWELL MOUNTAIN RARD	Thompson Peak Pkwy	-200	33.6296011	-111.86378
Northbound Thompson Peak Parkway and Aquatic Center / Park Access Road													
3289712	10/13/2017 13:10	2017	1	1	1	1	0	1	Thompson Peak Pkwy	07 MCDOWELL MOUNTAIN RARD	-0.095	33.6282334	-111.86447
Southbound Thompson Peak Parkway and Aquatic Center / Park Access Road													
3366141	4/11/2018 8:30	2018	2	1	2	2	0	2	07 THOMPSON PEAK PKWY	McDowell Mountain Ra Rd	-1000	33.6272671	-111.86564

**APPENDIX C: RAW CITY OF SCOTTSDALE SOCCER FIELD TRIP GENERATION DATA**

94th St & Bell Rd. Multi-Use Fields												
Land Use: (488) Soccer Complex												
# of Fields 6	Weekday Daily		Weekday AM Peak		Weekday PM Peak		Saturday Daily		Saturday Peak Hour		Sunday Peak Hour	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
Dir. Dist.	50%	50%	53%	47%	47%	53%	50%	50%	48%	52%	46%	54%
ITE Trip Rate	71.33		1.77		16.9		404.88		40.1		28.78	
Trips	214	214	6	5	48	54	1215	1215	115	125	79	93
	428		11		101		2429		241		173	

























94th St & Bell Rd. Multi-Use Fields												
Actual Count Data (10/14-10/18 2020 - Sports Complex #1 Bell & Princess)												
# of Fields 6	**Weekday Daily		Weekday AM Peak		Weekday PM Peak		Saturday Daily		Saturday Peak Hour		Sunday Peak Hour	
	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit	Enter	Exit
Dir. Dist.	50%	50%	53%	47%	47%	53%	50%	50%	48%	52%	46%	54%
Count Data	120		8		34		305		47		38	
Trips	360	360	25	23	96	108	915	915	135	147	105	123
	720		48		204		1830		282		228	

\*\* Thur only

## **APPENDIX D: SYNCHRO ANALYSIS RESULTS**

## Lanes, Volumes, Timings 2: Thompson Peak Pkwy & McDowell MRR

Existing Conditions  
Saturday Peak

												
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	21	35	83	559	38	119	95	407	463	107	579	15
Future Volume (vph)	21	35	83	559	38	119	95	407	463	107	579	15
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			88			141			503			148
Lane Group Flow (vph)	23	38	90	608	41	129	103	442	503	116	629	16
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	14.0	26.0	26.0	29.0	13.0	26.0	55.0	26.0	13.0	42.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	7.0	27.5	21.4	22.2	31.4	19.7	54.8	81.9	6.7	41.8	47.1
Actuated g/C Ratio	0.05	0.06	0.25	0.20	0.21	0.29	0.18	0.51	0.76	0.06	0.39	0.44
v/c Ratio	0.14	0.17	0.19	0.89	0.06	0.23	0.16	0.25	0.23	0.54	0.46	0.02
Control Delay	51.1	49.6	7.2	59.3	34.2	3.8	37.9	16.6	0.7	59.0	27.4	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.1	49.6	7.2	59.3	34.2	3.8	37.9	16.6	0.7	59.0	27.4	0.1
LOS	D	D	A	E	C	A	D	B	A	E	C	A
Approach Delay		24.6			48.8			11.0			31.6	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	8	13	1	213	12	0	30	97	0	40	183	0
Queue Length 95th (ft)	21	31	37	#311	27	29	55	133	14	70	240	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	171	262	472	684	754	547	635	1795	2213	222	1369	776
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.15	0.19	0.89	0.05	0.24	0.16	0.25	0.23	0.52	0.46	0.02

### Intersection Summary

Cycle Length: 108

Actuated Cycle Length: 108

Offset: 6 (6%), Referenced to phase 2:SWT and 6:NET, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.89

Intersection Signal Delay: 28.2

Intersection LOS: C

Intersection Capacity Utilization 57.5%

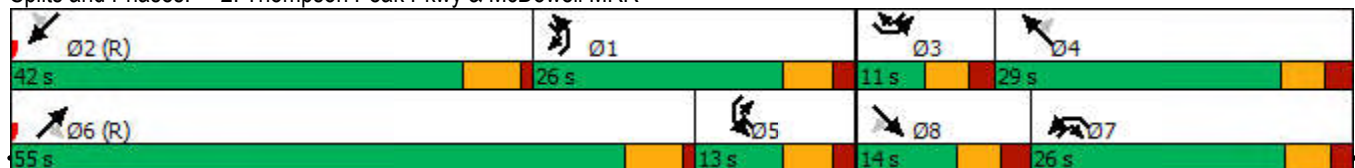
ICU Level of Service B

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Scenario 1 12:42 pm 05/15/2021 Baseline

Synchro 11 Report

Intersection						
Int Delay, s/veh	1.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	2	25	17	66	14	1
Future Vol, veh/h	2	25	17	66	14	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	27	18	72	15	1

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	90	0	-	0	49 18
Stage 1	-	-	-	-	18 -
Stage 2	-	-	-	-	31 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1505	-	-	-	960 1061
Stage 1	-	-	-	-	1005 -
Stage 2	-	-	-	-	992 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1505	-	-	-	959 1061
Mov Cap-2 Maneuver	-	-	-	-	893 -
Stage 1	-	-	-	-	1004 -
Stage 2	-	-	-	-	992 -

Approach	EB	WB	SB
HCM Control Delay, s	0.5	0	9.1
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1505	-	-	-	903
HCM Lane V/C Ratio	0.001	-	-	-	0.018
HCM Control Delay (s)	7.4	0	-	-	9.1
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.1

Intersection						
Int Delay, s/veh	0.5					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	76	0	1016	1235	11
Future Vol, veh/h	0	76	0	1016	1235	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	83	0	1104	1342	12

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	671	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-
Pot Cap-1 Maneuver	0	399	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	399	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	16.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	- 399	-	-
HCM Lane V/C Ratio	- 0.207	-	-
HCM Control Delay (s)	- 16.4	-	-
HCM Lane LOS	- C	-	-
HCM 95th %tile Q(veh)	- 0.8	-	-

Intersection						
Int Delay, s/veh	0.1					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	19	957	59	0	1246
Future Vol, veh/h	0	19	957	59	0	1246
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	21	1040	64	0	1354

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	552	0	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-
Pot Cap-1 Maneuver	0	477	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	-	477	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	12.9	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	477
HCM Lane V/C Ratio	-	-	0.043
HCM Control Delay (s)	-	-	12.9
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1



Lanes, Volumes, Timings  
2: Thompson Peak Pkwy & McDowell MRR

Existing Conditions  
Sunday Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	18	24	64	445	25	75	58	365	373	83	461	10
Future Volume (vph)	18	24	64	445	25	75	58	365	373	83	461	10
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			88			141			405			148
Lane Group Flow (vph)	20	26	70	484	27	82	63	397	405	90	501	11
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	14.0	26.0	26.0	29.0	13.0	26.0	55.0	26.0	13.0	42.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	7.0	24.7	18.8	21.8	31.9	16.9	57.6	82.1	6.5	49.4	55.8
Actuated g/C Ratio	0.05	0.06	0.23	0.17	0.20	0.30	0.16	0.53	0.76	0.06	0.46	0.52
v/c Ratio	0.12	0.11	0.16	0.81	0.04	0.14	0.12	0.21	0.18	0.44	0.31	0.01
Control Delay	50.9	48.8	4.7	54.1	33.1	0.9	37.5	15.3	0.7	55.7	23.1	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	50.9	48.8	4.7	54.1	33.1	0.9	37.5	15.3	0.7	55.7	23.1	0.0
LOS	D	D	A	D	C	A	D	B	A	E	C	A
Approach Delay		22.6			45.8			10.1			27.5	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	7	8	0	166	6	0	19	83	0	31	135	0
Queue Length 95th (ft)	19	23	23	220	20	4	37	119	13	57	188	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	171	262	472	661	812	541	635	1888	2184	222	1620	892
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.10	0.15	0.73	0.03	0.15	0.10	0.21	0.19	0.41	0.31	0.01

Intersection Summary

Cycle Length: 108

Actuated Cycle Length: 108

Offset: 6 (6%), Referenced to phase 2:SWT and 6:NET, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 25.3

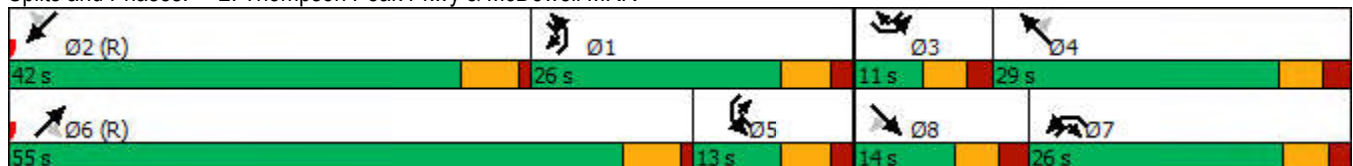
Intersection LOS: C

Intersection Capacity Utilization 51.0%

ICU Level of Service A

Analysis Period (min) 15

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Intersection						
Int Delay, s/veh	4					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	6	13	15	35	41	3
Future Vol, veh/h	6	13	15	35	41	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	14	16	38	45	3

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	54	0	-	0	44
Stage 1	-	-	-	-	16
Stage 2	-	-	-	-	28
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1551	-	-	-	967
Stage 1	-	-	-	-	1007
Stage 2	-	-	-	-	995
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1551	-	-	-	962
Mov Cap-2 Maneuver	-	-	-	-	895
Stage 1	-	-	-	-	1002
Stage 2	-	-	-	-	995

Approach	EB	WB	SB
HCM Control Delay, s	2.3	0	9.2
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1551	-	-	-	905
HCM Lane V/C Ratio	0.004	-	-	-	0.053
HCM Control Delay (s)	7.3	0	-	-	9.2
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.2

Intersection						
Int Delay, s/veh	0.3					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	40	0	853	942	7
Future Vol, veh/h	0	40	0	853	942	7
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	43	0	927	1024	8

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	512	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	507	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	507	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	12.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	-	507	-
HCM Lane V/C Ratio	-	0.086	-
HCM Control Delay (s)	-	12.8	-
HCM Lane LOS	-	B	-
HCM 95th %tile Q(veh)	-	0.3	-

Intersection						
Int Delay, s/veh	0					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	6	807	46	0	949
Future Vol, veh/h	0	6	807	46	0	949
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	7	877	50	0	1032

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	464	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	545	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	545	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	11.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	545
HCM Lane V/C Ratio	-	-	0.012
HCM Control Delay (s)	-	-	11.7
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0

Lanes, Volumes, Timings  
2: Thompson Peak Pkwy & McDowell MRR

Existing Conditions  
Weekday AM Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	18	41	125	553	65	99	99	392	410	81	539	17
Future Volume (vph)	18	41	125	553	65	99	99	392	410	81	539	17
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			103			108			446			82
Lane Group Flow (vph)	20	45	136	601	71	108	108	426	446	88	586	18
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	14.0	15.0	44.0	47.0	13.0	15.0	49.0	44.0	13.0	47.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	8.5	23.0	26.0	33.5	42.4	8.5	55.7	87.4	6.5	53.7	59.0
Actuated g/C Ratio	0.04	0.07	0.19	0.22	0.28	0.35	0.07	0.46	0.73	0.05	0.45	0.49
v/c Ratio	0.14	0.18	0.35	0.81	0.07	0.17	0.44	0.26	0.21	0.47	0.37	0.02
Control Delay	57.3	54.8	15.7	53.5	32.5	4.0	59.3	20.9	0.7	63.4	23.6	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.3	54.8	15.7	53.5	32.5	4.0	59.3	20.9	0.7	63.4	23.6	0.1
LOS	E	D	B	D	C	A	E	C	A	E	C	A
Approach Delay		28.6			44.8			15.9			28.0	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	7	17	21	230	22	0	41	102	0	34	153	0
Queue Length 95th (ft)	21	37	79	275	39	30	72	154	13	62	222	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	154	249	362	1098	1209	605	257	1643	2151	200	1584	823
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.18	0.38	0.55	0.06	0.18	0.42	0.26	0.21	0.44	0.37	0.02

**Intersection Summary**

Cycle Length: 120

Actuated Cycle Length: 120

Offset: 71 (59%), Referenced to phase 2:SWT and 6:NET, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.81

Intersection Signal Delay: 28.5

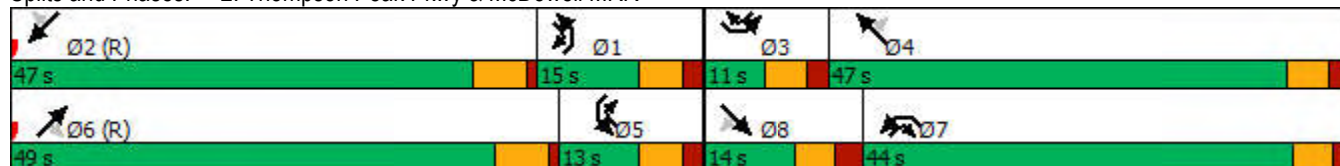
Intersection LOS: C

Intersection Capacity Utilization 56.3%

ICU Level of Service B

Analysis Period (min) 15

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Intersection						
Int Delay, s/veh	3.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	4	20	34	127	84	5
Future Vol, veh/h	4	20	34	127	84	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	22	37	138	91	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	175	0	-	0	67
Stage 1	-	-	-	-	37
Stage 2	-	-	-	-	30
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1401	-	-	-	938
Stage 1	-	-	-	-	985
Stage 2	-	-	-	-	993
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1401	-	-	-	935
Mov Cap-2 Maneuver	-	-	-	-	877
Stage 1	-	-	-	-	982
Stage 2	-	-	-	-	993

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1401	-	-	-	885
HCM Lane V/C Ratio	0.003	-	-	-	0.109
HCM Control Delay (s)	7.6	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4

Intersection						
Int Delay, s/veh	0.8					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	109	0	1144	1236	17
Future Vol, veh/h	0	109	0	1144	1236	17
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	118	0	1243	1343	18

Major/Minor	Minor2	Major1	Major2		
Conflicting Flow All	-	672	-	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-
Pot Cap-1 Maneuver	0	398	0	-	-
Stage 1	0	-	0	-	-
Stage 2	0	-	0	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	-	398	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	17.8	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	- 398	-	-
HCM Lane V/C Ratio	- 0.298	-	-
HCM Control Delay (s)	- 17.8	-	-
HCM Lane LOS	- C	-	-
HCM 95th %tile Q(veh)	- 1.2	-	-

Intersection						
Int Delay, s/veh	0.2					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	27	1015	129	0	1253
Future Vol, veh/h	0	27	1015	129	0	1253
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	29	1103	140	0	1362

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	622	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	430	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	430	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	14	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	430
HCM Lane V/C Ratio	-	-	0.068
HCM Control Delay (s)	-	-	14
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.2



# Lanes, Volumes, Timings

## 2: Thompson Peak Pkwy & McDowell MRR

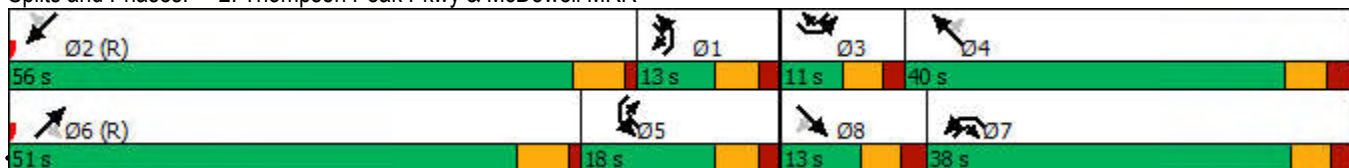
Existing Conditions  
Weekday PM Peak

	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	13	30	114	407	27	95	114	527	583	124	520	10
Future Volume (vph)	13	30	114	407	27	95	114	527	583	124	520	10
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			124			103			588			82
Lane Group Flow (vph)	14	33	124	442	29	103	124	573	634	135	565	11
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	13.0	13.0	38.0	40.0	18.0	13.0	51.0	38.0	18.0	56.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effect Green (s)	5.1	7.0	14.6	37.8	38.7	52.9	6.8	45.3	88.8	11.8	50.3	55.5
Actuated g/C Ratio	0.04	0.06	0.12	0.32	0.32	0.44	0.06	0.38	0.74	0.10	0.42	0.46
v/c Ratio	0.10	0.16	0.41	0.41	0.03	0.14	0.64	0.43	0.29	0.40	0.38	0.01
Control Delay	56.5	55.7	11.9	35.1	30.5	3.4	70.6	29.0	1.1	54.5	25.0	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	56.5	55.7	11.9	35.1	30.5	3.4	70.6	29.0	1.1	54.5	25.0	0.0
LOS	E	E	B	D	C	A	E	C	A	D	C	A
Approach Delay		24.0			29.2			19.6			30.2	
Approach LOS		C			C			B			C	
Queue Length 50th (ft)	5	13	0	148	8	0	49	172	5	51	156	0
Queue Length 95th (ft)	17	31	54	198	21	27	#82	223	24	84	203	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	154	206	304	1081	1141	743	200	1335	2215	343	1483	779
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.16	0.41	0.41	0.03	0.14	0.62	0.43	0.29	0.39	0.38	0.01

### Intersection Summary

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 76 (63%), Referenced to phase 2:SWT and 6:NET, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.64  
 Intersection Signal Delay: 24.5  
 Intersection LOS: C  
 Intersection Capacity Utilization 51.8%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

### Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Intersection						
Int Delay, s/veh	4.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	4	35	13	53	88	2
Future Vol, veh/h	4	35	13	53	88	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	38	14	58	96	2

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	72	0	-	0	60 14
Stage 1	-	-	-	-	14 -
Stage 2	-	-	-	-	46 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1528	-	-	-	947 1066
Stage 1	-	-	-	-	1009 -
Stage 2	-	-	-	-	976 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1528	-	-	-	944 1066
Mov Cap-2 Maneuver	-	-	-	-	881 -
Stage 1	-	-	-	-	1006 -
Stage 2	-	-	-	-	976 -

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1528	-	-	-	884
HCM Lane V/C Ratio	0.003	-	-	-	0.111
HCM Control Delay (s)	7.4	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4

HCM 6th TWSC  
 3: Thompson Peak Pkwy & Aquatic Rd

Existing Conditions  
 Weekday PM Peak

Intersection						
Int Delay, s/veh	0.5					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	86	0	1330	1055	14
Future Vol, veh/h	0	86	0	1330	1055	14
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	93	0	1446	1147	15

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	574	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	462	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	462	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	14.8	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	- 462	-	-
HCM Lane V/C Ratio	- 0.202	-	-
HCM Control Delay (s)	- 14.8	-	-
HCM Lane LOS	- B	-	-
HCM 95th %tile Q(veh)	- 0.7	-	-

Intersection						
Int Delay, s/veh	0.3					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↗	↕			↕
Traffic Vol, veh/h	0	39	1238	92	0	1069
Future Vol, veh/h	0	39	1238	92	0	1069
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	42	1346	100	0	1162

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	723	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	369	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	369	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	16	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	369
HCM Lane V/C Ratio	-	-	0.115
HCM Control Delay (s)	-	-	16
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.4

Lanes, Volumes, Timings  
2: Thompson Peak Pkwy & McDowell MRR

Total Traffic Volumes  
Saturday Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	27	39	107	561	41	119	118	419	465	107	590	21
Future Volume (vph)	27	39	107	561	41	119	118	419	465	107	590	21
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			88			141			504			148
Lane Group Flow (vph)	29	42	116	610	45	129	128	455	505	116	641	23
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	14.0	26.0	26.0	29.0	13.0	26.0	55.0	26.0	13.0	42.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	7.0	27.5	21.4	22.3	31.4	19.7	54.7	81.9	6.7	41.7	47.1
Actuated g/C Ratio	0.05	0.06	0.25	0.20	0.21	0.29	0.18	0.51	0.76	0.06	0.39	0.44
v/c Ratio	0.18	0.18	0.25	0.90	0.06	0.23	0.20	0.25	0.23	0.54	0.47	0.03
Control Delay	51.8	49.8	10.6	59.6	34.3	3.8	38.3	16.7	0.7	59.0	27.5	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.8	49.8	10.6	59.6	34.3	3.8	38.3	16.7	0.7	59.0	27.5	0.0
LOS	D	D	B	E	C	A	D	B	A	E	C	A
Approach Delay		25.8			48.9			11.8			31.4	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	10	14	14	213	13	0	39	100	0	40	187	0
Queue Length 95th (ft)	25	33	56	#314	28	29	66	136	15	70	245	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	171	262	472	684	754	547	635	1793	2212	222	1367	775
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.17	0.16	0.25	0.89	0.06	0.24	0.20	0.25	0.23	0.52	0.47	0.03

Intersection Summary

Cycle Length: 108

Actuated Cycle Length: 108

Offset: 6 (6%), Referenced to phase 2:SWT and 6:NET, Start of Green

Control Type: Actuated-Coordinated

Maximum v/c Ratio: 0.90

Intersection Signal Delay: 28.4

Intersection LOS: C

Intersection Capacity Utilization 57.9%

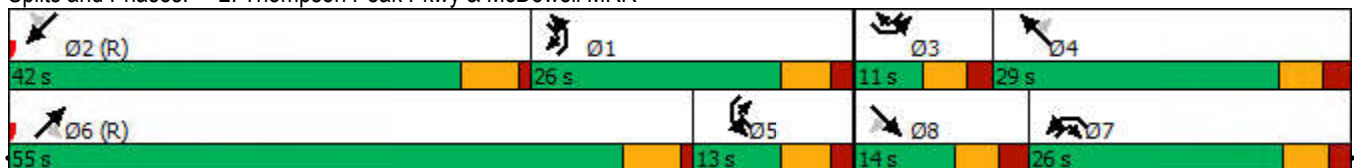
ICU Level of Service B

Analysis Period (min) 15

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Scenario 1 12:42 pm 05/15/2021 Baseline

Synchro 11 Report

Page 1

Intersection						
Int Delay, s/veh	3.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	2	25	17	84	66	1
Future Vol, veh/h	2	25	17	84	66	1
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	2	27	18	91	72	1

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	109	0	-	0	49 18
Stage 1	-	-	-	-	18 -
Stage 2	-	-	-	-	31 -
Critical Hdwy	4.12	-	-	-	6.42 6.22
Critical Hdwy Stg 1	-	-	-	-	5.42 -
Critical Hdwy Stg 2	-	-	-	-	5.42 -
Follow-up Hdwy	2.218	-	-	-	3.518 3.318
Pot Cap-1 Maneuver	1481	-	-	-	960 1061
Stage 1	-	-	-	-	1005 -
Stage 2	-	-	-	-	992 -
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1481	-	-	-	959 1061
Mov Cap-2 Maneuver	-	-	-	-	893 -
Stage 1	-	-	-	-	1004 -
Stage 2	-	-	-	-	992 -

Approach	EB	WB	SB
HCM Control Delay, s	0.6	0	9.4
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1481	-	-	-	895
HCM Lane V/C Ratio	0.001	-	-	-	0.081
HCM Control Delay (s)	7.4	0	-	-	9.4
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.3

HCM 6th TWSC  
3: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Volumes  
Saturday Peak

Intersection						
Int Delay, s/veh	1					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	131	0	1090	1259	24
Future Vol, veh/h	0	131	0	1090	1259	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	142	0	1185	1368	26

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	684	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	391	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %			
Mov Cap-1 Maneuver	-	391	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	19.4	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	- 391	-	-
HCM Lane V/C Ratio	- 0.364	-	-
HCM Control Delay (s)	- 19.4	-	-
HCM Lane LOS	- C	-	-
HCM 95th %tile Q(veh)	- 1.6	-	-

HCM 6th TWSC  
4: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Volumes  
Saturday Peak

Intersection						
Int Delay, s/veh	0.2					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↗	↕			↕
Traffic Vol, veh/h	0	34	980	110	0	1283
Future Vol, veh/h	0	34	980	110	0	1283
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	37	1065	120	0	1395

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	593	0	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-
Pot Cap-1 Maneuver	0	449	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	-	449	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	13.7	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	449
HCM Lane V/C Ratio	-	-	0.082
HCM Control Delay (s)	-	-	13.7
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.3



Intersection						
Int Delay, s/veh	2.8					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Vol, veh/h	74	17	32	83	18	34
Future Vol, veh/h	74	17	32	83	18	34
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	80	18	35	90	20	37

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	98	0	204 49
Stage 1	-	-	-	-	89 -
Stage 2	-	-	-	-	115 -
Critical Hdwy	-	-	4.14	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	-	-	2.22	-	3.52 3.32
Pot Cap-1 Maneuver	-	-	1493	-	766 1009
Stage 1	-	-	-	-	924 -
Stage 2	-	-	-	-	897 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1493	-	748 1009
Mov Cap-2 Maneuver	-	-	-	-	750 -
Stage 1	-	-	-	-	924 -
Stage 2	-	-	-	-	876 -

Approach	EB	WB	NB
HCM Control Delay, s	0	2.1	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	750	1009	-	-	1493	-
HCM Lane V/C Ratio	0.026	0.037	-	-	0.023	-
HCM Control Delay (s)	9.9	8.7	-	-	7.5	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

HCM 6th TWSC  
6: Aquatic Rd & South Site Driveway

Total Traffic Volumes  
Saturday Peak

Intersection						
Int Delay, s/veh	4.8					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	55	15	51	76	11	13
Future Vol, veh/h	55	15	51	76	11	13
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	60	16	55	83	12	14

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	205	12	26	0	0
Stage 1	12	-	-	-	-
Stage 2	193	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	783	1069	1588	-	-
Stage 1	1011	-	-	-	-
Stage 2	840	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	755	1069	1588	-	-
Mov Cap-2 Maneuver	755	-	-	-	-
Stage 1	975	-	-	-	-
Stage 2	840	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	9.8	3	0
HCM LOS	A		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SELn2	SWT	SWR
Capacity (veh/h)	1588	-	755	1069	-	-
HCM Lane V/C Ratio	0.035	-	0.079	0.015	-	-
HCM Control Delay (s)	7.3	0	10.2	8.4	-	-
HCM Lane LOS	A	A	B	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.3	0	-	-

Lanes, Volumes, Timings  
2: Thompson Peak Pkwy & McDowell MRR

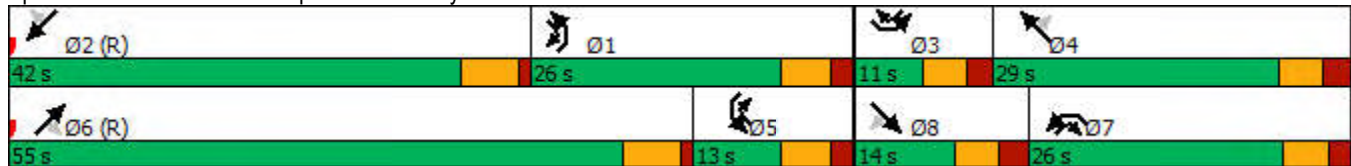
Total Traffic Conditions  
Sunday Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	23	27	85	447	28	75	75	375	375	83	470	14
Future Volume (vph)	23	27	85	447	28	75	75	375	375	83	470	14
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			92			141			408			148
Lane Group Flow (vph)	25	29	92	486	30	82	82	408	408	90	511	15
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	14.0	26.0	26.0	29.0	13.0	26.0	55.0	26.0	13.0	42.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	7.0	27.3	18.9	19.7	28.6	19.5	57.6	82.1	6.5	44.6	49.9
Actuated g/C Ratio	0.05	0.06	0.25	0.18	0.18	0.26	0.18	0.53	0.76	0.06	0.41	0.46
v/c Ratio	0.15	0.13	0.20	0.81	0.05	0.16	0.13	0.22	0.18	0.44	0.35	0.02
Control Delay	51.4	49.0	6.8	54.1	34.7	1.0	37.6	15.4	0.7	55.7	24.6	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.4	49.0	6.8	54.1	34.7	1.0	37.6	15.4	0.7	55.7	24.6	0.1
LOS	D	D	A	D	C	A	D	B	A	E	C	A
Approach Delay		22.8			45.8			10.7			28.5	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	8	10	0	167	8	0	24	85	0	31	139	0
Queue Length 95th (ft)	22	25	37	221	22	4	46	122	14	57	192	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	171	262	475	661	753	497	635	1886	2184	222	1460	813
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.15	0.11	0.19	0.74	0.04	0.16	0.13	0.22	0.19	0.41	0.35	0.02

Intersection Summary

Cycle Length: 108  
 Actuated Cycle Length: 108  
 Offset: 6 (6%), Referenced to phase 2:SWT and 6:NET, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.81  
 Intersection Signal Delay: 25.7  
 Intersection LOS: C  
 Intersection Capacity Utilization 51.3%  
 ICU Level of Service A  
 Analysis Period (min) 15

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Intersection						
Int Delay, s/veh	4.1					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	6	13	15	50	54	3
Future Vol, veh/h	6	13	15	50	54	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	7	14	16	54	59	3
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	70	0	-	0	44	16
Stage 1	-	-	-	-	16	-
Stage 2	-	-	-	-	28	-
Critical Hdwy	4.12	-	-	-	6.42	6.22
Critical Hdwy Stg 1	-	-	-	-	5.42	-
Critical Hdwy Stg 2	-	-	-	-	5.42	-
Follow-up Hdwy	2.218	-	-	-	3.518	3.318
Pot Cap-1 Maneuver	1531	-	-	-	967	1063
Stage 1	-	-	-	-	1007	-
Stage 2	-	-	-	-	995	-
Platoon blocked, %		-	-	-		
Mov Cap-1 Maneuver	1531	-	-	-	962	1063
Mov Cap-2 Maneuver	-	-	-	-	895	-
Stage 1	-	-	-	-	1002	-
Stage 2	-	-	-	-	995	-
Approach	EB	WB	SB			
HCM Control Delay, s	2.3	0	9.3			
HCM LOS			A			
Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1	
Capacity (veh/h)	1531	-	-	-	903	
HCM Lane V/C Ratio	0.004	-	-	-	0.069	
HCM Control Delay (s)	7.4	0	-	-	9.3	
HCM Lane LOS	A	A	-	-	A	
HCM 95th %tile Q(veh)	0	-	-	-	0.2	

Intersection						
Int Delay, s/veh	0.6					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	86	0	909	963	18
Future Vol, veh/h	0	86	0	909	963	18
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	93	0	988	1047	20

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	524	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	498	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %			
Mov Cap-1 Maneuver	-	498	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	13.9	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	- 498	-	-
HCM Lane V/C Ratio	- 0.188	-	-
HCM Control Delay (s)	- 13.9	-	-
HCM Lane LOS	- B	-	-
HCM 95th %tile Q(veh)	- 0.7	-	-

HCM 6th TWSC  
4: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Conditions  
Sunday Peak

Intersection						
Int Delay, s/veh	0.1					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	18	824	85	0	981
Future Vol, veh/h	0	18	824	85	0	981
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	20	896	92	0	1066

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	494	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	521	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	521	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	12.2	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	521
HCM Lane V/C Ratio	-	-	0.038
HCM Control Delay (s)	-	-	12.2
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.1

Intersection						
Int Delay, s/veh	3.1					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Vol, veh/h	54	13	24	49	16	29
Future Vol, veh/h	54	13	24	49	16	29
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	59	14	26	53	17	32

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	73	0	145 37
Stage 1	-	-	-	-	66 -
Stage 2	-	-	-	-	79 -
Critical Hdwy	-	-	4.14	-	6.84 6.94
Critical Hdwy Stg 1	-	-	-	-	5.84 -
Critical Hdwy Stg 2	-	-	-	-	5.84 -
Follow-up Hdwy	-	-	2.22	-	3.52 3.32
Pot Cap-1 Maneuver	-	-	1525	-	833 1027
Stage 1	-	-	-	-	949 -
Stage 2	-	-	-	-	935 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1525	-	819 1027
Mov Cap-2 Maneuver	-	-	-	-	799 -
Stage 1	-	-	-	-	949 -
Stage 2	-	-	-	-	919 -

Approach	EB	WB	NB
HCM Control Delay, s	0	2.4	9
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	799	1027	-	-	1525	-
HCM Lane V/C Ratio	0.022	0.031	-	-	0.017	-
HCM Control Delay (s)	9.6	8.6	-	-	7.4	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

HCM 6th TWSC  
6: Aquatic Rd & South Site Driveway

Total Traffic Conditions  
Sunday Peak

Intersection						
Int Delay, s/veh	5.4					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	46	12	39	40	7	11
Future Vol, veh/h	46	12	39	40	7	11
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	50	13	42	43	8	12

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	135	8	20	0	0
Stage 1	8	-	-	-	-
Stage 2	127	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	859	1074	1596	-	-
Stage 1	1015	-	-	-	-
Stage 2	899	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	836	1074	1596	-	-
Mov Cap-2 Maneuver	836	-	-	-	-
Stage 1	988	-	-	-	-
Stage 2	899	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	9.4	3.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SELn2	SWT	SWR
Capacity (veh/h)	1596	-	836	1074	-	-
HCM Lane V/C Ratio	0.027	-	0.06	0.012	-	-
HCM Control Delay (s)	7.3	0	9.6	8.4	-	-
HCM Lane LOS	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	0	-	-





Intersection						
Int Delay, s/veh	3.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	4	20	34	130	87	5
Future Vol, veh/h	4	20	34	130	87	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	22	37	141	95	5

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	178	0	-	0	67
Stage 1	-	-	-	-	37
Stage 2	-	-	-	-	30
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1398	-	-	-	938
Stage 1	-	-	-	-	985
Stage 2	-	-	-	-	993
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1398	-	-	-	935
Mov Cap-2 Maneuver	-	-	-	-	877
Stage 1	-	-	-	-	982
Stage 2	-	-	-	-	993

Approach	EB	WB	SB
HCM Control Delay, s	1.3	0	9.6
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1398	-	-	-	884
HCM Lane V/C Ratio	0.003	-	-	-	0.113
HCM Control Delay (s)	7.6	0	-	-	9.6
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4

HCM 6th TWSC  
3: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Conditions  
Weekday AM Peak

Intersection						
Int Delay, s/veh	0.9					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↑↑	↑↑	↗
Traffic Vol, veh/h	0	118	0	1157	1240	20
Future Vol, veh/h	0	118	0	1157	1240	20
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	128	0	1258	1348	22

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	674	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	397	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %	-	-	-
Mov Cap-1 Maneuver	-	397	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	18.3	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	-	397	-
HCM Lane V/C Ratio	-	0.323	-
HCM Control Delay (s)	-	18.3	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	1.4	-

HCM 6th TWSC  
4: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Conditions  
Weekday AM Peak

Intersection						
Int Delay, s/veh	0.2					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	29	1019	138	0	1260
Future Vol, veh/h	0	29	1019	138	0	1260
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	32	1108	150	0	1370

Major/Minor	Minor1	Major1	Major2		
Conflicting Flow All	-	629	0	0	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-
Pot Cap-1 Maneuver	0	425	-	-	0
Stage 1	0	-	-	-	0
Stage 2	0	-	-	-	0
Platoon blocked, %			-	-	-
Mov Cap-1 Maneuver	-	425	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-
Stage 1	-	-	-	-	-
Stage 2	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	14.1	0	0
HCM LOS	B		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWT
Capacity (veh/h)	-	-	425	-
HCM Lane V/C Ratio	-	-	0.074	-
HCM Control Delay (s)	-	-	14.1	-
HCM Lane LOS	-	-	B	-
HCM 95th %tile Q(veh)	-	-	0.2	-

Intersection						
Int Delay, s/veh	0.4					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Vol, veh/h	104	3	6	161	3	5
Future Vol, veh/h	104	3	6	161	3	5
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	113	3	7	175	3	5

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	116	0	217
Stage 1	-	-	-	-	115
Stage 2	-	-	-	-	102
Critical Hdwy	-	-	4.14	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	-	-	2.22	-	3.52
Pot Cap-1 Maneuver	-	-	1470	-	752
Stage 1	-	-	-	-	897
Stage 2	-	-	-	-	911
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1470	-	748
Mov Cap-2 Maneuver	-	-	-	-	753
Stage 1	-	-	-	-	897
Stage 2	-	-	-	-	906

Approach	EB	WB	NB
HCM Control Delay, s	0	0.3	9.1
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	753	996	-	-	1470	-
HCM Lane V/C Ratio	0.004	0.005	-	-	0.004	-
HCM Control Delay (s)	9.8	8.6	-	-	7.5	-
HCM Lane LOS	A	A	-	-	A	-
HCM 95th %tile Q(veh)	0	0	-	-	0	-

HCM 6th TWSC  
6: Aquatic Rd & South Site Driveway

Total Traffic Conditions  
Weekday AM Peak

Intersection						
Int Delay, s/veh	1.2					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	9	2	9	109	17	3
Future Vol, veh/h	9	2	9	109	17	3
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	10	2	10	118	18	3

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	156	18	21	0	0
Stage 1	18	-	-	-	-
Stage 2	138	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	835	1061	1595	-	-
Stage 1	1005	-	-	-	-
Stage 2	889	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	829	1061	1595	-	-
Mov Cap-2 Maneuver	829	-	-	-	-
Stage 1	998	-	-	-	-
Stage 2	889	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	9.2	0.6	0
HCM LOS	A		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SELn2	SWT	SWR
Capacity (veh/h)	1595	-	829	1061	-	-
HCM Lane V/C Ratio	0.006	-	0.012	0.002	-	-
HCM Control Delay (s)	7.3	0	9.4	8.4	-	-
HCM Lane LOS	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0	-	0	0	-	-

Lanes, Volumes, Timings  
2: Thompson Peak Pkwy & McDowell MRR

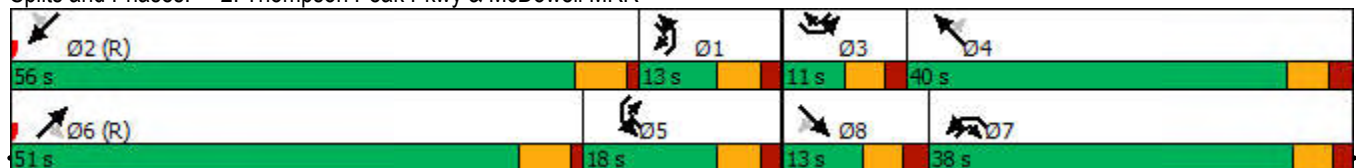
Total Traffic Conditions  
Weekday PM Peak

Lane Group	SEL	SET	SER	NWL	NWT	NWR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Traffic Volume (vph)	18	32	132	409	29	95	130	537	585	124	528	14
Future Volume (vph)	18	32	132	409	29	95	130	537	585	124	528	14
Satd. Flow (prot)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Flt Permitted	0.950			0.950			0.950			0.950		
Satd. Flow (perm)	3433	3539	1583	3433	3539	1583	3433	3539	2787	3433	3539	1583
Satd. Flow (RTOR)			143			103			571			82
Lane Group Flow (vph)	20	35	143	445	32	103	141	584	636	135	574	15
Turn Type	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov	Prot	NA	pm+ov
Protected Phases	3	8	1	7	4	5	1	6	7	5	2	3
Permitted Phases			8			4			6			2
Total Split (s)	11.0	13.0	13.0	38.0	40.0	18.0	13.0	51.0	38.0	18.0	56.0	11.0
Total Lost Time (s)	5.6	6.0	6.0	5.6	6.0	6.0	6.0	5.7	5.6	6.0	5.7	5.6
Act Effct Green (s)	5.2	7.0	14.7	20.5	21.4	35.7	6.9	62.4	88.7	11.9	67.4	72.7
Actuated g/C Ratio	0.04	0.06	0.12	0.17	0.18	0.30	0.06	0.52	0.74	0.10	0.56	0.61
v/c Ratio	0.14	0.17	0.45	0.76	0.05	0.19	0.71	0.32	0.29	0.40	0.29	0.02
Control Delay	57.3	55.8	11.7	55.8	38.4	4.5	75.3	18.9	1.2	54.4	15.9	0.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	57.3	55.8	11.7	55.8	38.4	4.5	75.3	18.9	1.2	54.4	15.9	0.0
LOS	E	E	B	E	D	A	E	B	A	D	B	A
Approach Delay		24.1			45.7			16.5			22.7	
Approach LOS		C			D			B			C	
Queue Length 50th (ft)	7	13	0	170	10	0	56	146	7	51	131	0
Queue Length 95th (ft)	21	31	57	215	24	30	#102	206	26	84	186	0
Internal Link Dist (ft)		599			1080			675			507	
Turn Bay Length (ft)	300		175	250		175	225		225	250		250
Base Capacity (vph)	154	206	321	926	1002	529	200	1841	2208	343	1988	994
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.13	0.17	0.45	0.48	0.03	0.19	0.70	0.32	0.29	0.39	0.29	0.02

**Intersection Summary**

Cycle Length: 120  
 Actuated Cycle Length: 120  
 Offset: 76 (63%), Referenced to phase 2:SWT and 6:NET, Start of Green  
 Control Type: Actuated-Coordinated  
 Maximum v/c Ratio: 0.76  
 Intersection Signal Delay: 24.5  
 Intersection LOS: C  
 Intersection Capacity Utilization 52.1%  
 ICU Level of Service A  
 Analysis Period (min) 15  
 # 95th percentile volume exceeds capacity, queue may be longer.  
 Queue shown is maximum after two cycles.

Splits and Phases: 2: Thompson Peak Pkwy & McDowell MRR



Intersection						
Int Delay, s/veh	4.6					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↑	↗	↘	
Traffic Vol, veh/h	4	35	13	67	100	2
Future Vol, veh/h	4	35	13	67	100	2
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	0	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	4	38	14	73	109	2

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	87	0	-	0	60
Stage 1	-	-	-	-	14
Stage 2	-	-	-	-	46
Critical Hdwy	4.12	-	-	-	6.42
Critical Hdwy Stg 1	-	-	-	-	5.42
Critical Hdwy Stg 2	-	-	-	-	5.42
Follow-up Hdwy	2.218	-	-	-	3.518
Pot Cap-1 Maneuver	1509	-	-	-	947
Stage 1	-	-	-	-	1009
Stage 2	-	-	-	-	976
Platoon blocked, %		-	-	-	
Mov Cap-1 Maneuver	1509	-	-	-	944
Mov Cap-2 Maneuver	-	-	-	-	881
Stage 1	-	-	-	-	1006
Stage 2	-	-	-	-	976

Approach	EB	WB	SB
HCM Control Delay, s	0.8	0	9.7
HCM LOS			A

Minor Lane/Major Mvmt	EBL	EBT	WBT	WBR	SBLn1
Capacity (veh/h)	1509	-	-	-	884
HCM Lane V/C Ratio	0.003	-	-	-	0.125
HCM Control Delay (s)	7.4	0	-	-	9.7
HCM Lane LOS	A	A	-	-	A
HCM 95th %tile Q(veh)	0	-	-	-	0.4



HCM 6th TWSC  
3: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Conditions  
Weekday PM Peak

Intersection						
Int Delay, s/veh	0.8					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations		↗		↕↕	↕↕	↗
Traffic Vol, veh/h	0	126	0	1382	1073	24
Future Vol, veh/h	0	126	0	1382	1073	24
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	130
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	137	0	1502	1166	26

Major/Minor	Minor2	Major1	Major2
Conflicting Flow All	-	583	0
Stage 1	-	-	-
Stage 2	-	-	-
Critical Hdwy	-	6.94	-
Critical Hdwy Stg 1	-	-	-
Critical Hdwy Stg 2	-	-	-
Follow-up Hdwy	-	3.32	-
Pot Cap-1 Maneuver	0	456	0
Stage 1	0	-	0
Stage 2	0	-	0
Platoon blocked, %			
Mov Cap-1 Maneuver	-	456	-
Mov Cap-2 Maneuver	-	-	-
Stage 1	-	-	-
Stage 2	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	16.2	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET SELn1	SWT	SWR
Capacity (veh/h)	-	456	-
HCM Lane V/C Ratio	-	0.3	-
HCM Control Delay (s)	-	16.2	-
HCM Lane LOS	-	C	-
HCM 95th %tile Q(veh)	-	1.2	-

HCM 6th TWSC  
4: Thompson Peak Pkwy & Aquatic Rd

Total Traffic Conditions  
Weekday PM Peak

Intersection						
Int Delay, s/veh	0.3					
Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations		↑	↑↑			↑↑
Traffic Vol, veh/h	0	50	1254	128	0	1097
Future Vol, veh/h	0	50	1254	128	0	1097
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	-	0	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	0	54	1363	139	0	1192

Major/Minor	Minor1	Major1	Major2			
Conflicting Flow All	-	751	0	0	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-
Critical Hdwy	-	6.94	-	-	-	-
Critical Hdwy Stg 1	-	-	-	-	-	-
Critical Hdwy Stg 2	-	-	-	-	-	-
Follow-up Hdwy	-	3.32	-	-	-	-
Pot Cap-1 Maneuver	0	353	-	-	0	-
Stage 1	0	-	-	-	0	-
Stage 2	0	-	-	-	0	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	-	353	-	-	-	-
Mov Cap-2 Maneuver	-	-	-	-	-	-
Stage 1	-	-	-	-	-	-
Stage 2	-	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	17	0	0
HCM LOS	C		

Minor Lane/Major Mvmt	NET	NERNWLn1	SWT
Capacity (veh/h)	-	-	353
HCM Lane V/C Ratio	-	-	0.154
HCM Control Delay (s)	-	-	17
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.5

Intersection						
Int Delay, s/veh	2					
Movement	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑↑		↖	↑↑	↖	↖
Traffic Vol, veh/h	123	12	22	66	14	25
Future Vol, veh/h	123	12	22	66	14	25
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	150	-	0	0
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	134	13	24	72	15	27

Major/Minor	Major1	Major2	Minor1		
Conflicting Flow All	0	0	147	0	225
Stage 1	-	-	-	-	141
Stage 2	-	-	-	-	84
Critical Hdwy	-	-	4.14	-	6.84
Critical Hdwy Stg 1	-	-	-	-	5.84
Critical Hdwy Stg 2	-	-	-	-	5.84
Follow-up Hdwy	-	-	2.22	-	3.52
Pot Cap-1 Maneuver	-	-	1432	-	743
Stage 1	-	-	-	-	871
Stage 2	-	-	-	-	930
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	1432	-	730
Mov Cap-2 Maneuver	-	-	-	-	739
Stage 1	-	-	-	-	871
Stage 2	-	-	-	-	914

Approach	EB	WB	NB
HCM Control Delay, s	0	1.9	9.2
HCM LOS			A

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT
Capacity (veh/h)	739	973	-	-	1432	-
HCM Lane V/C Ratio	0.021	0.028	-	-	0.017	-
HCM Control Delay (s)	10	8.8	-	-	7.6	-
HCM Lane LOS	B	A	-	-	A	-
HCM 95th %tile Q(veh)	0.1	0.1	-	-	0.1	-

HCM 6th TWSC  
6: Aquatic Rd & South Site Driveway

Total Traffic Conditions  
Weekday PM Peak

Intersection						
Int Delay, s/veh	3.8					
Movement	SEL	SER	NEL	NET	SWT	SWR
Lane Configurations						
Traffic Vol, veh/h	40	11	36	86	14	10
Future Vol, veh/h	40	11	36	86	14	10
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	0	-	-	-	150
Veh in Median Storage, #	0	-	-	0	0	-
Grade, %	0	-	-	0	0	-
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	43	12	39	93	15	11

Major/Minor	Minor2	Major1		Major2	
Conflicting Flow All	186	15	26	0	0
Stage 1	15	-	-	-	-
Stage 2	171	-	-	-	-
Critical Hdwy	6.42	6.22	4.12	-	-
Critical Hdwy Stg 1	5.42	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-
Follow-up Hdwy	3.518	3.318	2.218	-	-
Pot Cap-1 Maneuver	803	1065	1588	-	-
Stage 1	1008	-	-	-	-
Stage 2	859	-	-	-	-
Platoon blocked, %				-	-
Mov Cap-1 Maneuver	782	1065	1588	-	-
Mov Cap-2 Maneuver	782	-	-	-	-
Stage 1	982	-	-	-	-
Stage 2	859	-	-	-	-

Approach	SE	NE	SW
HCM Control Delay, s	9.6	2.2	0
HCM LOS	A		

Minor Lane/Major Mvmt	NEL	NET	SELn1	SELn2	SWT	SWR
Capacity (veh/h)	1588	-	782	1065	-	-
HCM Lane V/C Ratio	0.025	-	0.056	0.011	-	-
HCM Control Delay (s)	7.3	0	9.9	8.4	-	-
HCM Lane LOS	A	A	A	A	-	-
HCM 95th %tile Q(veh)	0.1	-	0.2	0	-	-